Small Scale Sustainable Electricity Production Discussion Paper

Prepared for:
The District of Squamish

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Introduction

- The District of Squamish's Community Energy Action Plan includes a 5-10 year Master Action Plan for practically implementing and monitoring a series projects intended to reduce energy consumption and GHG emissions.
- One of the proposed catalyst projects is the creation of a small-scale demonstration of a responsive, local network for electricity and potential alternative electricity generation.
- This analysis explains the current institutional context for local electricity production in B.C., reviews key technologies for local electricity production relevant to Squamish, and identifies policies / actions to encourage greater uptake of net metering within Squamish.

Institutional Context for Local Electricity Production

- Currently, electricity generated in B.C. can only be consumed by a customer at their own site, sold to BC Hydro, or sold to wholesale customers or marketers such as industrial customers, other utilities, or Powerex.

- Specific options for producing and using electricity locally in B.C.:
  - Self-generation (self-contained facility, no size limit)
  - Net metering (0 – 50 kW systems located behind the a customer's meter)
  - Grid-connected Independent Power Producers (IPPs)
    - Sell to BC Hydro
      - < 10 MW (BC Hydro Standing)
      - > 10 MW (BC Hydro competitive calls
    - Sell to large industrial customers, Powerex or other wholesale utilities
  - Create a municipal distribution utility or micro-grid to serve local customers with electricity purchased from BC Hydro and/or local sources.

Self-Generation

- Generating systems may be located behind an individual customer's meter.
- Large facilities can generate and consume electricity within the facility.
- No size limit.
- Any generation supply in excess of customer needs could be sold to BC Hydro (requires special contract) or other wholesale customers (using BCTC's wholesale transmission tariff).
- BC Hydro developed the Large Project Incentive program to help BC Hydro customers implement large energy efficiency and load displacement (self-generation) projects.
- The Large Project Incentive Program offers incentives through a request for proposal process for projects over $1 million.
- All load displacement projects must be approved by BCUC.

Net Metering (0-50 kW)

- BC Hydro established a net metering tariff in March 2004.
- Systems must be owned by the customer and located on the customer's premises, behind their electric meter.
- Systems may be behind an individual residential meter, strata meter (for common electrical systems) or commercial customer meter. This could include municipally-owned buildings.
- If a generator is less than 50 kW in size and meets the criteria for B.C. Clean electricity, it qualifies for net metering.[1]
- A single meter runs backwards when the on-site generator produces more electricity than the customer requires and runs forward when the generator produces less than the customer requires.
- Customers are only billed for their net consumption.
- Customers with an electricity "surplus" in a given billing cycle will be credited for that surplus in the next billing cycle. One year from the start of the net metering service, the customer will be credited for any remaining excess generation at a rate of $0.54/kW.h.

[1] Examples of a clean energy source 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 waste, fuel cells and efficiency improvements at existing facilities.

Grid-Connected Independent Power Producers (IPPs)

- IPPs connect directly to the distribution or transmission grid (not behind a customer meter)
- IPPS may sell to BC Hydro, other wholesale customers (e.g., Fortis, municipal utilities or large industrial customers under BC Hydro's stepped industrial tariff), marketers such as Powerex, or export markets.
- Sales to BC Hydro tend to be the easiest and most cost-effective option for most IPPs.
- There are currently two options for IPPs to sell electricity to BC Hydro:
  - Generators under 10 MW may participate in BC Hydro's proposed standing offer.
  - Generators over 10 MW may participate in a competitive call.

BC Hydro's Standing Offer Program (<10 MW)

- Projects between 0.05 MW and 10 MW can secure long-term electricity purchase agreements.
- BC Hydro expects the program will commence in Spring 2008.
- For the Lower Mainland the base price is $78/MW.h (2007$)
- The base price is then adjusted depending on time of delivery. The adjustment ranges from 72% at a low load hour in July to 126% at a high load hour in February, thus the purchase price ranges from $56/MW.h to $98/MW.h.

BC Hydro's Clean Power Call (> 25 GW.h/year)

- The Call will likely be issued in 2008. The call will be for "clean" energy as defined by the province in its forthcoming guidelines for clean and renewable resources, from projects using proven technologies.
- Projects must deliver a minimum of 25 GW.h per year of seasonal or hourly firm energy.

Municipal Utility

- A municipal utility can purchase electricity from BC Hydro, IPPs, retail customers, or municipally-owned generation.
- Energy services not subject to regulation by the B.C. Utilities Commission, so a municipal utility has significant flexibility in terms of rate setting.
- There are 6 electrical municipal utilities in B.C. New Westminster, Penticton, Kelowna, Grand Forks, Summerland, Nelson.
- A good way to achieve local sustainability objectives and bolster local energy security
- Involves a high initial capital outlay (to acquire the distribution assets), new municipal staff and skill sets, and additional financial risk.
- All of the existing municipal electric utilities in B.C. were established many years ago.
- There is only one recent example of the creation of a new electric utility in B.C. This is the utility established for the Sun Rivers development near Kamloops, which does not actually produce any power, but rather purchases electricity from BC Hydro for sale to residents of the development.

Micro-grid Concept

- An alternative to a full municipal utility is a smaller micro-grid.
- Commonly refers to a discrete local grid that can be disconnected from the “macro-grid” and operated in “islanded mode” with local generating resources.
- In a typical development, the existing local electricity distribution system would simply be extended to individual buildings sites as needed, resulting in multiple connections to the macro-grid.
- Most buildings would also require emergency generation systems under existing building codes. Emergency power would typically be provided by diesel gensets.
- A micro-gird could offer opportunities to pool emergency power requirements at one or more sites within a local area.
- Under current regulations, it may be necessary for the District to own a micro-grid, particularly if the intention is to provide emergency power service and utilize local generation. There would also likely be conflicts with existing (prescriptive) building, electrical, fire and safety codes. These issues would need to be explored further in a more detailed feasibility study.

Technologies for Local Electricity Production

- There are several technologies suited to local electricity production, including:
  - Solar
  - Wind
  - Small Hydro
  - Ocean
  - Biomass
  - Fuel cells (varied fuel sources)
- There are two main factors to consider when assessing potential alternative technologies: 1) availability of the resource, and 2) cost.

- Levelized unit costs are used for comparing alternative electricity technologies with BC Hydro's avoided cost of new electricity supply. For BC Hydro's avoided cost we use $0.079/kW.h, which is the average cost of electricity from a CCGT ($0.072/kW.h), the 2007 Call for Power ($0.086/kW.h), and the Standing Offer ($0.079/kW.h).

Small-Scale Technology Summary

Technology	Ample Resource?	Cost ($/kWh)	Other Issues	Pursue?
Solar PV	- Likely, however varies considerably and limited to rooftops and exposed areas	$0.50-0.60	- Very low conversion efficiency	Possibly
Solar BIPV	- Possibly, though limited to building facades (commercial) and roofs (SFD)	$0.40-1.10	- Affects design, can limit views/glazing	Possibly
Wind	- No, low average wind speeds	$0.06-0.12 (large scale) $0.20-0.35 (small scale)	- Aesthetics, bird flight pattern disturbance, noise	No
Small Hydro	- Numerous site in surrounding area already developed	$0.04-0.09	- Active IPP sector already developing promising sites	Possibly
Ocean	- Wave, current tidal – No - Tidal barrage – ample tidal range but no narrow bay	$0.11-0.25	- Significant ecological impacts with tidal barrage	No
Biomass Gasification	- Yes, ample local wood residue	Not commercial yet	- Promising but 5 years away from commercialization	No
Fuel Cells	- Capable of varied inputs (natural gas, biofuels)	$0.11-0.26	- Low conversion efficiency, natural gas or biogas input	Possibly

Applicable Technologies for Squamish

Solar PV

- If stand-alone, some form of on-site storage is required. Systems can also be integrated into the existing electricity grid, either as part of BC Hydro's Standing Offer or BC Hydro's Net Metering program.
- Solar PV systems are not economically competitive. However, may wish to pursue for other reasons (e.g. profile, environmental objectives).
- Through the Net Metering program, the customer receives a credit for the surplus electricity (if any) supplied to the grid. Payouts are not provided unless there is a net balance in the customers favour at year end. If so, BC Hydro will credit the customer for any remaining excess generation at the Net Metering Rate Schedule of $0.054/kWh.

Solar BIPV

- The viability of solar BIPV is dependent on optimal solar orientation.
- Costs are partly offset by the fact that BIPV displaces standard building envelope components.
- Intangible trade-offs: distinct and fairly uniform appearance (e.g., deep-blue to black in colour), suitable area for BIPV in Squamish is likely much smaller than available building surfaces, surfaces need to be optimally oriented to sun.

Applicable Technologies for Squamish

Small Hydro

- Often economically competitive.
- Unless District wants to develop power projects, we recommend it leave small hydro development to IPPs, who are likely less averse to risk and possess expertise in this area.
- Squamish may want to consider a small hydro project using its own water supply. Currently the District of Lake Country, CRD and GVRD are developing small hydro power projects. District of Lake Country has an Electricity Purchase Agreement secured with BC Hydro. GVRD is awarding a tender for the turbine design/build and intends to go through BC Hydro's standing offer process. The CRD project is going to tender and intends to go through BC Hydro's Standing Offer process.

Fuel Cells

- Small fuel cells (1 kW) are possible. A natural gas or biogas fuel input would be required, potentially compromising environmental objectives. Also, using natural gas/biogas may require the addition of a separate fuel reformer to the system.

IPP Development

- From a policy perspective, the District can only play a limited role in IPP development:
  - Zoning or rezoning allowances to support IPPs (Note: Bill 30 invoked amendments to section 121 of the Utilities Commission Act, which now states that nothing in or done under the Community Charter or the Local Government Act supersedes or impairs a power conferred on the Commission or a public utility.)
  - Information and support for IPP developments (e.g., partner with BC Hydro and/or IPPBC to provide a GIS layer of resource inventories for possible IPP projects)
  - Municipal ownership or co-ownership of IPP projects.
  - Possible link with district energy project (cogeneration opportunities).

Municipal Utility or Micro-Grid

- The creation of a municipal utility or smaller micro-grid is an option for facilitating more use of local generation.
- Significant capital outlays, new municipal staff and expertise, and additional financial risks to the District.
- Only one recent example of the creation of an electric utility in B.C. (Sun Rivers) and that development is fairly simple in that it is largely residential applications with no local generation.
- The most viable near-term step would be the creation of a limited micro-grid, ideally owned by the District (alone or in partnership).
- The micro-grid concept would be most appropriate for a large new development requiring significant upgrading of the existing electrical grid and containing significant commercial and multi-family residential developments that require emergency power back-up under the building code and/or have sensitive power uses (e.g., high-tech industrial facility).
- A detailed feasibility study would be required if such a site were identified.

Net Metering (< 50 kW)

- The best option for the District to advance local electricity production is through BC Hydro's Net Metering program.
- The focus should be on net metering by residents and small businesses because no major new municipal buildings currently planned (to allow municipal implementation of net metering or self-generation)
- BC Hydro's net metering tariff took effect in March 2004. Since that time there has been very little uptake by the public.

Summary by Status (All Applications)

Status	Generator Capacity (KW)	Number of Projects
In Service	238	34
To be in service	25	5
In application stage	99	11
Total	362	50

Source: BC Hydro, Generator Interconnections

Net Metering (< 50 kW)

- The 34 systems currently in service break down by resource as follows:

Summary by Resources (In Service)

Resource	Generator Capacity (KW)	Number of Projects
Hydro	8	2
Fuel Cell	120	1
Photovoltaic	105	29
Wind	5	2
Total	238	34

Source: BC Hydro, Generator Interconnections

Net Metering Challenges

- There are no systems currently installed in Squamish or in the application process.
- The primary reason for the lack of uptake is cost (as demonstrated in the resource/cost assessment). Also, for projects over 5 kilowatts, BC Hydro must undertake a Field Acceptance Test at a cost of up to $600 to the customer.
- The regulatory process is fairly streamlined. Two permits are required: an electrical permit and a BC Hydro intertie permit. Both are easy to get, provided the system is installed by a qualified professional.
- In the case of Solar PV and BIPV the capacity factor is highly sensitive to solar incidence. Solar obstruction from adjacent buildings would prevent adequate solar incidence and greatly affect the economics of solar PV.

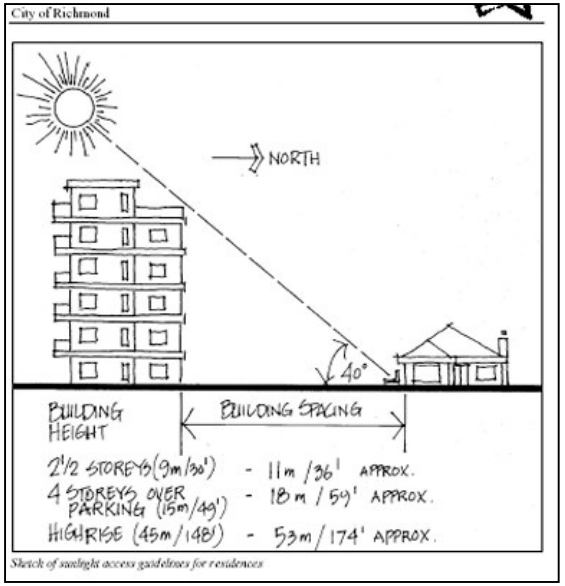
Options for Advancing Solar PV/BIPV and Fuel Cells

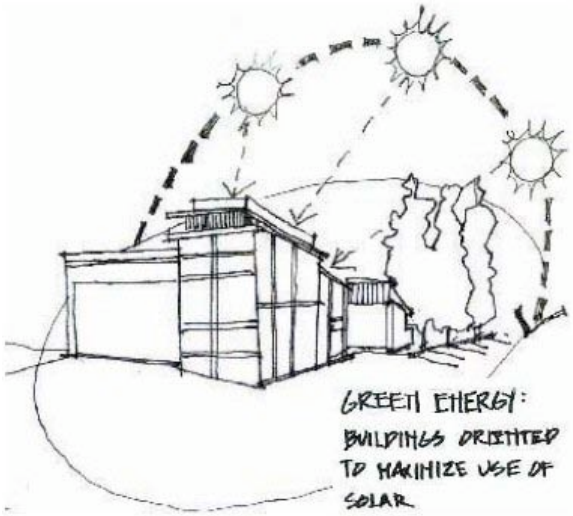
- Several strategies to encourage solar PV though net metering:
  - Ensure the building inspectors are informed about solar PV/BIPV and fuel cell systems and the permit approval process. Even though the permit process does not require their approval, awareness of the technology and permits involved may prevent unnecessary confusion.
  - Remain sensitive to solar obstruction (i.e., consider height, orientation and shadow effects of new development).
  - Consider a Density Bonusing regime for encouraging solar PV/BIPV/fuel cells
  - Consider tax exemptions for Solar PV/BIPV/fuel cells
  - Monitor potential to use Local Improvement Charges
  - Provide information to consumers
- Fuel cells are analogous to energy end-use equipment, like furnaces. There are few policy tools available to municipalities to encourage uptake of energy using equipment. The density bonus tool and tax exemption tool could be used for fuel cells if the District wanted to go in that direction.

Options: Prevent Solar Obstruction

Example 1 – The City of Richmond's Development Permit Area guidelines (s.9.3.2) include:

- a requirement that a minimum of 75% of dwellings & open spaces receive direct sunlight every day of the year; and
- Minimum north-south spacing





Example 2 – The District of Saanich is revising its DPA guidelines to include:

- Provisions to prevent solar obstruction; and
- Provisions to encourage solar orientation, to optimize solar energy collection through the use of solar thermal and photo voltaic (PV) modules.

Policy Options – Density Bonusing

- LGs permitted to grant additional density where specified amenities are provided.
- Squamish is in the process of developing a downtown neighborhood plan and a new zoning bylaw. Zoning for the downtown area will likely max out at 4-6 floors. There may be some room for "bonusing" but not as much as in metropolitan areas.

<u>Example – SFU UniverCity Community Trust</u>

- Grants additional density for:
  - Enhanced stormwater management (5% floor area ratio (FAR) bonus)
  - Enhanced energy efficiency (5% FAR bonus)
  - Alternative energy systems (10% FAR bonus)
- Verification by an approved green building consultant is required

Options: Revitalization Tax Exemption

- Council can establish a revitalization program.
- Councils are free to specify the amounts and extent of tax exemptions available.
- Revitalization tax exemptions are limited to municipal property value taxes and do not extend to school and other property taxes. An exemption may be granted for up to 10 years.
- Section 131.1 of the School Act has specific language around school tax exemptions for approved and eligible alternative energy power projects, though this section should be reviewed by a municipal solicitor to ensure it is a viable option.

MAPLE RIDGE
British Columbia

Example

- The District of Maple Ridge offers a property tax exemption for high-rise residential development that occurs within the pre-designated revitalization area.
- Residential development that meets basic criteria is eligible for a two-year tax exemption. Developments that are LEED® Silver, Gold or Platinum qualify for a four-year tax exemption.

Options: Local Improvement Charges

- Allows municipalities to cover the capital costs of specific improvements to a site or neighbourhood, then recover those costs through the property taxes of the owner(s) that benefit from the improvement.
- With the exception of the Yukon, LICs have not been used to finance energy improvements on private property anywhere in Canada to date. However, a 2007 legal opinion obtained by the District of Central Saanich suggests that B.C. municipalities do have the legislative authority to use LICs for such purposes.
- There is still considerable uncertainty at the Province on the use of LICs for energy purposes. We recommend waiting for greater clarity on this issue before proceeding.

Other Options for Advancing Net Metering

- Partner with BC Hydro to provide consumers with information on the net metering program. There is a useful one page handout available at http://www.bchydro.com/info/ipp/ipp8842.html
- Create an online inventory of links and information for assessing the viability of different technologies, for example:
  - RETScreen (http://www.retscreen.net/) - a decision support tool that can be used worldwide to evaluate the energy production and savings, life-cycle costs, emission reductions, financial viability and risk for various types of energy efficient and renewable energy technologies.
  - HOMER (https://analysis.nrel.gov/homer/) - a computer model that simplifies the task of evaluating design options for both off-grid and grid-connected power systems for remote, stand-alone, and distributed generation (DG) applications.

Summary and Recommendations

- Support for private sector net metering and IPP development is the most appropriate role for the District.
- The District can support IPP development through information-sharing and zoning (though limited).
- The most promising technology for local electricity production is solar PV/BIPV, small hydro and fuel cells.
- Solar PV/BIPV very costly. For BIPV some of the costs can be minimized by offsetting cladding costs.
- The small hydro resource is being developed by IPPs in the region. The District is probably not well-suited to IPP development due to level of financial risk and lack of expertise in project development. One exception may be a partnership to develop small hydro in relation to the District's water supply.
- Fuel cells (with cogen) are less costly than solar PV/BIPV but at minimum double the cost of new electricity from BC Hydro.
- There are numerous local government scale policy tools suited to promoting solar PV/BIPV/Fuel Cells through net metering:
  - Design guidelines
  - Density bonusing
  - Tax exemptions
- The District can also play an active role in providing information on net metering and online technology assessment tools.
- The District can also ensure plan checkers and inspectors are familiar with the permitting process associated with different net metering technologies.

Discussion Question

- Which policy and education tools are well suited to advance net metering in the Squamish context?