



Clean Energy for a Green Economy

An introduction for rural BC communities

May 2010

Community Energy Association

BRITISH COLUMBIA
The Best Place on Earth

Project partners
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About the RuralBC Secretariat, Ministry of Community and Rural Development
The RuralBC Secretariat is a division of the British Columbia Ministry of Community and Rural Development. It provides links between government and rural communities, and support, tools and resources to build resilient rural communities and robust regional economies. Contact: www.ruralbc.gov.bc.ca Tel: 250-387-0220
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About the Community Energy Association
Connecting communities, energy and sustainability
The Community Energy Association is the 'first stop' for local government leaders addressing energy sustainability and climate action. It is a charitable organization and interagency collaboration, with several branch staff throughout British Columbia. The organization assists local governments and First Nations to promote energy efficiency and alternative energy through community energy planning and project implementation.
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Table of Contents

Acronyms in this Guide

BC ..... British Columbia
CEA ..... Community Energy Association
CED ..... Community economic development
CEEP ..... Community Energy and Emissions Plan (or Planning)
CHP ..... Combined heat and power
CPP ..... Community power producer
ED ..... Economic development
FCM ..... Federation of Canadian Municipalities
GHG ..... greenhouse gas (in carbon dioxide equivalents)
HRV ..... heat recovery ventilator
IPP ..... independent power producer
IRR ..... integrated resource recovery
kW ..... kilowatt
kWh ..... kilowatt hour
LFG ..... landfill gas
MOU ..... memorandum of understanding
MW ..... megawatt (a 10 megawatt project typically provides about 40 gigawatt hours per year of energy, or enough electricity to power 4,000 households)
MSW ..... municipal solid waste
NRCan ..... Natural Resources Canada
OCP ..... Official Community Plan
RBCS ..... Rural BC Secretariat
RETScreen ..... Renewable energy and energy-efficient technologies project analysis software
VANOC ..... Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games

Clean Energy for a Green Economy: Introduction

The guide is intended as a starting point, providing an overview of various energy and community economic transition opportunities applicable for rural communities. Links to more in-depth information are included throughout the document, and at the end.

Purpose of this Guide

Clean Energy for a Green Economy is intended as an introduction to the wide range of clean energy strategies and green economy opportunities for rural communities in British Columbia. Rural communities can reap substantial benefits by leading the development of clean energy and energy efficiency, and the transition to a green economy. Primary benefits include:

- improved air quality
- local economic development through attracting investment, clean energy job creation, infrastructure development and keeping energy dollars circulating locally
- increased local energy reliability, resilience and security.

In addition such projects can result in significant greenhouse gas (GHG) reductions, which support local, provincial and global climate objectives.

Clean Energy for a Green Economy is written primarily for local governments and band councils, elected officials and staff, to support an active local government and band role in the development of clean energy and a green economy. It may also be useful to local economic development officers and others with an interest in clean energy and the green economy. The document has been written primarily for rural BC communities: those outside urban centres of the Lower Mainland and Capital Region.

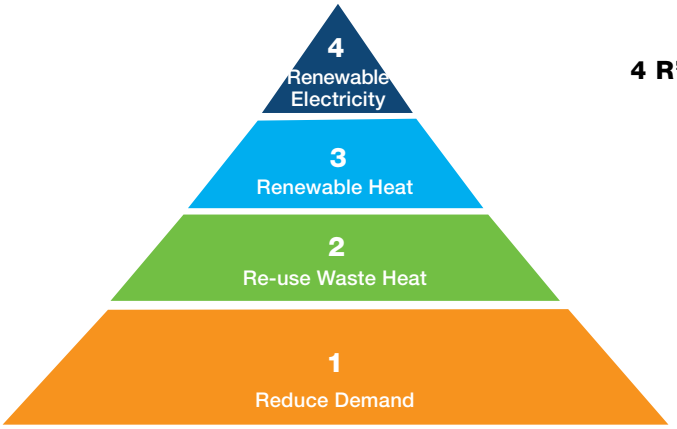
How to Use this Guide

Part One: Clean energy strategies	Introduction to a range of clean energy strategies or types of projects: for each strategy, the guide provides a brief overview, related green economy opportunities, one or more case studies, and information resources.
Part Two: Getting started	Assessment tool for getting started with clean energy strategies and building a green economy: tools for gauging your community's readiness to implement clean energy and energy efficiency, and creating a plan of action to implement an energy project; outline of how clean energy and energy efficiency can help launch a local green economy.

Part One is a primer introducing a variety of clean energy strategies and project case studies from communities throughout BC. Part Two provides a framework to get your community to the stage where it can begin to implement a clean energy or energy efficiency project, helping your community to create new employment and business development opportunities, and transition to a green economy.

The Green Buildings section emphasizes the importance of improving energy efficiency for both new and existing buildings, to reduce community-wide energy demand. This section also includes mechanisms that encourage various renewable heating strategies in buildings. The guide omits several important strategies, such as electricity from biomass, wind and tidal/wave energy; these may be available in future versions; in the meantime, see *Powering Our Communities.*

Links to information resources are provided in blue copy throughout the document, with a full resource list provided at the end.



4 R's of Sustainable Community Energy Planning

1. **Reduce Energy Demand** – through community design, green buildings, and efficient technologies.
2. **Re-use Waste Heat to heat buildings and hot water** – e.g. industrial or commercial waste heat, sewer and wastewater heat recovery.
3. **Renewable Heat Sources to heat buildings and hot water** – e.g. solar and geo-exchange.
4. **Renewable Energy for Electricity** – e.g. biomass/biogas combined heat and power, micro-hydro, wind, solar, tidal and geothermal.

Suggested steps in energy planning. *Concept source: Robyn Wark and Jorge Marques, BC Hydro*

Learn More

BC Climate Action Toolkit
e.g. Quick starts in small and rural communities

Community Energy and Emissions Planning

Funding Your Community Energy and Climate Change Initiatives

BC Hydro Sustainable Communities Program

What is Clean Energy

Energy uses in our communities typically relate to:

- heating and cooling of building space and water
- powering electrical equipment and appliances
- mobility – moving people and goods around.

All of these uses occur in industrial, commercial and residential activities.

For purposes of this guide, 'clean energy' may include:

- renewable heat (e.g. biomass, solar, ground-source and others)
- utilization of waste energy (e.g. landfill gas, agricultural waste, waste heat from industrial and commercial uses)
- renewable electricity (e.g. biomass, run-of-river, wind, solar PV, tidal).

While the guide is primarily focussed on clean energy strategies (which are about the *source* of the energy), the guide also includes green buildings which are based in part on *energy efficiency* as well as on low-carbon energy.

The pyramid above outlines elements of a clean energy strategy, in a suggested relative order of priority. It is important to recognize that energy efficiency – reducing energy demand through community design, green buildings and technology – is the large foundation piece of energy sustainability and greenhouse gas reduction. Harnessing waste energy and developing renewable energy will not serve us well if we continue to use energy inefficiently. The double bonus through energy efficiency is that:

1) energy cost savings remain in the local economy, and
2) energy-efficiency efforts, such as energy retrofits to existing buildings, provide a significant boost to the local economy.

A comprehensive energy and greenhouse gas planning approach (Community Energy and Emissions Planning or CEEP) is recommended, so that any clean energy development is based on a strong foundation of energy efficiency efforts in the community to reduce energy demand.

British Columbians pay on average $4200 per person annually for energy in their communities ... For most communities, 70-80% of money spent on energy leaves town, going to utilities, oil companies, and provincial and federal taxes.

Why Clean Energy

British Columbians pay on average $4200 per person annually for energy in their communities (i.e. electricity, natural gas and transportation fuels), not including energy consumed by industry, airlines, ferries, etc. For most communities, 70-80% of money spent on energy leaves town, going to utilities, oil companies, and provincial and federal taxes.

Local clean energy development and energy efficiency can be drivers of economic diversification in rural BC, presenting opportunities for communities to transition to a green economy, generating long-term economic and community development benefits. A green economy is characterized by low carbon (with renewable energies replacing fossil fuels), low resource depletion and low environmental degradation.

Local clean energy development and energy efficiency can result in the following potential benefits:

Community benefits

Enhanced local energy security
Retrofitted or renewed local infrastructure
Provision of local government or First Nation revenue streams
Reduced infrastructure costs
Insulation from world energy price shocks
Local involvement in, and potential control of, development and use of local energy resources
Enhanced community engagement
New partnerships and collaborations

Environmental benefits

Improved local air quality and health
Reduced greenhouse gas emissions

Workforce benefits

Local job creation and transition
Training and skills development

Economic benefits

Retained energy expenditures in the local economy
Attraction of new business and investment
Competitive advantage in the green investment climate
Leverage of local natural and human resource assets
Innovation and commercialization
Diversified local economy
Expanded and new cross-sector partnerships
Development of local service centres for the broader region.

More and more communities are discovering the benefits of leading on energy efficiency and clean energy development. Will your community be next?

Part One: Clean Energy Strategies

Green Buildings

District Energy

Renewable Heating
Biomass

Renewable Heating
Earth, Water and Air Energy

Renewable Heating
Solar Energy

Integrated Resource Recovery
Waste Heat Recovery

Clean Electricity
Small-scale Hydro

"It is not just about the energy source — efficiency comes first."

Ted Battiston,
manager of sustainability initiatives
Resort Municipality of Whistler

The LiveSmart BC Efficiency Incentive Program resulted in average energy savings per home of 31 per cent and average greenhouse gas reductions of 2.6 tonnes per home per year.

What are Green Buildings?

A 'green building' is designed, constructed and situated to reduce its negative impact on the natural environment and human health, by conserving energy, water and materials, and by reducing or eliminating waste and pollution over the building's lifecycle, from construction to operation. A green building holistically considers indoor environmental quality, material use and waste management, location of the building and proximity to transit and urban services, as well as energy efficiency and clean energy.

This section focuses on the energy dimension of greening new and existing buildings (private and public); specifically on mechanisms communities can use:

- to reduce the amount of heating, cooling and electrical power that buildings use, and
- to incorporate clean energy systems, introduced in the rest of this guide, into buildings.

Effective use of clean energy requires that buildings use energy as efficiently as possible. Several green building and energy-based rating systems encourage high levels of energy efficiency (see ratings table, page 13); such systems may support local policies and bylaws. In addition, buildings should be designed to be ready to utilize clean energy, now or in the future. Sustainability checklists can be an effective start to securing energy innovation through development approval processes.

Existing buildings, community-wide

A comprehensive energy retrofit program for existing buildings has the potential to significantly reduce community-wide emissions, since existing buildings constitute the majority of a community's overall building stock.

Policy and regulation:

- Energy policies and goals in OCP or First Nations Master Plan
- Bylaws requiring energy upgrades during major building renovations

Financial incentives:

- Incentives such as building permit fee rebates, design assistance, support for energy-efficiency audits
- Local improvement charges to help finance neighbourhood-level clean energy systems
- Possible use of local improvement charges or other financing mechanisms to finance energy efficiency or clean energy upgrades for single-detached home upgrades
- On-bill financing programs initiated by utility providers or local governments

Education and persuasion:

- Public education including promotion of federal, provincial and utility energy-efficiency and clean energy programs and incentives; energy fair, trade show or community workshops
- Home energy-efficiency labelling to build a market for efficient homes (e.g. Prince George voluntary program)
- Energy awareness billing for First Nations homes (where the band pays the bill); smart metering
- Training to increase knowledge of energy-efficient construction, clean energy systems, as well as commissioning, maintenance and operations:
  - for local government staff (building inspectors, development permit officials)
  - working with local colleges and training associations to train local trades (e.g. solar hot water installation)

Case Study: Dawson Creek Energy Efficiency in the Community

Heather Banyard is part of a home energy-efficiency assessment team, called Get Dawson Creek Green.
Source: Get Us Green

Description

The City of Dawson Creek is a climate action leader. The City is encouraging energy retrofits in the community by supporting a 10-month community-led project called Get Us Green, providing free energy efficiency surveys to households and businesses, and hosting energy sustainability events. The City provides free advertising and low-flow shower heads. The project is led by local business, Hill Computing Inc. and develops valuable job skills. Other Dawson Creek activities include:

- Energy sustainability throughout the OCP
- Encouragement of commercial building owners to join the Building Owners and Managers Association (BOMA) BESt program
- Encouragement of solar hot water installations throughout the community, and support for Northern Lights College Solar Hot Water Installation Training program
- Municipal green buildings policy.

Rationale

Energy efficiency in residential and commercial buildings; energy sustainability skill training

Status

Completed over 100 energy efficiency assessments by March 2010.

Benefits

Survey results not yet quantified. Participants gain valuable skills.

Funding and financing

Project funded through Canada – British Columbia Labour Market Development Agreement; support provided by: Hill Computing Inc, EnCana, Northern Environmental Action Team (NEAT), City of Dawson Creek, many local businesses and organizations.

Learnings

There is much education to be done to encourage people to act on energy efficiency. Many are not motivated by potential cost savings; focusing on social responsibility.

Information

Get Us Green, City of Dawson Creek, Planning for People

New buildings, community-wide

A high level of energy efficiency and provision for clean energy systems can be achieved in new buildings through energy-aware building design and construction. Local governments and bands can use the following tools to encourage or require new buildings in the community to be energy-efficient and ready to use clean energy now or in the future.

Policy and regulations:

- Energy policies and goals in OCP or First Nations Master Plan
- Incorporate energy efficiency and clean energy into a sustainability checklist for rezoning or major developments; use rezoning or OCP amendment application opportunities to require high-performance buildings and clean energy (see ratings table p. 13)
- Use Development Permit Area guidelines to designate areas of the community where higher levels of energy efficiency, district energy, ground-source heat, or passive solar are encouraged
- Implement solar-ready and/or district-energy-ready bylaws
- Use local service area bylaws to mandate district energy hook-ups

Financial incentives:

- Partner with the development industry to craft incentive packages for energy efficiency and clean energy in new homes, e.g. rebates on building permit fees, design assistance, free audits, construction financing that passes extra costs for energy innovations to the future owner or strata council
- Development cost charges can be waived or reduced for low-impact development
- Tax exemption bylaws can encourage environmental revitalization, e.g. district energy on a brownfield site
- Density bonusing, e.g. additional floor space for amenities such as on-site district energy or energy efficiency
- Expedited approvals and/or reduced permit fees, usually combined with a sustainability checklist

Education and persuasion:

- Builder recognition program
- Training courses for construction and development industry, similar to R2000 program

Case Study: District of Ucluelet Green Building Policy

Ucluelet 6-plex resort. Built Green Platinum 6-plex resort, with solar hot water pre-heat and other features. *Source: Icon Developments Ltd.*

Description District of Ucluelet Green Building Initiatives:

All new Tourist Commercial and Multi-Unit Residential Buildings (MURB) must be built to a minimum LEED™ Silver standard (Aug 21, 2007 bylaw) and/or Built Green Platinum (amended 2009); Ucluelet was the first community in North America to pass such a bylaw.

Publishing a Green Building Guide, and establishing a BuildGreen Network.

LiveSmart Ucluelet – Affordable Housing Energy Retrofit – energy efficiency upgrades to 70 dwelling units (50 MURB units and 20 SFD/Duplex units) with City Green Solutions; target to save 280 tonnes GHG and increase affordability to the operation of the units.

All new municipal buildings must be LEED™ Gold.

Energy Day – OCP engagement event that allowed residents to learn about renewable energy production (wave, PV, micro-wind), energy efficiency, electric vehicles, and setting community-wide energy targets.

Rationale GHG reduction; environmental protection; sustainability

Status 5 Green Building projects at various stages (4 LEED™ Gold; 1 BuiltGreen Platinum)

Benefits Local sustainability; international / national / provincial leadership awards

Funding and financing

Community Action Energy and Emissions (CAEE)
LiveSmart BC Grant
Infrastructure Planning Grant

Governance

Ucluelet Affordable Housing Committee
Build Green Industry Network
District of Ucluelet

Learnings To involve the community and local industry as much as possible, make it a community-based challenge and learning process.

Information

District of Ucluelet Planning Principles
Ucluelet's Approach to Sustainable Development Planning
Ucluelet winning application for 2007 Energy & Climate Action Award
Ucluelet 2008 Energy & Climate Action Award application summary

Local government and band buildings

High levels of energy efficiency and clean energy in public buildings will significantly reduce expenditures in the long run, by saving annual energy costs. For most local governments, an additional value is the reduction in necessary carbon offset purchases. In local government and band buildings, energy-efficiency retrofits are generally the best way to reduce energy use and greenhouse gas emissions, particularly in the shorter term; a green building policy for new public buildings may also be of merit. Greening public buildings builds local capacity, demonstrates leadership and provides a showcase for innovation.

Target and plan:

- Conduct an energy audit, set energy and GHG reduction targets, create an energy and emissions plan (e.g. retrofit plan, clean energy sources, reduce waste, optimize operations, energy-efficient equipment)
- Adopt a green buildings policy for new public buildings, e.g. LEED™ Gold minimum standard

Action:

- Hire an energy manager, or share one with other nearby communities
- Undertake a comprehensive energy-efficiency retrofit program for all public buildings, introducing clean energy (e.g. solar hot water) where practical

Education and persuasion:

- Educate building operators and staff on energy-efficiency techniques and new systems
- Provide public information about local government or band leadership, and cost savings achieved, through energy efficiency and clean energy in community buildings.

Case Study: Castlegar City Hall and Other Operations

Award-winning Castlegar City Hall.
Source: Community Energy Association

Description

An old inefficient City Hall was replaced with a new 12,000 ft² energy-efficient building:

Ground-source heating and cooling system (open loop)
Insulation at R-40
Heat recovery ventilators
Heating controlled by sensors
Radiant heating and cooling slab in lobby
Thermally broken window frames
Energy-efficient elevator
Sun tunnels providing natural light to the upper floor corridor
Daylight photo sensors connected to the lights
Lighting control switch tied to security system
Low-flush toilets
Recycled roof material.

2008 FortisBC PowerSense Award and Community Energy Association Energy Action Award.

Rationale

GHG reduction, reduced energy consumption, and financial savings.

Benefits

The new building is designed to save 50% of the energy or 275,000 kWh per year (est. $24,000 annually) compared to a conventional building of a similar size – GHG savings of about 29 tonnes per year. Potential annual savings of an additional $21,500 or 13 tonnes GHG, when energy-efficiency retrofit measures in other City buildings are implemented as budgeted for in 2010.

Funding and financing

New City Hall cost $4.2 million (on budget and on time), using City reserve funds and FortisBC grant. Energy efficiency retrofits are through the City budget.

Governance

All systems owned by the City

Learnings

City Hall initiative was a major success, now providing impetus for continued energy-efficiency efforts. Public communication about City leadership requires effort, especially about items not visible, e.g. ground-source heating.

Information

City of Castlegar
2008 Winner – Energy Action Award

Planning for Green Buildings — Many of the mechanisms outlined above can form part of your Community Energy and Emissions Plan (CEEP). Support is available, including funding toward a Community Energy Manager to lead this process.

Will green buildings work here?

Energy Efficiency and Clean Energy Questions

- ☑ Have we incorporated energy efficiency and clean energy objectives into the OCP, First Nations Master Plan and operational procedures?
- ☑ Which bylaws, policies and incentives can we consider implementing for existing buildings?
- ☑ Shall we initiate discussions with local developers around incentives for energy efficiency and clean energy in new developments?
- ☑ Do local building inspectors or permit officials, and/or local developers, require additional training / knowledge?
- ☑ What training do staff need to enable them to encourage energy efficiency and clean energy?
- ☑ How can we work with local education and training facilities to encourage them to initiate broader local training for energy sustainability in buildings?
- ☑ Can we work with local utilities to hire an energy manager?
- ☑ Can expertise that exists within energy-intensive industries in the community be better leveraged?
- ☑ Have we completed energy audits of public buildings?
- ☑ Have we completed a comprehensive retrofit program of public buildings?
- ☑ What are potential community concerns and how should the community be engaged?
- ☑ How can we use public outreach and education to communicate the leadership we are demonstrating with energy efficiency and clean energy in public buildings?

Green Economy Opportunities

Plan / Design

- Education and training fostered locally
- Creating new local industry skills to serve surrounding communities
- Develop expertise in designing green buildings that can be exported to surrounding communities
- Instill knowledge in local homebuilders and developers

Build / Install

- Energy retrofits, like other forms of building renovation activity, generally use local goods and services (construction, trades and supplies), benefitting local business
- Creating new industry skills to serve surrounding communities (e.g. energy retrofit firms that can service the region)
- With sufficient demand, create new training programs with local technical colleges to support green, energy-efficient construction

Operations / Maintenance

- Energy-efficiency retrofits to existing buildings, or the design and construction of new green buildings, may foster development of a local clean energy industry

Community Economic Development

- Attraction of related clean energy companies
- Increased local tax base and/or non-tax revenue stream
- Partnerships and collaborations with neighbouring local governments, First Nations and the private sector
- Enhanced community profile and branding

Cowichan Valley Regional District

The Cowichan Valley Regional District is requiring use of air-source or ground-source heat pumps, or equivalent heating systems, as well as passive solar orientation and design, and other energy efficiency measures, through development approval processes. *Source: Cowichan Valley Regional District*

Learn More

BC Climate Action Toolkit website e.g. Quick starts in small and rural communities

Rural BC Secretariat – Economic development guidance

Energy Efficiency & Buildings

Renewable Energy Guide for Local Governments in British Columbia:
- *Heating Our Communities*
- *Policy and Governance Tools*

Community Action on Energy and Emissions (CAEE) project summaries 2005-2010

BC Hydro Sustainable Communities Program – Funding available for community energy and emissions planning, design charrettes, community energy manager, projects (pre-feasibility, feasibility and capital incentives), district energy

Light House Sustainable Building Centre

Rating system applicability to building types

	Existing homes	Existing commercial buildings	New homes	New commercial buildings	Public buildings
EnerGuide for Homes	√		√		
EnerGuide for Commercial & Industrial Buildings		√		√	
Built Green	√		√		
BOMA BESt		√		√	
LEED™ Canada for New Construction & Major Renovations		√		√	√
LEED™ Canada for Homes			√		

Such rating systems may support local bylaws and policies. LEED also has a new standard for neighbourhoods (LEED-ND™)

Who is doing it?

Fifty-four BC communities, including seven First Nations, have participated in the Community Action on Energy and Emissions (CAEE) program to date, most implementing some measures toward green buildings. Highlights plus some other communities:

First Nations

- **Adams Lake Indian Band** - energy planning
- **Coldwater Indian Band** – energy audits and policies, green building standards
- **Ktunaxa First Nation** – energy conservation toolbox for new buildings, audits
- **Musgamagw Tsawataineuk Tribal Council** - alternative energy feasibility studies, action plan, outreach program
- **Seabird Island Band** – action plan, renewables research, communications
- **T'sou-ke First Nation** - renewable energy toolkit for off-grid First Nations, First Nations renewable energy network, solar energy demonstration
- **West Moberly First Nation** – planning, renewable options, building audits

Local governments

- **Campbell River** - energy efficiency checklist for developments requiring a development permit or rezoning; building audits.
- **Cowichan Valley Regional District** – encouraging renewables through development approval processes
- **Kelowna** - sustainable building primer (of potential use to other communities); energy efficiency building checklist
- **Merritt** - incentives for EnerGuide for New Houses building labeling
- **Prince George** - green building plan; incentive program for energy efficiency in new homes (EnerGuide 80 and 82); energy labeling program for existing homes
- **Quesnel** - partnered with BC Hydro and Terasen Gas to hire an energy coordinator to promote energy-efficient home designs, and retrofit 20 homes and several commercial and institutional buildings for increased energy efficiency

"RCEC is currently working with the City of Revelstoke on the Community Energy and Emissions Plan. This will help form the basis of the new RCEC strategic plan."

David Johnson, President, Revelstoke Community Energy Corporation

City of Revelstoke – British Columbia's first renewably-based district heating system, providing heating and hot water to the city core. *Photo: Revelstoke Chamber of Commerce*

Space heating and hot water are major energy demands, and sources of greenhouse gas emissions. Cooling (e.g. for air conditioning, ice rinks, refrigeration) is another significant energy demand. District energy systems can be fuelled by many of the clean energy sources introduced in this guide.

What is District Energy?

District energy is a key strategy for implementation of renewable energy and/or waste heat recovery in a community. District heating systems typically generate heat at a central plant (or series of mini-plants) or recover waste heat from other sources. This heat is transferred to a fluid, usually water, that is then distributed via pipes, to one or more buildings where it may be used for space and domestic water heating. Water is then returned to the heating plant to be re-heated. Cooling can be similarly provided.

A district energy system is an integrated, flexible, energy-efficient and cost-effective way to distribute heating (and/or cooling) to more than one building. A well-designed system is readily adaptable to a variety of clean energy sources, and energy sources can be changed over time.

District energy for a community: Red lines: heating supply; blue lines: cool water return. For a small neighbourhood system, heat may be supplied by solar hot water panels, ground-source heat pumps, a small biomass plant and/or heat recovery from a diesel generator (e.g. in a remote community). *Source: Vital Energi Utilities Ltd*

Who is doing it?

District energy systems operate in municipalities throughout the province, including:

Burnaby (BCIT)
Burns Lake
Grand Forks
Kelowna (Okanagan College and UBC-O)
Kitimat
City of Langley
City of North Vancouver
Prince George (UNBC, Prince George Regional Hospital, Baldy Hughes Therapeutic Community)
Revelstoke
Surrey
Vancouver (South-East False Creek, Central Heat, UBC, BC Children's Hospital, St. Paul's Hospital)
Victoria (Dockside Green, University of Victoria)
Resort Municipality of Whistler.

In addition, many BC communities are actively seeking to implement district energy systems in their communities, including: Burnaby (SFU and UniverCity), Burns Lake, Capital Regional District, Coquitlam, Gibsons, Houston, Kelowna, Township of Langley, Midway, Nakusp, Nelson, New Westminster, District of North Vancouver, Peachland, Penticton, Port Hardy, Prince George, Quesnel, Salmon Arm, Squamish, Summerland, Surrey, Trail and Vancouver.

The most suitable clean energy sources for district energy systems are:

- **waste heat** (e.g. recovered from wastewater treatment, electricity generation or industrial activities)
- **biomass** (e.g. burning woodwaste)
- **biogas** (e.g. landfill gas and sewer gas)
- **solar hot water**
- **ground or water-body heat.**

Although **cogeneration** (simultaneous generation of electricity and useful heat) and the burning of **woodwaste** are commonly associated with district heating globally, other district heating sources available in your community may include **landfill and sewer gas, municipal solid waste, wastewater treatment, and waste heat from industry, refrigeration plants or ice rinks**. In many cases, it is advisable to integrate three to four energy sources into the design of a district energy system, instead of relying on a single source; this can increase resilience and improve economic benefits.

Will it Work Here?

Zones of higher-density development are the best candidates for connection to a district heating systems. A rural community may have a village centre, or cluster of buildings such as a school, hospital, recreation centre, band or government buildings and nearby residences and businesses; these could possibly be served by district energy. A district energy system can be as small as serving just two buildings, or serving a small neighbourhood. New developments, where community-scale infrastructure will be planned and installed, and where the purchase of heating equipment for individual buildings can be avoided, are ideal candidates for district heating. Low-density developments (such as distributed single-family housing) are less suitable for district heating, due to larger distances over which heat must be distributed.

How district energy can be used in the community

Residential & mixed use	Good potential where new high density, mixed-use developments are being planned Multi-unit clusters are best candidates
Commercial & institutional	Good potential where there is a cluster of varied energy demand Potential for combined heat and power (CHP) production
Government operations	Provincial, local government and First Nations buildings, and health and education institutions can be the impetus and anchor for a larger community system

District energy should be integrated into local growth plans, encouraging development in areas serviced by the system, and planning for future expansion. Ideally, timing of laying of district energy pipes should coincide with other sub-surface infrastructure work, to save costs. System design should be modular so that it can be extended to new users who wish to join the system at a later date. Service area bylaws can ensure both existing and new buildings connect to the district energy system.

UK's growing commitment to district heating

Local planning authorities should assess their area for opportunities for decentralised energy. The assessment should focus on opportunities at a scale which could supply more than an individual building and include up-to-date mapping of heat demand and possible sources of supply. Local planning authorities should in particular look for opportunities to secure:
i. decentralised energy to meet the needs of new development;
ii. greater integration of waste management with the provision of decentralised energy;
iii. co-location of potential heat suppliers and users; and,
iv. district heating networks based on renewable energy from waste, surplus heat and biomass, or which could be economically converted to such sources in the future.

Planning Policy Statement 1: Delivering Sustainable Development, LCF1.4

Learn More

BC Climate Action Toolkit

Rural BC Secretariat – Economic development guidance

Fact Sheet: *District Energy Sector in British Columbia*

Renewable Energy Guide for Local Governments in British Columbia:
- *Heating Our Communities*
- *Utilities and Financing*
- *Policy and Governance Tools*

Resources from Waste: A Guide to Integrated Resource Recovery

BC Hydro Sustainable Communities Program – Funding available for community energy and emissions planning, design charrettes, community energy manager, projects (pre-feasibility, feasibility and capital incentives), district energy

Canadian District Energy Association

IMBY (In My Backyard) Energy Project

Clean Energy Questions

- ☑ What are my community's sources of low-cost heat?
- ☑ Are these available for the long-term?
- ☑ Is there a mixed-use development fairly close to available heat source(s)?
- ☑ Is there a hospital, rink or pool close to mixed-use development?
- ☑ Can public sector buildings (that share a carbon neutral commitment) serve as an anchor for a broader district energy system?
- ☑ Are there new developments that can be encouraged to incorporate district energy?
- ☑ Can we time the laying of district energy pipes to coincide with regular infrastructure improvements, or with new infrastructure installations, to save installation costs?
- ☑ How can our local government or band play an active role to encourage district energy?
- ☑ Should the local government or band own and/or operate the district energy utility, fully or in part?
- ☑ What are potential community concerns and how should the community be engaged?

Green Economy Opportunities

Plan / Design
- R&D in local colleges, universities and manufacturing firms
- Creation of new local industry skills to serve surrounding communities

Build / Install
- Installation of district energy system
- Building of local industry skills to serve surrounding communities

Operations / Maintenance
- Establishment of a local energy utility
- Utilization of local energy resources to fuel the system, including supporting local industry through use of waste heat or waste biomass
- Ongoing operation and maintenance of the system

Community Economic Development
- Attraction of related clean energy companies to form a clean energy hub
- Increased local tax base and/or non-tax revenue stream
- Partnerships and collaborations with neighbouring communities, First Nations and the private sector
- Enhanced community profile and branding

Laying of insulated district heating pipes in Revelstoke. *Source: Revelstoke Community Energy Corporation*

Case studies

City of Revelstoke biomass district heating, and Whistler Cheakamus Crossing neighbourhood wastewater district heating are presented here as case studies. A small-community biomass district heating system, Baldy Hughes treatment centre near Prince George, is presented as a case study in the biomass section which follows. The Okanagan College campus heating loop is presented in the heat recovery section.

Case Studies: Revelstoke and Whistler District Energy

Revelstoke: Biomass

Description City of Revelstoke low-temperature district heating system: launched 2005; provides hot water heating and domestic hot water to city core buildings (school, community centre, aquatic centre, hotels, offices, church); burns woodwaste from Downie Timber sawmill, providing hot water for district energy, and low pressure steam for Downie's drying kilns (1.5 Megawatt clean-burning biomass boiler; 1.75 MW back-up propane boiler; 2.3 km insulated piping).

Rationale Potential mill closure due to air pollution from silo burning
Improved air quality by reduced silo burning; and GHG reduction
Renewable energy source; propane import displacement
Incremental plant expansion opportunity
Value-added use of woodwaste; local processing of local resources.

Status Phase 1: operational 2005, served 6 buildings and kilns
Phase 2: added four buildings to the system
Revelstoke Community Energy Corporation (RCEC) is currently working with City of Revelstoke on the Community Energy and Emissions Plan which will help form the basis of the new RCEC strategic plan.

Benefits
Improved air quality (diversion of waste from silo burner)
GHG reduction 3,400 tonnes annually
Retained sawmill employment
Lower energy costs and price stability for customers
Long-term stable energy pricing and increased energy resilience
No need for a boiler and boiler maintenance; space saving in building
'Win-win' solution to woodwaste
Return on investment 5.3% (over 25 years); simple payback 13 years
Return on equity 8.8% (over 25 years)
Non-tax and non-taxable source of City revenue
One FTE; plus jobs in construction, fuelling, maintenance, etc.

Funding and financing Total project $7.0m: FCM Green Municipal Funds $1.81m grant and $1.35m low-interest loan; Towns for Tomorrow grant $0.375m; wholly-owned City subsidiary interest-free loan $1.25m; City of Revelstoke $1.2m preferred shares; credit union loan.

Governance Owned and operated by municipally-owned Revelstoke Community Energy Corp (RCEC).

Learnings
Steep learning curve in project development (demise of proposed cogeneration project); boiler staffing requirements; change in wood supply; technical challenges. Ultimately a very successful project.
Fuel supply guarantee is crucial.
An experienced and integrated project development team can reduce development risks and cost overruns.
Early community engagement is beneficial.

Information City of Revelstoke, Natural Resources Canada

Whistler district energy, heated by wastewater effluent, provides space and water heating to Cheakamus Crossing (Whistler Athletes Village), reducing GHGs by 90-95% compared with traditional methods. *Source: David McColm Photography*

Whistler: Wastewater heat recovery

Project Whistler Athletes Village (Cheakamus Crossing neighbourhood): District energy, using low-temperature water, warmed by wastewater effluent (via a heat exchanger), provides 95-99% of space heating requirements and more than 50% of domestic hot water requirements for entire ~375,000 ft^2 Athletes Village neighbourhood; located beside a wastewater treatment plant due for upgrades; LEED-ND™ pilot (LEED™ for new developments). All units (primarily multifamily duplexes and triplexes) designed to achieve Energuide 83.

Rationale Provision of housing; sustainability commitment.

Status Operational 2010; hosted 2010 Olympic and Paralympic athletes; final commissioning.

Benefits GHGs 90-95% less than conventional heating technologies; energy costs to homeowners expected to be 12%-20% less than in comparable existing units in Whistler.

Funding and financing Energy system cost $4.1m, recovered through sale of residential housing; operational costs will be recovered through a Local Area Services designation.

Governance Municipally owned; development managed by the municipality's wholly-owned subsidiary, Whistler 2020 Development Corporation; supported by Province of British Columbia, Government of Canada and VANOC.

Learnings System required neighbourhood planning and sufficient densities to support energy infrastructure and available heat resources. Low temperature water allows for uninsulated piping, reducing costs. It is not just about energy source, efficiency comes first.

Information Cheakamus Crossing Neighbourhood

Caution: Consider long-term feedstock supply when building heating infrastructure.

Photo: Revelstoke district energy fuel bin. *Source: Revelstoke Community Energy Corporation*

Biomass and biogas are significant renewable energy sources for a wide range of energy needs, including heating, electricity generation and transportation fuels. This section focuses on wood combustion and gasification for heating, either through district energy or in individual buildings; the section can apply to combustible agricultural wastes as well. Other forms of agricultural waste, municipal waste (liquid and solid), landfill gas, and other biomass decomposition processes are included in the *Integrated Resource Recovery* section, dealing with 'waste' recovery.

What are Biomass Combustion and Gasification?

Biomass refers to renewable organic matter; here we are primarily referring to woodwaste resulting from the forest industry, construction or demolition. Combustion of biomass harvested sustainably is considered carbon neutral. Widespread availability of biomass in forest-rich British Columbia, particularly in areas affected by pine-beetle kill, makes biomass an attractive option for many community applications.

Direct Combustion

Many forms of wood biomass can be directly burned to generate hot water or steam, which can then be used to heat individual buildings or for district heating

"The only thing static about fibre availability, is that it is highly dynamic."

Don Gosnell, Ministry of Forests and Range

Who is doing it?

Combustion

Revelstoke biomass district energy
Baldy Hughes biomass district energy
University of Northern BC, Prince George campus - wood pellet boiler at I.K. Barber Enhanced Forestry Lab
Kalamalka Research Station office and two greenhouses heated with wood pellet boiler and solar hot water system
Westbank First Nation 22,000 ft² office and industrial space heated with wood pellet boiler system
Huber's Furniture 30,000 ft² plant in Vernon, heated with woodwaste from manufacturing process
Nazko School in Quesnel, heated with a wood pellet boiler
Structurlam Products in Penticton, plant heated with woodwaste from manufacturing
Williams Lake Generating Station major biomass facility with 60 MW electrical capacity
Many BC greenhouses combust wood pellets or woodwaste for energy
Many mills have large-scale biomass combustion for heat or combined heat and power (CHP) production

Gasification

Dockside Green biomass district energy
Tolko plywood mill in Heffley Creek, woodwaste gasification system to heat hot water and dry veneer
UNBC to install a Nexterra system for central Prince George campus
UBC to install a Nexterra cogeneration system at Vancouver campus
Kruger Products in New Westminster will use syngas from gasified wood residue

systems, and/or to generate electricity. Pellets and wood residue from mills such as sawdust, chips, bark or hog fuel can be burned in modern biomass boilers with sophisticated emissions controls, which if regularly maintained and depending on feedstock, can result in minimal particulate emissions.

Mills can have a ready availability of woodwaste and also a need for heat, usually in the form of low pressure steam. By burning their woodwaste for energy, mills can reduce costs of disposal and environmental liabilities associated with using silo or 'beehive' burners. Sawmills typically produce more woodwaste than they can use for heating, so woodwaste and/or heat may be available for other uses such as a district heating system. With fluctuating supply and demand and fluctuating prices, long-term woodwaste supply contracts may be difficult to establish, particularly for larger projects.

For individual home heating, new woodstove technologies including advanced combustion and pellet stoves, have boosted heat output and reduced air quality concerns. Pellet stoves and boilers are able to operate automatically, controlling heat output and emissions with a high degree of precision.

Gasification

Gasification is production of gas from biomass by adding heat without sufficient oxygen for combustion. This causes biomass to gasify into a mixture of hydrogen, carbon monoxide and methane, known as syngas, which can then be cleanly burned for heat.

Will it Work Here?

Key factors in cost-effective use of wood biomass for heating are fuel availability and a nearby use for the heat generated; communities with nearby, stable, long-term supplies of woodwaste are the most likely candidates.

How wood biomass can be used in the community

Residential	Multi-unit and single-family residential are good candidates for biomass heating of space and water. Use of advanced woodstoves and pellets should be encouraged, for efficiency and air quality.
Commercial & institutional	Well-suited for space heating and hot water heating Potential for combined heat and power production Potential for greenhouse heating
Public sector buildings	Heating recreation centres and other buildings, and domestic hot water Public buildings can anchor larger community projects

Biomass plants do generate air emissions, including nitrogen oxides, carbon monoxide, particulate emissions and sometimes sulphur dioxide; use of advanced emission controls in well-maintained systems can reduce levels to well below provincially-required limits. A primary driver for the establishment of a biomass

District of Houston

Houston was the first local government in Canada to mandate fuel efficiency for solid fuel burning appliances and removal of non-efficient appliances by 2010. The District also investigated development of a district heating system, based on key District facilities.

Learn More

BC Climate Action Toolkit

Rural BC Secretariat – Economic development guidance

Renewable Energy Guide for Local Governments in British Columbia:
- *Heating Our Communities*
- *Utilities and Financing*
- *Policy and Governance Tools*

Information Guide on Pursuing Biomass Energy Opportunities and Technologies in British Columbia – for First Nations, Small Communities, Municipalities and Industry

Fact Sheet: *Bioenergy Sector in British Columbia*

BC Bioenergy Strategy

Resources from Waste: A Guide to Integrated Resource Recovery

Ministry of Environment education materials on wood stove use and air quality

BC Bioenergy Network

Northern Bioenergy Partnership

Beetle Action Coalitions:
- Cariboo-Chilcotin
- Omineca
- Southern Interior

Green Heat Initiative

Baldy Hughes fuel silo.
Source: Del-Tech Manufacturing Inc.

district heating system in Revelstoke was to divert woodwaste from the local silo burner – a main source of air pollution. Air emissions from old residential woodstoves are a more significant air quality issue than emissions from advanced biomass burners.

Local governments and band councils can foster major community economic development opportunities by connecting biomass heat producers with potential heat consumers. Where heat cannot be used by the facility that produces it, there may be options for a district heating system to serve other buildings in the community. Greenhouses may provide synergistic business opportunities, as they require large amounts of heat and may be flexible in their location. To facilitate economic development, proactive consideration should be given to adjacent energy uses and potential for synergies when issuing development permits and rezoning.

Clean Energy Questions

- ☑ Is there a nearby source of biomass? Type? Quality? Quantity? Availability?
- ☑ Could a long-term feedstock supply contract be negotiated?
- ☑ Is there a heat need within economic reach of the biomass source?
- ☑ Is the energy use best suited to district heating or individual buildings?
- ☑ Is there potential to produce electricity as well as heat?
- ☑ Can public buildings serve as an anchor for a biomass project?
- ☑ Can air quality be sufficiently protected?
- ☑ Should clean-burning super-efficient appliances in homes be encouraged?
- ☑ What are potential community concerns and how should the community be engaged?

Green Economy Opportunities

Plan / Design
- Creating new biomass-related technical expertise

Build / Install
- Pellet, puck and other biomass manufacture and sourcing
- Reducing transportation and/or disposal costs of woodwaste
- Supporting the local forest industry by adding a new revenue stream for mill residues, enhancing economic viability

Operations / Maintenance
- Phasing out polluting silo burners and burning of roadside debris; improved air quality and attracting residents
- Creating new biomass-related technical expertise

Community Economic Development
- Attraction of other biomass-related companies
- Increased local tax base and/or non-tax revenue stream
- Partnerships and collaborations with neighbouring local governments, First Nations and the private sector
- Enhanced community profile and branding

Case Study: Baldy Hughes Biomass District Heating

Baldy Hughes Residence. *Source: BC New Hope Society*

Description

Baldy Hughes Addiction Treatment Centre and Therapeutic Community (owned and operated by BC New Hope Society): Long-term residential community for over 80 people (22 buildings on site), near Prince George; projected expansion to 500 people; wood pellet district heating system operational 2009 (no propane for peaking or backup), 8 buildings first phase (buildings previously used propane); system by Del-Tech Manufacturing Inc.; Pacific Bioenergy donated 100 tonnes of pellets toward initial system start; long-term pellet purchase agreement in place. Planned Phase 2: combined heat and power (CHP) plant to heat all buildings on site and for the site to undertake a greenhouse operation; proposed Phase 2 fuel is green biomass locally available.

Rationale

Reduction of fossil fuel use; demonstration of a renewable energy system that can readily be used throughout many small communities and institutions; and long-term fuel cost reduction

Status

Phase 1 operational 2009

Benefits

GHG reduction: approx. 190 tonnes /year

Fuel cost reduction: 30-50% compared to propane previously used (depends on distance of propane or pellet travel)

Local employment: Logging; local wood pellet manufacturing from Pacific Bioenergy in Prince George (from beetle-kill biomass); pellet transport; technology and system manufacturing, installation and servicing from Del-Tech Manufacturing Inc (Prince George); local operator on-site.

Comfort: More comfortable indoor temperatures than with previous propane heat

Funding and financing

Funders: ICE fund, Northern Development Trust, BC New Hope Society, Del-Tech Manufacturing Inc.; pellet start-up contribution from Pacific Bioenergy

Governance

Owned by BC New Hope Society

Learnings

Fuel delivery, storage and feed systems: build as automated as possible, and maximize speed of fuel deliveries to storage silo.

Project too small to pursue Pacific Carbon Trust offset money, due to reporting and verification cost.

Closer proximity of buildings would reduce cost of extending pipes.

Information

Del-Tech Manufacturing Inc.

Baldy Hughes Addiction Treatment Centre and Therapeutic Community

This Community Cares

"Tk'emlúps Indian Band is proud to lead the way in innovative, quality development on reserve land in Canada while maintaining our cultural and environmental stewardship over our lands and providing opportunities for our people."

Chief Shane Gottfriedson, Tk'emlúps Indian Band

Photo: Sun Rivers Golf Resort Community – each home heated by geo-exchange. *Source: Bob Huxtable and Sun Rivers Golf Resort Community*

Energy for heating (and cooling) can be tapped from the world around us – from the earth, lakes, rivers, ocean and even the air – using heat pumps.

What are Heat Pumps

A heat pump operates similarly to a refrigerator, extracting heat to heat air or water, which is then used to heat a house or building; most can reverse the process, providing both heating and cooling. Heat pumps usually require electricity to operate, and their efficiency increases the closer the source temperature is to the required temperature. These systems typically use one-quarter to one-half of the electricity, or less, than baseboard heaters and, unlike natural gas, produce no direct greenhouse gas or local air emissions. (Heat pumps are also used for heat recovery, discussed in the *Integrated Resource Recovery* section.) In addition to providing energy for district energy systems, heat pumps may be used for individual heating and cooling applications, both in individual buildings and also for clusters of individual buildings ('distributed' applications).

Earth and Water Energy

Ground-source heat pumps (or 'geo-exchange' systems) use the earth's natural heat for heating and cooling buildings, via horizontal or vertical liquid-filled ground 'loops'. Horizontal loops are generally cheaper to install, but require a larger space for installation. Vertical loops fit into a smaller space, but may be more costly depending on ground-drilling conditions.

At Sun Rivers, Corix Utilities installs and manages vertical ground-source heat loops as community infrastructure. Residents are billed a monthly ground loop access fee as part of their utilities, and save on monthly energy bills. *Source: WaterFurnace International*

Who is doing it?

Sun Rivers Golf Resort Community, Tk'emlúps Indian Band
Wilden Estates Kelowna
Town of Gibsons community-owned district energy
Oliver Curling Club
South Cariboo Ice Arena
Houston Leisure Centre
Salmon Arm City Hall
Elkford Fire Hall
Castlegar City Hall
Township of Langley City Hall
Grand Forks Aquatic Centre, arena and curling rink – air source heat pumps (see Grand Forks Case Study in Solar section)
Nelson installing system to heat/cool Selkirk College dorms
Kaslo City Hall
Regional District of Kootenay Boundary Admin building, Trail – installation summer 2010
Cristina Lake information and arts centre
Whistler, multiple buildings
Vancouver city works yard
Many schools e.g. Crawford Bay Elementary-Secondary School

Water-source heat pumps use lakes, ponds, rivers or the ocean as a heat source; they work in much the same way as a ground-source heat pump.

Most systems are closed loops – water is not exchanged with the environment; in 'open-loop' systems, water from the ground or a water body is drawn into the system, used for heating or cooling, and returned back to the environment.

The benefit of ground- and water-source heat pump systems in comparison with air-source heat pumps is that ground and water temperatures are relatively stable throughout the year, as compared to air temperatures. Higher ground temperatures in winter and cooler temperatures in summer mean improved efficiency throughout the year. Use of the system for cooling, as well as heating, can recharge the field with heat for use in winter.

Energy from the Air

Air-source heat pumps are the most common heat pump type, and are typically used in houses and small commercial buildings. They extract heat from the outside air and deliver it into a room or ventilation system for a building; for cooling, the pump is reversed and used as an air-conditioner. Most air-source heat pumps cut out near -10°C, below which auxiliary electric or gas heat is used; while most efficient applications are in year-round mild climates, such as coastal BC, they can provide excellent renewable energy applications throughout the province. The Grand Forks Aquatic Centre, ice arena and curling rink make extensive use of air-source heat pumps. (See the Grand Forks case study in the Solar Energy section.)

Will it Work Here?

Applicability of ground-source heating depends largely on heating loads and ground conditions. Ground-source heating in major residential developments, including Sun Rivers Golf Resort (near Kamloops) and Wilden Estates (Kelowna), are demonstrations of how geo-exchange can be successfully used to heat our communities. For individual building projects, the economics will be best for buildings with both heating and cooling requirements, long operating hours and adequate space to install a ground field. Air-source heat pumps are quite broadly applicable in British Columbia.

How earth, water and air energy can be used in the community

Residential	Vertical fields are common due to property space limitations High installation costs overcome by large-scale projects installing many individual fields at one time (e.g. Sun Rivers, Wilden Estates)
Commercial & institutional	Potentially better heating load requirements than residential Adjacent playing field is ideal; parking lots are a possibility for ground-field; buildings in denser areas may require vertical fields
Government buildings	Ground-source can be considered for most new public buildings Ground-source systems are used effectively in multi-purpose recreation facilities, e.g. arenas, swimming pools, gymnasiums, day care centres, running tracks and offices; they can be configured to simultaneously serve heating and cooling needs of different areas. Rooftop heating/cooling units in small buildings can usually be replaced with air-source heat pumps when equipment is due for replacement.

Gibsons

The **Town of Gibsons** won the *2009 Energy & Climate Action Award* in the **Community Planning and Development category** for development of the Upper Gibsons Neighbourhood Plan. The centerpiece of this neighbourhood plan is the new **Upper Gibsons Geo-exchange District Energy Utility**. The first of its kind in North America, this system, which will be owned and operated by the municipality, will provide renewable earth energy heating to all new buildings in Upper Gibsons, reducing GHG emissions from heating and hot water by an astonishing 96% (1,450 tonnes). This innovative project will result in energy cost savings of $350,000 annually and about 1/3 of that will be returned to residents as energy cost savings.

The *Energy & Climate Action Award* is sponsored annually by the Community Energy Association, Province of British Columbia, Union of BC Municipalities and BC Hydro.

Learn More

BC Climate Action Toolkit

Rural BC Secretariat – Economic development guidance

Encouraging and Implementing Ground-Source Heating in Development Projects

Renewable Energy Guide for Local Governments in British Columbia:

- *Heating Our Communities*
- *Utilities and Financing*
- *Policy and Governance Tools*

GeoExchange BC

Video explaining geo-exchange

Clean Energy Questions

- ☑ Is a new development proposed adjacent to a school field or parking lot, where a horizontal ground-source field could be situated?
- ☑ Do soil conditions permit easy vertical drilling?
- ☑ Could developers be encouraged to incorporate ground-source heating into major developments?
- ☑ For a new ice rink, has the use of ground-source heat pumps been investigated?
- ☑ Is there a local water body which could support a water-source heat pump?
- ☑ Are air-source heat pumps supported by the local climate?
- ☑ When are rooftop heating units due for replacement on public buildings?
- ☑ How can local government and band policies encourage the use of ground-, water- and air-source heat pumps?
- ☑ Is a geo-exchange based district energy system a possibility?
- ☑ What are potential community concerns and how should the community be engaged?

Green Economy Opportunities

Plan / Design

- Possible development of local engineering expertise in system evaluation, sizing, design and implementation; expertise could support other communities.

Build / Install

- Local developers familiar with heat pumps are better positioned to integrate these technologies into developments

Operations / Maintenance

- Potential community-owned geo-exchange district energy system, with either in-house or contracted operations and maintenance
- Possible attraction or development of a distributed energy utility that owns the geo-exchange systems in individual homes.

Community Economic Development

- Attraction of related clean energy companies
- Increased local tax base and potential non-tax revenue stream
- Potential to insulate local residents against energy price fluctuations
- Partnerships and collaborations with neighbouring local governments, First Nations and the private sector
- Enhanced community profile and branding

Laying of horizontal geo-exchange loops at LEED™-Gold Crawford Bay Elementary-Secondary School, Crawford Bay, BC; and finished school. *Source: Adam James, Community Energy Association*

Case Study: Sun Rivers Geo-exchange Community

Six neighbourhoods along Sun Rivers Drive, Sun Rivers Clubhouse and the "soon to be" Village Centre. *Source: Bob Huxtable and Sun Rivers Golf Resort Community*

Description

Projected 2,000-home Sun Rivers Golf Resort Community; all residential and commercial buildings to have vertical geo-exchange systems for ground-source heating and cooling; all homes have two separate water mains (filtered and treated water for drinking, and untreated water for outside irrigation); large number of BuiltGreen Platinum homes; Green Dream Home (near net-zero annual energy consumption) CMHC EQuilibrium™ Sustainable Housing Demonstration; will feature a village centre and community amenities; site on Tk'emlúps Indian Band land adjacent to the City of Kamloops.

Rationale

Tk'emlúps Indian Band and the developer saw economic opportunity in their partnership creating a more environmentally sustainable community development; environmental benefits, long-term energy affordability.

Status

550 homes (single family and condos) built to summer 2010 (approx 1000 people); projecting 10-year build-out to 2000 homes. EQ house (net-zero energy showcase) completed.

Benefits

Residential economic benefits: Residents pay the same or up to 30% less than other residents in the region, for heating and water utilities.
Estimated GHG savings: 3 tonnes per home/yr
Band receives property taxes, rebating 29% to Sun Rivers Services Corporation (SRSC) for on-site services
First Nations employment (e.g. construction, grounds maintenance, restaurant)
National First Nations leadership and profile

Funding and financing

Cost of geo-exchange system per home approximately $15-25,000; this cost is managed and recovered by Corix Utilities; costs are recovered from customers through monthly ground loop access fees.

Governance

Project partnership between Tk'emlúps Indian Band, Government of Canada and the developer. Original utility services including geo-exchange systems were funded and owned by SRSC; utilities were sold to Corix Utilities, which now owns them and manages them. The Band issues building permits and business licences. There is good regular communication between SRSC and the Band.

Learnings

The Band and developer pioneered a positive relationship based on environmental innovation, which continues to yield rewards for both.

Information

Sun Rivers Golf Resort Community
Green Dream Home
Tk'emlúps Indian Band

"Certainly we would recommend a solar and heat recovery hybrid system to all public pools in BC, especially when they have an ice rink nearby."

Susan Huber,
Swiss Solar Tech Ltd.

Photo: Solar panels on Dawson Creek City Hall, for domestic hot water. *Source: City of Dawson Creek*

Solar energy reaching the earth from the sun dwarfs all other forms of energy used by humans; solar energy is vastly underutilized as an energy source. It is clean, plentiful, renewable and, depending on the site, easy to access.

What is Solar Heating?

Solar energy can go a long way to meeting the heating needs of communities. It is a myth that solar heating is inappropriate in BC, due to cold temperatures and lack of sunshine; an enormous quantity of solar energy reaches most of the province throughout the year.

A solar hot water system will supply up to 60% of hot water used in a typical BC home annually; in summer months, it would meet all residential hot water needs, while in winter a backup system is needed. BC has a similar climate to many western European countries, including Germany, one of the world leaders in solar hot water.

Three methods of capturing and using solar energy for heating:

1) **Solar water heating**: used for domestic or commercial water use; where significant hot water load, e.g. pools, showers; indoor space heating; one of multiple heat sources for district heating

Solar hot water in BC

A solar hot water system will supply up to 60% of hot water used in a typical BC home annually; in summer months, it would meet all residential hot water needs, while in winter a backup system is needed. BC has a similar climate to many western European countries, including Germany, one of the world leaders in solar hot water.
Source: SolarBC

Who is doing it?

Solar Communities – see Case Study page, this section
Tofino
Dawson Creek
West Moberly First Nation
Kelowna
T'Sou-ke First Nation
Whistler
District of North Vancouver
Saanich
Vancouver
Grand Forks Aquatic Centre – see Case Study, this section
City of Quesnel recreation centre
Corporation of Delta municipal hall
Regional District of Nanaimo transportation administration building
Town of Ladysmith city hall
City of Port Coquitlam Hyde Creek Recreation Centre, saving an estimated $4000 annually from its solar-hot-water-heated pool
City of North Vancouver solar hot water panels on the library, supplying hot water for downtown district heating system, reducing natural gas use
First Nations schools and many other schools
Peace River North School District #60 3 solar walls

Description and considerations
- Roof-mounted solar panels heat water (or a water/antifreeze solution) as it passes through the collector; a pump and heat exchanger then transfer the energy to a hot water storage tank.
- Solar water space heating is best incorporated from the outset in design of new buildings.

2) **Solar air heating (solar wall)**: used for space heating; any building with a south-facing wall and a requirement for ventilation; industrial facility, operations building, retail shop, school, home

Solar wall on Dr. Kearney Junior Secondary School, Fort St. John – one of 3 solar walls in the school district, all working well, highly recommended by the school district, especially for new buildings.
Source: Peace River North School District #60

Description and considerations
- Sunlight heats air required for ventilation, prior to its entry into a building, through suspension of a large, dark coloured metal panel on the south face of a building. Air is drawn up the side of the building, gathering heat, to a fan intake near the roof.

3) **Passive solar heating**: used for space heating; residential, commercial, institutional, local government and band operations

Description and considerations
- Capturing heat within the material of the building and slowly releasing it when the sun is not shining; building design emphasizes south-facing windows, and thermal mass (such as masonry, concrete or adobe) in walls and floors to act as a solar collector, heat storage or battery and distribution system.
- One of the most cost-effective ways to significantly reduce energy use without increasing construction costs; encouraged by bylaws and policies protecting solar access (restricting blockage).

Installing solar hot water panels.
Source: *Swiss Solar Tech Ltd.*

Will it work here?

Solar energy is a clean, renewable resource, sufficiently available almost everywhere in the province. Solar heating is financially viable over its life-cycle, and can be applied on a small or large scale with well-established technology. There are many applications for solar heating, of both water and air, throughout the community and in local government and band operations. Federal and provincial governments offer funding incentives.

Learn More

BC Climate Action Toolkit

Rural BC Secretariat – Economic development guidance

Fact Sheet: *Solar Energy Sector in British Columbia*

SolarBC – Solar hot water support

Renewable Energy Guide for Local Governments in British Columbia:
- *Heating Our Communities*

How solar heating can be used in the community

Residential	Both multi-unit and single unit are good candidates for solar water heating due to high domestic water load. Outdoor swimming pools are a good application. New and retrofitted houses are introducing solar-heated water for space heating, e.g. through in-floor water coils. Passive solar is highly appropriate.
Commercial & institutional	Buildings with high domestic water loads such as hotels, laundromats, car washes and hospitals provide the best opportunity for solar hot water systems. Space heating using solar-heated hot water is also a possibility, and is best incorporated from the outset in the design of new buildings. Warehouse and industrial facilities with high ventilation requirements are the best candidates for solar air heating. Passive solar is highly suited.
Government operations	Public swimming pools are one of the best applications of solar hot water for rural communities, reducing GHGs by about 500 tonnes/yr, saving energy costs and GHG offset costs. Other buildings with high domestic hot water loads, such as recreation centres, are also good candidates for solar water heating. Solar air heating can be used wherever there is a south facing wall and a high ventilation load. This could include recreation facilities or offices with separate ventilation fans. Wastewater treatment plants are good candidates for solar air heating as they have large air exchange requirements and walls without windows. Again, solar air heating is most cost-effective when incorporated into the design of new facilities. Many opportunities for passive solar.

Clean Energy Questions

- ☑ Has the use of solar hot water been explored for local swimming pools and recreation centres?
- ☑ Could solar hot water potentially be used for space heating, e.g. in a district energy system?
- ☑ Could a bulk-buy buyers group be formed to further reduce solar hot water costs and increase market potential?
- ☑ For new large commercial or industrial buildings, could solar air heating be applied on a south-facing wall?
- ☑ Are local building inspectors sufficiently trained to approve solar systems?
- ☑ How can the local government or band encourage the use of solar heating broadly in the community?
- ☑ What are potential community concerns and how should the community be engaged?

Green Economy Opportunities

Plan / Design
- Training designers and estimators to work locally and service surrounding region
- Bringing community together to form a buyers group to lower costs, potentially leading to increased social connection and cohesion in the community

Build / Install
- Training installers to work locally and service surrounding region

Operations / Maintenance
- Limited to ongoing energy savings and possibly a small amount of maintenance unless a distributed utility is formed to own the solar hot water physical assets and charge clients for heat used

Community Economic Development
- Attraction of related companies to form a solar energy hub
- Increased local tax base and/or non-tax revenue stream
- Partnerships and collaborations with neighbouring local governments, First Nations and the private sector
- Enhanced community profile and branding

Case Study: Grand Forks Aquatic Centre

Solar Hot Water, Air-Source Heat Pumps and Heat Recovery

Solar hot water collectors atop Grand Forks Aquatic Centre; together with air-source heat pumps, saving an estimated $52k annually.
Source: Swiss Solar Tech Ltd.

Description
Pool heat and domestic hot water provided by solar hot water collectors and air-to-water heat pumps; heat recovery from ice arena to pool.

Rationale
Reduce carbon footprint of pool; escalating natural gas costs; reduce fossil fuel dependency.

Status
Solar operational since 2006, following 4-5 years of planning stage.

Benefits
Saving $52,000 annually; return on investment 15.2%; simple payback 6.6 yrs.
Natural gas consumption reduced by 30% to date; this reduction alone has reduced the carbon footprint of the whole Regional District operations by 10%; benefits will be increased with additional heat exchanger to come.

Funding and financing
Total project cost $380,000; federal refund $36,000; FortisBC grant $20,000.
Balance financed by the Regional District over 5 years.

Governance
Owned and project managed by Regional District of Kootenay Boundary.

Learnings
Major success; will now proceed with projects in other Regional District buildings.
Boiler (often in disuse) must be started occasionally to prevent corrosion.
Renewable heat and waste heat are not free heat, but they have advantages over natural gas.
Doing this kind of work is sort of addictive; once you get into it you are always looking for ways to do new things, to do better things, like pre-heating Zamboni water for rink grooming with air-to-water heat pumps.
Solar technology supplier was very helpful.

Information
John Mackey, Director of Recreation & Facilities, Grand Forks and District Recreation, Regional District of Kootenay Boundary
Swiss Solar Tech Ltd.

Solar Communities and their innovations

Several local governments and First Nations are currently demonstrating leadership as pioneering *Solar Communities* – as designated by the SolarBC program of the BC Sustainable Energy Association, in partnership with Natural Resources Canada, and Province of British Columbia. The following provides a snapshot of innovations completed and underway in rural *Solar Communities* as of February 2010:

Tofino – bulk buy, school, building permit process, rebates and incentives
Dawson Creek – targets, local improvement charges model bylaw, solar readiness, training, demonstration
West Moberly First Nation – targets, training, installations
Kelowna – targets, partners, policies, permitting, pool, training, conference
T'Sou-ke First Nation – extensive hot water and photovoltaic demonstration, training

"Doing this kind of work is sort of addictive ... Once you get into it you are always looking for ways to do new things, to do better things."

John Mackey
Regional District of Kootenay Boundary

Photo: Okanagan College Kelowna campus is heated by heat recovery from the adjacent city wastewater treatment plant. *Source: Peter Robinson, Community Energy Association*

An Integrated Resource Recovery (IRR) approach regards waste as a potential resource, mimicking the closed-loop cycles in nature. The IRR approach encompasses water, energy and infrastructure. Energy components of resources previously viewed as waste are outlined below:

IRR approaches to energy resources

Waste heat	**Source examples:** Ice rinks, wastewater treatment, wastewater (e.g. sewer pipes and sewer lift stations), industry **IRR approach:** District heating; potential electricity generation
Biosolids	**Source examples:** Biosolids from wastewater treatment **IRR approach:** Anaerobic digestion to produce biomethane; or combustion
Wet organic waste	**Source examples:** Wet organic waste such as food waste (from processing, retailing, preparation and consumption of food), agricultural waste **IRR approach:** Anaerobic digestion to produce biomethane
Dry organic waste	**Source examples:** Dry organic waste such as yard waste and woodwaste **IRR approach:** Combustion for heating and/or electricity; biofuels for heating or mobility; or compost
Landfill gas	**Source:** Landfill **IRR approach:** Capture and burn for heating and/or electricity generation

Nature has no waste.

Who is doing IRR?

Whistler – wastewater treatment heat recovery for district heating
Prince George – wastewater treatment plant anaerobic digestion, with biogas used for heat and electricity
Regional District of Kootenay Boundary – heat from ice arena for Zamboni and Grand Forks Aquatic Centre pool and domestic hot water; space heating to come
Kelowna – wastewater treatment plant heat recovery to heat Okanagan College
Regional District of Nanaimo – heat from anaerobic digestion at wastewater treatment plant
South-East False Creek – heat recovered from sewage at lift station, for district energy
Dockside Green – on-site sewage treatment and resource recovery; biomass district energy
Kelowna – electricity from landfill gas

Planned or under construction

Regional District of Nanaimo – planned heat and power from anaerobic digestion at wastewater treatment plant
Penticton – wastewater treatment plant anaerobic digestion with intended use for heat and electricity
City of Grand Forks – heat recovery from sewer lift station, to heat buildings
Capital Regional District – wastewater treatment heat recovery for district heating in Saanich Peninsula

All of the above IRR strategies offer economic development potential in many rural communities. From the list above, the focus of this IRR section is primarily on waste heat recovery; the Kelowna landfill microturbine pilot is also featured. For the other items, the reader is referred to *Resources from Waste: A Guide to Integrated Resource Recovery; Heating Our Communities* (particularly on biogas); and *Powering Our Communities* (for landfill gas).

What is Waste Heat Recovery?

Waste heat recovery is one of the most cost-effective clean energy forms, and opportunities to take advantage of this untapped resource are all around us.

Opportunities for Waste Heat Recovery

Buildings exhaust air: Heat recovery ventilator (HRV) to use exhaust air to heat or cool incoming air. **Application**: Government buildings, recreation centres, theatres, maintenance shops, sewage treatment plants.

Ice rinks or refrigerated warehouses: Rejected heat is a low-temperature heat source. **Application**: Recover heat to a nearby swimming pool or other building.

Wastewater treatment plant: Treatment discharges a large amount of clean water containing low-temperature heat (12-22°C), suitable for upgrade by heat pumps to heat nearby buildings. **Application**: District heating system, or facilities with high hot-water load, e.g. hospitals, recreation centres, multi-unit residential

Untreated sewage – sewer pipes or lift stations: Heat recovered from untreated wastewater, is normally at a lower temperature than treated effluent, but can be upgraded by heat pumps to heat nearby buildings, and may be closer than treatment plants to heat demands. Excessive decrease of sewage temperature may negatively affect the treatment process downstream. **Application**: District heating system, or facilities with high hot-water load, e.g. hospitals, recreation centres, multi-unit residential

Wastewater heat recovery system in a mixed residential/commercial facility at Cedar Corner, Tofino. *Source: Cedar Corner, Tofino* and *www.GoTofino.com*

Combustion or flue gas: Heat exchanger to capture heat from older natural gas boiler chimneys. **Application**: Older or large facilities may be candidates, except where boilers may soon be replaced.

Industrial facility: Usually high temperature; technically easy. **Application**: Where close proximity to a community.

Will it work here?

Heat recovery is the low-hanging fruit of clean heat sources, and opportunities to use it abound. The breadth of possibilities, from residential through to public facilities and district heating, is indicated above.

Kelowna Landfill Gas:

Microturbine Power Generation
City of Kelowna, with support from CanmetENERGY, has completed a pilot project to test microturbine technology, designed for power generation from small landfills. The Glenmore Landfill initiated the project in 2005 and has completed the pilot, having tapped 6% of available landfill gas and having sold the resulting electricity to FortisBC. Microturbines are efficient and clean burning; and a small array of microturbines proved to be a sound option for electricity generation at smaller landfills. The pilot technology continues to operate while the City explores next options:

- Expanded microturbine network system for several more years
- Larger generator package
- Combined heat and power
- Upgraded gas for local gas pipeline.

Information: City of Kelowna Microturbine Project

Photo: Darren Enevoldson, City of Kelowna Landfill Gas Specialist, beside Capstone C-30 microturbines at the Glenmore Landfill. *Source: City of Kelowna*

Learn More

BC Climate Action Toolkit

Rural BC Secretariat – Economic development guidance

Resources from Waste: A Guide to Integrated Resource Recovery

Resources from Waste: Phase 1 study report

Renewable Energy Guide for Local Governments in British Columbia:
- *Heating Our Communities*

Ministry of Energy, Mines and Petroleum Resources

A wastewater heat recovery system for multi-unit residential buildings is an elegant, efficient solution for preheating domestic hot water. The technology is simple and can be applied to both new and existing building stock. It is also highly applicable for commercial and institutional buildings with high domestic hot water loads, including laundromats, car-washes, hotels and hospitals, as well as recreation facilities and sewage treatment plants. Local governments and bands can encourage companies producing waste heat to locate near those with a heat requirement, and vice versa. Such 'eco-industrial networking' has good potential for community economic development.

Clean Energy Questions

- ☑ What are sources of waste heat in the community (local industry, rinks, wastewater treatment, etc.)?
- ☑ Could any of these sources potentially provide heat for a building or district energy system?
- ☑ Will any new buildings be built adjacent to sources of waste heat, e.g. new swimming pool next to an ice arena?
- ☑ Will any sewage infrastructure be built or refurbished soon, such as sewer pipes or lift stations, that could have heat recovery built into it?
- ☑ Are there industrial processes needing moderate heat, that could support a district energy business case?
- ☑ How can the local government or band encourage 'eco-industrial networking' to foster establishment of new businesses adjacent to others that have complementary energy provisions and needs?
- ☑ Do government buildings sufficiently tap heat recovery (e.g. do they have heat recovery ventilators) or can more be done?
- ☑ What are potential community concerns and how should the community be engaged?

Green Economy Opportunities

Plan / Design
- Creating local industry skills to serve surrounding communities.

Build / Install
- Creating local industry skills to serve surrounding communities.

Operations / Maintenance
- Serving one building or establishment of a district energy system
- Utilization of local energy resources to fuel district energy or capturing waste heat to be used by local industries
- Ongoing operation and maintenance of the system

Community Economic Development
- Attraction of related clean energy companies
- Building of local industry skills to serve surrounding communities
- Potential cost savings from reduced energy costs over time
- Increased local tax base and/or non-tax revenue stream
- Partnerships and collaborations with neighbouring local governments, First Nations and the private sector
- Enhanced community profile and branding

Case Study: Okanagan College Campus Heating Loop: Wastewater Effluent Heat Recovery

Okanagan College Centre for Learning:
The new Centre for Learning draws 100 per cent of its heating and cooling energy from treated effluent water discharge of the neighboring wastewater treatment plant, operated by the City of Kelowna. (This campus loop system can be described as a district energy system.) The building atrium and agora walkways feature in-floor radiant heating and cooling; depending on the season, cool or warm water from the neighbouring treatment plant flows through the concrete mass providing long-lasting clean heating and cooling solutions. Reverse flow ventilation technology recovers 90 per cent of energy from warm and cool air expelled from the building, reusing this energy in incoming air.

This building uses 47 per cent less energy than prescribed in Canada's energy-saving National Energy Model and has been built to LEED™ Gold certification – it is a high performance green building. Compared to standard construction with boiler operating systems, the building saves approximately 420 tonnes of CO2e per year, the equivalent of taking 118 mid-size cars off the road.

Learn more: www.okanagan.bc.ca/green
Photo source: Peter Robinson, Community Energy Association

Description
Okanagan College Kelowna campus heating loop: Heat pumps extract heat from effluent from adjacent City of Kelowna wastewater treatment plant for college heating; cooling is similarly provided. Heat pumps supply 100% of heating requirements in new Centre for Learning, and 60% in main college building, supplemented by natural gas boilers when necessary.

Rationale
A study of energy retrofit options identified a need for College boiler upgrades, and potentially usable free heat in adjacent wastewater treatment plant.

Status
Operational since 2004; 2009 expanded to Centre for Learning building

Benefits
GHG reduction: 1200 tonnes/year
Heating cost savings (for original buildings only): $100,000/year; simple payback 15 years (much more savings with new building)

Funding and financing
Original project cost $1.5 million; NRCan $24,000 feasibility study incentive; balance financed through Okanagan College budget

Governance
Okanagan College owns and operates the project; City of Kelowna signed an MOU allowing the College to use treatment plant effluent heat at no charge.

Learnings
Project cost/benefit was based on expected infrastructure lifecycle; economic models limiting acceptable payback to less than 15 years would have discounted this project even though it yields a positive rate of return.
Installation of 500 metres of piping to wastewater plant was the most costly item; project would not have been viable if distance had been greater.
Addition of new building is working very well so far…..the balance between office space and classrooms complements the heating and cooling systems; on many occasions treatment effluent water is not used, rather heat pumps simply transfer heat from one area to another.

Information
IRR Case Study: Okanagan College Wastewater Heat Recovery
Okanagan College Green Initiatives
Heating Our Communities, see Okanagan College case study, p.24
Peter Csandl, Manager Operations and Energy Systems, Okanagan College, Kelowna

"Rather than 'IPP', our Council prefers to call it a CPP – Community Power Project."

Jack Allingham,
Utility Manager
District of Lake Country

Photo: District of Lake Country, Eldorado water reservoir and power project.
Source: District of Lake Country

In support of provincial clean electricity objectives, such as electricity self-sufficiency by 2016 and all new power generation to have zero net GHG emissions, BC Hydro is seeking clean electricity projects, including smaller community-scale projects and micro-scale projects.

British Columbia is fortunate to have prodigious clean electricity resources. Opportunities likely to be of interest to rural communities in British Columbia include:

- Small or micro hydroelectric power, including opportunities within municipal water systems
- Biomass power generation (or combined heat and power)
- Energy from waste, from anaerobic digestion of organic waste, or gasification
- Landfill gas utilization
- Wind power
- Ocean power (tidal and wave energy).

Provincial government definition of 'clean power' includes all of the above and more.

The focus of this section of the guide is on small hydroelectric power; for other power generation opportunities of interest to rural communities, the reader is referred to *Powering Our Communities*, which covers all the above technologies, as well as community incentives such as net metering through BC Hydro and FortisBC.

Typical run-of-river hydro project.
Source: Soren Henrich, Watershed Watch Salmon Society

Who has done it?

Atlin – 100% First Nation owned hydroelectric project
Chu Chua – Simpcw First Nation in North Thompson
Hupacasath First Nation with City of Port Alberni – run-of-river
District of Lake Country – water supply
District of West Vancouver – water supply
City of Greenwood – net metered photovoltaic system, selling power to FortisBC

What is Small-scale Hydro?

Hydroelectric power generation (i.e. the flow of water driving a turbine to generate power), occurs at different scales. Some hydro projects use a dam to store water, while others divert water from the river flow without significant storage. Hydro projects without significant storage are often referred to as 'run-of-river'; while these may involve small dams, they are usually defined as having less than 48 hours of storage capacity. Definitions of 'small' and 'micro' hydro vary; BC Hydro defines 'small' as 2-50 MW of capacity, and 'micro' as anything below 2 MW.

While hydroelectric power is a renewable resource generating low or zero GHG emissions, it must be developed appropriately to avoid damage to river ecology and fish populations, and terrestrial impacts associated with power-lines, access roads and construction. Smaller hydro installations (less than 30 MW) are generally considered less damaging than large dams, and run-of-river hydro is generally considered less damaging than projects involving significant storage behind a dam. All projects require careful impact assessment and design.

'Celebrating Green Energy' opening day for the Lake Country power project. *Source: District of Lake Country*

Communities may have opportunities to become independent power producers (IPP's – or community power producers – CPPs, terminology District of Lake Country prefers) – or to work with private IPPs – using small or micro hydro projects, particularly in relation to their drinking water supply where the water source lies at an elevation above the service area and pressure-reduction is required, or along a local river. Drinking water systems can sometimes be fitted with turbines to harness energy in water flowing downstream. The Districts of Lake Country (in the Okanagan) and West Vancouver have developed such projects.

Will it work here?

Opportunities range from tiny systems for single buildings, to larger systems in creeks or in the local drinking water system. Small projects (under 5MW) are not as cost-effective as larger projects (due to scale, and off-setting the interconnection cost to the grid); best economic opportunities for small projects are where they are added onto existing infrastructure or facilities (e.g. adding a turbine onto an existing dam), minimizing upfront capital costs. Lake Country is a good example of this.

The BC Hydro run-of-river resource assessment provides a sense of whether there are commercial-scale opportunities in your area. For smaller systems, there are guidance documents to help identify opportunities at a local site:

- BC Ministry of Agriculture guidelines for on-farm use, and
- NRCan buyers guide for those seeking to develop very small projects, less than 100 kW.

The BC Hydro *Handbook for Developing Micro Hydro in British Columbia* and the NRCan *RETScreen tool* can help determine viability of potential hydro power projects.

I am pleased that the early success of Upnit will lead to other such energy projects within the traditional lands of my people—currently the Hupacasath are engaged in three other such opportunities.

Shaunee Casavant, Chief of the Hupacasath First Nation

Learn More

BC Climate Action Toolkit

Rural BC Secretariat – Economic development guidance

Renewable Energy Guide for Local Governments in British Columbia:
- *Powering Our Communities*
- *Utilities and Financing*

BC Hydro power acquisition

FortisBC Independent Power Producer and Net Metering

Fact sheets on various clean power generation sectors in BC

Handbook for Developing Micro Hydro in British Columbia

Green electricity resources and map

Resources from Waste: A Guide to Integrated Resource Recovery

BC Hydro Resource Options Report

RETScreen tool to help identify viability of potential power projects

Independent Power Producers Association of British Columbia

Clean Energy Questions

- ☑ Where is there opportunity for small hydro given present water licences?
- ☑ Does the community water supply present opportunities?
- ☑ Is there sufficient energy in the water for economically viable power generation?
- ☑ What permits are required?
- ☑ What capital cost is required and how can that capital be raised?
- ☑ What ecological and terrain issues must be managed?
- ☑ What are potential community concerns and how should the community be engaged?

Green Economy Opportunities

Plan / Design
- Local design jobs

Build / Install
- Local construction jobs
- Construction-related services (backhoe rentals, cement manufacture, etc.) related to construction

Operations / Maintenance
- On-going maintenance of the power facility
- Power generation revenues flowing to the local government or First Nation
- Potentially increased security of local power supply

Community Economic Development
- Attraction of related clean energy companies
- Secure local power supply could be a positive factor in attracting and retaining local business
- Increased local tax base and/or non-tax revenue stream
- Partnerships and collaborations with neighbouring local governments, First Nations and the private sector
- Enhanced community profile and branding

Hupacasath First Nation – China Creek Small Hydro

The China Creek small hydro project is a story of successful community partnership and co-operation. The Hupacasath First Nation led a project to develop a small run-of-river project on China Creek, near Port Alberni. With a generating capacity of 6.4 MW, the project signed a 20-year power purchase agreement with BC Hydro, and is expected to reduce GHG emissions by 4000–5000 tonnes per year. The Hupacasath created the Upnit Power Corporation, along with minority partners Ucluelet First Nation, Synex Energy and City of Port Alberni. Upnit is a Nuu-chah-nulth word meaning 'a calm place.' The project cost a total of $14.5m, including financial assistance from FCM Green Municipal Funds and Western Economic Diversification. The project has been operational since 2005, employing two First Nations staff and providing revenue to project partners. **Information**: Upnit Power Corporation

China Creek power plant. *Source: Upnit Power Corporation*

Case Study: District of Lake Country Micro Hydro



Photos from left: Water flows down the penstock, generating power as it flows into the drinking water reservoir. 'Celebrating Green Energy' opening day festivities for the Lake Country power project. *Source: District of Lake Country*

Description

Lake Country Eldorado Hydroelectric Generating Station: Low-impact micro hydro in the Okanagan, harnessing power of the existing high elevation water supply system, selling power to BC Hydro. A 1.1 MW turbine is installed adjacent to the Eldorado Reservoir which is part of the District of Lake Country water system; there is no environmental impact additional to the existing water supply.

Rationale

Environmental benefits; using a resource more efficiently; leadership and innovation; potential financial benefits

Status

Commissioned June 2009

Benefits

Long-term revenue source, expecting $350,000 annually ($225,000 net annually), to the District of Lake Country Climate Action Reserve Fund for sustainability projects; 5.4 year payback; projected to produce 3900 Megawatt-hours annually of emission-free, renewable electricity, enough to power roughly 400 homes. Improved water system operations.

Funding and financing

Grants
- $2,000,000 Innovations Fund
- $500,000 Community Works Fund
- $72,000 GMEF Feasibility Grant

Borrowing
- $500,000 MFA Loan
- $500,000 FCM Loan

DLC Capital
- $500,000 Municipal Reserves

NRCan Production Credit
- $380,000 Operating revenue over 10 years - ecoEnergy for Renewable Power Program

Governance

Municipally owned and operated

Learnings

Importance of a champion; leadership and commitment of staff and Council were critical to overcoming financial, regulatory and technical barriers; contracted project manager also had an important role

Information

District of Lake Country
District of Lake Country Eldorado Reservoir
Winner of the 2009 Energy & Climate Action Award in Corporate Operations:
- News Release
- Application

Part Two: Getting Started

Assessing Your Community's State of Readiness

Framework for Project Implementation

Launching a Green Economy through Clean Energy

Assessing Your Community's State of Readiness

Questions and considerations

This assessment checklist is designed to help you reflect upon and gauge your community's readiness to implement an energy project and lay the foundation to launch a green economy. Questions have been grouped into five categories and a "Get ready, Get set, and Go!" framework, that will guide you in creating an implementation plan for clean energy and energy efficiency in your community:

Get ready	Get set	Go!
Community Energy & Emissions Planning	Local leadership & capacity Collaboration & partnerships	Funding strategies Governance choices

As you complete each readiness question, think about which stage your community is at: just starting, making good progress, or at a completion stage. The table below provides considerations to help assess your community's readiness status.

Status [√]	Example of steps at each stage
[ ] Starting	Start building the business case. Network and identify allies, secure support. Conduct research.
[ ] Good progress	Conduct additional investigations, analysis, feasibility studies. Complete the business case. Develop project budget.
[ ] Done	Apply for grants and/or secure financing. Partnership agreements / MOUs in place. Governance aspects settled / shareholder agreements in place.

Note that communities do not need to reach a "Good progress" or "Done" status in all questions before developing an implementation plan. Instead, use these questions and helpful links for more information as a **starting point** (to get you going), or as a **reference checklist** (if you already have a project underway). This will help you identify where additional research and investigation may need to be done, and where there are opportunities worth pursuing.

Get ready: Community Energy and Emissions Planning

Does your community have a community energy plan or similar guiding document that includes your community's energy objectives, current and future energy picture, opportunities for clean energy, and a set of proposed actions? [ ] Starting [ ] Good progress [ ] Done

Did you know? Community energy and emissions plans (CEEPs) are an important way in which rural communities can assess their energy requirements, revealing opportunities for energy efficiency, renewable energy systems, GHG emission reductions and local economic development. Creating a community energy and emissions plan is a way to support your community-wide emissions reduction targets, expressed in your Regional Growth Strategy (RGS), Official Community Plan (OCP) or First Nations Master Plan. An energy plan can include a spatial assessment of clean energy opportunities in your area, revealing key locations for capturing waste heat (e.g. from industry, wastewater treatment and sanitary sewers), areas suitable for geo-exchange systems, methane capture potential at the local landfill, and cogeneration opportunities at industrial facilities. At a regional scale, locations suitable for wind energy, small-scale hydro, tidal power, or biomass collection could also be identified.

Where to get more information
BC Climate Action Toolkit: Guiding documents for community energy and emissions planning
Community Energy Association *Community Energy and Emissions Planning* guide
BC Hydro Sustainable Communities Program

Energy inventory: Do you know the current annual energy expenditures made by your local government or First Nation operations, and by the community overall? Do you know the future energy demands in your community? [ ] Starting [ ] Good progress [ ] Done

Did you know? Typically, 70-80% of money spent on energy leaves your community. By investing in local energy efficiency and clean energy projects, a significant portion of that money will remain in the community, circulating within the local economy.

Where to get more information
Energy utility and capital asset companies (FortisBC, BC Hydro, Terasen, Pacific Northern Gas) servicing your area may have aggregate annual electricity and natural gas consumption figures for your community. Also, the Province has energy and GHG emission inventories for most BC communities.

Land use: Has your community adopted policies that support efficient land use: encouraging compact communities, homes located close to employment and services, homes and businesses located close to transit or within walking / cycling distance? [ ] Starting [ ] Good progress [ ] Done

Why this is important: Examining the geographic layout of your community from an energy and emissions perspective will reveal opportunities to use land wisely and your community more energy efficient. Focused development can support district energy systems, and lead to shorter travel times, reduced infrastructure costs, and lower operating costs for businesses and residents. Creating compact, complete communities is one of the most effective ways that communities can reduce their overall GHG emissions profile.

Where to get more information
BC Climate Action Toolkit: Actions for Land Use
Smart Planning for Communities (Fraser Basin Council)
A Tool Kit for Community Energy Planning in British Columbia

Infrastructure planning: When making decisions about local infrastructure planning and investment, are you taking an integrated perspective that considers potential future district energy opportunities in your community? [ ] Starting [ ] Good progress [ ] Done

Did you know? In 2007 the Province of British Columbia enacted several changes to the *Local Government Act* and *Community Charter* allowing local governments a number of mechanisms through which it is possible to encourage the use of clean energy in buildings and new development.

Where to get more information

BC Climate Action Toolkit overview of planning and policy tools

Community Energy Association *Renewable Energy Guide for Local Governments in British Columbia:*

- *Utilities and Financing*
- *Policy & Governance Tools*

City of Kelowna district energy pre-feasibility study

Natural capital: Are there opportunities to harness local biomass (e.g. forest, agricultural, municipal waste), wind, small-scale hydro, ground-source, air-source, tidal or other resources within your community? [ ] Starting [ ] Good progress [ ] Done

Did you know? Many regional and local governments and bands are currently conducting opportunity analyses that identify clean energy opportunities. Some of these exercises consist of mapping clean energy opportunities spatially, within the immediate community and surrounding region. This could include identifying areas best suited for ground-source heating, clusters of buildings that could feasibly support a district energy system, collection sites for surplus wood feedstock or agricultural biomass residues for bioenergy, and areas potentially suitable for small-scale hydro, wind or tidal power generation.

Where to get more information

Community Energy Association *Renewable Energy Guide for Local Governments in British Columbia:*

- *Heating our Communities*
- *Powering our Communities*

Ministry of Energy, Mines and Petroleum Resources Fact Sheets

BC Hydro green electricity resources and map

Many other resources listed in specific topic sections in this guide

Energy Efficiency: Are you participating in various energy efficiency programs for existing commercial, residential and institutional buildings in your community?
[ ] Starting [ ] Good progress [ ] Done

Why this is important: There is synergy between energy efficiency and clean energy systems, with efficiency improvements playing an important role in reducing the overall need for additional heating and cooling energy, or electrical power in your community. Energy efficiency programs for buildings can provide a significant job-creation stimulus, as energy-related building renovations tend to be done by a local workforce.

Where to get more information

BC Hydro *Power Smart*

FortisBC *PowerSense*

LiveSmart BC program

Get set: Local Leadership and Capacity

Are your local leaders engaged and working together on energy sustainability and climate action? Are they involved in creating a clean energy plan of action for your community?
[ ] Starting [ ] Good progress [ ] Done

Did you know? Highly motivated local individuals, organizations and businesses can inspire new perspectives and innovative approaches. Local leadership in clean energy systems and enhanced energy efficiency can create new local jobs and favourably affect economic investment, bringing new skills and talent to your community.

Some useful first steps
You are already showing tremendous leadership simply by creating a clean energy action plan. The process of developing action plans and implementation strategies is a great opportunity to broaden and develop local leadership by including other individuals, organizations and businesses that may be keen to help out.

Does your community have sufficient resources in place to implement clean energy projects? Does your community have a local community energy champion in place to spearhead and help implement clean energy initiatives? [ ] Starting [ ] Good progress [ ] Done

Did you know? Even the most financially-constrained communities can benefit from creating a business case for an adequately resourced clean energy plan. Completing this readiness assessment, and exploring the accompanying links for further information, should generate some good ideas on potential sources of funding and collaborative partnerships. This will help you build the rationale for the required resources, as well as pinpoint possible sources of funding.

Some useful first steps
Working with your local leaders, develop a business case for the required resources (staff time and budget) and a project timeline to implement the project *(A Tool Kit for Community Energy Planning in British Columbia).* Review potential sources of direct funding, 50/50 matching grant programs, and low-interest financing *(Funding Your Community Energy and Climate Change Initiatives).* The Smart Planning for Communities Program of the Fraser Basin Council is a BC-wide collaborative initiative that assists rural communities by providing resources and tools for planning socially, culturally, economically and environmentally sustainable communities.

Get set: Collaboration and Partnerships

Are you collaborating with energy utilities and energy capital asset companies that serve your community regarding energy efficiency programs, community energy planning, and district energy opportunities? Do partnerships with these organizations have a place in your 'mix' of financing strategies for your clean energy initiatives? [ ] Starting [ ] Good progress [ ] Done

Did you know? BC Hydro Power Smart, FortisBC PowerSense and Terasen have energy conservation programs and services to help local consumers and businesses save money on their energy bills. They also have new programs that support integrated community-wide energy planning, district energy systems and cogeneration opportunities. Many clean energy companies offer extensive help as well. These companies

may be strategic partners to make things happen locally, especially in terms of energy efficiency and clean energy opportunities. Conduct due diligence before engaging any potential partners.

Where to get more information
BC Hydro *Power Smart*
BC Hydro Sustainable Communities Program
FortisBC PowerSense
Terasen conservation programs, district energy expertise
Corix Utilities
Community Energy Association *Utilities and Financing*

Q **Have you considered collaborating with nearby communities to achieve mutually beneficial goals in energy efficiency and energy sustainability?** [ ] Starting [ ] Good progress [ ] Done

Did you know? The Carbon Neutral Kootenays project is a good example of capacity-building through collaboration, assisting 30+ local governments and First Nations in the Kootenay / Columbia Basin region to prepare their corporate emission inventories as part of meeting BC Climate Action Charter commitments. This project is jointly funded by the Columbia Basin Trust, Regional District of Central Kootenay, East Kootenay Regional District and Central Kootenay Regional District.
Power in numbers – Did you know that some clean energy projects may cross boundaries, and therefore represent opportunities to work together and share project costs and benefits, particularly at a regional scale.

Some useful first steps
Liaise with local leaders from neighbouring municipalities, regional districts and First Nations to explore opportunities for sharing knowledge and experiences, as well as pooling resources for clean energy projects that could deliver cross-jurisdiction benefits. Carbon Neutral Kootenays Project

Go! Funding Strategies

Q **Are you evaluating investments in clean energy and energy efficiency in terms of lifecycle costs? Have you considered the full range of social, environmental and economic benefits that could accrue to your community as a result of these investments?** [ ] Starting [ ] Good progress [ ] Done

Why this is important: Reframing the notion of 'limited budgets' and 'additional cost' with the concept of 'investing in your community' and 'return on investment' can improve the discussion surrounding clean energy and energy conservation. Beyond calculating simple payback, also consider annual return on investment during the project lifecycle, as it may provide a compelling financial case for investment in energy efficiency and clean energy. Establishing 'multiple-bottom-line' decision criteria on these investments is another strategy to broaden the analysis to include consideration of social and environment benefits in addition to economic benefits.

Where to get more information
BC Climate Action Toolkit: Advice on holistic budgeting
BC Climate Action Toolkit: Primer on lifecycle costs

Are you aware of funding and financing programs available for clean energy in BC?
[ ] Starting [ ] Good progress [ ] Done

Did you know? There is a range of funding grants and below-market loan programs available to rural communities. Some programs provide additional services such as education and training resources to assist communities in meeting their sustainable goals. Accessing these funding and financing resources could help move your project from the idea stage to reality.

Where to get more information
Community Energy Association *Funding Your Community Energy and Climate Change Initiatives*
Rural BC Secretariat summary of programs
BC Climate Action Toolkit summary of funding and financing programs
BC Hydro power acquisition, e.g. community-based biomass power call

Have you explored financial aggregation and/or financial leverage strategies for your clean energy initiatives? [ ] Starting [ ] Good progress [ ] Done

Power in numbers – Did you know that grouping a number of smaller clean energy projects together into a larger project 'bundle' could create a more financially attractive investment? Project bundling could group several energy efficiency / clean energy initiatives together to leverage economies of scale (e.g. bulk purchasing of materials and equipment, spread professional services and project management costs across several projects, or bundle several solar hot water installations together).

Count your leverage – Did you know that you can grow your local investment in your clean energy initiative with 2 to 5 times the investment potential from outside sources (public or private-sector partners, matching grant programs) to make the project happen?

Where to get more information
BC Climate Action Toolkit: Case studies of community success
More on building the business case for a clean energy project

Did you know that some investments in clean energy may qualify for carbon offsets, thus reducing the capital cost of the initiative? [ ] Starting [ ] Good progress [ ] Done

Did you know? Clean energy and energy efficiency projects in the community, that reduce the use of fossil fuels, may attract offset investments. To qualify as a carbon offset, the project must produce quantifiable emissions reductions additional to what would have occurred in absence of the project, or the offsets were necessary to clear financial or technical obstacles in carrying out a project that reduces GHG emissions. In general, projects need to generate at least 5,000 tonnes per year in emission reductions to be economically viable as a carbon offset, based on the current price of $25 per tonne; offset projects may require periodic verified emission reduction reports. For local governments that have signed the BC Climate Action Charter, committing to carbon-neutral corporate operations by 2012, projects that reduce the local government's current corporate emissions count towards internal reductions to move towards zero emissions rather than as offsets, so are not available to attract offset investment.

Where to get more information
Pacific Carbon Trust
Offsetters

Go! Governance Choices

Have you thought about the business models that may be applicable to your clean energy initiative?
[ ] Starting [ ] Good progress [ ] Done

Did you know? Several governance options are available for clean energy systems in your community (shown below). Ownership strategies may vary from project to project, depending upon the financing and funding model for each initiative, as well as local capacity and experience.

- 100% public ownership and operation
- 100% public ownership with private service contract
- Less than 100% public ownership with private sector participation
- 100% private ownership and operation
- Energy service company or municipal utility installs system and rents to building occupants
- Strata ownership (no municipal ownership)
- Co-operative ownership by customers (no municipal ownership)

Where to get more information
Community Energy Association *Utilities & Financing*

Framework for Project Implementation

A way forward for your clean energy or energy efficiency project

The next section of the guide shows how completing the readiness assessment checklist will help you formulate next steps and a plan of action for potential clean energy projects. It will show you how to strengthen your action plan by aligning it with other community plans and strategies, and engaging and building support with interested organizations, local supporters and potential funding partners.

The framework is all about getting your community to the stage where it can begin to implement a clean energy initiative, helping your community to create new employment and transition to a green economy.

A

Review the energy strategies in this Guide

1

Green Buildings

District Energy

Renewable Heating
Biomass
Earth, Water and Air Energy
Solar Energy

Integrated Resource Recovery
Waste Heat Recovery

Clean Electricity
Small-scale Hydro

Think about each of these strategies in the context of your community

Complete the Readiness Assessment

2

Get ready
Community energy and emissions planning

3

Get set
Local leadership and capacity
Collaboration and partnerships

4

Go!
Funding strategies
Governance choices

B

Identify a priority project and next steps

Based on the Readiness Assessment you completed, the following questions will help you articulate next steps:

Q. Which clean energy strategies are the most applicable for your community?
Q. Are detailed technical investigations required? If so, for which opportunities?
Q. Are there information gaps that need to be filled before taking these next steps?
Q. Who are the key people in your community that you need to connect with?
Q. Have you identified organizations that you could potentially collaborate with?

C

Align and integrate with existing plans and strategies

D

Communicate and build support

Share your project concept with agencies, organizations and potential partners.

Contact **key people** who could play a supportive role (local government staff, elected officials, local business, engaged citizens

Contact potential **partners** to share your strategy and determine their level of interest (consider all sectors)

Contact relevant **provincial** regulatory authorities and staff from ministries that could provide support

Contact **NGOs / agencies** that have a capacity-building role in clean energy and energy efficiency

Begin thinking about how and when you will raise awareness and engage the broader community in your initiative.

E

Create a project implementation plan

Your project implementation plan should consider the following elements: financing, ownership options, operation and contracting options, technical / design issues, human resource requirements, community engagement and partnerships

The next section of the Guide shows how clean energy and energy efficiency can play a key role in launching a local green economy, by creating new jobs, attracting new enterprise, and helping existing businesses and organizations to prosper.

Launching a Green Economy through Clean Energy

Recognizing the green economy in your community means seeing the "green elements" that are present in all sectors of the existing economy, and understanding how your clean energy project can be integrated with those elements that are transitioning to a low-carbon economy. A clean energy project can place your community on a path to building a local green economy, by creating new, career-track jobs in related goods and services, as well as education and training opportunities related to clean energy installation, operation and maintenance. Retrofitting existing residential and commercial buildings to improve energy efficiency can stimulate business for suppliers of materials and equipment, local designers, installers and contractors, while at the same time laying the groundwork for effective use of clean heating, cooling and power when it comes on stream. Your clean energy initiative(s) can also create opportunities to attract new enterprise and investment to your community, helping to diversify and transition to a local green economy.

Benefits and Opportunities of Clean Energy

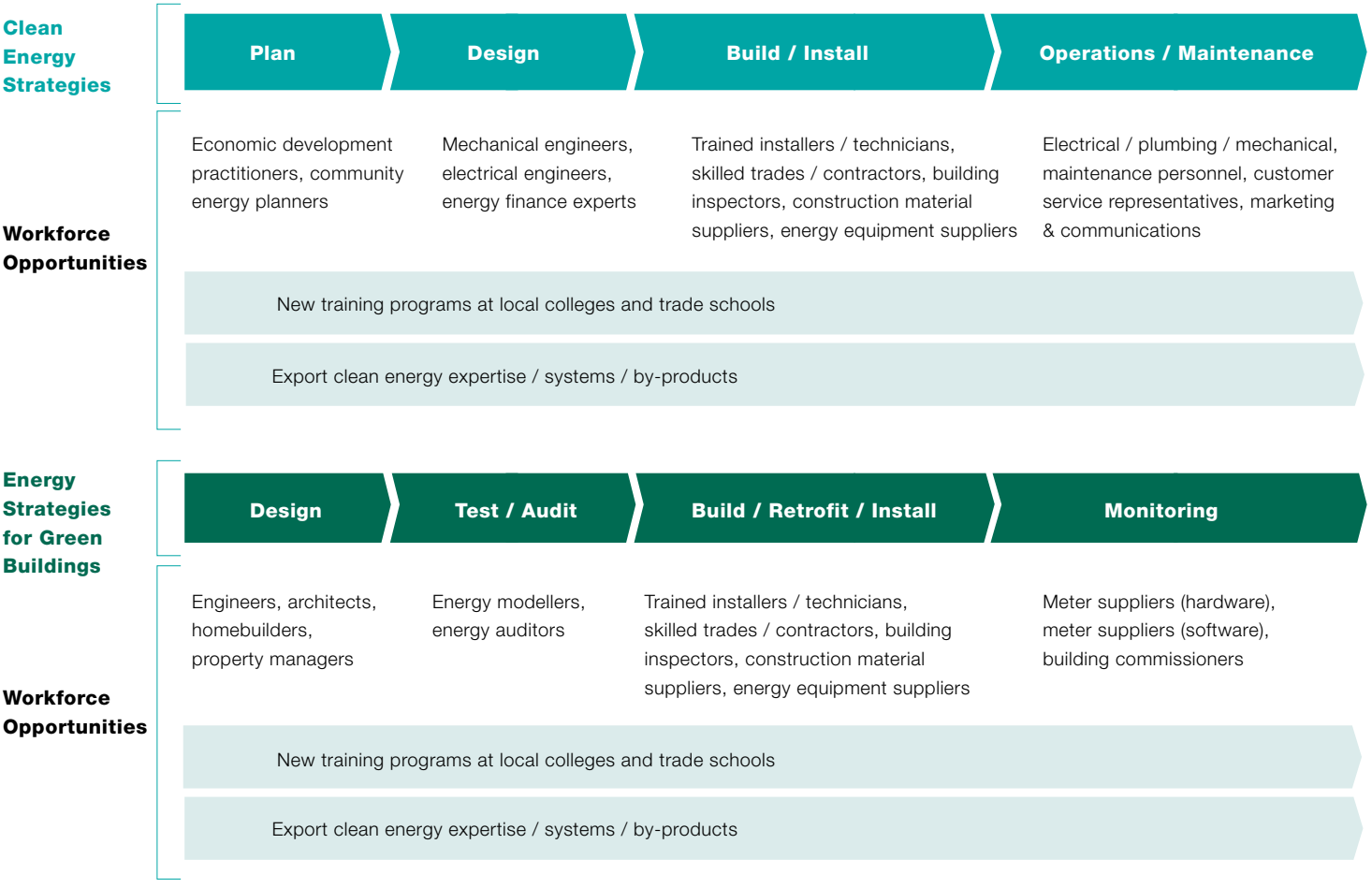
Building a stronger community and more resilient local economy

Reduced monthly energy costs	Energy efficiency programs for buildings can reduce monthly energy costs for local residents and businesses, thus reducing economic leakage from the community and increasing disposable income. Energy cost savings can then be allocated to other local needs and priorities, such as improving economic diversification.
Improved energy security	Clean energy projects can improve your community's energy security, particularly over the long-term, as fossil fuel costs rise due to carbon taxes and peaking conventional oil and gas reserves.
Reduced infrastructure costs	A clean energy project can potentially reduce service infrastructure costs in your community, as well as contribute to job creation through the operation and maintenance of new infrastructure.
Leveraging local assets	Taking advantage of the natural capital within your community and surrounding region can help launch a green economy. Adequate sunshine is available throughout most of BC for hot water heating, and ground-source heating is also widely available. Potential opportunities may exist to harness surplus wood fibre feedstock or agricultural biomass residues for bioenergy. Depending upon the location of your community, some areas may be suitable for small-scale hydro, wind or tidal power generation.
Unlocking new revenue streams	Clean energy projects may unlock new revenue streams providing future sources of non-tax revenue for your community. The Province's commitment to reducing GHG emissions will likely mean that grant applications from communities taking action on climate change may be looked upon more favourably.
Support services and programs	The Province of British Columbia has set a long-term policy direction to encourage clean energy development and a low carbon economy. This includes a range of support programs and services for local communities, businesses, and organizations that will continue to evolve over time.

Local workforce opportunities

New employment	A clean energy project potentially opens up opportunities for existing workers to transition to new employment within the community. Workforce opportunities exist at all stages of a clean energy project, including planning, design, manufacture and installation, operations and maintenance. In addition, energy-efficiency-related jobs tend to require a wide range of skill-sets, with ongoing employment benefits accruing to the community.
New training opportunities	Clean energy projects may require the creation of new training programs at local colleges and trade schools, expanding the education programming available locally. This creates new skill development opportunities for local residents.

The following graphic shows how your clean energy project can be a springboard to creating a green economy for your community. It shows how the design, construction, operation and technical aspects of the project can be linked to economic diversification goals (training / education, manufacturing and export), as well as strategies to attract new businesses and expanding opportunities for existing businesses in your community.



Did you know?

The Globe Foundation's report *British Columbia's Green Economy: Building a Strong Low Carbon Future* summarizes the provincial impact of a green economy on job creation and direct GDP in BC. This report translates broad provincial policies to an operational level, where rural communities can strategically position themselves to develop and encourage green economic opportunities to happen locally.

Building community capacity

New partnerships and collaboration	Clean energy projects provide opportunities to engage key people and supportive organizations, and build new partnerships and collaboration within the community, with neighbouring communities, with provincial regulatory authorities, other agencies, institutions, and businesses.
Confidence in your future	The leadership you are showing by developing an implementation plan for your clean energy project will help articulate a direction for a local green economy, while at the same time building new expertise, experience and confidence in your community's economic future.

Environmental and community health

Reduced emissions and improved air quality	Clean energy can result in reduced emissions, improved local air quality, and healthier ecosystems, with associated health benefits. In addition, energy efficiency and clean energy can significantly reduce GHG emissions, helping to meet local GHG reduction targets.
A healthier community	Efficient land use and transportation planning (that support district and renewable energy) can also promote walking and cycling opportunities, thus promoting a healthier lifestyle and viable alternatives to the automobile.

Business attraction and expansion

Clean energy service centre	Undertaking a clean energy project will lead to a net increase in specialized knowledge and practical experience within your community. The expertise gained can lead to the creation of a regional clean energy service centre, providing training, capacity-building and project management services to neighbouring communities interested in their own clean energy initiatives.
Attracting investment	A clean energy project will attract business and investment capital that can be leveraged by the community. For example, the Pacific Carbon Trust currently has $25 million available to invest on carbon-reducing projects within British Columbia. In addition, a range of funding grants and below-market loan programs are available for clean energy and energy efficiency programs. These funding streams can be used to attract other investment partners to your community.
Competitive advantage	Showing leadership in developing a local green economy can give your community a competitive advantage by attracting green investment and developing a green community brand. Forecasts for employment and investment growth in the clean energy sector in North America and world-wide are uniformly high for the foreseeable future. Clean energy can position your community to take part in this growing sector of the economy.
Business expansion and development	Business expansion and new business development can also result from undertaking a clean energy project and related service infrastructure upgrades, helping to diversify and strengthen the local economy and retain existing businesses. Opportunities exist for specialized manufacturing and knowledge-based businesses, training and education services, as well as local suppliers of goods and services.

Showing local leadership in clean energy can expand existing businesses and services as well as attract new enterprise and talent to your community. Clean energy initiatives will also have a positive effect on the demand for goods and services in your community, benefiting local businesses. That is why it is important to see the 'big picture', using your initial clean energy project(s) as part of a larger, long-term strategy to strengthen, diversify and transition your local economy. This integrated approach to business attraction and expansion is shown in the following graphic.

Support growth of existing green businesses	Inventory existing green businesses, identify how a clean energy project could assist in retaining or expanding local enterprises (those directly involved in the project and those businesses potentially supplying goods or services).
Stimulate the green market	Create demand for local green businesses through your clean energy initiatives (property tax incentives, political leadership, supportive planning and bylaws, creation of 'green development zones'). This will help attract new business to your community that want to be green.
Develop workforce skills to fill gaps	Work with local colleges, technical institutes, science councils and local businesses to identify and develop new training programs to bridge workforce skill gaps for your new green economy.
Promote your green advantages	Let others know about the leadership your community is taking in clean energy. Make the development of local green economy a priority in your economic development strategies and marketing approaches.
Enhance and leverage partnerships	Engage businesses, industry, education institutions, non-profit organizations, senior governments and others to articulate and maximize the economic and community-building potential associated with a green economy.
Lead by example	Explore the potential to use local government and First Nation assets such as buildings and vehicle fleet to demonstrate leadership, build the green economy, and meet local climate action commitments.

Resources

Inside Cover

Rural BC Secretariat www.ruralbc.gov.bc.ca

Community Energy Association www.communityenergy.bc.ca

Introduction

Learn More

BC Climate Action Toolkit www.toolkit.bc.ca

Quick starts in small and rural communities http://www.toolkit.bc.ca/quick-starts-small-communities

Community Energy and Emissions Planning (CEEP)
http://www.communityenergy.bc.ca/resources-introduction/community-energy-emissions-planning-guide

Funding Your Community Energy and Climate Change Initiatives
http://www.communityenergy.bc.ca/news/funding-your-community-energy-and-climate-change-initiatives

BC Hydro Sustainable Communities Program http://www.bchydro.com/powersmart/ps_communities.html

Links from Introduction

Page 4: *Renewable Energy Guide for Local Governments in British Columbia: Powering Our Communities*
http://www.communityenergy.bc.ca/resources-introduction/powering-our-communities-renewable-energy-guide-for-local-governments

Page 5: *Community Energy and Emissions Planning (CEEP)*
http://www.communityenergy.bc.ca/resources-introduction/community-energy-emissions-planning-guide

Green Buildings

Learn More

BC Climate Action Toolkit www.toolkit.bc.ca

Quick starts in small and rural communities http://www.toolkit.bc.ca/quick-starts-small-communities

Rural BC Secretariat – Economic development guidance http://www.ruralbc.gov.bc.ca/

Energy Efficiency & Buildings http://www.fraserbasin.bc.ca/publications/documents/EnergyEfficiencyOnlineGuide2009.pdf

Renewable Energy Guide for Local Governments in British Columbia *http://www.communityenergy.bc.ca/resources/cea-publications-0*
- *Heating Our Communities* http://www.communityenergy.bc.ca/node/487
- *Policy and Governance Tools* http://www.communityenergy.bc.ca/node/625

Community Action on Energy and Emissions (CAEE) project summaries 2005-2010 http://www.fraserbasin.bc.ca/programs/caee.html

BC Hydro Sustainable Communities Program – Funding available for community energy and emissions planning, design charrettes, community energy manager, projects (pre-feasibility, feasibility and capital incentives), district energy.
http://www.bchydro.com/powersmart/ps_communities.html

Light House Sustainable Building Centre http://www.sustainablebuildingcentre.com/

Links from Green Buildings section

Page 8: LiveSmart BC www.livesmartbc.ca

Page 9: Building Owners and Managers Association (BOMA) BESt www.boma.bc.ca/gogreen.php

Page 9: Get Us Green www.getusgreen.org

Page 9: City of Dawson Creek www.dawsoncreek.ca

Page 9: Planning for People www.planningforpeople.ca

Page 10: Icon Developments Ltd. http://www.icon-developments.com/

Page 10: Local sustainability; international /national / provincial leadership awards http://www.ucluelet.ca/district/districtawards.php

Page 10: District of Ucluelet Planning Principles http://ucluelet.ca/district/planning.php

Page 10: Ucluelet's Approach to Sustainable Development Planning
www.toolkit.bc.ca/success-story/ucluelet-s-approach-sustainable-development-planning

Page 10: Ucluelet winning application for 2007 Energy & Climate Action Award
http://www.communityenergy.bc.ca/sites/default/files/Ucluelet%20-%20Multiple%20Projects.pdf

Page 10: Ucluelet 2008 Energy & Climate Action Award application summary
http://www.communityenergy.bc.ca/showcase-and-awards-introduction/2008-district-of-ucluelet

Page 11: Community Energy Association www.communityenergy.bc.ca

Page 11: FortisBC PowerSense Award
http://www.fortisbc.com/about_fortisbc/news/releases_2008/PowerSenseAwardsNewsRelease-Castlegar.html

Page 11: Community Energy Association Energy Action Award http://www.castlegar.ca/sustainable/index.html

Page 11: City of Castlegar http://www.castlegar.ca/sustainable/index.html

Page 11: 2008 Winner – Energy Action Award http://www.communityenergy.bc.ca/showcase-and-awards-introduction/2008-city-of-castlegar

Page 12: *Community Energy and Emissions Planning* Guide
http://www.communityenergy.bc.ca/resources-introduction/community-energy-emissions-planning-guide

Page 12: *Funding Your Community Energy and Climate Change Initiatives*
http://www.communityenergy.bc.ca/news/funding-your-community-energy-and-climate-change-initiatives

Page 12: Community Energy Manager: BC Hydro Sustainable Communities Program
http://www.bchydro.com/powersmart/ps_communities.html

Page 13: Cowichan Valley Regional District http://www.cvrd.bc.ca

Page 13: EnerGuide for Homes http://oee.nrcan.gc.ca/energuide/home.cfm?attr=4

Page 13: EnerGuide for Commercial & Industrial Buildings http://oee.nrcan.gc.ca/energuide/home.cfm?attr=4

Page 13: Built Green http://www.builtgreencanada.ca/content.php?id=262

Page 13: BOMA BESt http://www.bomabest.com/

Page 13: LEED™ Canada for New Construction & Major Renovations http://www.cagbc.org/leed/systems/index.htm

Page 13: LEED™ Canada for Homes http://www.cagbc.org/leed/systems/homes/index.php

Page 13: LEED-ND™ http://www.cagbc.org/leed/systems/neighbourhood_developments/index.php

Page 13: Community Action on Energy and Emissions (CAEE) program http://www.fraserbasin.bc.ca/programs/caee.html

District Energy

Learn More

BC Climate Action Toolkit www.toolkit.bc.ca

Rural BC Secretariat – Economic development guidance http://www.ruralbc.gov.bc.ca/

Fact Sheet: *District Energy Sector in British Columbia* http://www.empr.gov.bc.ca/MACR/investors/Pages/English.aspx

Renewable Energy Guide for Local Governments in British Columbia *http://www.communityenergy.bc.ca/resources/cea-publications-0*
- *Heating Our Communities* http://www.communityenergy.bc.ca/node/487
- *Utilities and Financing* http://www.communityenergy.bc.ca/node/588
- *Policy and Governance Tools* http://www.communityenergy.bc.ca/node/625

Resources from Waste: A Guide to Integrated Resource Recovery http://www.cd.gov.bc.ca/lgd/infra/resources_from_waste.htm

BC Hydro Sustainable Communities Program – Funding available for community energy and emissions planning, design charrettes, community energy manager, projects (pre-feasibility, feasibility and capital incentives), district energy
http://www.bchydro.com/powersmart/ps_communities.html

Canadian District Energy Association http://www.cdea.ca/

IMBY (In My Backyard) Energy Project http://www.n2e.org/imby/

Links from District Energy section

Page 15: Vital Energi Utilities Ltd. www.vitalenergi.co.uk

Page 15: Neighbourhood: IMBY Energy Project http://www.n2e.org/imby/

Page 17: City of Revelstoke http://www.cityofrevelstoke.com/edc/energyproject2002.htm

Page 17: Natural Resources Canada
http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/buildings_communities/communities/publications/revelstoke.html

Page 17: Cheakamus Crossing Neighbourhood http://www.whistler.ca/index.php?option=com_content&task=view&id=885&Itemid=401

Biomass

Learn More

BC Climate Action Toolkit www.toolkit.bc.ca

Rural BC Secretariat – Economic development guidance http://www.ruralbc.gov.bc.ca/

Renewable Energy Guide for Local Governments in British Columbia *http://www.communityenergy.bc.ca/resources/cea-publications-0*
- *Heating Our Communities* http://www.communityenergy.bc.ca/node/487
- *Utilities and Financing* http://www.communityenergy.bc.ca/node/588
- *Policy and Governance Tools* http://www.communityenergy.bc.ca/node/625

Information Guide on Pursuing Biomass Energy Opportunities and Technologies in British Columbia – for First Nations, Small Communities, Municipalities and Industry http://www.energyplan.gov.bc.ca/bioenergy/PDF/BioenergyInfoGuide.pdf

Factsheet: *Bioenergy Sector in British Columbia* http://www.empr.gov.bc.ca/MACR/investors/Pages/English.aspx

BC Bioenergy Strategy http://www.empr.gov.bc.ca/MACR/investors/Pages/English.aspx

Resources from Waste: A Guide to Integrated Resource Recovery http://www.cd.gov.bc.ca/lgd/infra/resources_from_waste.htm

Ministry of Environment education materials on wood stove use and air quality
http://www.bcairquality.ca/topics/wood-stove-exchange-program/index.html

BC Bioenergy Network http://www.bcbioenergy.ca/

Northern Bioenergy Partnership http://www.bioenergypartnership.ca/

Beetle Action Coalitions (Cariboo-Chilcotin, Omineca, Southern Interior)
- http://c-cbac.com/
- http://www.ominecacoalition.ca/
- http://www.nsifs.bc.ca/sibac.php

Green Heat Initiative http://www.greenheatinitiative.com/

Links from Biomass section

Page 20 & 21: Del-Tech Manufacturing Inc. http://www.deltech.ca/

Page 21: Baldy Hughes Addiction Treatment Centre and Therapeutic Community http://www.baldyhughes.com/

Page 21: This Community Cares http://www.thiscommunitycares.com/baldy-hughes.html

Earth, Water and Air Energy

Learn More

BC Climate Action Toolkit www.toolkit.bc.ca

Rural BC Secretariat – Economic development guidance http://www.ruralbc.gov.bc.ca/

Encouraging and Implementing Ground-Source Heating in Development Projects
http://www.communityenergy.bc.ca/resources-introduction/surrey-groundsource-heat-pump-study

Renewable Energy Guide for Local Governments in British Columbia *http://www.communityenergy.bc.ca/resources/cea-publications-0*
- *Heating Our Communities* http://www.communityenergy.bc.ca/node/487
- *Utilities and Financing* http://www.communityenergy.bc.ca/node/588
- *Policy and Governance Tools* http://www.communityenergy.bc.ca/node/625

GeoExchange BC http://www.geoexchangebc.com/

Video explaining geo-exchange http://www.youtube.com/watch?v=NBHHqw6TRXk

Links from Earth, Water and Air Energy section

Page 22 & 25: Bob Huxtable www.hux.net

Page 22 & 25: Sun Rivers Golf Resort Community www.sunrivers.com

Page 23: WaterFurnace International www.waterfurnace.com

Page 23 & 24: Crawford Bay Elementary-Secondary School
http://www2.sd8.bc.ca/schools/crawfordbay/pdfs/crawford-bay-school-awards-submission.pdf

Page 24: Town of Gibsons http://www.gibsons.ca/

Page 24: 2009 Energy & Climate Action Award http://www.communityenergy.bc.ca/news/2009-energy-climate-action-awards-winners

Page 25: Green Dream Home http://www.cmhc-schl.gc.ca/odpub/pdf/66409.pdf

Page 25: Tk'emlúps Indian Band http://www.tkemlups.ca/

Solar Energy

Learn More

BC Climate Action Toolkit www.toolkit.bc.ca

Rural BC Secretariat – Economic development guidance http://www.ruralbc.gov.bc.ca/

Fact Sheet: *Solar Energy Sector in British Columbia* http://www.empr.gov.bc.ca/MACR/investors/Pages/English.aspx

SolarBC solar hot water support www.solarbc.ca

Renewable Energy Guide for Local Governments in British Columbia: Heating Our Communities
http://www.communityenergy.bc.ca/resources-introduction/heating-our-communities-renewable-energy-guide-for-local-governments-in-bc

Links from Solar section

Page 27 & 29: SolarBC www.solarbc.ca

Page 27 & 29: Solar Communities www.solarbc.ca/solar-communities

Page 27: Funding incentives www.solarbc.ca

Page 27 & 29: Swiss Solar Tech Ltd. www.swisssolartech.com

Page 29: BC Sustainable Energy Association http://www.bcsea.org/

Waste Heat Recovery

Learn More

BC Climate Action Toolkit www.toolkit.bc.ca

Rural BC Secretariat – Economic development guidance http://www.ruralbc.gov.bc.ca/

Resources from Waste: A Guide to Integrated Resource Recovery
http://www.cd.gov.bc.ca/lgd/infra/library/Resources_From_Waste_IRR_Guide.pdf

Resources from Waste: Phase 1 study report http://www.cd.gov.bc.ca/lgd/infra/library/Resources_From_Waste_IRM_Study.pdf

Renewable Energy Guide for Local Governments in British Columbia: Heating Our Communities
http://www.communityenergy.bc.ca/resources-introduction/heating-our-communities-renewable-energy-guide-for-local-governments-in-bc

Ministry of Energy, Mines and Petroleum Resources http://www.empr.gov.bc.ca/MACR/investors/Pages/English.aspx

Links from Waste Heat section

Page 31: *Resources from Waste: A Guide to Integrated Resource Recovery*
http://www.cd.gov.bc.ca/lgd/infra/library/Resources_From_Waste_IRR_Guide.pdf

Page 31 & 33: *Renewable Energy Guide for Local Governments in British Columbia: Heating Our Communities*
http://www.communityenergy.bc.ca/resources-introduction/heating-our-communities-renewable-energy-guide-for-local-governments-in-bc

Page 31: *Renewable Energy Guide for Local Governments in British Columbia: Powering Our Communities*
http://www.communityenergy.bc.ca/resources-introduction/powering-our-communities-renewable-energy-guide-for-local-governments

Page 31: Cedar Corner http://www.cedarcorner.com/index.htm

Page 31: Cedar Corner, Tofino http://www.gotofino.com/tofinocedarcorner.html

Page 31: www.GoTofino.com

Page 32: City of Kelowna Microturbine Project www.kelowna.ca/waste

Page 33: IRR Case Study: Okanagan College Wastewater Heat Recovery
http://www.cd.gov.bc.ca/lgd/infra/library/IRR_Okanagan_College_Case_Study.pdf

Page 33: Okanagan College Green Initiatives www.okanagan.bc.ca/green

Small-scale Hydro

Learn More

BC Climate Action Toolkit www.toolkit.bc.ca

Rural BC Secretariat – Economic development guidance http://www.ruralbc.gov.bc.ca/

Renewable Energy Guide for Local Governments in British Columbia *http://www.communityenergy.bc.ca/resources/cea-publications-0*
- *Powering Our Communities* http://www.communityenergy.bc.ca/node/626
- *Utilities and Financing* http://www.communityenergy.bc.ca/node/588

BC Hydro Power Acquisition http://www.bchydro.com/planning_regulatory/acquiring_power.html

FortisBC Independent Power Producer and Net Metering http://www.fortisbc.com/customer_service/independent_power_producer.html

Factsheets on various clean power generation sectors in British Columbia http://www.empr.gov.bc.ca/MACR/investors/Pages/English.aspx

BC Hydro *Handbook for Developing Micro Hydro in British Columbia*
http://www.bchydro.com/etc/medialib/internet/documents/environment/pdf/environment_handbook_for_developing_micro_hydro_in_bc.Par.0001.File.environment_handbook_for_developing_micro_hydro_in_bc.pdf

Green electricity resources and map http://www.bchydro.com/planning_regulatory/energy_technologies/green_energy_research.html

Resources from Waste: A Guide to Integrated Resource Recovery
http://www.cd.gov.bc.ca/lgd/infra/library/Resources_From_Waste_IRR_Guide.pdf

BC Hydro Resource Options Report
http://www.bchydro.com/planning_regulatory/long_term_electricity_planning/past_plans/2006_iep/2005_resource_options_report.html

RETScreen tool to help identify viability of potential hydro power projects www.retscreen.net

Independent Power Producers Association of British Columbia http://www.ippbc.com

Links from Small-scale Hydro section

Page 34: *Renewable Energy Guide for Local Governments in British Columbia: Powering Our Communities*
http://www.communityenergy.bc.ca/resources-introduction/powering-our-communities-renewable-energy-guide-for-local-governments

Page 34: BC Hydro http://www.bchydro.com/planning_regulatory/acquiring_power/net_metering.html

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Page 35: Watershed Watch Salmon Society *Run-of-River Hydropower in BC*
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