



Encouraging and Implementing Ground-Source Heating in Development Projects

Prepared for:
City of Surrey Planning and Development Department
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The 'first step' for local government leaders addressing
energy sustainability and climate change



Connecting communities, energy and sustainability

About the Community Energy Association

The Community Energy Association is a charitable organization assisting BC local governments to promote energy efficiency and alternative energy through community energy planning and project implementation. For contact information and many more local government resources, please visit: <www.communityenergy.bc.ca>.

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Encouraging & Implementing Ground-source Heating in Development Projects

A Community Energy Association report for the City of Surrey

Executive Summary

The City of Surrey is undertaking an extensive planning process for the Grandview Heights area in South Surrey and is exploring ground-source heat pumps (GSHPs) as an option for meeting neighbourhood heating and cooling needs. This report, prepared by the Community Energy Association, introduces GSHP technology, suggests options for encouraging GSHPs in the community, and illustrates possibilities for City involvement in the ownership and operation of GSHP systems. The report does not address the financial cost-effectiveness or technical considerations of installing ground-source heat pumps.

Ground-source heat pumps are an efficient and green technology

Ground-source heat pumps (GSHPs) use the energy in the ground for heating and cooling in buildings. They are much more efficient than conventional heating systems, leading to significantly lower operating costs and better environmental performance, particularly in terms of greenhouse gas emissions.

Most GSHP systems serve a single building. This report also describes the options for GSHPs in district heating systems, which are an integrated, large-scale, modular and flexible way to distribute heat to a number of buildings. Zones characterized by high-density development, such as commercial areas or multi-unit residential clusters, will lend themselves well to connection to a district GSHP system. District systems can be more efficient, benefiting from load aggregation and economies of scale.

The City of Surrey has many options for encouraging GSHPs

Surrey has laid the foundations for policies to encourage GSHPs through supportive language in its Official Community Plan. The report outlines a number of policy options. All measures suggested have been previously used by other BC local governments to encourage energy efficiency and/or renewable energy.

	Education and awareness	Incentives	Zoning-related policies
Benefits	Lack of awareness consistently cited as barrier. Greater knowledge among public, staff and developers enables uptake	High upfront costs a major existing barrier – incentives help developers make the case for investment	The zoning system can be a powerful lever to encourage particular kinds of development
Options	<ul style="list-style-type: none"> ▪ Education campaigns ▪ Demonstration projects ▪ Development permit checklists 	<ul style="list-style-type: none"> ▪ Reduced permit fees ▪ Expedited approvals ▪ Tax exemptions in revitalization areas ▪ Density bonuses 	<ul style="list-style-type: none"> ▪ Planning rules that enable GSHP through density, setbacks etc. ▪ Rezoning policy ▪ Local Service Area for district heating system
Examples*	City of Whiterock operations centre; City of New Westminister’s development permit checklist	District of Saanich reduced permit fees and expedited approvals; District of Maple Ridge tax exemptions	City of North Vancouver’s Service Area Bylaw for district heating; Bowen Island’s rezoning policy

*Examples are of BC local governments using these measures to promote energy efficiency or renewables, not GSHPs specifically.

There are options for City involvement in owning or operating GSHP systems

In addition to encouraging developers and the private sector to install ground-source heat pumps, the City can take a more active role in the delivery of ground-source heating. The report outlines options for ownership and operation with different levels of involvement and commitment from the City.

Ownership model	Description	Examples
100% public ownership and operation	City owns and operates the system, possibly through a subsidiary or SPV	None for GSHPs, several for electric utilities, e.g. Nelson Hydro
100% public ownership with service contract	City owns system, contracts out operations to private third party	None for GSHPs. North Vancouver's Lonsdale Energy Corp. contracts Corix
Less than 100% public ownership	City could own an equity share in a utility, or could wholly own some assets (such as distribution system)	Sudbury District Energy; Enwave Corp. (Toronto); and the Village of Anmore (electric utility)
Field Rental model (public or private ownership)	Energy services company or municipal utility installs ground-source heat loops, and rents them out to building occupants	Kamloops Sun Rivers Golf Course Resort; Wilden in Kelowna; and Wakefield Beach on the Sunshine Coast
Strata ownership (no municipal ownership)	GSHP System owned by the strata council, capital paid off in strata fees (higher fees offset by lower energy bills)	Simon Fraser University's UniverCity development
Co-operative ownership (private and/or public)	Customers are members who jointly own the utility.	Delta-Montrose Electric Association, Colorado, installs GSHPs.

The City can form a municipal energy utility

The formation of a local government utility is one option for delivering ground-source heating and other sustainable energy systems. Municipal utilities can support sustainability objectives, bolster local energy security, and potentially contribute to local economic development by keeping energy dollars circulating locally. Energy services provided by a local government within its boundaries are not subject to regulation by the BC Utilities Commission, which means that the municipal utility has significant flexibility in terms of planning and setting its own rates. These benefits must be balanced against costs, which may include the installation of infrastructure, administrative costs (including additional metering and billing), as well as regulatory and governance costs.

Liability concerns should be minimized

There are a number of ways in which the City could find itself legally liable if GSHP systems fail:

- The building code requires adequate provision of heating. While a Professional Engineer certifies most buildings, and thus assumes responsibility, liability for building permits for single family homes rests with the City. If a GSHP is inadequate, the City may be liable. Ultimately, the City will need to either transfer the risk by requiring a professional engineer, or be satisfied that systems are designed appropriately through installation standards and training of municipal staff.
- In cases where the local government is recommending or requiring the use of ground-source heat pumps, it is possible that the local government could be open to liability if the system fails. Again, this can be minimised by transferring risk to a professional engineer and ensuring that systems are installed to appropriate standards.

- Where the City has an ownership stake in an energy system, this clearly implies legal liability, which can be limited through exercising due diligence and other appropriate legal means.

Conclusion

Increased adoption of GSHPs in Surrey would contribute to the City's social, environmental and economic sustainability objectives. The City has a number of options for encouraging ground-source heat pump systems throughout the community. This report provides an overview of the mechanisms available, and provides the City with a basis to move forward with specific projects and policies.

1. Introduction

The City of Surrey is undertaking an extensive planning process for the Grandview Heights area in South Surrey and is exploring ground-source heat pumps as a potential option for meeting neighborhood heating and cooling needs. The purpose of this report is to address selected issues relating to governance and mechanisms for encouraging implementation of ground-source heat pumps in development projects with a wide range of building types and tenures.

This report seeks to introduce selected tools that will allow the City to encourage and actively promote the use of ground-source energy, also referred to as geoexchange. The scope of this report will include:

- i) a discussion of individual versus district ground-source energy systems,
- ii) options for promoting the use of ground-source heat pumps, and
- iii) alternative ownership models for ground-source energy systems within a suburban municipal context.

This report is not intended to address the financial cost-effectiveness or technical considerations of installing ground-source heat pumps. These issues have been addressed in a report by Hemmera Engineering, with support from GeoExchange BC and Corix.

2. Context

2.1 Ground-source Heat Pumps

Ground-source heat pumps (GSHPs) are a type of heat exchange technology that use the ground or ground water as a source of low temperature heat (10-20 °C) for space heating and cooling as well as preheating domestic hot water.

Local examples of facilities that incorporate ground-source energy systems include:

- The City of Vancouver Works Yard (Vancouver)
- 4th St. “Capers” Building (Vancouver)
- Oakridge Shopping Centre (Vancouver)
- NRC Building (UBC Point Grey)
- University of British Columbia’s Marine Residence (UBC Point Grey)
- Clement's Green (UBC Point Grey)
- Simon Fraser University’s UniverCity Development (Burnaby)
- Association of Professional Engineers and Geoscientists of BC Building (Burnaby)
- Glen Eagles Recreation Centre (West Vancouver)
- Vancouver International Airport Terminal (Richmond)
- Performing Arts Centre at Brentwood College (Mill Bay)
- Gulf Island’s Secondary School (Saltspring Island)
- Residential communities like Sun Rivers (Kamloops) and Shoal Point (Victoria).

A key benefit of a GSHP is the reduced energy cost to operate the system, which can be significantly lower than conventional alternatives. In addition, local and regional sustainability objectives, including reduction in greenhouse gas emissions, are addressed through the use of renewable ground-source energy. Use of GSHPs flattens the electricity heating demand profile by up to two-thirds and replaces the use of conventional heating fuels. However, higher initial costs remain a barrier to widespread acceptance.

Although there are many benefits to ground-source heat pumps, including a relatively low environmental impact, their use may prompt concerns with respect to changes in groundwater temperatures and, for open-loop systems, in particular, groundwater contamination. Ways to mitigate these concerns are discussed in Section 8, below.

Most GSHP systems have been installed as individual systems designed to serve a single house or building. Although less common, it is also possible to have a ground field serve multiple buildings through a district system. Both types are described below.

2.2 Individual Fields and Pumps

2.2.1 Description

The most common way to structure a ground-source heat pump system is by using individual fields and heat pumps. Here, individual ground loops are installed on a parcel-by-parcel basis. These individual systems can be open or closed loop systems and take the form of individual pond loops, horizontal loop systems in larger areas such as playing fields,

parks and very large back yards, or vertical closed loops that may be installed under a driveway or yard.

2.2.2 Applicability

Individual fields and pumps can be (and have been) installed into most types of development. They are best suited to medium and low densities where there is sufficient space for the field to be installed. Higher density developments may be able to use individual fields by locating fields under the building, drilling vertically or at an angle, or locating the field on adjacent properties or public spaces. This type of installation is extremely flexible, as adjacent parcels may have systems that are similarly or uniquely configured, depending upon the preference of the landowner.

2.2.3 Benefits & Other Considerations

Ownership and Control. One option is for individual systems to be owned and operated by the building owner, whether that is a homeowner, strata council, or commercial business. This places ownership considerations and control of the system with the building owner. It also results in the building owner being responsible for financing the installation costs.

Another option is to have common ownership of a number of individual field systems. This is an option that has been used in some recent BC developments (see Field Rental Model). Under this scenario, the fields are individual, but installed and paid for by one organization. This organization is typically a private energy services company, but could also be a municipality or other organization. The organization retains ownership of the fields, and allows the building owner use of it in exchange for a monthly fee. This “rental field” system addresses one of the largest stumbling blocks to ground-source energy, the high up-front cost to homeowners.

Initial Cost. With individual ownership the financial responsibility for the installation usually rests with the building owner. This alleviates the need for large scale financing arrangements, but makes it more difficult to convince owners to install heat pump systems. In the case of commercial buildings, energy costs are often passed onto the tenants, reducing the incentive for some owners to install a GSHP system, while others with a long term perspective will realize the operating cost benefits. Individual homeowners may not live in the house long enough to pay off the initial cost.

Quality of Installations. With individual fields care is required to ensure systems are designed and installed by individuals with sufficient skills and experience. Failed systems could potentially result in a liability for the City. There are ways to avoid these problems, such as contractor certification requirements, installation of fields by a single company, or common ownership and installation. See Section 6 for further discussion of legal liability.

Economies of Scale and Integration. If each system is installed individually, there are few economies of scale. There would be cost savings through economies of scale if the systems were installed all at once by a single installer. This would occur if a developer chose to install fields in all homes in a new subdivision, or if a third party paid for the installation in a “field rental” scheme, as described above.

2.3 District System

2.3.1 Description

In a district field or system, a GSHP system is an integrated, large-scale, modular, and flexible way to distribute thermal energy to a number of buildings. The ground field is common, and shared between multiple buildings. The field (or, more likely, multiple fields) may be located in public areas such as parks or school playing fields, or on private property. Each building connected to the system has its own heat pump(s) and uses the common field as a heat source or sink.

2.3.2 Applicability

Any zone characterized by high-density development will constitute a high load on an energy distribution system and is suitable for a district system. Technology parks, commercial areas, and multi-unit residential clusters all lend themselves well to connection to a district GSHP system. Low-density developments (such as distributed single family housing) may not as suitable for the development of a district system due to the increased length of piping required.

2.3.3 Benefits and Other Considerations

Ownership & Control. The viability of a district system is dependent upon development patterns as well as the local authority's ability to encourage load interconnection. There are very few examples of contemporary district systems in a situation in which there is not, at least initially, a single owner – usually the local government, regional district or a single private developer – across many parcels. Connecting to the services provided via a district field implies to a greater or lesser degree relinquishing control of how energy is provided to the building.

Load Aggregation. Since not all buildings have the same load profile, the size and footprint of equipment required to run the system (and associated costs) may be reduced with aggregation of loads. Efficiency may also be improved through the transfer of simultaneous heating and cooling loads. This advantage of district systems is more pronounced with multi-unit residential, industrial and commercial buildings than with single-family houses.

Economies of Scale. A district system is a larger scale project that can benefit from economies of scale, with savings from bulk purchasing of equipment and coordinated installation of systems.

Use of Horizontal Fields. A district system is more likely to be able to use horizontal fields, since the fields can be located in public areas such as parks or schools. Individual fields in urban areas are usually too constrained by space for horizontal fields, and must use vertical drill holes instead. Horizontal fields are less costly and receive additional energy from sunlight.

System Flexibility. A district system has the opportunity to be supplemented by other renewable heating sources. These could include waste heat from ice rinks or sewage treatment, combined heat and power plants, or solar thermal heating.

3. Encouraging The Use of Ground-source Heat Pumps

There are many ways in which local governments can encourage the use of ground-source heat pump systems in their communities. These range from simple education programs to investment in large-scale district systems with mandatory connection and use. Other policies fall somewhere in between. The following sections describe some of the potential policy measures the City could consider. In most cases it would be preferable to enact more than one policy initiative (e.g., an education program to support an incentive policy).

Regardless of what policies are chosen for implementation, it is important that the policies are supported by language in the OCP or neighbourhood plan, or civic policies. Surrey has made considerable reference to energy considerations in its OCP, including a reference to ground-source heat pumps. That language helps indicate that GSHPs are a priority for the City and give staff the authority to promote and recommend GSHPs amongst developers.

3.1 Education & Awareness

Raising awareness through education programs can be an important way in which a municipality can increase the use of GSHPs. Municipalities have a high level of credibility amongst both developers and the public. The public is often unaware of renewable energy technologies, or are confused by different messages presented by various groups. A City-led education campaign can help address both issues.

Education can take many forms. Some possible ideas include:

- Pamphlets for inclusion with other City mailouts
- Brochures for handout at public events
- Developer workshops
- Public workshops
- Host an energy fair

To be effective, an education campaign should probably include a number of these, and target both builders and the public. It can be worthwhile to partner with a local non-profit organization (e.g., BC Sustainable Energy Association, Sustainable Building Centre, Community Energy Association) to increase the visibility of the campaign.

3.1.1 Demonstration Projects

Demonstration projects are a form of education that encourage the use of GSHP in two ways. First, they bring attention to the technology and provide a local, real-life example for people to see. Second, they show that the City is demonstrating leadership on the issue, and “putting their money where their mouth is”. If GSHP is to be promoted for a certain neighbourhood, it would make sense to have an official policy that all civic buildings in that area will use GSHP where applicable.

A demonstration project can have even more impact if it is easily available to the public to see. This can be done by having viewing windows and explanatory diagrams on site.

3.1.2 Development Permit (DP) Checklists

A DP checklist is a form of education that is more deeply integrated within the City's planning and permitting process. Although educational in nature, it does have a compulsory component – filling out the checklist. A developer can be asked to complete a checklist that lists various environmental/sustainability features that could be incorporated into the design. The idea is to bring these features to the attention of the developer, and let them know that the City views such things as important. To encourage GSHPs, a specific section of the checklist might be dedicated to related to them, energy efficiency and other alternative forms of energy. It is important to note that, although the developer is required to complete the checklist, they are under no obligation to implement any of the items. That step would remain voluntary. Councils may, however, consider such checklists when considering approvals of rezoning or the issuance of DPs.

3.2 Incentives

Incentives are a popular way to encourage renewable energy or energy efficiency technologies, often used by utility companies and senior governments. Although incentives will sometimes cover the incremental cost of a technology, often a much smaller amount is sufficient to kick-start interest.

A municipality may directly provide cash incentives to homeowners for the installation of GSHPs. Incentives cannot be given to businesses due to the prohibition on assistance to business (Community Charter Section 25). Most municipalities do not like the optics of providing direct incentives, and have chosen to take a more subtle approach.

3.2.1 Reduced Permit Fees

Reduced permit fees for buildings that include GSHPs is a way of providing an incentive to the developer that has been done for energy efficiency in other jurisdictions (e.g., Saanich). Although this has been used without challenge, it may not actually be permitted.

Despite being promoted as a fee reduction, reduced permit fees are in fact an incentive provided by the municipality. This is because permit fees are only allowed to cover the cost of processing permit applications. Therefore the regular permit fees cannot be increased to offset the fee reduction, and the money must be found from other sources. Since the Community Charter specifically prohibits incentives to business, this may not be legal, in spite of having been used without challenge in some municipalities.

Although a permit fee reduction is no different from a direct incentive, it can be more visible to developers. People are often drawn to a reduction in fees or taxes than they are to a separate incentive. It can also be linked to an expedited permit process, as described below.

3.2.2 Expedited Permits

A non-cash form of incentive is an expedited permitting process. This involves prioritizing applicants that include GSHPs in their buildings. As time is of value to developers, this can be an important tool to influence development decisions. Of course, the benefit will depend

on how much faster a permit can be moved through the system. This policy has been used in conjunction with reduced permit fees by the District of Saanich.

3.2.3 Tax Exemptions

Municipalities may grant tax exemptions to projects within revitalization areas (Community Charter, Section 226). Conditions for the tax exemption can be set, which may include sustainability objectives (presumably including GSHPs). This can potentially be a significant amount of money, and may be an attractive proposition to the owner. From the City's perspective, the incentive does not need to come out of current budgets, but rather from future tax revenue. And presumably the revitalization tax incentive is required in order for development to happen, so this can be viewed as additional tax revenue anyway. This policy has been enacted by the District of Maple Ridge.

3.2.4 Density Bonusing

Municipalities can allow an increase in zoning density in exchange for community amenities (Local Government Act, Section 904). It is possible that this could be used to promote GSHP, if improved air quality and economic benefits from the use of GSHP are considered community amenities. However, this has not been tested.

3.3 Policies Related to Zoning

Significant policies to encourage GSHPs can be adopted related to zoning. These policies range from building siting criteria to required use.

3.3.1 Planning for GSHP

Planning decisions can help facilitate the installation of GSHP systems. For individual systems, building footprint and setbacks can be designated so as to allow sufficient space for the field to be installed. For a district system, there are many factors that will help make a GSHP system feasible. These include having sufficient density to utilize available energy while minimizing piping distances, mixed uses to provide load diversity, locating buildings with large heat rejection loads (such as ice rinks) nearby, including parks or playing fields where ground loops can be installed, and making allowance for piping within utility corridors.

3.3.2 Rezoning Policy

Developments that require a rezoning must apply to council for approval. This is an opportunity for council to weigh the benefits to the community of the proposed rezoning. Although the OCP speaks to community and council expectations, a rezoning policy can also be adopted. A rezoning policy does not set requirements for rezoning; it sets expectations for the community. However, if a development does not meet expectations, it is unlikely to be recommended by staff or approved by council. GSHP could be listed as an expectation for rezoning within certain areas. Bowen Island Municipality has enacted a rezoning policy that sets expectations of efficiency standards for new houses.

An alternative to a rezoning policy is to use a checklist (similar to the DP checklist) to score rezoning applications. This would be less rigid than a rezoning policy, but would help staff

and council to judge the benefits of the project. To encourage GSHP, it could be given a relatively high weighting in scoring the application.

3.3.3 Local Service Areas

The Community Charter allows a municipality to deliver and charge for any Local Area Service it deems beneficial to the community (Community Charter, Section 216). Once the service is in place, the municipality can mandate connection to and use of the service. Heating or cooling via a district energy system qualifies as a service, as would a district GSHP system. The City of North Vancouver has implemented a district heating system using a Local Area Service bylaw.

An important consideration of this approach is that the service must be funded up-front by the provider, rather than by the developer or owner. However, there are several private sector companies which will finance and operate these types of systems, should the City not wish to.

Although it has not been tried, it would appear that individual GSHP systems could also qualify as a service. The systems would need to be paid for by the City or a third party.

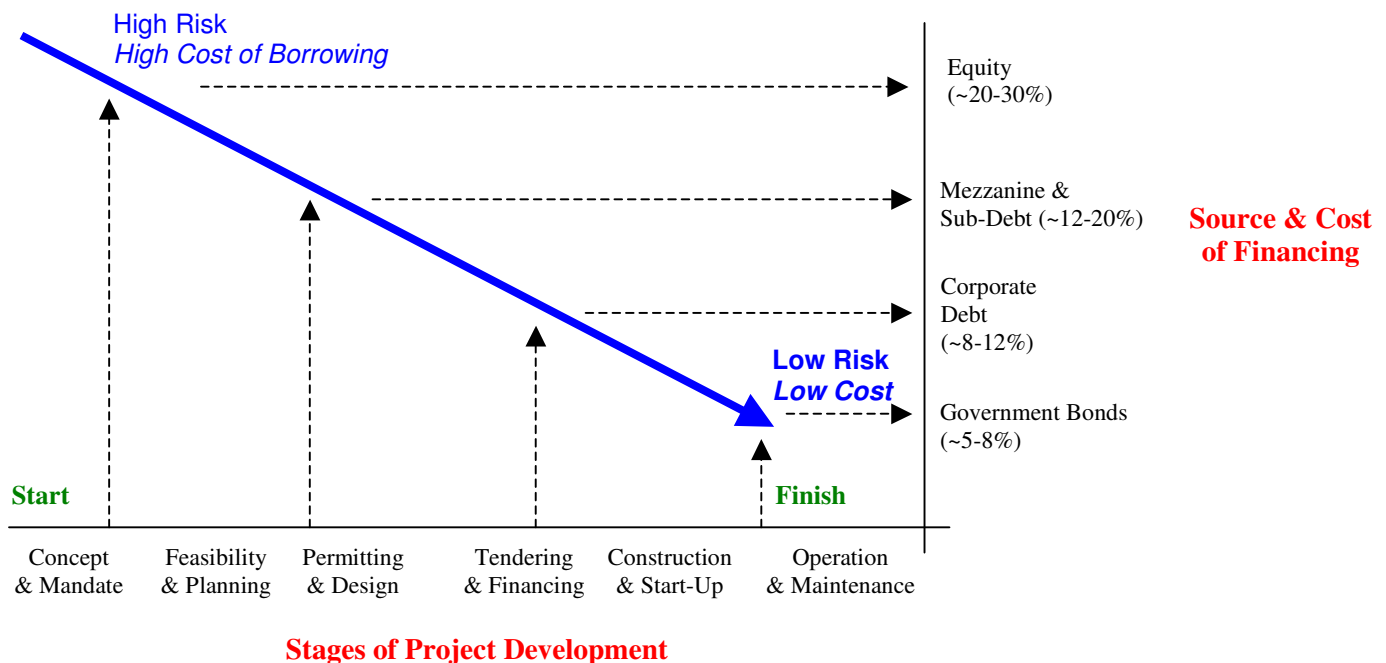
4 Options for Financing, Ownership, and Operations

In most cases, ground-source energy systems have been privately financed, either by the individual user (home or building owner) or by a developer. In the event that a local government determines that it is in the public interest to own some or all of the system, it may choose to fund an energy project entirely out of its general revenues or, more likely, through city funds and matching grant monies. A third option that a local government may wish to pursue, following a risk analysis and review of internal competencies, is a partnership with another organization that will bring capital and/or complementary capacity to the table.

This partner or partners, usually private, provide equity, i.e., investment, in exchange for an ownership share of the project, and/or flow-through credit—particularly for start-up expenses when capital costs are high and project return, generated primarily from tariffs charged to energy consumers, is low. Partnerships allow risk to be spread amongst multiple parties and are intended to ensure that each owner and operator is maximizing its own efficiency and working within its capacity. This reduction of risk by the City and assumption of risk by the private partner or partners will always come at a negotiated cost.

Different kinds of partners may be invited into the project at different stages of its development. Who becomes a partner and when they sign on will depend on the resources they bring to the table, their tolerance of risk and their organizational requirement for return on investment.

Figure 5. Relationship Between The Cost of Money and Different Stages of Project Development



Source: Adapted from *The Anmore Community Power Project*, produced by Renaissance Power Corp on behalf of the Village of Anmore, Nov. 2006.

Figure 5 outlines varying stages of risk in the development of an energy project. It demonstrates that at the start of project, risks are greatest. As a result of this, any partners who are offering financial assistance (and not simply working on a fee for service basis) will likely require an equity share in the project. As the project proceeds, risk decreases and other forms of financing such as corporate (bank) debt and government bonds become available.

There are many ways that ownership and operation of large-scale energy systems may be structured. The four main variations are discussed below and include:

- i) total ownership and operation by a local or regional authority,
- ii) total ownership by a local or regional authority, with operation provided in whole or part by a third party,
- iii) partial ownership and operation by a local or regional authority, and
- iv) no ownership by a local or regional authority.

Two alternative ownership models that have been used in BC recently are also discussed.

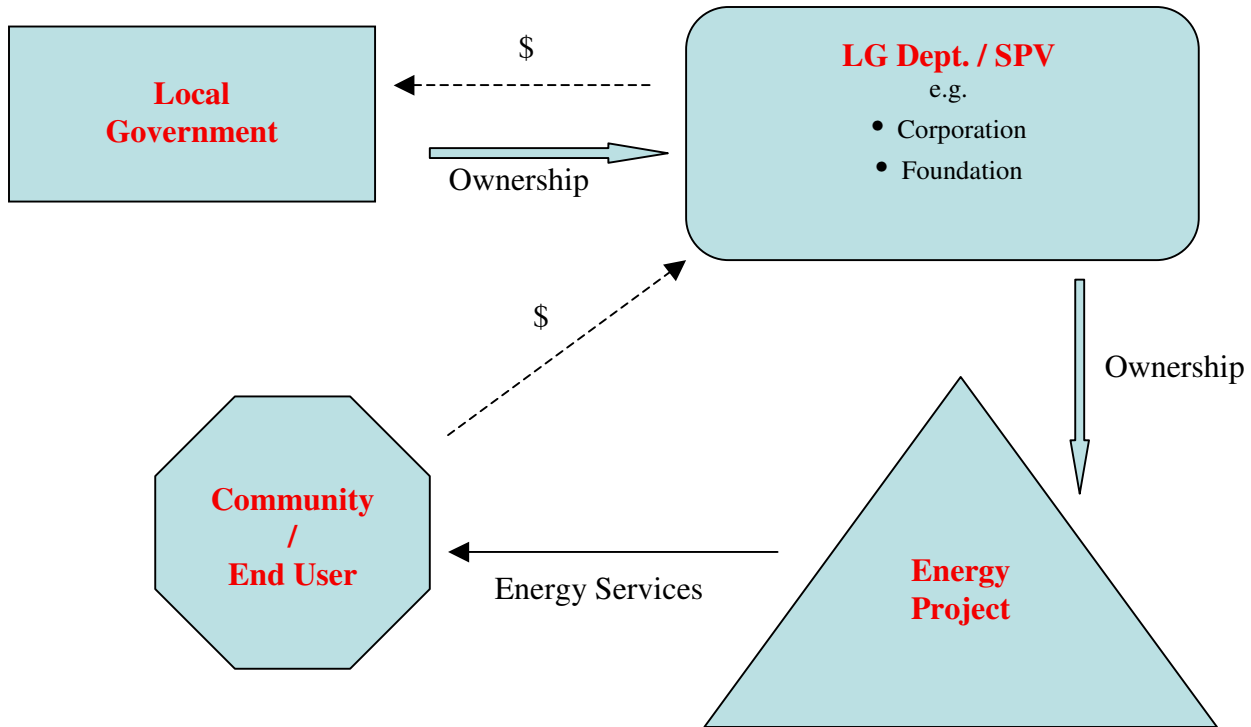
4.1 Model #1: 100% Public Ownership—Local Government Owns and Operates All Energy Assets

Here, the City of Surrey would own all of the generation and distribution assets to the point of connection with the energy consumer. All regulatory and operational control resides with the City – it operates and maintains the system and collects payment from users. Depending upon the risk tolerance of the local authorities, the municipality may own and operate the energy-related assets outright or it may create a wholly owned, arms length, subsidiary of the corporation, commonly known as a special purpose vehicle (SPV), to do so. In the case of the former, the asset will be owned and operation of the utility will occur through the regular channels of corporate structure, operating as any other department within the local government.

In order to protect itself from liability, Council will likely choose to form an SPV. Managerial direction for this subsidiary corporation could come from a variety of sources, including city council or a group of staff specially tasked to direct the entity.

Figure 1 demonstrates the division between – and the relationships amongst – the local government, its SPV (or internal department), the energy project and the end users.

Figure 1. 100% Public Ownership & Operation – Local Government Department / SPV



4.2 Model #2: 100% Public Ownership & Service Contract

A second way that an energy project may be structured is by vesting total ownership of the system and its assets in the local government, but contracting service-related obligations to third parties. In this scenario, the City of Surrey would own all of the utility's assets, as described above, but contract out some or all of the construction, operations and/or customer services to a service provider.

An example of a 100% municipally owned system, which has contracts with a service provider, is the City of North Vancouver. The Lonsdale Energy Corporation (LEC) was established in spring of 2003 and is a wholly owned corporation of the City of North Vancouver. The LEC manages the Lonsdale district energy system, which produces and distributes hot water at a series of natural gas fired mini-plants within Lower Lonsdale.

All of the buildings to be constructed within the district energy catchment area, including City land and the pier development, are required to utilize hot water heating so as to be compatible with a possible future connection to a district heating system.

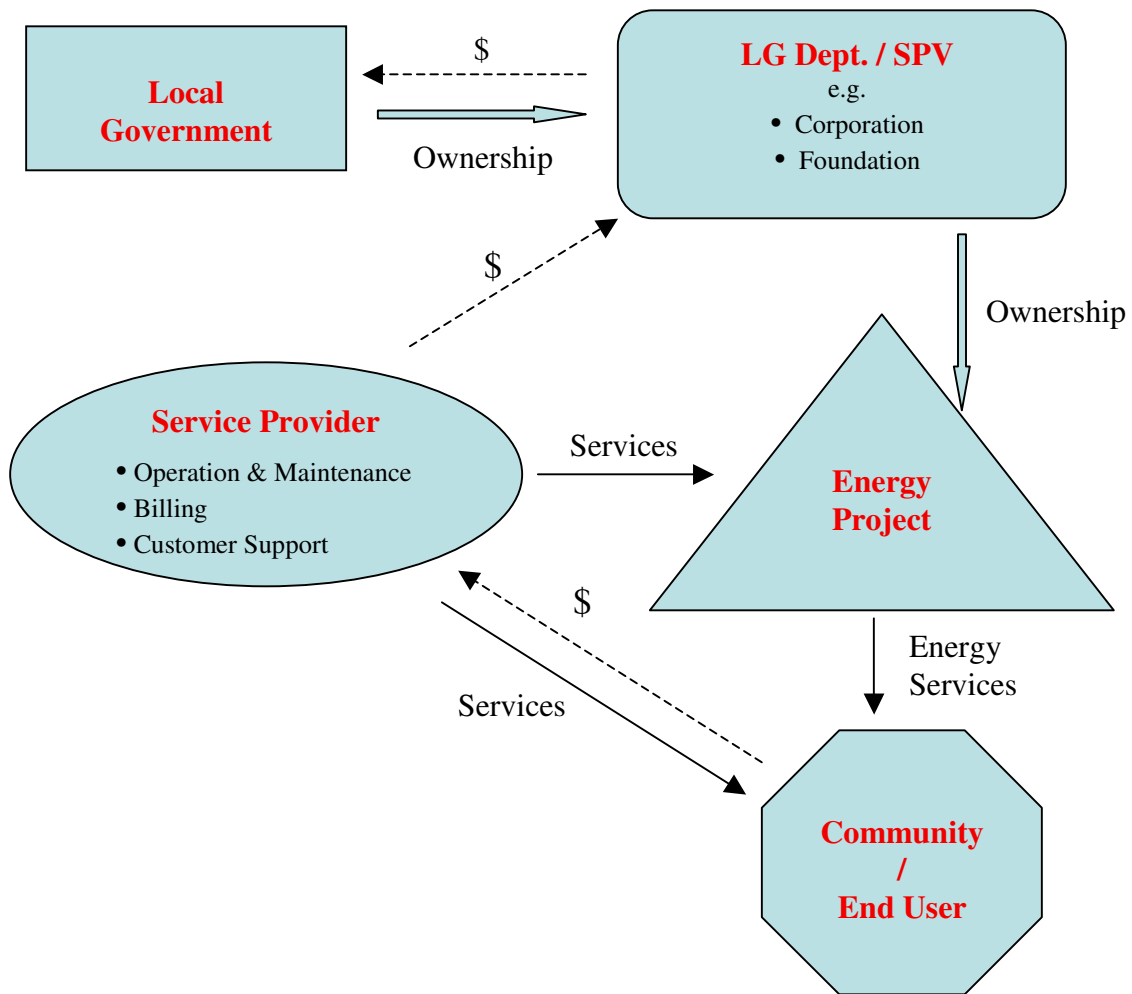
LEC reports regularly to Council on its performance and, as it is not regulated by the BC Utilities Commission (BCUC), Council approves utility tariffs. The local government has signed a ten-year agreement with Terasen Utility Services (now Corix) to provide operating

services, customer care services and billing, as well as the design, construction installation, maintenance and operations of all boiler plants.

For more information on the LEC model, contact the LEC General Manager at 604-983-7335.

Figure 2 builds on the basic structure shown in Figure 1, adding a third party (or parties) who will become part of the project through the execution of a contract for service.

Figure 2. 100% Municipally Owned & Service Contract



4.3 Model #3: Less Than 100% Public Ownership & Operation

In British Columbia, a local government is empowered to provide any service directly or through another person, pursuant to Section 8(2) of the *Community Charter*. This means that public private partnerships are permitted, in any variation considered to be reasonable by council. This model, in which the local government owns less than 100% of the system and provides less than all of the operation, maintenance and customer service, provides the greatest range of opportunity for creativity. While the requirement for BCUC oversight may still be avoided in many of these arrangements, a legal opinion should be requested by the private partner to confirm their exemption, on a case-by-case basis.

Partial municipal ownership can take many forms. The City may consider ownership of some or most of the system assets, which, in the case of ground-source energy might include the ground loops but not the pumps and other equipment, with a private party (or parties) owning the remainder.

Two examples of how this model may be applied are:

- i) when the local government retains an ownership interest in only the system's distribution assets, and
- ii) when there is agreement to partner and share ownership of the system with another entity.

Distribution Assets Only In this case, the local authority owns only the distribution assets while other investors own the remaining system components. The City may also contract for additional services such as construction, operations and billing. In the case of ground-source heat pumps, Surrey could own the distribution piping, while others own the fields, pumps, and/or meters. This is most commonly seen in the case of electrical infrastructure or gas lines, where the energy source is located outside the municipal boundaries. There are no local examples of this for a ground-source energy system.

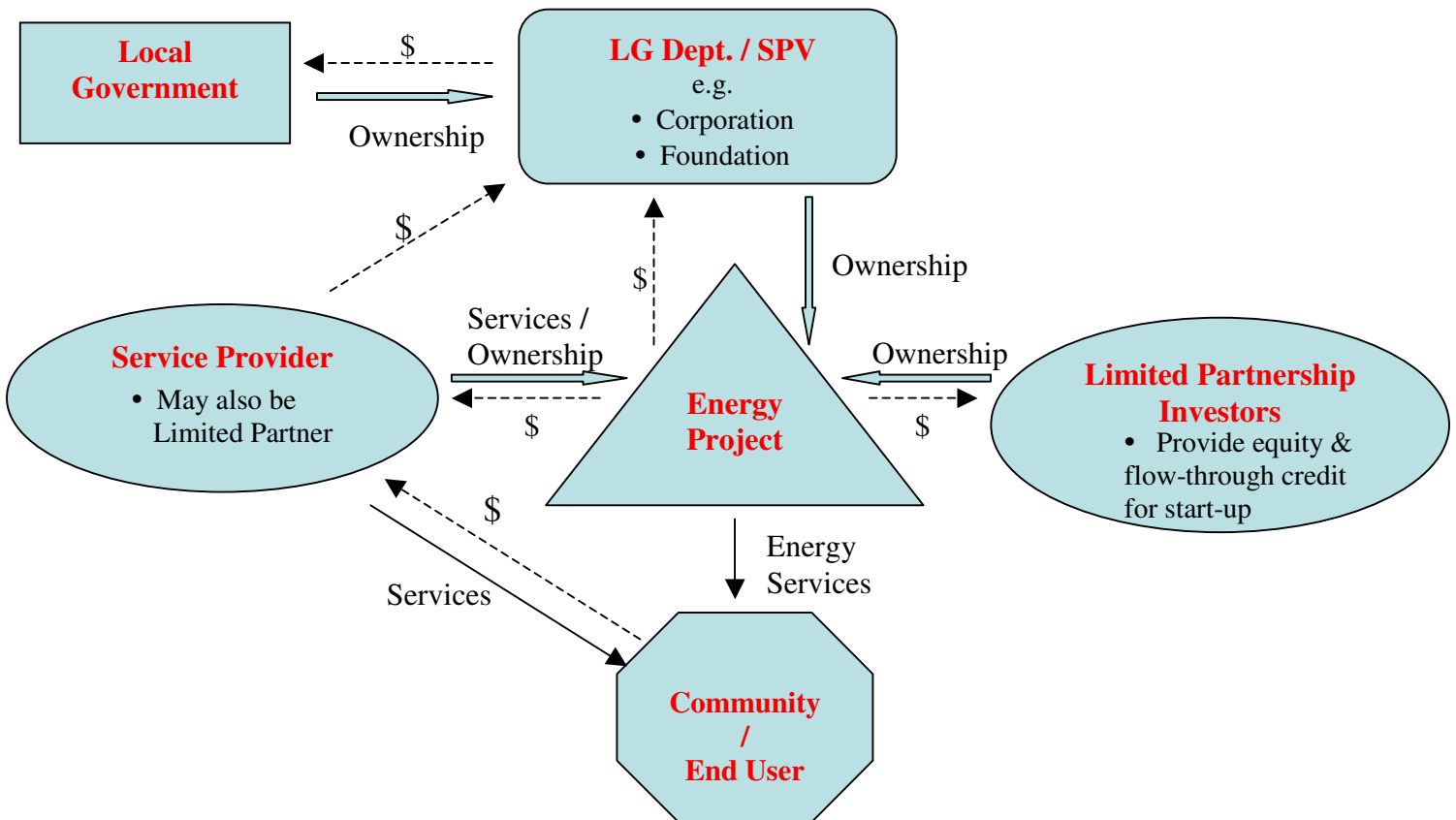
Joint Equity Venture Model Here, the City shares ownership of the entire energy system with a company from the private sector. The party with the greatest capacity performs operational and service requirements, or in the event that neither has adequate competence, certain elements may be contracted out to specific service providers. Sudbury District Energy and Enwave Energy Corporation (Toronto) have adopted this model.

The Village of Anmore is developing a good example of a joint equity venture. There, an electricity-generating project (which, in many ways, is analogous to the creation of a thermal utility) is in the early stages of development. The Anmore Project proposes to utilize the water flowing through an existing hydro tunnel to develop a 3.8 MW micro-hydro system. In 2005 the Village of Anmore created a wholly owned subsidiary in the form of a Trust, called a "Foundation" by its creators. This Foundation holds the head lease for the right to use the water flowing through the Buntzen tunnel. The head lease is the Foundation's sole asset.

Control of the project ultimately resides with the municipal council, as the Council sets the terms of reference for the Foundation and appoints its trustees. Various equity partners, however, will capitalize the project. The Foundation's contribution to the partnership is its ability to grant sub-leases on the head lease, which enables other parties to build a generating station as well as use and profit from the water resource. A service provider holds the management contract for the project and is responsible for securing further funding, as required, through capital markets.

Figure 3 shows the increasingly complex relationships that develop, through the introduction of partners, once the energy project is less than 100% owned by the local authority.

Figure 3. Less Than 100% Public Ownership, Operation & Maintenance



4.4 Model #4: No Municipal Ownership

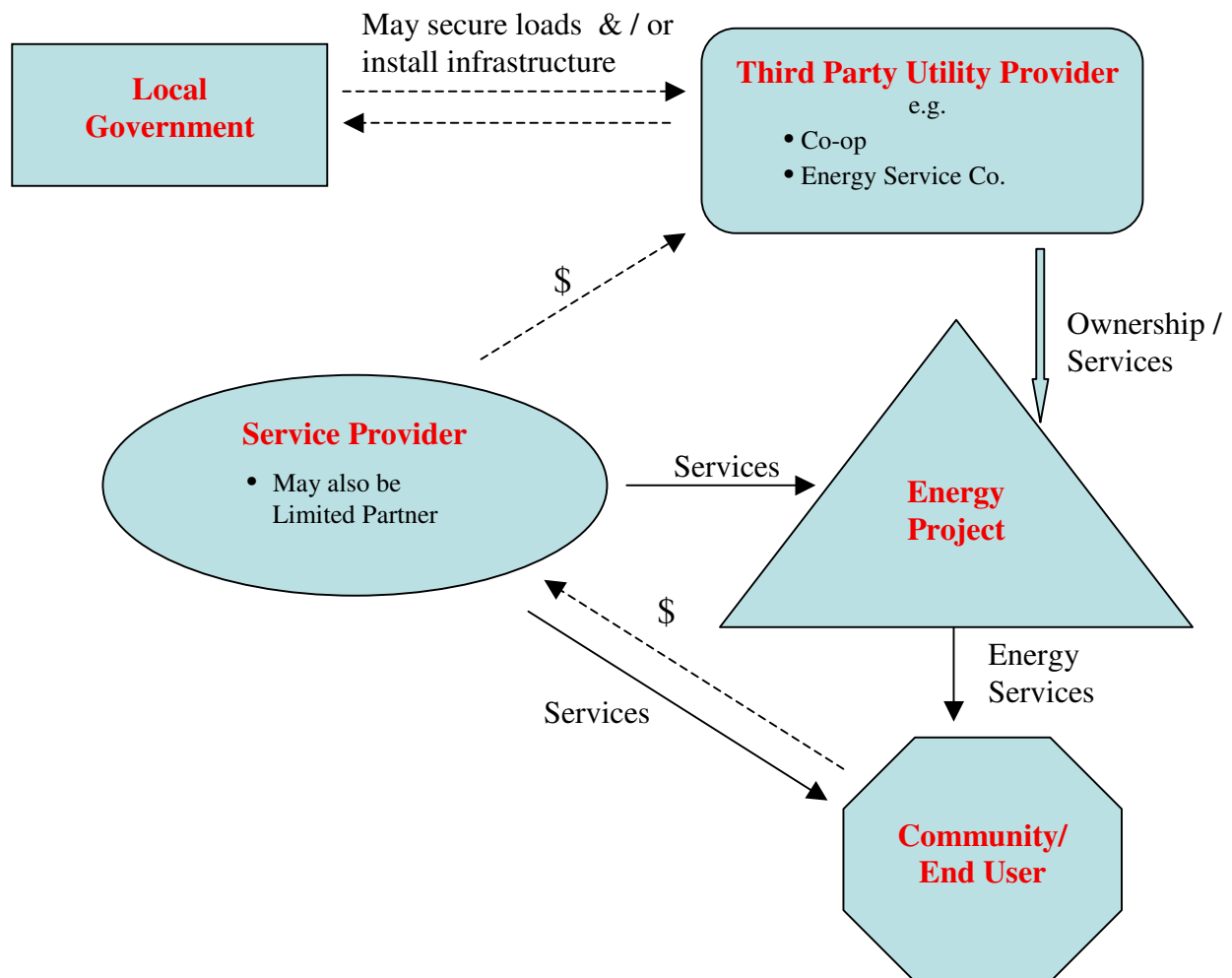
No involvement by the local government in the ownership or operation of energy utilities has been the norm until recently, within the province. Typically, generation and transmission assets, as well as service requirements have been owned and operated, in most cases, by third parties and large public utilities such as BC Hydro, FortisBC, Terasen Gas, Corix and Pacific Northern Gas. Private parties, without municipal intervention or

involvement, have designed, built and operated the bulk of the ground-source heat pump systems that are currently operating within the province. This model offers the least exposure to liability for the local government, but also the least control.

In this model, the project is owned and operated by a third party with limited or no involvement of the City. This third party would not be able to require connection to the system under the Charter. Limited involvement of the local government could include working with the private energy provider to secure loads and install infrastructure. 100% private ownership of the project will likely result in BCUC oversight (Utilities Commission Act, Sections 1, 21). Note that although the BCUC has indicated that it considers the provision of ground-source energy services to fall within its area of oversight, no enforcement by BCUC of these services is currently occurring.

Figure 4 reflects that the local government may or may not be involved in an energy project when it has no ownership interest in the system. This figure also shows that when a third party utility provider is involved, the third party utility may assume responsibility for the provision of energy as well as services (thereby eliminating the need for an additional service provider).

Figure 4. No Public Ownership



4.5 Field Rental Model

Several recent developments in BC have used a new financing and ownership model for GSHP system. For lack of an official name, we are using the term “Field Rental” to describe it. In this model, a private sector energy services company (ESCO) installs and finances the ground loop fields in a development. They then charge the homeowner a monthly ground loop “access fee” for the use of the field. The homeowner is responsible for the heat pump equipment located within the house, while the ESCO maintains the field.

The advantage of this model is that the up-front cost to the homeowner is greatly reduced, while the developer does not need to cover any up-front cost either. This is the largest obstacle to wide spread acceptance of GSHP systems. Long-term field maintenance concerns are also addressed. The field rental model has been used for several private residential projects around the province, including Sun Rivers in Kamloops, Wilden in Kelowna, and Wakefield Beach on the Sunshine Coast. A municipality could also play the role of ESCO.

For more information on this financial model, see the following:

Corix Utilities – www.corix.com

Terasen Energy Services – www.terasen.com/EnergyServices

Sun Rivers – www.sunrivers.com

Wilden Estates – www.wilden.ca

Wakefield Beach – www.wakefieldbeach.com

4.6 Strata Ownership

For multi-family residential developments, a GSHP system can be owned by the strata council, with the financing payments included in strata fees. The benefit of this arrangement is that the system cost is not included in the purchaser’s mortgage. Therefore, if the homeowner sells the unit prior to paying off the loan, the payments will carry on to the next owner. Although the strata fees would be higher, they would be offset by lower energy costs. This type of arrangement has been used at the Verdant development at Simon Fraser University’s UniverCity.¹ Although strata ownership would not involve the municipality, the City may wish to play a role in bringing developers and financial institutions together for this type of arrangement.

4.7 Co-operative Ownership

Another way that the private ownership model may be expressed is through the creation of a co-operative. Under this type of ownership, a non-profit corporation owns all of the system assets. Individuals and larger bodies purchase shares (usually expressed as a “membership”) in the corporation and the entity is governed like any other non-profit corporation. As with any other enterprise, the success or failure of a co-operatively owned energy system is affected by the management of the co-op. One of the strengths of a co-op is that it is able to pool resources and expertise – usually from local people – who are personally invested in their local system.

¹ <http://www.verdantliving.com/sustainability.html>

An example of a district electrical co-op in British Columbia is the Peace Energy Cooperative (PEC), which was founded in 2002 by individuals from Dawson Creek who recognized the potential for wind energy in their region. Now, with 200 members, PEC is “committed to making renewable energy accessible and affordable” for its members in the Peace Region of northern British Columbia and Alberta. A wind-generation company, Aeolis, and PEC have a signed Memorandum of Understanding, which outlines the intention of the two organizations to work out a joint agreement for the development of a wind park on Bear Mountain—a site secured by PEC in July 2004 and identified by BC Hydro as one of the most promising wind-power sites in British Columbia.

Due to the large up-front cost of ground-source heat pump systems, a co-op with limited capitalization might consider partnering with a local government or the private sector to install a district field or individual fields and pumps.

A very different approach to how a co-op may assist its members exploit a local, thermal resource is exemplified by the Delta Montrose Electric Association (DMEA), a rural electricity co-op based in Montrose, Colorado. Through its heating program “Co-Z”, DMEA provides low cost financing for the purchase and installation of the components of a ground-source heat pump system that are outside a member’s home. DMEA’s subsidiary, Intermountain Energy, reviews the potential site and prepares the installation proposal. If the terms of the proposal are acceptable to the co-op member, the member completes a credit application with DMEA, which, once approved, is secured by a deed of trust and a promissory note. To secure the loan, DMEA registers a lien on the homeowner’s property, much like a second mortgage. Ownership of the loop remains with the homeowner.

Repayment of the loan occurs monthly, and is “invoiced” via the member’s monthly electric bill, which itemizes payable principal and interest as well as energy use. In the United States, this interest is a deductible expense for the purposes of the member’s income tax return. As an additional inducement, DMEA locks in the billing rate for electricity for 5 years and there is no pre-payment penalty, so members can repay the loan on an accelerated basis. If the member wishes to sell their residence, prior to repaying the equipment loan, there are three options: i) the member may repay the financing prior to the sale, thereby removing the lien on the property, ii) they may repay the financing through the proceeds of the sale of the property, or iii) the purchaser may assume the remainder of the outstanding loan (after receiving successful credit approval from DMEA).

On January 1st, 2007, DMEA will be initiating a “loop tariff” pilot project, whereby the co-op will retain ownership of the ground loop and the system will be leased to the member. This lease charge will be noted in a member’s monthly utility bill, along with their energy use. It is anticipated that this will result in significant savings for DMEA’s customers.

5 Utilities and Regulation

Both district systems and individual fields and pumps may be administered as a municipal “utility.” Ownership and operation of the utility may be through the same or different entities and the municipality may choose to participate in that ownership and operation to a greater or lesser degree. This section explores some of the considerations surrounding the establishment of a municipal utility.

5.1 What is a Utility?

A utility is a company (which may consist of a person or organization) that performs a public service such as the provision of water, light, heat, garbage collection or telecommunications and is often subject to government regulation. Although local governments in British Columbia have a long history of utility provision in the areas of water, sewer and transportation infrastructure, it is only recently that local and regional governments have ventured into the provision of energy services.

Historically, provincially controlled or private energy-related utilities (such as BC Hydro and Terasen Gas, respectively) have predominantly provided a monopoly service to multiple customers. This model has been useful, as it has allowed upfront costs to be amortized and recovered along with operating and maintenance costs through a levy, which has usually been regulated.

In British Columbia, “public utilities” – as defined by the *Utilities Commission Act* – are regulated by the BC Utilities Commission (BCUC). The BCUC establishes amongst other things, the rates that can be charged to utility customers. The Act defines an energy related public utility as a person or organization who:

- Owns or operates
- Within British Columbia
- Equipment or facilities that
 - Produce, generate, store, transmit, sell, deliver or provide
 - Any agent for the production of light, heat, cold or power (including electricity, natural gas and steam)
- To the public or a corporation
- For compensation.

Services provided by the local government or regional district within its own boundaries, however, are specifically *excluded* from the definition of public utility and, are therefore outside the scope of the *Utilities Commission Act*. This means that if, for example, the City of Surrey provides ground-source energy services to a neighbourhood within its municipal limits, it will not be regulated by the Act, whereas a private developer providing the same service to the same community, *would* be considered a public utility and subject to the rules and regulations of the BCUC.

Although it is common in British Columbia to think of utilities as organizations that distribute electricity generated in several key locations like large hydroelectric dams, or heating fuel through centralized delivery systems (such as those operated by a small

number of natural gas providers) this model is beginning to change. Increasingly, local governments are investigating ways that they can provide heating and electricity produced in a decentralized manner to their constituents, thereby acting in the role of the "public utility" provider.

5.2 Why Consider a Utility Model?

A utility model can enable the development of both a district ground-source heat pump system as well as one based on individual fields and pumps. There are many benefits to providing monopoly service to multiple customers, including economies of scale and the potential for higher and more efficient utilization of integrated infrastructure in the case of district systems, specifically. Pooling of financial and operating risk is also a significant positive consideration in both types of systems.

This model of energy delivery also carries costs. Depending on how the system is structured, these may include the purchase and placement of infrastructure, extra administrative costs (including additional metering and billing), as well as regulatory and governance costs.

5.3 Why a Local Government Energy Utility?

Increasingly, local governments are seizing the opportunity to provide energy services within their jurisdiction as a way of supporting their sustainability objectives, bolstering local energy security, and, possibly, contributing to local economic development by keeping "energy dollars" circulating locally. Energy services provided by a local government or regional district within its boundaries are not subject to regulation by the BCUC, which means that the local utility has significant flexibility in terms of planning and setting its own rates. See Annex 1 for a table that lists selected examples of local governments, provincially and nationally, which has chosen to do this.

In contrast to individual energy consumers or private energy service providers, local and regional authorities have much longer time horizons and lower discount rates. By virtue of their unique public-service position, they have the flexibility to look beyond immediate, bottom-line considerations and balance investment return with customer rates, long term energy security and environmental considerations. Unlike private business, local authorities are better positioned to bundle financial and operating risk and consider the life-cycle implications of their infrastructure decision-making.

5.4 Steps Involved in Establishing a Municipal Utility

The process for establishing a municipal utility will be unique in each jurisdiction and will be influenced by the way in which ownership and operation of the system is structured. Section 6 discusses options for the ownership and operation of a ground-source heat pump system in much greater detail. In every case, however, there are certain common steps that must be considered, irrespective of the ultimate "form" that the utility takes. These include:

1. Confirming that at least one of the following is in place, in the event that a **district system** is being considered:
 - There is a new development being proposed with a number of buildings that could be connected to a system
 - There are a number of buildings within close proximity to each other,
 - There is a major load (i.e. hospital, recreation centre, industrial facility) that could serve as a primary customer to anchor the project, or
 - There are existing key buildings on the system that could be easily converted to district heating.
2. Contacting **critical partners** to determine if there is any interest in developing a ground-source heat pump system. Partners will differ between jurisdictions, but in addition to city staff from relevant departments, critical partners will likely include individuals from the development community, utilities and potential customers.
3. Establishing a **working group** to collaborate on the project. This group should include at least one elected official, municipal staff members and the key partners identified in the previous step.
4. Contacting the **relevant regulatory authorities** (e.g. Ministry of Environment) and, if appropriate, involve them from the earliest stage possible.
5. Investigating **sources of funding** for the preliminary scoping study. The CEA's *Funding Your Community Energy Initiatives Guide* provides an up to date reference for this.
6. Launching a **scoping study** to investigate the potential for district heating. Much of the work can be done in-house, such as determining the willingness of local buildings owners to participate, identification of new developments, and assessing the distances between potential customers.
7. If the scoping study shows promise, undertaking a full **feasibility study**, which should include a detailed investigation of the technical and financial aspects of the project. Note that the cost of a feasibility study can vary widely depending on scope and complexity of the energy system being considered. In certain situations, energy service companies may perform the feasibility study for free in exchange for the right to develop the project.

Based on the information obtained from the scoping and feasibility studies, city staff should, at this point, have sufficient information to present informed options to council regarding system ownership and the best way to structure governance. Depending on how ownership and operation of the system is allocated, the key partners (identified in step 2, above) will help inform or materially shape the project, according to their respective interest.

6 Additional Considerations

6.1 Partners

Ownership models that involve partners will require continual interaction and negotiation between local government staff and partners. Partnerships, however, may result in a net saving in staff time, depending on the partners involved and the definition of their activities in relation to one another.

6.2 Legal Liability

This section provides a brief introduction to the legal liabilities to which local governments may expose themselves in relation to ground-source heating. However, the advice in this section is no substitute for independent legal advice, which should be sought if there are concerns about the liabilities to which the City may be exposed.

6.2.1 Liability and the building code

The building code requires adequate provision for heating, and local governments must therefore be satisfied that any ground-source heating system meets these requirements before issuing a building permit. For most buildings, a professional engineer assumes responsibility for ensuring that the provisions of the code are satisfied, by providing letters of assurance. This is not required for single-family homes (Part 9 of the Code) however, and the responsibility associated with granting a building permit for a ground-source heating system thus rests with the local government. Should the system fail, the local government may be liable. In BC, some local governments (Kelowna and Abbotsford, for example) have limited this risk by requiring that ground-source heating systems are either certified by a professional engineer or are fully backed-up by conventional heating systems. Some ground-source heating companies (for example, Geotility) now provide an in-house engineer to certify systems, and thus accept liability themselves.

The Canadian GeoExchange Coalition has taken the view that the requirement for a professional engineer's signature is too stringent for installations at the scale of a single-family home. However, the Coalition recognizes that local governments need to be in a position to issue building permits with confidence. It is in the process of developing Municipal Inspector Guidelines, which will be published later this year. It has also recently developed a quality assurance program, in an effort to provide greater confidence to those buying and permitting ground-source heating systems. The program involves the training and professional accreditation of installers, designers and engineers. Further details on this program are available from the Coalition (www.geo-exchange.ca).

Ultimately, the City will need to either transfer the risk by requiring a professional engineer, or be satisfied that systems are designed appropriately through a combination of installation standards and training of municipal staff.

In cases where the local government is recommending or requiring the use of ground-source heat pumps, it is possible that the local government could be open to liability if the system fails (as opposed to simply providing inadequate heating). In installations in non-Part 9 buildings (i.e. all buildings except those in single-family homes), an engineer will have

accepted responsibility for assessing the adequacy of the system. In single family homes, the same need will exist for the City to either transfer risk through a professional engineer or satisfy themselves as to the adequacy of the installation.

6.2.2 Liability and ownership of ground-source heating systems

Ownership, in part or whole, of any business implies legal liability. This goes beyond the requirements to ensure that the installation meets building code requirements. There are a number of ways that the City may shield or minimize its exposure to liability, several of which are described below. The City should seek independent legal advice, however, if it intends to own or part-own a ground-source heating business. The Canadian GeoExchange Coalition has worked in the past with Canadian local governments on these issues, and has worked with law firms with expertise in this area.

First, appropriate agreements must be executed with all the parties that the local government does business with—this includes customers as well as service providers and partners, as appropriate. The liability of an energy service provider to its customers for failure to supply heat, for example, should be well defined in service provision agreements. Both the City of New Westminster's *Electricity Bylaw* and the City of North Vancouver's *Bylaw to Create Hydronic Heat Energy Service* provide useful examples of liability-limiting language.

A second way for the City to limit its liability is through the creation of a wholly owned subsidiary. This is the Special Purpose Vehicle that was described above and is an independent legal entity that is exclusively responsible for its own debts and liabilities.

A third way to mitigate potential claims is through appropriate due diligence on the part of City staff and its agents. A discussion of this follows.

Due Diligence

Due diligence on the part of city staff—in relation to an energy system—means that staff and their agents (including contractors) have acted in a prudent and reasonable manner in relation to the establishment and operation of the energy system. In law, what is “reasonable” is judged in relation to the actions that city staffers elsewhere would have taken if faced with a similar situation. This standard requires that thoughtful, informed, diligent inquiry and action be involved when approving, creating or running an energy system.

Ensuring that all permitting and regulatory issues have been addressed (to the degree possible) is a basic element of due diligence. There are few permitting considerations that relate to the installation of a closed loop ground-source heat pump system at the local or regional level. Federal and provincial codes and regulations (e.g. *Canadian Environmental Protection Act* and the proposed *Drinking Water Act*) may affect the feasibility of open-loop systems, however, as they are subject to more stringent regulatory and practical restraints as relates to water use and disposal.

Federal legislation applies to all ground-source heat pump systems but, with certain exceptions, is limited to mechanical safety requirements and performance certification

under the *Energy Efficiency Act*. Three national standards for performance certification and installation must also be observed. First, *CAN/CSA-C448 Series-02* provides a design and installation standard for commercial, institutional, residential and other small buildings and underground thermal energy storage systems for commercial and institutional buildings. Second, *CAN/CSA-C748-94 (R1999)* is a standard for the performance of direct expansion ground-source heat pumps and third, *CAN/CSA-C13256-01* provides a performance rating standard for earth energy heat pumps providing COP (heating) and EER (cooling) data, including water-to-air and brine-to-air heat as well as water-to-water and brine-to-water heat pumps (as required by the *Energy Efficiency Act*).

The Canadian Geo-Exchange Coalition has recently developed a quality assurance program, in an effort to provide greater confidence to those buying and permitting ground-source heating systems. The program involves the training and professional accreditation of installers, designers and engineers. Further details are available from the CGC website (www.geo-exchange.ca).

In addition to the above, a non-exhaustive list of issues relating specifically to ground-source heat pump systems might include:

- The cost effectiveness of ground-source energy systems in relation to other energy technologies that could be used to meet municipal energy policy guidelines
- System design for future expansion potential
- Building design (particularly hydronic system design) to ensure systems are able to efficiently handle the utility's supply and return temperature specifications
- The appropriate minimum clearance of loops to lot lines to ensure that there is no potential for interaction with current or future adjacent systems
- The local experience of the team that is designing the system and installing the ground loops
- Open loop system issues, including whether:
 - All relevant provincial codes and regulations have been factored into the feasibility/risk assessments
 - Regulatory and practical restraints as relate to water use and disposal have been considered
- The inclusion of access provisions re: private property in energy service agreements (between the utility and energy consumer) to ensure that in the event of system failure or required maintenance that the *local government* can gain access to system equipment
- Sufficiency of municipal in-house and contracted capacity to deal with technical issues and service considerations that may arise from time to time.

In order to meet basic due diligence obligations and also as a matter of common sense, city staff should contact managers of similar (or analogous) projects elsewhere to benefit from lessons learned. A list of relevant projects may be found in Annex 1.

7 Conclusion

Increased adoption of ground-source heat pumps in Surrey would contribute to the City's social, environmental and economic sustainability objectives. The City has a number of options for encouraging ground-source heat pump systems throughout the community, in particular by building on the enabling language in the City's OCP to promote GSHP systems through the planning and permitting system. Potential measures include:

- Education campaigns to raise awareness of ground-source heat pumps amongst developers and the public
- Development permit checklists that highlight the City's sustainable energy objectives and specifically reference ground-source heat pumps
- Reduced permit fees and an expedited approvals process for green buildings and those including ground-source heat pumps
- Revitalization area tax exemption, rezoning, and density bonusing policies that reward the incorporation of ground-source heat pumps
- Designation of local service areas for ground-source heating supply

A further possibility is for the City to more actively promote ground-source heat pumps, through involvement in installing and operating GSHP systems. Possibilities include:

- Establishment of a municipal utility that would own and operate GSHP systems, potentially as a district heating system
- Some municipal involvement or equity in a privately owned utility or energy services company that builds and operates GSHP systems
- Installation of GSHPs in municipal buildings, ideally as a demonstration project to promote knowledge and awareness of GSHPs in the community

Clearly there is no one-size-fits-all package available when structuring energy projects. An assessment of community needs, available assets (including the geoexchange potential of an area and staff resources) and community values should be conducted early on in the process.

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Annex 1 - Energy Utility Precedents

Location	Type of System	Ownership Model	Notes
Heat			
City of Markham <i>Markham District Energy Inc. (MDEI)</i>	District Heat & Electricity - Natural gas	100% Municipally Owned & Operated	MDEI was created in 2000 by the Town of Markham to offer an environmentally sustainable energy solution to developers of Markham's Smart Growth downtown - Markham Centre. This cogeneration system operates with high efficiency boilers and chillers. http://www.markham.ca/markham/channels/newscentre/newsreleases/040603_gmifund.htm
Sherwood Park, AB <i>Centre in the Park Community Energy System</i>	District heat – Natural gas	100% Municipally Owned & Operated	Strathcona County operates the Community Energy System, a hot water district heating system, as a utility with all costs paid through user fees. System can be converted to use alternative fuels (including biomass) once/if economical. http://www.strathcona.ab.ca/Strathcona/Whats+New/News+releases/2005/March+2005/Community+energy+system+to+be+developed.htm
North Vancouver <i>Lonsdale Energy Corp.</i>	District Heat - Natural gas	100 % Municipally Owned & Service Contract	Mini-plants located in parking garages throughout the precinct heat water, which is circulated through energy district. This is a municipally-owned district energy system with some equipment and services provided by Terasen Utility Services/Corix. http://www.cnv.org/server.aspx?c=2&i=98
City of Revelstoke <i>Revelstoke Community Energy Corporation (RCEC)</i>	District Heat – Biomass Boiler (Wood Residue Fired)	100 % Municipally Owned & Service Contract	RCEC is a 100% municipally owned steam heating system with long-term energy supply agreements signed with private partners. RCEC's system assets are held directly by the City and by Revelstoke Community Forest Corporation (RCFC), a wholly-owned City corporation Along with 50% Green Municipal Fund's project funding (FCM), RCFC has loaned the project \$1.25M (in exchange for a small number of non-voting common shares). The balance of funding has come from the Revelstoke Credit Union and the City's Electrical Utility Reserve Fund. RCEC is administered by a self-governing board, which is appointed annually by City council. http://www.cityofrevelstoke.com/edc/energy-project-announcement.htm

Location	Type of System	Ownership Model	Notes
Heat (cont'd)			
City of Windsor <i>District Energy Windsor (DEW)</i>	District Heating and Cooling – Natural Gas	Less than 100% Municipally Owned (Distribution Assets)	<p>Windsor’s district energy system was developed by DEW, a division of the Windsor Utilities Commission (WUC), to support its City Centre's rapid revitalization and development. This system was the first in North America to supply both district heating and cooling. DEW owns and operates the thermal distribution assets, purchasing heat and other services from a privately owned central energy plant. All end users are customers of WUC.</p> <p>The City of Windsor is DEW’s sole shareholder. An independent Board of Directors (also called a Commission) governs it. The Chair is the Mayor who, along with 3 City Councilors and 4 or 5 private industry individuals, form the Commission.</p> <p>http://www.wuc.on.ca/index.asp?scn=65000&sub=65100</p>
City of Greater Sudbury <i>Sudbury District Energy Corporation (SDEC)</i>	District Heating & Electricity – Natural Gas	Less than 100% Municipally Owned	<p>The SDEC is a 5MW natural gas fired cogeneration plant, which produces 4.4 MW of thermal energy in the form of steam for seven different steam hosts in downtown Sudbury. It is 50% owned by the City of Greater Sudbury. In 1998, Sudbury and Toromont Energy Ltd. created the SDEC, Canada's first district-energy, public-private partnership. Toromont brought financing capability to the project and expertise that the City did not have in establishing and operating a co-generation plant. The SDEC was built at a cost of \$15 million with each partner holding 10 percent equity. Toromont provided most of the remaining funding in the form of a loan. As well as providing the initial loan, the Government of Canada provided \$500,000 in seed funding from the Climate Change Action Fund.</p> <p>http://www.summitconnects.com/Articles_Columns/Summit_Articles/2001/special_focus/PPP/Sudbury_energy.htm</p>

Location	Type of System	Ownership Model	Notes
Heat (cont'd)			
City of Toronto <i>West Don Lands / East Bayfront</i>	District Heating – Natural Gas (with potential to convert to renewable source)	Less than 100% Municipal Ownership	<p>The Toronto Waterfront Revitalization Corporation (TWRC) is 1/3 owned by each of the City, Province and Federal Government. It is currently pursuing the development of a district energy system to serve the West Don Lands and East Bayfront. Large urban infill projects will be comprehensively serviced with new infrastructure. The district energy system will be comprised of a central energy plant, a piped distribution system and energy transfer stations at individual buildings. A single central energy plant is proposed to serve both the West Don Lands and East Bayfront. The plant would be designed in a way that would enable its capacity to be expanded incrementally to coincide with the development of the precincts.</p> <p>TWRC is hoping to develop the project with a joint venture partner and may be moving to a concession RFP in Spring 2007.</p> <p>www.toronto.ca/legdocs/2006/agendas/committees/pof/pof060918/it044.pdf</p>
Grande Prairie <i>Aquatera Utilities Inc</i>	Preliminary District Energy feasibility study completed. To be followed by a “Next Steps” (implementation) document.	Less than 100% Municipal Ownership	<p>Aquatera is a for profit entity that is wholly owned by 3 partners: the City of Grande Prairie, the Town of Sexsmith and the County of Grand Prairie. This regional utility corporation currently provides water and wastewater treatment, garbage collection and recycling services to local residents. The Federation of Canadian Municipalities has granted Aquatera \$95,000 Green Municipal Fund (GMF) undertake the business development work required to establish a Community Energy System (CES) in Grande Prairie.</p> <p>The system is expected to distribute heat to approximately 30 buildings (including public municipal and provincial facilities, schools, and the hospital), with the first customer connection scheduled for fall 2008. A recently completed biomass-fuelled Combined Heat and Power (CHP) plant owned by Canadian Gas & Electric will provide steam, which will be purchased by Aquatera to provide heat for the system.</p> <p>http://www.fcm.ca/english/media/press/aug92006.html</p>

Location	Type of System	Ownership Model	Notes
Heat (cont'd)			
City of Toronto <i>Downsview Park</i>	District Heat – Natural gas (diesel fuel backup)	0% Municipal Ownership	Parc Downsview Park Inc. (PDP) is 100% federally owned. PDP owns steam plant, which includes 4 gas fired water tube boilers and the distribution system. 5 stationary engineers are retained onsite for ongoing operation and maintenance requirements. Enbridge Gas supplies fuel. http://www.pdp.ca/The_Plan.408.0.html
City of Vancouver <i>Central Heat Distribution Ltd.</i>	District Heat – Natural gas	0% Municipal Ownership	Central Heat is an investor owned utility that provides heat to buildings in downtown Vancouver.
City of Cornwall <i>Cornwall Electric</i>	District Heat & Electricity – Natural Gas	0% Municipal Ownership	In 1995, CDH District Heating Limited – a subsidiary of Cornwall Electric, a wholly owned City subsidiary – opened the first municipally owned hot water district heating/co-generation system in Canada. CE was purchased and is now 100% owned by a private company. This district heating/co-generation system heats approximately 14 buildings including hospitals, schools, a library, and senior citizens' residence. http://www.greenlearning.ca/climate-change/policy/index.php?section=6&sub=1
Kamloops First Nations Reserve <i>Sun Rivers Development</i>	Individual Heat & Cooling – Ground-source heat pump	0% Municipal Ownership	Multi-utility concept including individual heating and cooling services from individual units in each residence. Provided by developer-owned utility.
Kelowna <i>Wilden Estates</i>	Individual Heat & Cooling – Ground-source heat pump	0% Municipal Ownership	Optional heating and cooling provided by developer-owned utility
City of Okotoks <i>Drakes Landing Solar Community</i>	District Heat - Solar Thermal	0% Municipal Ownership	Solar heated hot water super charges the ground. This energy is withdrawn and used for space heating in the winter. The project was conceived of by Natural Resources Canada, which worked with a private company to develop the community. http://www.dlsc.ca/about.htm

Location	Type of System	Ownership Model	Notes
Heat (cont'd)			
City of Halifax	District Heat – Natural Gas	Pending	Halifax Regional Municipality and Nova Scotia Department of Energy have signed an MOU with Dalhousie University, Saint Mary's University and the Capital District Health Authority to move forward with a Community Energy Project. It is expected that the project will involve construction of a natural gas-fired combined heat and electrical power plant on Halifax's peninsula. Waste energy from the plant will be utilized to provide heat to the universities and hospitals through an underground distribution system. http://www.halifax.ca/mediaroom/pressreleases/pr2005/050817CommunityEnergyProject.html
City of Richmond <i>Thermal Energy Network</i>	District Heat– Waste water, ground-source heat pump and skating oval	Pending	The City is planning a new 2,500-unit mixed-use development to be built on municipally owned land next to the new Olympic speed-skating oval. Heat for the system is expected to come from waste water, ground-source heat pumps and waste heat from the skating oval.
City of Toronto <i>Regent Park District Energy</i>	At the design stage	Pending	Toronto Community Housing Corporation (TCHC) is currently designing district energy system for Regent Park, located near the West Don Lands (see above). It is expected that it will be similar to or form part of the West Don Lands Project.
Electricity			
City of New Westminster	Electric Utility	100 % Municipally Owned Distribution System & Power Purchase Agm't	The City owns distribution lines and purchases electricity from BC Hydro as well as additional services in some cases http://www.city.newwestminster.bc.ca/cityhall/finance/electrical.htm
City of Kelowna	Electric Utility	100 % Municipally Owned Distribution System & Power Purchase Agreement	FortisBC supplies power to the electric utility, and through a partnership contract with the City of Kelowna. FortisBC also provides all network operations for the electrical distribution system including operation & maintenance, capital project planning, management and construction, all electric meter installations and all street light maintenance throughout the city. http://www.city.kelowna.bc.ca/CM/Page391.aspx

Location	Type of System	Ownership Model	Notes
Electricity (cont'd)			
City of Penticton	Electric Utility	100 % Municipally Owned Distribution System & Power Purchase Agreement	The City owns distribution lines and purchases electricity from FortisBC. The utility designs, installs, operates and maintains the City's electrical power distribution system and provides electrical service to residential, commercial and industrial customers within its service area. The utility provides engineering design and construction for alterations and extensions made to the electrical utility system as well as revenue metering equipment and meter replacement when applicable. http://www.penticton.ca/electrical/default.asp
City of Grand Forks	Electric Utility	100 % Municipally Owned Distribution System & Power Purchase Agreement	Owns distribution lines, purchases electricity from FortisBC. The electrical department has a crew of three journeyman line technicians who are responsible for the operation and maintenance of the utility, which includes approximately 50 kilometres of electrical lines. The maintenance and operation of the system includes connecting and disconnecting customers to and from the electrical system, maintaining the street light system, reading electrical meters, and general system maintenance of poles and wires. http://www.city.grandforks.bc.ca/services/
City of Summerland	Electric Utility	100 % Municipally Owned Distribution System & Power Purchase Agreement	Owns distribution lines purchase electricity from FortisBC, as well as additional services in some cases. http://www.summerland.ca/Default.asp
City of Nelson <i>Nelson Hydro</i>	Electric Utility	100 % Municipally Owned Electrical System & Power Purchase Agreement	Nelson Hydro provides electricity and related services to customers in the City of Nelson and surrounding area including Blewett, Taghum, the North Shore, Harrop, Procter, Balfour and Queen's Bay. 45% of its annual energy requirements are obtained via power purchase from West Kootenay Power. Nelson Hydro is fully vertically integrated operating generation, transmission, substation and distribution facilities. Nelson Hydro operations are managed by two staff personnel who oversee a crew of fifteen others. http://www.city.nelson.bc.ca/html/hydro.html