

PRIORITIZED RECOMMENDATIONS TO ADVANCE GEOEXCHANGE AMONGST MUNICIPALITIES

Final Report

Prepared For.



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1. Executive Summary

GeoExchange™¹ energy systems maximize energy efficiency and conservation, which in turn reduces operating costs for occupants and minimizes the environmental and atmospheric impacts associated with fossil fuel combustion. These highly efficient systems, under the right circumstances, are cost-effective, reliable alternative energy sources. Yet often this alternative is not fully explored during the development planning process, in which municipal government plays a key role. The Municipal Roadmap Exercise Final Report explores why.

Following a review of common barriers to greater uptake of geexchange, this report explores potential solutions. Solutions are then evaluated and ranked, resulting in prioritized recommendations for municipalities to advance the uptake of geexchange energy systems.

As a foundation for any subsequent policy or action, it is recommended that municipalities pass a council policy supporting energy efficiency and improved community energy management. Such a policy gives staff the mandate to pursue innovative ways to provide incentives to developers who are interested in alternative systems. See page 6 of this report.

Regarded as ‘easy wins’, the following solutions ranked medium-high to high overall, and should be pursued first and with concerted effort:

- Review and revise, where appropriate, building bylaw requirements (pg. 5)
- Establish a life cycle cost procurement policy (pg. 6)
- Implement a geexchange policy (pg. 7)
- Establish priority permit processing (pg. 9)
- Provide information to developers and homeowners (pg. 11)
- Provide information on funding opportunities (pg. 12)
- Promote geexchange during development process (pg. 13)
- Profile municipalities as early adopters (pg. 13)

The second tier of solutions ranked medium, suggesting attention is warranted, but not at the expense of solutions in the medium-high category:

- Offer amenity bonusing in exchange for installing geexchange (pg. 9)
- Explore and adopt a Local Improvement Charges program (pg. 9)
- Broker financial partnerships (pg. 10)

The third category of solutions ranked low to medium-low, suggesting attention may be warranted in the future, once ‘easier wins’ have been realized:

- Pursue utility services (pg. 8)
- Discount building permit fees (pg. 9)

¹ The Canadian GeoExchange™ Coalition is the owner and manager of the Canadian trademark rights for the term “GeoExchange™”. It is the preferred term for what is historically known as ground source heat pump systems.

- Develop a geoexchange potential map (pg. 12)

It is evident that municipalities have a strong role to play in advancing geoexchange energy systems. But they cannot do it alone. Effective policies and subsequent action will require collaboration among CGC, developers, provincial and federal agencies, municipal planners, engineers and building staff, financiers, consulting engineers, learning institutions, and citizen-consumers. This Roadmap Exercise Final Report is the first step in charting a path for collaborative action.

2. Introduction

Though growing in popularity, relatively few new developments install geoexchange² systems when compared to the large uptake of conventional space heating and cooling systems. This is at odds with the numerous benefits that geoexchange systems can potentially offer, such as:

- Lower building annual operating costs;
- Significant energy savings for jurisdictions;
- Smoother energy load profiles for utilities / distribution companies;
- Intangible ‘green’ and status benefits from elimination of dependence on natural gas or oil;
- Mechanical systems space savings;
- Potentially increased comfort and humidity control using low-temperature hydronic (hot water) distribution systems;
- Recovery of heat that otherwise would be lost (i.e. waste heat), such as heat from an adjacent sewer, an arena ice slab, or from building cooling systems;
- Recovery of commonly wasted internally generated heat (e.g. from mechanical/computer rooms); and,
- Partial protection from increasing energy prices - only a portion of the heat delivered comes from electricity.

With so many potential benefits, there is good reason to believe that geoexchange systems would be used wherever possible. Yet they aren’t, due to a number of barriers, both real and perceived.

Recognizing that municipalities are a key player in the development approval process, the Canadian GeoExchange Coalition (CGC) developed a decision framework (a ‘Roadmap’). The main objective of the Municipal Roadmap Exercise is to provide Canadian municipalities with prioritized recommendations to help overcome barriers and/or accelerate the uptake of geoexchange energy systems, and thereby to help actively encourage greater uptake of geoexchange energy systems in private and public projects.

3. Roadmap Exercise Methodology

The Municipal Roadmap Exercise included the following steps:

1. Developing a Roadmap Discussion Document, intended to stimulate discussion and solicit input from Canadian municipal representatives and other relevant stakeholders.
2. Conducting a nation-wide conference call on November 23, 2006 to solicit input on the discussion document. See Appendix A for meeting summary notes and participants list.
3. Presenting findings at the CGC’s national conference in Gatineau, Quebec on November 27th, 2006.

² The Canadian GeoExchangeTM Coalition is the owner and manager of the Canadian trademark rights for the term “geoexchangeTM”. It is the preferred term for what is historically known as ground source heat pump systems.

4. Conducting targeted interviews and research to fill knowledge gaps. Interviewees included consulting engineers, municipal and provincial government officials, developers, and industry representatives.
5. Conducting a prioritization exercise with approximately ten municipal representatives and other stakeholders during a December 12, 2006 nationwide conference call.
6. Producing a Municipal Roadmap Exercise Final Report, including prioritized recommendations for municipalities to overcome barriers to and/or accelerate uptake of geexchange energy systems.

4. Scope

There are numerous examples of applications where geexchange systems are economically and technically feasible, and some where they are not. Feasibility factors include ground conditions, heating and cooling loads, ownership structure of the building, energy prices, climate, and provincial- and municipal-specific policies, to name only a few. These factors vary across Canada. Thus, the Roadmap Report focuses on common barriers and solutions that are widely applicable. Not all barriers and solutions will be relevant to every situation. When crafting geexchange-related policy or other solutions, context-specific discretion is always best. The Roadmap Report explores options available to municipal governments to address a range of widely-encountered barriers.

5. Organization of Roadmap Exercise Final Report

Section 6 of this Roadmap Report explores barriers inhibiting greater uptake of geexchange energy systems in private and civic developments. Following barriers, potential solutions and the actors required to realize those solutions are identified are explored in Section 7. Solutions do not exist in a one to one relationship with barriers – each solution addresses several barriers. Section 8 includes a summary table of each solution, the barriers it addresses, and primary and secondary actors required to implement the solution. Section 9 identifies the evaluative criteria used to assess potential solutions. Using a matrix format, Section 10 evaluates and ranks potential solutions. Section 11 summarizes the findings of this final report and roadmap exercise.

6. Barriers

Three types of barriers are prevalent: policy, market, and information. Barriers can be real or perceived. Either way, they inhibit greater uptake of geexchange systems where such systems may otherwise be feasible.

6.1. Market barriers

To paraphrase one developer who was interviewed: ‘Land costs are fixed, sell costs are fixed, so we’re continually value-engineering, looking for ways to reduce costs for our product. GeoExchange™ is an extra.’ To paraphrase another: ‘The market doesn’t demand this technology yet.’ It is evident market barriers exist.

6.1.1. Capital costs

The high incremental capital costs of geexchange systems compared to conventional heating and cooling systems are typically very difficult for developers or landlords to pass on to purchasers in the sales price or lease rate. As well, in regions with rapidly rising construction costs, such as Greater Vancouver, many developers are undergoing what is commonly but mistakenly referred to as value-engineering exercises: seeking ways to strip what are perceived as unnecessary costs out of projects. GeoExchange™ systems are generally mistakenly considered an extra without value or a value proposition, which is a common barrier for technologies that have not yet achieved significant market penetration.

For example, in the Wilden single- and multi-family subdivision in Kelowna, BC, the capitalized cost of a 4 (6) ton geexchange system is \$10,000 (\$14,000). Home purchasers often either will not consider life cycle costs, or do not expect to be in the house long enough to enjoy the financial benefits that accrue after the payback period.

Compounding the challenge are the limited opportunities to finance the capital costs of a geexchange system. It was noted during the November 23rd web cast conference call that lenders are generally thought to be averse to financing alternative energy systems.

6.1.2. Cost effectiveness

GeoExchange™ energy systems’ higher capital costs are offset by low operating costs (relative to conventional energy sources). Operating cost savings over the entire year reduce the life cycle cost of the system, which helps justify the initial incremental capital cost of a geexchange system over conventional systems. There are many factors that reduce operating costs, including, for example, a high, balanced demand for both heating and cooling in the building (thus reducing both heating and cooling costs), soil conditions, efficiency of the overall geexchange system, and building type, to name only a few. Where operational costs are not lower than the operating costs associated with conventional heating and cooling systems (e.g. furnaces, air conditioners), the geexchange system may not be cost-effective.

6.1.3. Split incentive

This barrier is related to the high capital cost barrier. Often the party incurring the incremental capital cost of the geexchange system is not the one to which the operating cost savings accrue. Thus, there is little incentive for a builder/developer to consider installing a geexchange system.

In a 60-unit multi-family development in Burnaby, BC, the incremental capital cost of a geexchange system over a conventional system was about \$5,000/unit, for a total incremental cost of about \$300,000. The prospect of passing these additional costs to a strata council, and ultimately to occupants, raised a challenge: without a reasonably attractive consumer financing option, homeowners may be unwilling to pay a premium for this type of system.

6.1.4. Parcel constraints

For small parcels in urban areas, often the only option is a vertical loop, which requires vertical bore holes. Depending on the heating and cooling load and parcel constraints, the amount of piping required for the vertical loop to make the system cost effective is often *thought* to be prohibitive. Options are available (e.g., angled bore holes, the combination of geexchange systems with other technologies to reduce system sizing requirements), but some engineers may not be aware of these options as they have not been fully trained.

6.1.5. Lack of knowledge among consulting engineers

During the CGC national conference on November 26-27, 2006, two high-profile developers explicitly mentioned the lack of knowledge about geexchange systems among consulting engineers. This barrier is particularly prevalent for residential buildings. The main consequence of this barrier is the lack of specific information related to costs and savings of the geexchange system. Lacking information themselves, developers are unable to effectively inform potential consumers of the benefits of geexchange systems. Without this marketing advantage, a developer may be less inclined to opt for a geexchange system over a conventional system.

6.2. Information barriers

The second type of barrier is information-oriented. Despite some market penetration, there remains a lack of awareness of geexchange benefits and caveats among local government staff, developers, consulting engineers and architects. This is possibly because of a lack of resources to undertake a comprehensive sustained information dissemination campaign to effectively reach all stakeholder groups.

6.2.1. Lack of awareness among developers and consulting engineers

Some projects are well suited to geexchange systems. Yet many developers and consulting engineers lack knowledge of geexchange systems, which results in the geexchange option not being considered during the design phase.

6.2.2. Lack of awareness among homebuyers

Whether real or perceived, the perception of a lack of market readiness for alternative heating and cooling systems prevents greater uptake from developers. Most developers are fairly risk intolerant; so without a clear demand signal, they are unlikely to install geexchange systems only to hope

consumers will consider them a worthwhile feature. Yet in the absence of full awareness of and confidence in geoexchange systems, consumers are not sending the necessary signal.

6.2.3. Lack of awareness among municipal staff

There is limited awareness of the advantages of and ‘natural fits’ for geoexchange systems among municipal staff and decision-makers. Planners, engineers, building officials, and elected officials are regularly interacting with developers, builders and residents. The ability of municipal representatives to influence building practices and energy equipment is substantial.

6.2.4. Absence of a municipal energy champion

The absence of an energy champion within the municipal setting is a perceived barrier. It helps to have someone influential in a municipal setting to introduce new technologies and ideas and see them through.

6.2.5. Lack of cookie-cutter information on savings

The costs and energy savings associated with geoexchange systems vary according to energy prices, ground conditions, climate, and system configuration (to name only a few). It is not possible to provide cost and energy saving estimates that would apply to every system in all regions. The absence of uniform figures makes it difficult to give consumers the confidence in potential financial and energy savings.

6.3. Policy barriers

A third type of barrier is policy-oriented. These barriers come in two forms: policies that directly discourage greater uptake of geoexchange systems: and, those that are simply inadequate in that they result in missed opportunities for geoexchange systems to be considered.

6.3.1. Building bylaws

Municipal building-related bylaws can mandate what some geoexchange proponents perceive as excessive standards. For example, in Kelowna, BC, city staff feel they lack the expertise to ensure geoexchange systems provide the necessary heating levels required by the BC Building Code and are concerned about liability issues. As a result, the municipality requires all systems to be either designed by a Professional Engineer or supplied with a backup heating system capable of supplying the entire heating needs.

6.3.2. Municipal procurement practices

Few municipal building design and construction procurement policies require life cycle cost analyses of heating/cooling energy end use equipment options. This often leads to missed opportunities to reduce operating costs over the lifespan of the building, and therefore reduce life cycle costs. Due to the long-term, single ownership of most public buildings, it is in a municipality’s interest to evaluate its energy equipment options in terms of life cycle costs. GeoExchange™ systems are usually one of the highest life cycle cost savings opportunities for all stakeholders.

6.3.3. Water issues and policies

Compared to most other municipalities, Kelowna, BC is experiencing rapid growth of geexchange systems. As a result, the city is facing challenges related to potable water. Open- and closed-loop geexchange systems are tapping aquifers that provide drinking water to residents. This creates a tension between the community's desire to encourage sustainable energy alternatives and ensure an adequate supply of potable water for its residents.

6.3.4. Slow approval process

Often municipal staff are not familiar with geexchange, or do not have an effective evaluation process in place to issue a permit for an alternative heating/cooling system. For example, when developing their High Park Loft condominium development in downtown Toronto, Stinson Properties encountered a six-month approval process for its geexchange system. This is a major barrier for developers, as it results in higher financing costs and potentially missed market opportunities.

7. Solutions to Overcome Barriers

The range of policies available to municipalities to overcome the identified barriers is limited by the provincial legislation under which they operate. Policies are grouped into three categories: policy/regulatory, incentive, and information. For each policy, the barrier it addresses and the primary and secondary policy actors are identified. Examples of potential policy actors include:

- GeoExchange™ industry – Canadian GeoExchange™ Coalition and its provincial affiliates
- Provincial governments
- Federal departments (Natural Resources Canada, Standards Council of Canada, Environment Canada, CMHC)
- Municipal governments
- Financial institutions
- Learning institutions (trades training program, colleges, universities)
- Related industry organizations (e.g. Engineering Associations, Canadian Ground Water Association)
- Electric and gas utilities
- Development community: private developers and industry associations (e.g. Canadian Home Builder's Association)

7.1. Policy/regulatory

7.1.1. Council policy supporting community energy management and energy efficiency

Establish a council policy that states the municipality's general support for community energy management and energy efficiency, ideally linked to broader affordability and environmental objectives. Consider including geexchange systems as a recommended technology, among a range of others. Such a policy gives staff the mandate to pursue innovative ways to provide incentives to developers who are interested in alternative systems.

Ideally, such a policy would be accompanied by council assigning responsibility to a staff member to handle energy-related policy development and implementation.

A council policy is the recommended foundation for all policies noted in this discussion document.

For an example of a council policy on community energy management, see Appendix E – Sample Policy #1, Community Energy Management. For an example of a council policy on energy efficiency, see Appendix F – Sample Policy #2.

Barriers addressed: Lack of awareness, absence of energy champion, building bylaws, municipal procurement practices, water issues

Policy actor(s): Municipal government (lead), credible geexchange industry groups

7.1.2. Life cycle cost procurement policies

Revise municipal procurement policies. Establish mandatory life cycle costing of heating/cooling energy end use equipment for all new civic building and equipment replacement. Ideally, this would be

part of a broader energy efficiency or green building policy framework. Such a policy will require consulting engineers to assess a range of options, one of which should be geexchange systems. This will ensure municipalities (and taxpayers) have access to greater information in order to make better-informed economic decisions. There are several co-benefits to this action:

1. Market signal – municipalities can take a lead role in sending a signal to the market that geexchange systems are feasible options, and should be assessed where appropriate.
2. Stimulates learning – encouraging consulting engineers to assess options puts the onus on the engineering community to develop a greater understanding of where geexchange systems are feasible.

For an example of a local government policy that requires life cycle costing, see the District of Saanich's Green Building Policy (2005), available at:

<http://www.gov.saanich.bc.ca/municipal/clerks/bylaws/greenbuildpol.pdf>.

Barriers addressed: Lack of awareness, municipal procurement practices, lack of knowledge among consulting engineers

Policy actor(s): Municipal government (lead), geexchange industry groups

7.1.3. GeoExchange™ policy

Establish a policy that specifies the use of design and installation guidelines for geexchange systems. Currently, Canada has no federal mandatory training program or certification for geexchange system installers and designers. The Canadian GeoExchange Coalition's Global Quality GeoExchange™ Program, (to be rolled out in 2007) will offer the first comprehensive quality assurance mechanism in Canada. It is based on provincial regulations and CSA standards. In the meantime, the CGC offers the following as a starting point:

Canadian GeoExchange Coalition encourages consumers to deal with contractors who:

- are members of or are recognized by the CGC [though, it should be noted, this alone does not ensure they are qualified designers or installers];
- have received at least basic training in installation [i.e. manufacturer or other training]; and,
- will sign and certify in writing, the following statement:

*"This system was designed and installed in accordance with all provisions of Canada Standards Act Standard C448.2 (Design & Installation of Earth Energy Systems for Residential and other Small Buildings) and all regulations applicable to such systems on the date of installation."*³

The geexchange policy should refer specifically to the CSA C448 standard. Upon the completion of the Canadian GeoExchange Coalition's nationwide accreditation program in 2007, municipalities can revise their policies to require all geexchange systems to be designed and installed by accredited professionals. For more information see Appendix D – Global Quality GeoExchange™ Program FAQ. Also, you may contact the CGC at Info@geo-exchange.ca or call (514) 807-7559 extension 33.

³ Source: Canadian GeoExchange Coalition: <http://www.geo-exchange.ca/EN/whatisgeo/consumeradvise.htm>

CGC is finalising Canada’s first national training materials and course curriculum for geexchange technology at four levels: installer, residential designer, commercial designer, and driller. CGC is developing the first nationally recognised Canadian installers manual as well. All materials under CGC development are based on CSA standard C-448, and include the optional environmental appendices.

Completing the CGC training course will form part of the first industry accreditation and certification mechanism. The accreditation mechanism will require that participants agree to the CGC Code of Conduct, carry professional liability and workmanship insurance, have completed a certain number of successful supervised installations, agree to the above statement, and be generally in good standing in the industry. Certification of systems signifies that ISO/CSA compliant parts are used and that all aspects of good practise have been followed in accordance with C-448-02. Ideally, municipal staff dealing with geexchange systems will be CGC trained.

CGC funded GeoExchange BC’s “Design Guidelines for GeoExchange System Design and Installations in BC,” which references the CSA 448 as a minimum requirement. The guidelines are available at: www.geoexchangebc.org.

Barriers addressed: Lack of awareness, building bylaws, municipal procurement practices, water issues
Policy actor(s): Municipality (lead), geexchange industry groups, related industry organizations, learning institutions

7.1.4. Building bylaw requirements

When the CGC’s Global Quality GeoExchange™ Program® is launched, and to the satisfaction of all municipal building staff, municipalities should consider reviewing their applicable bylaws, policies or bulletins for building and/or heating system requirements that may be perceived as barriers. However, this should not be done in the absence of a geexchange system policy.

Barriers addressed: Lack of awareness, building bylaws, municipal procurement practices, slow approval process, water issues
Policy actor(s): Municipality (lead), geexchange industry groups

7.2. Incentives

7.2.1. Utility services

Explore partnerships to provide the ground loop services for new subdivisions and large-scale developments. The owner of the ground loop provides heat services for buildings, recovering the investment by charging homeowners a lease rate for loop access and heat services. For example, the Waverly West subdivision in Winnipeg, Manitoba is providing geexchange services to all 2,300 residential units over the next five years (12,000 building lots at build-out). This is a partnership between Manitoba Hydro, the Province of Manitoba, private developers and the City of Winnipeg.

In Kelowna, BC, Wilden subdivision uses a similar business model, though the ground loop and utility services are provided by a private company.

In BC, legislation allows municipalities, if they wish, to provide the ground loop and heating services and establish it as a revenue stream. BC municipalities are not subject to the same regulations as public utilities and can offer energy services independent from BC Utilities Commission Act regulations. Provincial utility regulations across Canada may differ.

Barriers addressed: Capital costs, split incentive, cost effectiveness (due to aggregation of loads)

Policy actor(s): All potential co-leads – Municipality, utilities, private developers, federal and provincial governments

7.2.2. Building permit fees

Explore the potential to lower a developer's building permit fees for assessing the viability of geexchange systems and/or installing a system. The building permit fee schedule would need to be adjusted in the building bylaw (or relevant bylaw, depending on province). Ideally, there would be a council policy that endorses the pursuit of geexchange systems. Municipal or provincial utilities are potential partners to help fund the subsidy. Note: municipalities should explore all relevant statutes to ensure they have the regulatory authority to reduce building permit fees.

Barriers addressed: Capital costs, lack of awareness

Policy actor(s): Municipality (lead), development community

7.2.3. Priority building permit processing

Establish a council policy to expedite permit applications for developers pursuing geexchange systems. Ideally this should be related to a broader council policy that endorses geexchange systems. This broader policy can help justify the allocation of resources required for faster processing. The City of Chicago has implemented a separate permitting process for buildings undergoing a certification / rating process such as the Green Building Council's LEED system or Green Building Initiative's Green Globes system.

Barriers addressed: Capital costs, lack of awareness, slow approval process

Policy actor(s): Municipality (lead), development community

7.2.4. Amenity bonusing

Establish a policy to grant developers additional density in exchange for installing a geexchange system. The additional density can help offset the associated incremental capital costs of the system. In BC, this is called amenity zoning. It must be acknowledged in a municipality's Official Community Plan and then set out in detail in the zoning bylaw. The protocol for granting amenity bonusing, if allowed at all, will likely vary from province to province. Research the legislative authority around amenity bonusing may be an appropriate role for CGC or its provincial affiliates.

Barriers addressed: Capital costs, lack of awareness

Policy actor(s): Municipality (co-lead), geexchange industry groups (co-lead), development community

7.2.5. Local improvement charges

A Local Improvement Charge (LIC) is a voluntary, innovative way for municipalities to cover the capital costs of specific improvements to a site or neighbourhood, and then recover those costs by

assessing a LIC to the property owner(s) that benefit from the improvement. The LIC shows up as an additional line item on the property owner's municipal taxes. The Pembina Institute conducted a national scoping exercise of LICs in its report "Using Local Improvement Charges to Finance Building Energy Efficiency Improvements: A Concept Report." The report notes that the main advantage of the LIC is that it associates the repayment of the cost of efficiency improvements with the building property rather than with the current building owner. Owners who are unsure whether they will remain at the location long enough to enjoy the operational cost savings associated with geexchange energy systems, may be hesitant to lay out the incremental capital costs of the system. The LIC instrument allows the incremental capital cost of alternative energy features or energy efficiency upgrades to be spread out over many years, paid either by the sole owner or shared by all owners of the building over time. The full report is available at: http://www.pembina.org/publications_item.asp?id=197.

The applicability of LICs to renewable energy and energy efficiency projects varies across provinces. Some provinces are open to the use of LICs or an LIC pilot project (Yukon, Nova Scotia), some note Ministerial approval is required (Saskatchewan, Manitoba, PEI, Newfoundland), and some feel it is beyond the original intent of the LIC legislation (Quebec, BC, Alberta, Ontario, New Brunswick). The latter category does not necessarily mean LICs are not permitted, just that special conditions apply and must be considered. See the Pembina Institute report for province-specific LIC legislation.

Web cast conference call participants noted the importance of clear communication if opting to use local improvement charges. The City of Yellowknife experienced challenges with LICs because property owners did not realize there would be an extra charge on their municipal tax bill.

Researching and reporting on the legislative authority around Local Improvement Charges may be an appropriate role for CGC and/or its provincial affiliates.

Barriers addressed: Capital costs, split incentive

Policy actor(s): Municipality (co-lead), geexchange industry groups (co-lead), provincial government

7.3. Information

7.3.1. Broker partnerships between developers and financial institutions

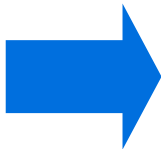
There may be opportunities to match financial institutions with development proponents. It should be noted that this may be beyond many municipalities' comfort level at this point. Pursuing this option is dependent on council support for geexchange systems.

Referred to as a 'Green Loan', there is a financing option in place in BC that works very similar to a house mortgage. The financial institution (VanCity Credit Union) provides financing to the developer for the capital cost of the geexchange system for a multi-family building. The credit union holds a 25-year loan, with a 5-year term. Upon the formation of a strata (typically upon sale of 50% of the units), the developer passes the loan onto the strata council. The strata council then incorporates the loan payments into its strata management fees charged to each unit holder. At 25 years, ownership of the asset is transferred to the strata council.

In order to demonstrate the cost effectiveness of the geoexchange system, the developer is required to make a compelling business case. This involves demonstrating that the loan payments assumed by the strata members would be less than or equal to what they would be paying otherwise for energy services associated with conventional equipment. The development manager conducts an energy modeling analysis to figure out the energy load of the building, which enables them to calculate energy and cost implications of a conventional system versus a geoexchange system.

In another example of what's possible for municipalities to encourage, Clean Energy Developments of Toronto, Ontario offers a consumer financing option in partnership with homebuilders which rolls capital costs into the mortgage and balances the higher sales price against lower operating costs – a classic home mortgage option. The consumer is offered monthly savings and an eco-friendly, reliable, and affordable way to heat and cool. See the following figure for a model of how this could work:

MORTGAGE COSTS			ENERGY COSTS		
	Fossil HVAC	GeoExchange™		Fossil HVAC	GeoExchange™
House and Land Cost	\$285,000	\$285,000	Monthly Energy Cost	\$250	\$125
HVAC Capital Cost	<u>11,000</u>	<u>\$28,000</u>			
Total Cost	\$296,000	\$313,000			
				TOTAL MONTHLY COSTS	
Mortgage Leverage	75%	75%	Mortgage	\$1465	\$1549
Mortgage Principal	\$225,000	\$234,750	Energy	<u>\$250</u>	<u>\$125</u>
Months Amortized	240	240	Total Costs	\$1715	\$1674
Annual Interest Rate	5%	5%			



POSITIVE CASH FLOW from Day One:

GeoExchange™ costs \$41 less per month (2004)

House Size: 2,500 ft²

Source: Canadian GeoExchange™ Coalition

Municipalities can broker partnerships in two ways. First, they can determine if there are any financial institutions that offer this tool. Secondly, they can match developers with these financial institutions early in the process (i.e. during the concept planning stage).

Barriers addressed: Capital costs, split incentive

Policy actor(s): Municipality, development community (co-lead), financial institutions (co-lead), geoexchange industry groups, provincial Ministries of energy, environment, and/or finance.

7.3.2. Provide information (collaborate with industry associations)

As part of a geoexchange policy, municipal staff can collaborate with the Canadian GeoExchange™ Coalition and its provincial affiliates to provide information tools to developers and consumers. Credible information packages can help build confidence in geoexchange systems, which will help stimulate demand. Ideally, municipalities and industry groups will jointly develop two information kits:

1. Developer's information kit – This information package could include information on life cycle costing, third party financing options, ownership options (for long term revenue stream), ground loop field options, where geexchange systems are a viable option, environmental benefits, case studies, and contact information. Much of this information is already available or could be compiled easily. CGC market studies may be a useful resource for the toolkits: <http://www.geoexchange.ca/en/studies/>.
2. Consumer's information kit – An information package specific to residents and building occupants could include information on life cycle costs, dependability, insulation from volatile energy costs, environmental benefits, homeowner profiles, case studies, and contact information.

Both information packages should be made available in hard copy at the municipal hall and in a digital format on the municipalities' website.

Barriers addressed: Parcel constraints, lack of awareness, lack of cookie-cutter information, water issues, lack of knowledge among consulting engineers

Policy actor(s): Municipality, geexchange industry groups (lead)

7.3.3. Information on funding opportunities

As part of a geexchange policy, municipal staff can inform development proponents of geexchange funding opportunities. There are a wide range of federal, provincial, and utility funding opportunities intended to help offset incremental capital costs of geexchange systems. Local governments can play a key role in disseminating this information to the development community and consumers. See Appendix B – Information Sources and Appendix C – Funding opportunities for more information.

Barriers addressed: Capital costs, split incentive

Policy actor(s): Municipality, geexchange industry groups (lead), provincial and federal governments, utilities

7.3.4. Develop a “geexchange suitability map” for the municipality.

This is an action that is likely contingent upon strong policy support for geexchange systems in the municipality.

Geotechnical factors may influence the sustainability of open loop and closed loop geexchange systems. Furthermore, ground loops can have impacts on aquifers that provide potable water to a community. To address this, the City of Kelowna, BC, under a larger sustainable community initiative, is exploring ways to collect subsurface data and develop a GIS database to allow for planning growth in the City. Such planning issues that could be addressed include location and type of geexchange systems, aquifer protection planning, stormwater disposal to ground, as well as many other applications. The City is preparing a strategy to collect and manage the data required and considering various business models for a financially self-sustaining service. For more information, contact Don Dobson, Dobson Engineering (ddobson@dobsoneng.com), Remi Allard, Golder Associates Ltd. (rallard@golder.com), or Don Degen, City of Kelowna (ddegen@kelowna.ca).

It is worth noting that the Alberta Geological Survey can provide drillers/contractors with information that is publicly available (e.g. surficial geology maps, many of them are of older vintage, though). However, they do not conduct specific surveys for drillers/contractors. Also Alberta Environment has a collection of water well drillers logs that should also be accessible as a further means of information on the nature of surficial materials. The water well drillers reports are available at http://www.telusgeomatics.com/tgpub/ag_water/ and includes brief lithology descriptions as well as information on flow rates, etc.

Barriers addressed: Capital costs, water issues, lack of information

Policy actor(s): Municipality (co-lead), provincial government (co-lead), geoexchange industry groups

7.3.5. Promote geoexchange during development process

Provided there is policy support, municipalities, as a key point of contact in the development process, can encourage developers to explore geoexchange systems early in the planning process. This can include providing the proponent with a developer's information kit during the concept planning stage.

Barriers addressed: lack of awareness

Policy actor(s): Municipality, development community, geoexchange industry groups

7.3.6. Profiling municipalities as early adopters

Municipalities can play a leadership role by adopting geoexchange systems in municipal buildings, where, due to single ownership and life cycle costing, a geoexchange system's economic feasibility is demonstrable. Projects can be profiled as community demonstration projects that developers, engineers and others can look at and evaluate, including both the technical and financial aspects. This helps trades people, residents, consultants and decision-makers witness the benefits and feasibility of geoexchange systems first hand. It also provides an opportunity to demonstrate leadership to its residents, other municipalities and other public authorities.

Barriers addressed: lack of awareness – consumers, developers, municipal staff, lack of knowledge among consulting engineers

Policy actor(s): Municipal government (lead), geoexchange industry groups,

There are numerous examples of municipalities playing an early adopter role. See CGC website for case studies: <http://www.geo-exchange.ca/en/studies/>.

8. Overview of Solutions Summary Table (unranked)

Potential Solution	Barriers Addressed	Lead Actor(s)	Secondary Actor(s)
Policy/regulatory			
Council policy supporting energy efficiency	Lack of awareness, absence of energy champion, building bylaws, municipal procurement practices, water issues	Municipal government	GeoExchange™ industry groups
Life cycle cost procurement policy	Lack of awareness, municipal procurement practices, lack of knowledge among consulting engineers	Municipal government	GeoExchange™ industry groups
GeoExchange™ policy	Lack of awareness, building bylaws, municipal procurement practices, water issues	Municipal government	GeoExchange™ industry groups, related industry organizations
Building bylaw requirements	Lack of awareness, building bylaws, municipal procurement practices, water issues, slow approval process	Municipal government	GeoExchange™ industry groups
Incentives			
Utility services	Capital costs, split incentive, cost effectiveness (due to aggregation of loads)	All potential co-leads – Municipality, utilities, private developers, federal and provincial governments	
Building permit fees	Capital costs, lack of awareness	Municipal government	Development community
Priority permit processing	Capital costs, lack of awareness, slow approval process	Municipal government	Development community
Amenity bonusing	Capital costs, lack of awareness	Municipal government, geoexchange industry groups	Development community
Local Improvement Charges	Capital costs, split incentive	Municipal government, geoexchange industry groups	GeoExchange™ industry groups, provincial government

Broker financial partnerships	Capital costs, split incentive	Development community (co-lead), financial institutions (co-lead)	Municipal government, geoexchange industry groups, provincial ministries
Information			
Provide information kits to developers and homeowners	Parcel constraints, lack of awareness, water issues, lack of cookie-cutter information, lack of knowledge – consulting engineers	GeoExchange™ industry groups	Municipal government
Provide information on funding opportunities	Parcel constraints, lack of awareness, water issues	GeoExchange™ industry groups	Municipal government
GeoExchange™ suitability map for the municipality	Capital costs, water issues, lack of information	Municipality (co-lead) provincial government (co-lead)	GeoExchange™ industry groups, educational institutions (technical research)
Promote geoexchange during development process	Lack of awareness	Municipal government	Development community, geoexchange industry groups
Profiling municipalities as early adopters	Lack of awareness, lack of cookie-cutter information, lack of knowledge – consulting engineers	Municipal government	GeoExchange™ industry groups

9. Evaluative Criteria

Upon finalizing the list of key barriers and potential solutions, the next step was to establish evaluation criteria to help assess and prioritize recommendations. Input from participants was sought on these criteria during the November 23rd conference call. The agreed-upon evaluation criteria include:

- Effectiveness – How well does the policy achieve the original objective of advancing uptake of geoexchange energy systems?
- Cost effectiveness – Is the policy cost-effective, both in terms of administrative costs to the municipality and costs imposed on those expected to comply with the policy (e.g. developers)?
- Administrative feasibility – Can the policy be implemented and administered easily by the municipality?
- Politically feasible – Is it reasonable to expect a politician to find this policy acceptable?

In the prioritization matrix that follows, each potential solution is assessed according to the evaluation criteria. A High-Medium-Low scale is used to rate potential solutions. For example, the Life Cycle Cost procurement policy solution is:

- High in terms of effectiveness – it induces direct action insofar as it requires consulting engineers to assess a range of alternatives in terms of life cycle costs;
- High in terms of cost-effectiveness – a council policy is relatively inexpensive to develop, and the additional costs of assessing options are offset by the life cycle cost savings of the most competitive equipment choice;
- High in terms of administrative feasibility – once the policy is in place, staff only have to evaluate options as presented; and,
- High in terms of political feasibility – this solution results in life cycle savings for energy using equipment. Council has little reason not to support the most competitive option.

Because this solution is ranked high according to each criteria, the overall ranking is high (marked in bold in far right column).

10. Prioritization Matrix

Solution	Evaluative Criteria				Overall Ranking
Policy/regulatory	Effectiveness	Cost effectiveness	Administrative Feasibility	Political Feasibility	
Council policy supporting energy efficiency	Low (will not induce direct action)	High	High	High	High
Life cycle cost procurement policy	High	High	High	High	High
GeoExchange™ policy	Low (will not induce direct action)	High	High	Medium (may be too specific)	Medium-High
Building bylaw requirements	High	High	Medium	Medium	Medium-High
Incentives					
Priority permit processing	Medium-High	High	High	High	High
Broker financial partnerships	Medium	Medium	Medium	Medium	Medium
Amenity bonusing	Medium	High	Low (onerous to municipality)	Medium-High	Medium
Local Improvement Charges	High	Medium (committed capital)	Low	Medium	Medium
Utility services	High	Low (huge capital costs)	Low (onerous)	Low-medium (risky)	Low-medium
Building permit fees	Medium	Low (cost to municipality)	Medium	Low (requires large commitment)	Low-medium
Information					
Promote geoexchange during development process	High	High	High	High	High
Profiling municipalities as early adopters	High	High	High	High	High
Provide information on funding opportunities	Medium-High	Medium	High	High	Medium-High
GeoExchange™ potential map	High	Low	Low-medium	Medium	Low-Medium

The following solutions rank medium-high to high overall, and should be pursued first:

- Council policy supporting energy efficiency (pg. 6)
- Life cycle cost procurement policy (pg. 6)
- Priority permit processing (pg. 9)
- Promote geoexchange during development process (pg. 13)
- GeoExchange™ policy (pg. 7)
- Building bylaw requirements (pg. 5)
- Provide information to developers and homeowners (pg. 11)
- Provide information on funding opportunities (pg. 12)
- Profiling municipalities as early adopters (pg. 13)

The following solutions rank medium, suggesting attention is warranted, but not at the expense of solutions in the high category:

- Amenity bonusing (pg. 9)
- Local Improvement Charges (pg. 9)
- Broker financial partnerships (pg. 10)

The following solutions are considered low to medium-low, suggesting attention may be warranted in the future, once ‘easier wins’ have been realized:

- Utility services (pg. 8)
- Building permit fees (pg. 9)
- GeoExchange™ potential map (pg. 12)

11. Conclusion

It is evident municipalities have a strong role to play in advancing geoexchange energy systems. But they cannot do it alone. Effective policies and subsequent action will require collaboration among municipal government, geoexchange industry groups, developers, provincial and federal agencies, financiers, consulting engineers, learning institutions, and citizen-consumers.

The findings of this exercise suggest municipalities exercise the greatest leverage at the policy level and through information exchange. Good policy will establish a framework that will enable and/or induce assessment and installation of geoexchange systems. Policy solutions range from a Council policy supporting community energy management and energy efficiency to more aggressive policies such as streamlining building/heating/plumbing bylaws.

Municipalities are a key point of contact in the development process. Municipal staff are also typically well connected within the community. For these reasons, municipalities’ role as effective information providers cannot be understated. Local governments bridge private interests and public interests, bringing together utilities, government, consumers, engineers and the development community under the rubric of the built environment. For these reasons, to name only a couple, municipalities will be key partners in advancing uptake of geoexchange energy systems in Canada.

Appendix A – Conference Call and Conference Summary Notes

Municipal Roadmap Exercise Conference Call

November 23, 1:00pm EST

Barriers

- **Cost effectiveness**
 - It is often thought that balanced load is key to cost effectiveness of geoexchange system, but systems can be cost-effective when highly unbalanced load. E.g. -- in Yellowknife there is a huge heating load and a very small cooling load, but systems are still cost-effective
 - Ground conditions in the north (Yellowknife) – having drillers that know exactly what needs to be done can help manage up front costs. Need for a driller’s course with a northern perspective.
- **Capital and LC costs**
 - Energy prices have significant impact on life cycle costs (in terms of competitiveness) of geoX system.
 - Limited finance opportunities for geoX. Lenders are risk averse with alternative systems
- **Costing tools**
 - Some discussion about cost templates that consumers could consult to get a ‘rough idea’ of costs; further noted that many variables affect operating costs; a ‘cost calculator’ could be a good consumer marketing tool
- **Lack of awareness** of success models, too much focus/attention on failures
- **Lack of an energy champion** in municipal setting is a suggested barrier. It helps to have someone in a municipal setting to introduce new technologies and ideas and see them through. A champion will also build institutional knowledge and capacity to ensure there is a legacy if they leave.
- **Lack of incentive for developers** to change standard practice. Developers risk-averse – want to be the second to do something new
- **Lack of unbiased assessment** – a participant noted the countless examples of where a range of options were overlooked for little good reason. This is considered a barrier. It was suggested that it is important to remain unbiased when exploring various configurations
- **Lack of cookie-cutter information on savings** – because the costs and energy savings associated with geoexchange varies by configuration, there is an absence of universal information on savings and costs
- **Municipal utilities** – there was some discussion of the varying willingness of municipal utilities to include incentives for geoexchange in their DSM portfolios. Some approve spending on geoexchange while others feel it adds electric load. There seems to be divergent opinions on this issue.

Solutions

- **Corix** was noted as a spin-off company of Kinder Morgan (new owners of Terasen Gas in BC) that provides financing, energy development and services for geoexchange systems

- **Caution** on immediately suggesting geoexchange as a solution – address heating load first (envelope, insulation, windows, etc) then explore alternative energies to satisfy load. A key step in the CGC training course will be ensure good design then address the geoexchange option.

Other issues

- There was some discussion about the evaluative criteria. It was suggested that solutions could also be assessed based on whether an energy champion is required to advance a particular solution. Presumably, the need for an energy champion to advance a solution would be a detractor, as relatively few municipalities have energy champions on staff.

Relevant Presentations at CGC Conference

(November 27/28, Gatineau, QC)

- Harry Stinson (Toronto-based developer)
 - Suggests geoX industry needs to focus on the consumer vs. developer (i.e. market pull)
 - For High Park Loft project, municipality required full auxiliary heating system because worried about liability (c.f. Roadmap discussion document – similar to auxiliary system requirements in Kelowna)
 - Took six months to get geoX system approved; major problem: idle capital
 - Lack of knowledge among consulting engineers for residential.
 - Numerous comments during the conference about lack of engineering knowledge for residential buildings. A little more expertise available for commercial buildings.
 - As part of Condominium Act builder has to provide details of first year operating costs. Nobody can tell him what those will be with geoX system. So builder has to pad the costs to avoid being accountable for under-estimating operating costs. This reduces marketability of product. Point: need for greater precision/aptitude around costing in consulting engineer sector.
 - Why builder install geoX?
 - 1. Marketing feature – sell more condos
 - 2. Incentives from federal government
 - Consumer demand – mid- to upper-level market; owner-occupant mostly interested, investor owners not as interested
- Windmill Developments
 - Lack of expertise with consulting engineers when assessing non-commercial buildings
 - Discomfort around pouring foundation over top of field; if something goes wrong, how can problem be remedied? Developer prefers field off to side rather than under the slab.
 - Split incentive barrier: alternative systems suited to a Design Build Operate P3 arrangement. Private partner has interest in life cycle costs.
 - Financing: geoX couldn't be financed as a 'construction cost' so Windmill had to use own money. Not as attractive lending rates. Tried DBO P3 but no takers.
 - Larger developers where mixed use buildings – can seek synergies in the time-of-day variation in heating and cooling loads (aka aggregation of loads). Helps balance load, make system more cost-effective.

- Friction with building permitting process. Need to smooth this in municipal permitting process.
- All buildings are LEED. Note: good guidepost for sustainable buildings, con: LEED does not include Life Cycle Costing requirement.
- Ujjval Vyas, Attorney (focus on green building rating systems)
 - Must be careful not to consider a rating system (e.g. LEED) as a proxy for performance
 - Caution confusing a rating system as a marketing piece and one that ensures building performance.
 - You only get operating cost savings from improved performance; need rating systems to ensure ongoing performance monitoring vs. just a marketing piece
 - If the rating system cites a standard, should also include a requirement for monitoring to make sure standard is met in perpetuity
 - Message: if using third party certification/labeling in building policies/regulations, make sure the labeling system has a focus on performance of the building over time

Appendix B – Information Sources

Canadian GeoExchange™ Coalition: <http://www.geo-exchange.ca/en/home/>.

Geo-Heat Centre, Oregon Institute of Technology <http://geoheat.oit.edu/techpap.htm>.

Geoexchange BC <http://www.geoexchangebc.ca>

US Geothermal Heat Pump Consortium, <http://www.geoexchange.org>.

Appendix C – Funding Opportunities and Incentives

Commercial Building Incentive Program (NRCan): Incentives to building owners who incorporate energy efficiency features in the design of new commercial or institutional buildings. Up to \$60,000. Exceed MNECB standards by 25%. <http://oee.nrcan.gc.ca/commercial/financial-assistance/new-buildings/index.cfm?attr=0>.

Industrial Building Incentive Program (NRCan): Incentives to building owners who combine energy-efficient features and processes into the design of new industrial buildings. Up to \$80,000. <http://oee.nrcan.gc.ca/industrial/financial-assistance/new-buildings/index.cfm?attr=0>.

Green Municipal Infrastructure Fund (FCM): Provides interest-bearing loans, loan guarantees, and grants to eligible recipients carrying out municipal environmental projects that improve energy and process efficiency in municipal buildings. <http://www.fcm.ca/english/gmf/gmf.html>.

Green Municipal Enabling Fund (FCM): Offers grants to eligible recipients for feasibility studies that assess the technical, engineering, environmental and/or economic viability of proposed municipal environmental projects. <http://www.fcm.ca/pcp/gmefcrit-e.html>.

Green Municipal Fund – energy stream (FCM): Through the Energy RFP process, GMF will award funds totaling approximately \$20 million in low interest rate loans and \$2 million in grants. There are two streams:

Stream A: Energy efficiency retrofits to municipal buildings, or the construction of new energy efficient municipal buildings.

Stream B: New renewable energy supply projects and energy distribution systems.

See www.fcm.ca or for more information contact: Simona Birea, Application Co-ordinator, Green Municipal Fund Phone: (613) 241-5221, ext. 238, E-mail: energy.rfp@fcm.ca.

Federal tax incentives for Class 42.1 and 43.1 investments apply to geoexchange systems, which provide process heat for industrial applications. See <http://www.fin.gc.ca> for more information.

Appendix D – Global Quality GeoExchange™ Program FAQ



Frequently asked questions concerning CGC Training and Accreditation for geoexchange in Canada *(March 2007)*



Frequently Asked Questions Concerning the New Training and Accreditation Framework for GeoExchange™ in Canada

1- Why and how have these courses been developed?

CGC has developed its courses as part of a national quality initiative. This initiative is the CGC's response to over four years of stakeholder requests to "raise the bar" in available training and in the consistency of quality of work delivered by geoexchange practitioners. The four new CGC courses – for installers, drillers, residential system designers, commercial system designers respectively – are part of the first national training and quality initiative based on Canadian climate, geology, and CSA Standards (C-448-02, principally). The course training materials are the product of over eighteen months of effort from CGC staff, with contributions from about fifty of the industry's top professionals and critical ongoing support from the federal government. The courses have gone through six drafts before release.

2- Why do I need to / should I take the CGC course in my specialisation?

The CGC courses are about providing quality assurance to the consumer and about describing and delivering industry best practices when designing, installing and/or drilling geoexchange systems. CGC members and partners understand that for the geoexchange industry to continue growing rapidly, consistently high quality of training and system design & installation is a top industry priority. Further, Canadian incentive programmes will likely refer to and require Canadian training and accreditation as developed with the federal government. Several levels of government are examining the training materials and accreditation mechanisms and have the option of referring to this new Canadian industry standard.

Those already engaged in quality assurance measures – such as the well developed regional or national distributor - understand that provincial governments, banks, insurance companies, and international partners all desire to work with one national quality framework for Canada. Taking the CGC course and supporting The CGC Global Quality GeoExchange™ Program® will in the longer term lead to higher quality and is therefore crucial to the long term growth of the industry.

3- What's the difference between training, accreditation and certification? Why all the terms?

The different terms all form part of the overall Global Quality GeoExchange™ Program®. There are three major steps within the Initiative:

- I. *Training for individuals* means that individuals may register and attend one or more of the four training courses (choosing according to their area of specialty and requirements), and take the examination;
- II. *Accreditation of individuals* is achieved by those who successfully complete training with a passing mark on the examination, and apply for accreditation. Accreditation requires:
 - a passing mark on the relevant CGC examination,
 - credit references if and where appropriate,
 - proof of adequate insurance and liability coverage if and where appropriate,
 - satisfactory work on up to five previous geoexchange systems,
 - assent to the CGC Code of Conduct, etc., and is valid for three years;
- III. *Certification of systems* is completed once an application for certification has been approved by CGC. Certification means that the system has been designed by an accredited designer, installed by an accredited installer, and any borehole work has involved an accredited driller. For a system to be certified it must follow all guidelines within CSA Standard C-448-02, use ISO/CSA-approved equipment, and engage such best practices as delivering an 'As-Is' book to the project owner, clearly labelling all piping and valves, be verified and inspected as necessary to ensure the system is in compliance with all provincial regulations, etc. Much of this is covered in initial training.

4- Do I have to join the CGC to get accredited or take courses? Will I become a member of CGC automatically at some point in this process?

Absolutely not. Quality is in the entire industry's interest, and CGC is about delivering value to the entire industry, not individual companies. Compulsory membership in an association can be seen as a form of market manipulation. Forcing members to join would not be about the value CGC provides in government relations, industry infrastructure and information for the public and members. To discuss why and how to become a CGC member, please call Ted Kantrowitz, at extension 34 or see www.geo-exchange.ca.

5- Where can I apply for accreditation, certification, etc?

CGC will be publishing the forms over the course of 2007 as each programme is ready. Make sure you are on our emailing list and check our website regularly – www.geo-exchange.ca – to ensure you have the latest information.

6- What if I have already taken other installer training (manufacturer, CETAF, IGSHPA, etc.)?

Given the variety of training initiatives available in the market and the wide variance in their content and quality control mechanism, the CGC has announced in December 2006 that in future it will only recognize other trainings which are harmonized with CGC training. Although several manufacturers and organisations have expressed their desire to discuss and harmonize their training with CGC training, CGC has only formally concluded one such agreement as of early March 2007.

Recognizing that experienced and knowledgeable professionals have been successfully working in the industry, and that elements of currently available trainings have merit, CGC is working developing training upgrade seminars for those who have successfully passed other trainings and/or have significant current experience in the field. These upgrade seminars will be developed/adapted as needed and on a case by case basis.

Having equivalent training is the first step in earning CGC accreditation. Therefore, those who have taken non-CGC courses before January 1st, 2007, and who want to become accredited, will need to take either the full CGC course or one of the upgrade seminars in their specialty – installation, drilling, or design. All those seeking equivalency with CGC training must at a minimum take and pass the CGC examination.

As announced in December 2006, training offered by other organizations after January 1st, 2007 will not be recognized by CGC unless an agreement is in place to recognize such training. **It is the responsibility of other organizations to inform their potential registrants of this policy. It is also the responsibility of those other organizations to contact the CGC to discuss partial or full harmonization.**

Upgrade seminars will only be offered if and when those third parties agree to discuss in good faith and with the spirit of moving the Canadian geoexchange industry toward a nationally recognised total quality approach.

7- What if I have years of experience or multiple installations in the technology but no formal training?

Please see question six, above. CGC training or equivalent will be required to apply for accreditation.

8- What is the cost of the one-day installer training / adjustment course?

CGC is working to determine a price for the one-day course, which will depend to some degree on materials delivered, instructor time required, etc. We anticipate that the price of the course will include course material and examination fees, but it will still cost significantly less than the full three-day installer course. CGC will announce prices when the courses are announced, by April first.

9- Ok, I want to register and take the course for installers / residential design. How do I do that?

Please check www.geo-exchange.ca for the latest training course detail and links, or contact us via fax or phone.

10- How much do the full CGC courses cost, anyway?

The Canadian GeoExchange™ Coalition Installers' Course®, a three day course, is offered across Canada for \$995 per participant. This fee includes three days of instruction in installation, an examination fee, course materials (over 380 slides), a detailed installers manual, supplementary materials including sample guidelines from various jurisdictions, and a properly licensed copy of CSA Standard C-448-02.

The Canadian GeoExchange™ Coalition Residential Designers' Course®, a two day course, includes over 150 additional slides, further supplementary materials and design guidelines, and an examination fee for a total cost of \$ 495.

The Canadian GeoExchange™ Coalition Drillers' Course® includes a detailed and specific text book of over 200 pages, about two classroom days of instruction, at a price that has yet to be determined.

The Canadian GeoExchange™ Coalition Commercial Designers' Course® includes over 280 slides in 31 sections, at a price that has yet to be determined.

11- Can anyone take a CGC course? What prerequisites are there?

Recognizing that some people may want to take CGC course only to acquire more technical knowledge about the geoexchange technology, anyone can take the CGC course. But remember that all provincial licensing & permit regulations must be respected in order to work in the field and receive the CGC accreditation.

However, the following are the prerequisites for each course:

Course	Prerequisites
Installer	No prerequisites; previous HVAC/Refrigeration experience or coursework strongly suggested.
Driller	No prerequisites; previous field drilling experience is strongly suggested.
Residential Designer	Successful completion of installer course with a passing mark.
Commercial Designer	Must be a registered engineer with one of Canada's provincial bodies; must complete CGC Installer course with a passing mark.

12- What other course prerequisites & requirements exist for accreditations?

To apply for accreditation as a Residential Designer, CGC will require participants to have taken and passed HRAI's Heat Design Loss Course or equivalent in Québec. Commercial Designers will likewise be required to take the HRAI course and to pass the installer course exam as well. Some further final decisions on requirements will be taken over the course of 2007 based on consultation results from 2006, as programmes are rolled out.

The CGC Global Quality GeoExchange™ Program®

STEP 1—TRAINING FOR INDIVIDUALS

Canadian GeoExchange™ Coalition Installers' Course®

For: Individuals who are involved in the installation of geoeexchange systems but who will not necessarily be engaged in the design of the system itself. The persons or individuals who should take this course usually belong to a trade or technical profession and are authorized or required by law to perform certain duties on a geoeexchange site / project. Depending on the province, this person is a driller, an electrician, a plumber, an HVAC or a refrigeration specialist, who usually belongs to a trade or technical profession and is authorized or required by law to perform certain duties.

Cost: CAN\$ 995 + applicable taxes
Duration: **Three (3) Days**
Prerequisites: **None; strongly recommended: previous R/HVAC experience**

Canadian GeoExchange™ Coalition Residential Designers' Course®

For: Individuals who are involved in the design of residential-sized geoeexchange systems but who will not necessarily be engaged in the installation of the system itself. The persons or individuals who should take this course usually belong to a trade or technical profession and are authorized or required by law to perform certain duties on a geoeexchange site / project. Depending on the province, this person is a driller, an electrician, a plumber, an HVAC or a refrigeration specialist, who usually belongs to a trade or technical profession and is authorized or required by law to perform certain duties.

Cost: CAN\$ 495 + applicable taxes
Duration: **Two (2) Days**
Prerequisites: **Canadian GeoExchange™ Coalition Installers' Course® – passing grade**

Canadian GeoExchange™ Coalition Drillers' Course®

For: Individuals who are involved in the drilling of geoeexchange wells but who will not necessarily be engaged in the installation of the system itself. The persons or individuals who should take this course usually belong to a trade or technical profession and are authorized or required by law to perform certain duties on a geoeexchange site / project. Depending on the province, this person is a driller, an electrician, a plumber, an HVAC or a refrigeration specialist, who usually belongs to a trade or technical profession and is authorized or required by law to perform certain duties.

Cost: TBD
Duration: **Two (2) Days — to be confirmed**
Prerequisites: **None; strongly recommended: previous field drilling experience**

Canadian GeoExchange™ Coalition Commercial Designers' Course®

For: Individuals who are involved in the design of commercial-sized geoeexchange systems but who will not necessarily be engaged in the installation of the system itself. The persons or individuals who should take this course are registered professional engineers or individuals required by law to perform certain duties on a geoeexchange site / project. This person will be a member of the provincial engineering association and / or a registered Professional Engineer and authorized or required by law to perform duties in commercial HVAC system design.

Cost: TBD
Duration: **Four (4) Days — to be confirmed**
Prerequisites: **Canadian GeoExchange™ Coalition Installers' Course® – passing grade, AND Registered / Professional Engineer status in the relevant province.**



A **Training Certificate** is issued for every course taken and when examination is passed with success

This document presents the simplified version of the CGC Global Quality GeoExchange™ Program®. Terms and conditions will vary by province in accordance with local labour laws, overall regulatory regimes and programs.

STEP 2—ACCREDITATION OF INDUSTRY PROFESSIONALS

Application for ACCREDITATION

CGC receives application for accreditation and verifies compliance

Prerequisite: *Training certificate or equivalence (see FAQ document)*

Core Criteria:

- Demonstrated field (work) experience in the geothermal sector,
- Full liability coverage if and where appropriate
- Provincial work permits and papers in order
- Adherence to CGC code of conduct
- Professional references
- Supervised / inspected installations
- Workmanship guarantee
- Other criteria to be finalised

NOT REQUIRED: CGC Membership

Term of Accreditation: three (3) years, non-automatic

Fee: One three-year fee, to be determined by April 2007



Driller becomes a CGC Accredited Driller

Installer becomes a CGC Accredited Installer

Designer becomes a CGC Accredited Small System Designer

Designer becomes a CGC Accredited Commercial System Designer

STEP 3—SYSTEM CERTIFICATION

Application for System CERTIFICATION

CGC receives application for certification and verifies compliance

Prerequisite: Installation, design and any drilling conducted by accredited professionals per Step 2

Core Criteria:

- Installation follows C-448-02 as updated, at a minimum
- Installation meets inspection guidelines under development
- Installation fully satisfies all relevant provincial and federal regulations
- To be determined

Term of Certification: To be finalised in 2007

Fee: To be finalised in 2007



Governments sales tax rebate programs

Utilities financial incentives and grants

Financial institutions special interest rates and financing

Federal government financial incentives

Municipal building permits

Etc.

Appendix E – Sample Policy #1, Community Energy Policies



District of Salmon Arm Memorandum from the Planning & Development Officer

TO: His Worship Mayor Mayes and Members of Council
DATE: August 30, 2004

**SUBJECT: OFFICIAL COMMUNITY PLAN BYLAW AMENDMENT APPLICATION NO.
3000-13 “Community Energy Policies”**

Applicant: District of Salmon Arm

MOTION FOR CONSIDERATION:

THAT: A Bylaw be prepared for Council’s consideration, adoption of which would amend Official Community Plan Bylaw No. 3000 in the following manner:

Section 2 – Planning Strategy – Add the following subsection and policy statements:

2.5 Community Energy Policies – The District encourages the voluntary use of alternative, renewable and sustainable energy producing and recovery technologies for all developments and infrastructure. Examples of these technologies include the use of “green” (or LEED) building design, geo-thermal heating and cooling systems, and solar heating devices; micro-hydro, fuel cell, bio-mass and wind power generation systems; and self-contained storm water, grey water and waste water treatment and recycling systems.

2.5.1 The District continues to promote water conservation strategies such as the Water Wise program, incorporation of innovative irrigation technologies, and the installation of low flush toilets, low flow aeration faucets and xeriscaping (i.e. drought resistant landscaping) for all developments.

2.5.2 In consideration of Sections 2.3, 2.4, 5.2, 6.5, 9.4 and 9.5 the District continues to implement growth strategies that discourage costly urban sprawl and encourage healthy communities, including:

- a. maintaining the Urban Containment Boundary;**
- b. encouraging higher density development;**
- c. supporting Neighbourhood Commercial development;**

- d. **promoting the development of sidewalks, bikeways and trails; and**
 - e. **increasing the service area and capacity of the Public Transit system.**
-

PROPOSAL

Adoption of the proposed Community Energy Policies outlined in the motion may be required as an initial step to qualify for Community Energy Association (CEA) funding and future grant applications. Grant funding from CEA may be available for a District energy project having the effect of reducing greenhouse gas emissions (see APPENDIX 1). For example, the geo-thermal heating system proposed for the new District Hall and Court House Facility may qualify as an eligible “green” project for grant funding. Beyond grant applications, the proposed energy policies recognize new technologies that are increasingly being incorporated in new development practices for the purposes of long-term cost saving measures, self-reliance and environmental sustainability.

BACKGROUND

The main intent of the proposed Community Energy Policies is to encourage the voluntary use of emerging green technologies for energy production. The proposed policies are *passive* in the sense that there are no regulatory demands, standards or expectations by the District for green energy technology, building design and infrastructure development. As well, the proposed policies reiterate existing conservation and growth management strategies already in effect in the District’s Official Community Plan. Section 878 of the Local Government Act allows for the inclusion of policies in an Official Community Plan relating to the preservation and protection of the natural environment.

Geothermal heating and cooling is one green technology proposed for the new District Hall and Court House Facility. Using a standard heating and cooling system with natural gas and hydro, the annual energy costs for the new facility were estimated to be \$43,000 / year. Using the proposed geothermal system, with a capital cost of \$130,000, energy costs are expected to be reduced by \$18,000 / year, for an estimated 7 year payback on the system’s capital cost.

Up to 50% of the capital cost of the geothermal heating system may be available if the District qualifies for the CEA funding. However, it is not known at this time if a comprehensive Community Energy Plan for the District would be required by the CEA. The CEA website cites two communities in BC with Community Energy Plans (see www.energyaware.bc.ca/sitemap.htm). The Municipality of Bowen Island and the City of Quesnel each recently adopted comprehensive energy plans (80+ pages) in partnership with the CEA, the Pembina Institute, BC Hydro and the Government of Canada.

The proposed Community Energy Policies could become a foundation for additional modifications to the Zoning, Subdivision and Servicing, and Development Cost Charge Bylaws. During its research staff found that some communities are somewhat aggressive in their approach to growth management and green energy policies. For example, the City of New Westminster just introduced a “Smart Growth Development Checklist”, which requires a developer to answer a questionnaire relating to the sustainability and green energy provisions of a development proposal before a rezoning or development permit application is submitted (see APPENDIX 2). Large scale smart growth development projects

underway in BC include East Clayton in Surrey, Southeast False Creek in Vancouver, and a new mixed-use village on Salt Spring Island. All of these developments incorporate green energy technologies.

Staff is not suggesting measures such as a sustainability checklist be implemented at this time, but there are a number of ideas that could be considered for future bylaw reviews. Some of these ideas could be *incentives* to developers, which may encourage smart growth and green energy technologies for new development in exchange for the following:

- 1) Lowering Development Cost Charges in serviced / high density areas (this would need to be addressed in the DCC Bylaw);
- 2) Relaxation of minimum servicing standards (e.g. road widths, and off-site sanitary and drainage requirements), which could be achieved with variances; and
- 3) Relaxation of Zoning Bylaw regulations by way of either variances, or by introducing more flexible use and density provisions (i.e. more mixed uses and density bonuses).

GLOSSARY

The proposed policy incorporates terms that may not be familiar to some. In order to make better sense of the language, staff prepared a short glossary of terms and definitions.

“Alternative Energy” - Renewable, non-polluting, and sometimes self-contained (“off-grid”) energy, such as solar, micro-hydro, wind and wave power. Opposite of conventional energy sources, such as major hydro dams, oil, gas and coal burning plants, and nuclear facilities.

“Bio-mass” - Plant matter such as trees, grasses, agricultural crops, and other material derived from living matter. These materials are renewable and sustainable, and can be used as a solid fuel or converted into liquid or gaseous fuels to supply the electricity, heating, transportation, and other energy markets. (Nanospace Technologies Inc. www.nanospace.org)

“Fuel Cell” - An electrochemical energy conversion device that converts hydrogen and oxygen into water, producing electricity and heat in the process. It is very much like a battery that can be recharged while you are drawing power from it. Instead of recharging using electricity, however, a fuel cell uses hydrogen and oxygen. (<http://science.howstuffworks.com/fuel-cell1.htm>)

“Green” - For energy, BC Hydro uses the following criteria to define green technology: “it must be renewable, licensable, socially responsible, and have low environmental impact”. Green building design is based on facets including water preservation and efficiency, conservation of materials and resources, recycling, indoor environmental quality and sustainable site planning (also referred to as “LEED” Design).

“Grey Water” - Any water that has been used in the home, except water from toilets, is called grey water. Dish, shower, sink and laundry water comprise 50 - 80% of residential “waste”

water. This may be reused for other purposes, especially landscape irrigation. (www.oasisdesign.net)

“LEED” - Leadership in Energy and Environmental Design: the new District Hall and Court House facility has been designed with LEED technologies (also referred to as “Green Building Design”)

“Micro-Hydro” - Small scale / miniature hydro-electrical generation. BC Hydro considers micro- hydro developments as ones with an installed capacity of less than 2 MW (2,000 kW). By comparison, BC Hydro's largest facility, the power generating station at the W.A.C. Bennett Dam, has a capacity of 2,730 MW. For small and micro hydro developments, 1 MW of installed capacity will supply enough power for about 550 homes. (BC Hydro)

“Smart Growth” - Smart Growth is a collection of urban development strategies to reduce sprawl that are fiscally, environmentally and socially responsible. Smart growth is development that enhances quality of life, protects the environment, and uses tax revenues wisely (Smart Growth BC www.smartgrowth.bc.ca). The District of Salmon Arm growth management strategies outlined in the Official Community Plan do encourage smart growth principles.

“Sustainability” - There are numerous definitions out there. Here, it means managing the District in a way that balances the economic, social and environmental implications of activities in order to meet the needs of people today without compromising the ability of future generations to meet their own needs (as defined in the District of Salmon Arm Official Community Plan).

“Xeriscaping” - Literally, the word xeriscaping comes from a combination of two other words: "xeri" derived from the Greek word "xeros" for dry; and "scape", meaning a kind of view or scene. While xeriscape translates to mean "dry scene," in practice xeriscaping means simply landscaping with slow-growing, drought tolerant plants to conserve water and reduce yard trimmings. (California Integrated Waste Management Board www.ciwmb.ca.gov)

Report prepared by - Kevin Pearson, MCIP
Planning and Development Officer

APPENDIX

1. Invitation for Expression of Interest from Community Energy Association
2. City of New Westminster - Smart Growth Development Checklist

Appendix F – Sample Policy #2, Energy Efficiency

Town of Merritt, British Columbia

POLICY TITLE: Energy Efficiency

Our File: 0595

ADOPTED BY COUNCIL: September 12, 2006

COUNCIL RESOLUTION No. 0369/06

Revised: Resolution No.

Policy Statement: The City of Merritt will promote the use of energy efficiency and will provide guidance to the community on how to effectively incorporate technologies and methods that encourage energy efficiency.

Policy Background: The City of Merritt recognizes that there is a need to encourage the use of energy efficiency in the community. While the City is not directly responsible for the provision of energy, the City can take an important participating role along with other agencies in ensuring that the community becomes knowledgeable about ways to promote energy efficiency.

In 2006, the City of Merritt received funding from the Community Action on Energy Efficiency program, which is a program operated by the Ministry of Energy, Mines, and Petroleum Resources to encourage the use of energy efficiency technologies and methods in new home construction. The specific purpose of this program would be to develop policies and procedures to encourage energy efficiency in new home construction. At a broader level, the goal would be to have energy efficiency principles permeate throughout the community with the City taking a lead in its promotion. This is part of the City's strategy to become a leader in the employment of energy efficiency technologies amongst smaller municipalities in the province of BC.

Policy Goal: The City of Merritt will become a leader amongst small to mid-sized municipalities in British Columbia in the promotion of energy efficiency principles.

Policy Objectives: The City will promote energy efficiency through improved land use planning practices, providing education and by leading by example through the employment of energy efficiency in various components of infrastructure. Energy efficiency will permeate throughout the community and will be a focal point of ensuring that new development respects these principles. The City will provide guidance to residents and developers alike by providing educational materials and working with other partners to promote energy efficiency.

Appendix G – About the Authors

Taylor Zeeg is a project consultant for the Canadian GeoExchange™ Coalition's Municipal Roadmap Exercise. He also provides consulting services to the Community Action on Energy Efficiency (CAEE) initiative, an initiative of the BC Ministry of Energy, Mines and Petroleum Resources. In this role he conducts local government policy research for 29 local governments participating in the CAEE initiative. Taylor has done consulting work for Parks Canada on community outreach, Natural Resources Canada on urban energy indicators, and the Sheltair Group on local government policy related to energy efficiency. Taylor is the author of the research report "Advancing geothermal energy systems: Is there a role for BC's municipalities?" The report was completed as part of his master's degree at UBC's School of Community and Regional Planning.

Eric Vance has over 25 years of experience as a professional planner (MCIP), economist (P. Econ.) and management consultant (CMC). He has conducted hundreds of consulting assignments for a broad range of public and private sector clients across Canada and in the United States, including many for local government. Eric was a senior member of the management consulting group at Coopers & Lybrand (now PricewaterhouseCoopers LLC) for eleven years. He served as Director of Planning for the City of Port Moody for three years prior to starting his own consulting practice in 1995. Eric is also an adjunct professor in the graduate School of Community & Regional Planning at the University of British Columbia. Eric was one of the primary authors of the *Canadian Fuel Cell Commercialization Roadmap* (2003), of which the Government of Canada was the primary sponsor. He has also examined a number of energy related proposals and has in-depth understanding of the municipal regulatory and policy environment.