



Canadian
GeoExchange
Coalition

Coalition
canadienne
de l'énergie
géothermique

The State of the Canadian Geothermal Heat Pump Industry 2010

Industry Survey and Market Analysis

Including Provincial Highlights and Analyses

(November 2010)

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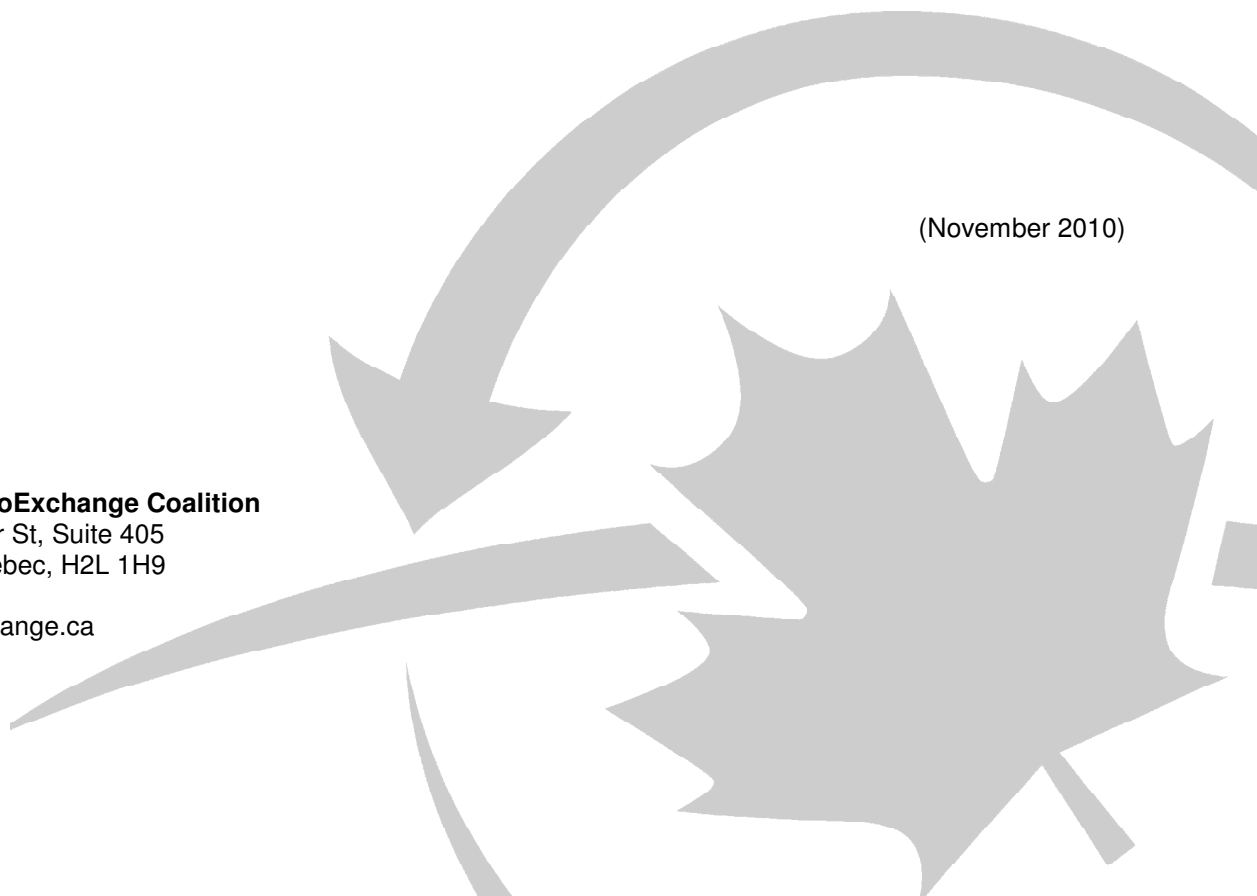


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The Canadian GeoExchange Coalition (CGC) would like to thank Natural Resources Canada (NRCan) for their longstanding support for CGC's market transformation initiative. From 2003 to 2009, NRCan participated financially in many market transformation projects developed and deployed by the CGC. The **CGC Market Survey 2008-2009**, one of the data sources used in the preparation of this report received partial funding from NRCan through the **ecoENERGY For Renewable Heat** initiative. NRCan was a crucial early supporter of CGC and has over more than a decade proven to be one of the geothermal heat pump industry's best friends.

The CGC is also grateful to the installers, designers, contractors and other Canadian industry stakeholders who participated in the many consultations and surveys conducted by the CGC in the past five years. Their deep knowledge of the industry was a key contribution to the preparation of this report. In total, more than 450 contractors provided data and strategic information. Whether CGC members or no, we appreciate the specific help in answering questions which has been crucial to this project's success and to helping this industry forward.

Thank you all for helping the CGC grow the Canadian geothermal heat pump industry in a sustainable and professional manner.



Denis Tanguay

President & CEO
Canadian GeoExchange Coalition

HIGHLIGHTS

The State of the Canadian Geothermal Heat Pump Industry 2010 – Industry Survey and Market Analysis is the first document ever published in Canada to present a comprehensive and credible picture of the Canadian geoexchange industry. Industry use of and government requirement of the ***CGC's Global Quality GeoExchange Program*** has proven a key link in developing the depth of the information in this report.

Starting in 2003, the CGC engaged in a significant market transformation initiative which strongly contributed to shape Canada's markets. The Canadian geoexchange industry has experienced phenomenal growth in the past five years. The market for ground source heat pumps grew by more than 40% in 2005 over 2004 and by more than 60 % annually in 2006, 2007 and 2008. The threefold increase in oil prices between 2005 and 2008 probably created a price effect strong enough to trigger fuel switching for many consumers. Despite harsh economic conditions, we estimate the market grew by an additional 5 % in 2009.

This phenomenal growth also coincides with various grant and financial assistance programs deployed by utilities, provincial governments and the federal government. The ***ecoENERGY Retrofit – Homes*** program which started in April 2007 encouraged the demand for geothermal heat pumps in the residential retrofit market. Tax rebates in Ontario, a loan program offered by Manitoba Hydro as well as direct grants by Hydro-Québec and Saskatchewan contributed to increase demand in the new built market segment.

The CGC market transformation initiative, strategically followed by financial assistance programs, had a significant impact on market growth. This is clearly reflected in the fact that Canada's geothermal heat pump markets are growing much faster than United States geothermal markets in recent years. Rising energy prices in both countries may explain the growth observed between 2005 and 2008 in the United States but only partially in Canada. The differential growth is more than likely due the CGC led market transformation initiative, and financial assistance programs which followed the deployment of this initiative.

In 2009, roughly 57 % of all residential installations were done in existing buildings, a significant increase from the 40 % level observed in 2005. The share of geoexchange systems installed in new homes declined from a high of 47 % in 2005 to a little under 30 % in 2009. Geoexchange system replacements (the replacement of an existing ground source heat pump by a new ground source heat pump) averaged 13 % of the market in 2009.

At about 64 %, oil and other fossil fuel switching clearly dominates the Canadian average for the retrofit market. The replacement of central electric heating systems, electric baseboard and existing geoexchange systems represent roughly 36 % of total installations. Provincial breakouts, which are presented later in this report, are useful in understanding provincial energy market structure.

Closed horizontal loops dominate residential installations in Canada. These systems accounted for 49.4 % of residential installations in 2003 and 52.5 % in 2009. The second largest segment is closed, vertical loops with 34.1 % of the installations in 2009 compared to 36.1 % in 2003. Closed pond / lake loops increased from 2.1 % market share in 2003 to 5.1 % in 2009. Open loops with a discharge to wells are relatively less popular in 2008 with a 4.7 % market share down from 10.7 % in 2003.

All loop types considered together, the average geothermal heat pump system price for Canada is \$24,455. On average in Canada, a closed loop horizontal system is sold for \$ 23,941 and a closed loop vertical system goes for \$ 28,003. The average system price on a per ton basis increased 4.7 % between 2008 and 2009 for closed horizontal loop systems and by 7.3 % for closed vertical loop systems.

The Canadian geexchange market is highly concentrated with the largest manufacturers located in the United States. The top three geexchange heat pump brands capture in excess of 82 % of the market and the top ten brands account for 93.2 % of all ground source heat pumps sold in Canada. Of the top ten brands by market share, only three are manufactured in Canada.

The top 10 installation companies in Canada are responsible for 25 % of all residential installations. Overall 25 installation companies capture 40 % of the residential market in Canada but very few compete with each other as they are mostly located in different regional markets.

In full deployment since early 2007, the CGC-led market transformation initiative has had resounding success across Canada. As part of this initiative, hundreds of industry stakeholders have taken one or more CGC course.

Through a network of training partners and independent trainers, the CGC has trained 2,968 installers, 1,368 residential designers, 125 commercial designers and 44 municipal inspectors between February 2007 and June 2010. As of June 2010, more than 100 specialists have taken the CGC DX course. The CGC courses also have also been delivered with success outside of Canada, with individuals trained in Palestine, South Africa, India, South Korea and in the United States.

Of all those who have taken CGC courses, 645 installers have applied for and received their CGC Installer Accreditation and 458 individuals have applied for and received their CGC Residential Designer Accreditation.

As part of its market transformation initiative, the CGC created its Academic Network, a group of colleges and public institutions with whom the CGC has signed a MOU. Together, these colleges offer standardized training recognized by the CGC for the purpose of the CGC quality program. The CGC Academic Network, which now has more than 15 training institutions, is unique in North America and shows the openness and inclusivity of the CGC led market transformation initiative.

The total economic activity of the Canadian geexchange industry in 2009 was likely in excess of \$500 million.

INTRODUCTION

After thorough, ongoing research, we have found over the past five years of examining reports and information available for this industry, that the vast majority of analysis of, in, or about the industry is based on self-referential reports, or even hearsay. People are repeating the guesswork of generations of inevitably biased guesswork before them.

Our research clearly showed that over the past 30 years, almost every article and publication referring to Canadian geothermal markets has used “strategic information” provided by “personal industry contacts” under the cover of “confidentiality”¹. Under these circumstances, it was very difficult to draw sensible conclusions about the state of the industry, let alone draw an accurate portrait of it. Policy makers and program developers therefore essentially based their work on unverifiable data and sources. In short, no statistically valid data has ever been published on the Canadian geothermal heat pump industry. As a result, industry stakeholders and government officials lacked the key, strategic information they needed to develop new programs or adapt existing programs.

Thanks to the market transformation initiative developed and deployed by the CGC from 2005 onwards, with the strong support of **Natural Resources Canada**, the industry now has at his disposal many reporting mechanisms to collect key market information. In turn, the CGC itself has built and maintains in-house capacity and capability to manage extensive databases and complete comprehensive and accurate geothermal market analyses.

Industry use of and government requirement of the **CGC’s Global Quality GeoExchange Program** has proven a key link in developing the depth of the information in this report. The data gleaned from the **CGC Market Survey 2008-2009** and data from the CGC system certification database are fairly consistent. Based on the sample sizes involved we also state with a high degree of confidence that the data sets validate each other. This report is therefore the first accurate representation of markets nationally for this industry.

The State of the Canadian Geothermal Heat Pump Industry 2010 – Industry Survey and Market Analysis is the first document ever published in Canada to present a comprehensive and credible picture of the Canadian geothermal industry. This report is long overdue. Shared knowledge within an industry is the key to improve best practices and guide legislators and regulators in their actions. Industry knowledge is also essential to governments, utilities and financial institutions to develop programs adapted for the needs of customers and of the industry.

¹ This culture of ‘proprietary’ and ‘unique’ information has been for years a barrier to further or more rapid industry growth, and has apparently also been of very little use in maintaining any but short term mostly regional market control.

CANADA

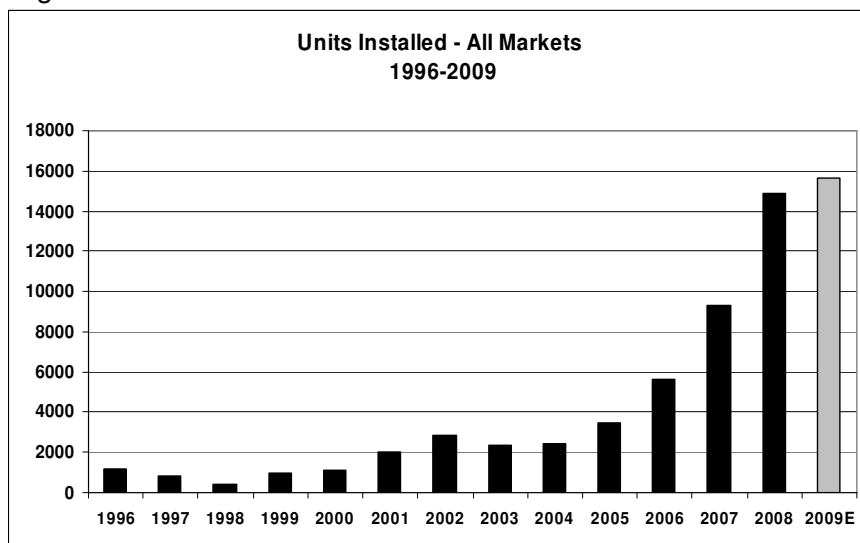
Market Size and Market Growth

The Canadian geoexchange industry has experienced phenomenal growth in the past five years. Early signs of such growth were observed in 2005 but a significant jump took place in 2007 and in 2008. The market for ground source heat pumps grew by more than 40% in 2005 over 2004 and by more than 60 % annually in 2006, 2007 and 2008. Despite harsh economic conditions, we estimate the market grew by an additional 5 % in 2009.

This situation is a solid contrast to the previous decade. As we can see in Figure 1, the number of installed units hit a 20 year historic low in 1998. We also surmise that the number of systems installed tumbled dramatically in a very short period of the mid 1990s. During the early 1990s, it is generally accepted that more than 7 000 residential units were installed in Canada. Most were installed in Ontario when Ontario Hydro was offering an incentive for the installation of ground source heat pumps in the early 1990s.

The presence of Canadian heat pump manufacturers in New-Brunswick and Manitoba also contributed to the initial development of the markets in those provinces in the 1980s and the 1990s. After many years of virtually no growth, the market started to gain momentum again in 2001 for unclear reasons but remained relatively stable until 2005 with two successive decreases in 2003 and 2004.

Figure 1²



There are a number of reasons explaining the recent strong growth. Some would suggest that the recent growth in the geothermal heat pump industry is conjectural and is closely correlated with the rise of fossil fuel prices. This vision is somewhat relevant. As we can see in contrasting Figure 1 and Figure 2, the geothermal heat pump industry started its strong growth period in 2005 as the

² Data for 2009 is subject to revision after the publication date of this report.

price of oil was gravitating around and over \$50 / barrel to peak at almost \$150 / barrel in 2008. This apparent correlation is also illustrated in Figure 3 where both oil prices and the installation of geothermal heat pump units are indexed and compared over a 14 year period.

The threefold increase in oil prices between 2005 and 2008 probably created a price effect strong enough to trigger fuel switching for many consumers.³ However, this is likely not the only factor explaining the strength of the geothermal heat pump growth during this period.

Figure 2⁴

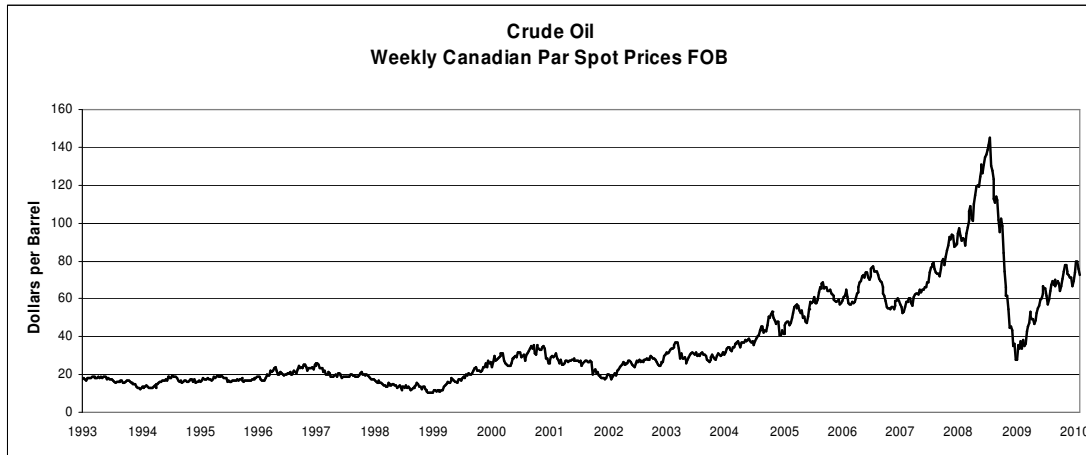
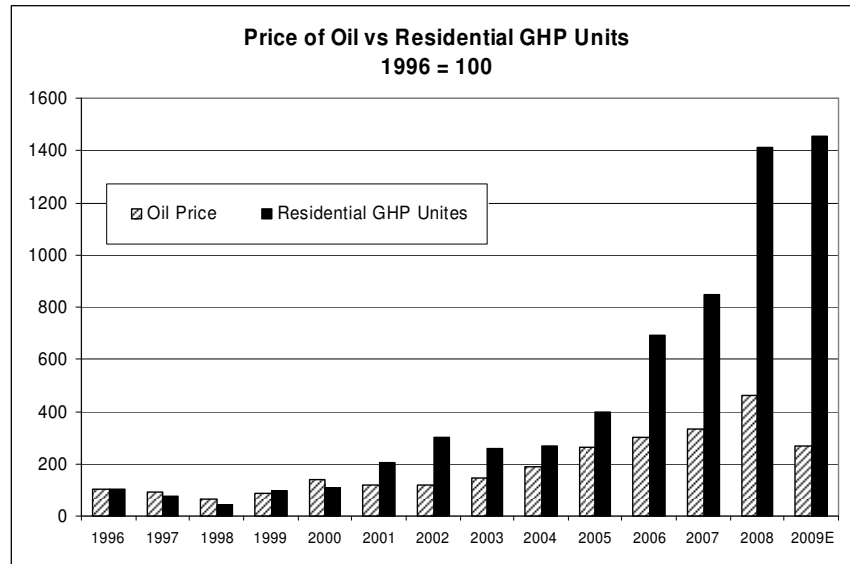


Figure 3



³ The relationship between fossil fuel prices (and energy prices in general) and demand for geothermal heat pumps is an area that would benefit from further research and goes beyond the scope of the current report. To the best of our knowledge, no comprehensive econometric study performed by specialized market analysts has ever been conducted for the geothermal heat pump industry in North America. At best, the industry has relied on back-of-the-envelope calculations and anecdotal affirmations by technical specialists rather than market specialists. Now equipped with a solid database, the CGC is contemplating conducting such a study in the coming year.

⁴ Source: Energy Information Agency (United States). All other tables and figures in this document were created with data from Canadian GeoExchange Coalition sources, with the exception of housing starts in Figure 7 which are from the Canadian Housing and Mortgage Corporation.

This phenomenal growth also coincides with various grant and financial assistance programs deployed by utilities, provincial governments and the federal government. The **ecoENERGY Retrofit – Homes** program which started in April 2007 encouraged the demand for geothermal heat pumps in the residential retrofit market. Tax rebates in Ontario, a loan program offered by Manitoba Hydro as well as direct grants by Hydro-Québec and Saskatchewan contributed to increase demand in the new built market segment.

Before any of these programs were in place, the CGC engaged in a significant market transformation initiative which strongly contributed to shape Canada's markets. Starting in 2003, pilot projects, co-financed by Natural Resources Canada, the CGC and electric utilities in British Columbia, Yukon, Saskatchewan, Manitoba, Ontario and Québec contributed to raise customer awareness in both the residential and commercial markets as well as raise the overall profile of the geothermal heat pump technology and its applications. The year 2005 also marks the beginning of an active presence of the CGC in the supplier (e.g. installer, distributor and designer) markets, with the deployment market transformation efforts, including training, accreditation, system certification as well as marketing⁵.

Over the years from 2005 to present, CGC staff has made close to 100 presentations in all provinces and two territories, reaching out to thousands of decision makers, developers, governments and industry stakeholders. These efforts were backed by a comprehensive government relations portfolio. CGC responded to many individual requests from provincial and municipal governments for accurate statistics and to those seeking independent market analysis and overall market assessment. CGC staff also facilitated many government consultations leading to new or revised regulations.

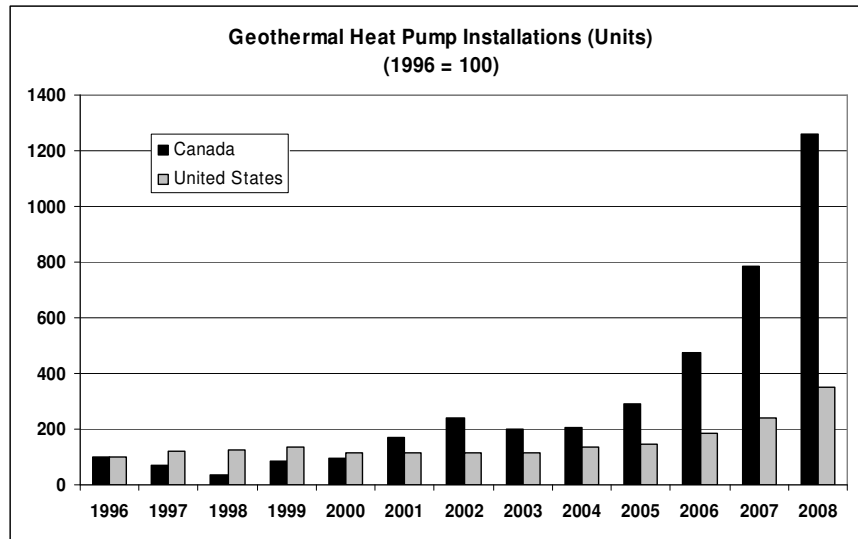
Following four years of sustained growth, the CGC estimates that a little over 15,643 geothermal heat pumps were installed in Canada in 2009 in the residential, commercial and industrial sectors. This compares to 14,879 units in 2008 and 9,284 units in 2007. We estimate the total capacity of the units installed (residential, commercial and industrial) to be slightly less than 35,000 tons in 2007 and over 60,000 tons in 2008 and in 2009.

While rising energy prices may explain part of this growth, we firmly believe that the CGC market transformation initiative, strategically followed by financial assistance programs were far more significant. This is clearly reflected in the fact that Canada's geothermal heat pump markets are growing much faster than United States geothermal markets in recent years.

An analysis of the numbers of geothermal heat pump installations, measured in units and indexed to 100 in 1996, is presented in Figure 4. The contrast between Canada and the United States is eloquent. We see that important growth in Canada coincide with the CGC market transformation efforts. The markets in the United States appeared to be more stable from 1996 to 2005 and then followed with growth in subsequent years, but at a much slower pace than in Canada. Rising energy prices in both countries may explain the growth observed between 2005 and 2008 in the United States but only partially in Canada. The differential growth is more than likely due to the CGC led market transformation initiative, and financial assistance programs who followed the deployment of this initiative.

⁵ CGC's history, development and impact on markets will be further detailed in an upcoming CGC ten year report, scheduled to be released in fall 2010.

Figure 4



Discussion of Residential and ICI Market Shares

The breakdown of units installed between the residential sector on the one hand, and the commercial and industrial sector, on the other hand, was roughly 50-50 in recent years. Based on the 2009 CGC Industry Survey and field results, we are confident that the residential market share of units installed was roughly 56 % and 55 % in 2008 and 2009. Units installed in the commercial and industrial sector accounted for 44 % and 45 % of all units. The table below is our best estimate of the number of units installed per year and per market segment.

Table 1
Number of Units Installed Per Market Segment

	<u>Residential Sector</u>	<u>ICI Sector</u>	<u>Total</u>
1996	591	591	1181
1997	430	397	826
1998	238	203	442
1999	564	443	1007
2000	634	459	1094
2001	1191	794	1985
2002	1774	1087	2861
2003	1528	860	2388
2004	1595	822	2417
2005	2345	1103	3448
2006	4103	1517	5620
2007	5013	4271	9284
2008	8332	6547	14879
2009E	8604	7039	15643

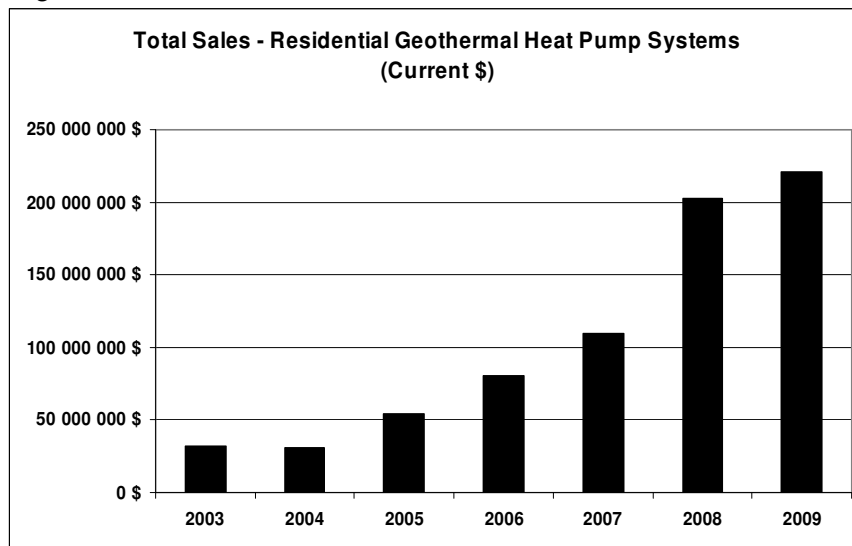
A more detailed analysis of commercial and industrial installations is almost impossible at this time. There are no systematic reporting mechanisms in place for those units or markets and to the best of our knowledge no agency is collecting information on commercial applications at the national or provincial level. Some utilities and provincial governments may have scattered technical information on specific buildings, but nothing comprehensive is available. Again, reported information in this regard, published or referred to in other reports, is considered as anecdotal only.

Furthermore, the number of assumptions necessary to further characterize the commercial segment of the geoexchange industry creates an important potential loss of accuracy. While a small commercial application may only have two or three heat pump units, larger commercial and industrial applications may include 50 units and more. The aggregate numbers discussed above are the best estimates available at this time. But these numbers only represent our best estimates of heat pump units installed in commercial and industrial applications, not the number of projects or heating / cooling tonnage involved.

Thanks to the results of the **CGC Market Survey 2008-2009**, we have however been able to better characterize the residential market. Coupled with other sources of information described in the methodology, we were able to generate a set of key market information for this sector.⁶

Based on the **CGC Market Survey 2008-2009**, industry revenues for the design and installation of residential geoexchange systems (including cost of heat pump, drilling, equipment as well as design, installation and commissioning) represented a total volume of approximately \$32 million in 2003.⁷ Six years later, those revenues are estimated to amount to more than \$220 million.

Figure 5



⁶ The results presented herein are just a sample of what can be extracted from the CGC databases. More specialized and specific information can be generated on demand to help policymakers, utilities and system operators develop and adapt new and existing programs.

⁷ These estimates are higher than initially published in a previous study of the Canadian geoexchange industry prepared for the CGC at the end of 2006. The estimated number of units in this report are higher than previous estimates, and is reflected, in a proportional manner, in the revenue figures provided here and observed in the 2006 study. For more information, see: *Final Report – Survey of Canadian Geoexchange Industry 2004-2006*, SAIC Canada, December 2006.

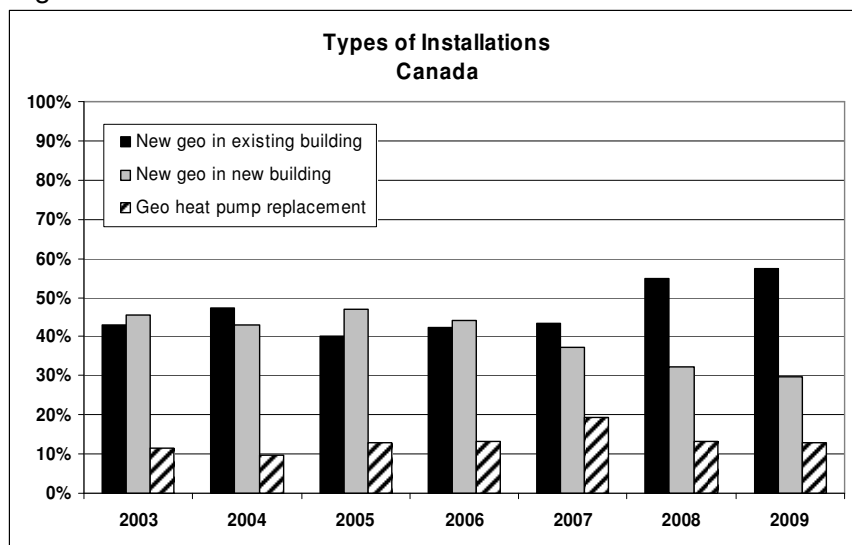
If we assume that sales in the commercial and industrial sector follow more or less the same cost patterns – although total costs are likely higher in those sectors due to engineering design and conductivity tests – the total economic activity of the Canadian geosource industry in 2009 was likely in excess of \$500 million.⁸ Some may argue that drilling and other costs are lower in the commercial and industrial sector due to economies of scale. However, on a per ton basis, we believe our estimate to be reasonable. Fragmented financial information CGC has collected on many commercial projects supports this conclusion.

Types of Installations

The results of the **CGC Market Survey 2008-2009** combined with other sources of information, and in particular the CGC’s own databases also allows us to draw conclusions regarding the types of geosource installations that have occurred in the past years.

We determined that in 2009, roughly 57 % of all residential installations were done in existing buildings, a significant increase from the 40 % level observed in 2005. On the other hand, as shown in Figure 6, the share of geosource systems installed in new homes declined from a high of 47 % to a little under 30 % in 2009. Geosource system replacements (the replacement of an existing ground source heat pump by a new ground source heat pump) averaged 13 % of the market in 2009 with a peak of almost 20 % in 2007. Together, geothermal heat pump retrofits and new systems in existing homes represented about 70 % of the Canadian market for residential geothermal heat pumps in 2009.

Figure 6

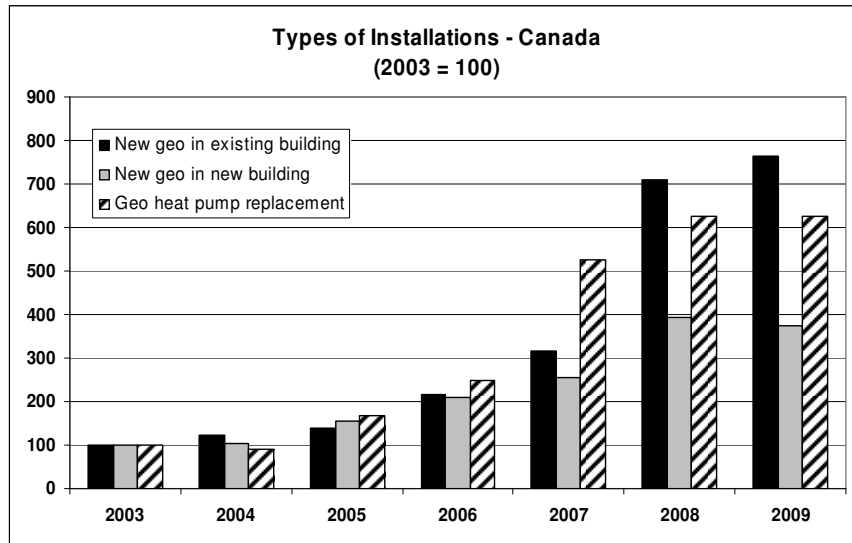


Despite these movements in relative market share for residential installations, significant growth is observed for all market segments. Figure 7 shows the relative growth of each market segment. We

⁸ The \$500 million figure is twice bigger than a previous estimate of \$250 million calculated in the first half of 2009 for the House of Commons Standing Committee on Natural Resources. This number was published in the following report: *Combining our Energies: Integrated Energy Systems for Canadian Communities*, House of Commons, June 2009. The result of the CGC Market Survey 2008-2009 had not been computed at the time of that document’s publication.

note that installations in existing buildings increased by more than 763 % between 2003 and 2009 while geexchange system replacements increased by 627 % during the same period. New geexchange systems installed in new buildings, on the other hand, only increased by 373 % over the same period.

Figure 7

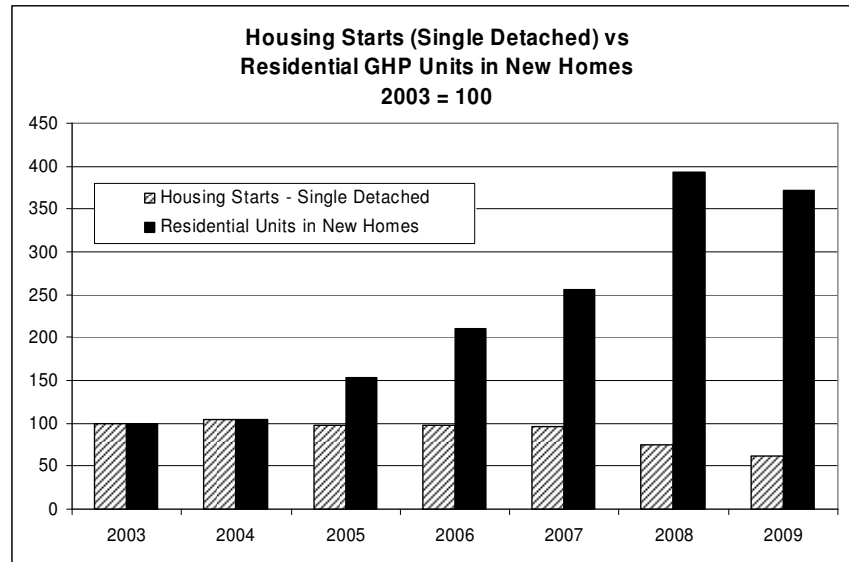


This situation would also tend to reflect the fact that there currently exist, when all government and utilities sources are taken together, more financial assistance programs for the installation of geexchange systems in existing buildings versus the installation of geexchange systems in new homes. The grant offered under the **ecoENERGY Retrofit – Homes** program (\$3500 at the beginning of the program and \$4375 as of June 2010) outweighs the scattered financial assistance programs offered for geexchange systems in new homes by some utilities and provincial governments in Canada.

Figure 8 compares housing starts for new single detached homes in Canada with the number of geothermal heat pump systems installed in this market segment. We note a 40 % decline in housing starts over the period while new geothermal heat pump systems grew by 373 %. A number of factors may explain this apparent reverse relationship including relative energy prices, high niche market penetration followed by saturation of the niche, worsening of overall economic conditions in 2008 in certain parts of Canada, etc. On the other hand, we believe that the new-build sector benefitted from the increased awareness of the technology.

The Canada-wide television marketing campaign conducted by the CGC on The Weather Network and *MétéoMédia* in 2008 and 2009 certainly contributed to sustain and develop the residential market segment. For The Weather Network, data provided by Nielson Media Advisor indicate that 34.2 % of English speaking Canadian adults between the age of 25 and 54 (3,899,000 individuals) saw one of the 2,411 commercial spots on an average of 7.6 times. On *MétéoMédia*, the outreach to French speaking adults between the age of 25 and 54 was 46.7 % (1,395,000 individuals). The 2,536 total spots were seen on average 6.2 times.

Figure 8



The nature of financial assistance programs and to some extent the market maturity of the geexchange industry, have an important impact on where the geexchange units are installed in each province. Table 2 and Table 3 present the provincial breakout of installations in new homes and in existing buildings. These tables present the average breakout of installations for 260 contractors in Canada according to the number of years each contractor has been in the geothermal heat pump industry. The numbers are therefore multi-year averages (some as far back as 30 years) and should not be compared directly to the numbers presented in figure 6 and figure 7. The weight of retrofit installations in recent years has undoubtedly biased the long term breakout averages between new homes and existing buildings. However, the figures provided interesting insights about market penetration and market maturity on provincial and national bases.

Table 2
Residential Installations in New and Existing Buildings
(Average for 260 Contractors Since in Business)

	Existing	New	Total
BC	17,5%	82,5%	100,0%
AB	13,8%	86,2%	100,0%
SK	54,1%	45,9%	100,0%
MB	43,5%	56,5%	100,0%
ON	66,8%	33,2%	100,0%
QC	30,7%	69,3%	100,0%
NB	50,4%	49,6%	100,0%
NS	31,5%	68,5%	100,0%
PE	43,1%	56,9%	100,0%
NF	70,0%	30,0%	100,0%
CANADA	51,1%	48,9%	100,0%

Table 3
Years in Business - Canadian Geothermal Heat Pump Contractors
(n=260)

	Years in Business	Standard Deviation	Years Min	Years Max
BC	7,5	6,0	1	28
AB	7,9	5,5	2	18
SK	5,7	4,2	1	16
MB	8,8	6,2	1	25
ON	11,0	9,4	1	30
QC	8,4	7,8	1	28
NB	9,6	11,1	1	30
NS	10,1	8,4	3	28
PE	10,7	15,1	1	28
NF	n.a.	n.a.	n.a.	n.a.
CANADA	9,5	8,4	1	30

For example, in Ontario, we are not surprised to see that 67 % of all installations are in existing buildings. It could be argued that the provincial financial assistance policy for the installation of geothermal heat pumps – Ontario doubles the federal grant and also provided a sales tax rebate on the installation before the provincial sales tax harmonization with the GST in the summer of 2010 – had an impact on this market segment. Total combined grants have generally been in the range of \$9,000-\$10,000 and therefore financial assistance for a \$25,000 geexchange system retrofit represents about 40 % of the cost. With such figures, geexchange becomes extremely attractive compared to other heating and cooling options.

In Alberta and BC, on the other hand, there are no provincial grants available. As a consequence, we note that the relative number of installations in existing buildings is much lower than the Canadian average. In those two provinces, the housing stock is also probably and relatively younger than in Eastern Canada. Although we have not yet analysed this variable in depth, it could also have a measurable impact on systems installed in new homes versus those installed in existing buildings. Further analysis would be required to confirm this latter hypothesis.

The relative price of energy in the residential sector also has significantly impacted geexchange markets. In Alberta for example, the price of natural gas is heavily subsidized by the province which makes the financial case of the dominant electric-driven geexchange systems type much less attractive than in Ontario. Also, the existing stock of heating equipment and fuel used in homes across Canada will influence customers when time comes to replace this equipment. In Québec, the conversion from electric baseboard to geexchange system implies the installation of completely new ducting systems within existing homes. This is a clear barrier to the introduction of geexchange as it increases the overall cost of the installations. The geexchange market dynamic appears to be quite variable from one province to the other and further analysis is required to better qualify the differences, if any, in provincial geexchange markets.

Finally, mixed market signals and messages from some industry stakeholders also contributed to creating market and consumer confusion. This was mainly observed in Alberta and the western part of Saskatchewan, parts of British Columbia and Manitoba as well as in Atlantic Canada. Faced with conflicting messaging from the industry, many customers opted for competing technologies.

Environmental Benefits

It has been demonstrated in another CGC study that increased penetration of geothermal heat pumps in the residential heating market has a positive impact on GHG emissions. This is true in all Canadian provinces.⁹

Table 4

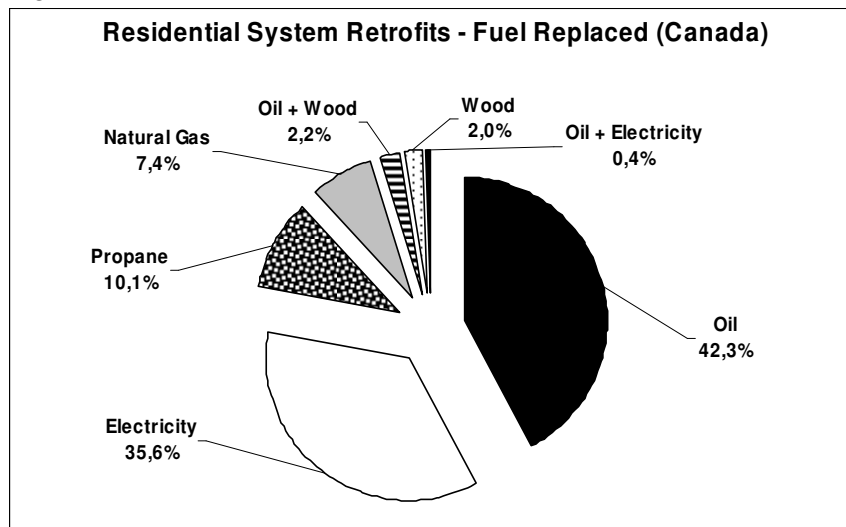
Geothermal Heat Pump GHG Savings Potential in Canada Compared with Different Market Penetration Scenarios, Considering Replacement of Actual Heating Systems

	Market Penetration			
	2%	4%	8%	16%
	GHG Savings (tons CO ₂ eq.)			
Electric Baseboard	115 350	230 701	461 402	922 804
Natural Gas	201 589	403 178	806 356	1 612 713
Oil	59 315	118 630	237 261	474 521
Total	376 254	752 509	1 505 019	3 010 038
Equivalent Number of Cars	111 981	223 961	447 922	895 845

A geothermal heat pump penetration rate of 2 % of singled detached residential homes in Canada would mean a recurrent annual reduction of 376,254 tons of CO₂ equivalent. Current penetration rate of the technology is believed to be below 0.5 %.

Figure 9 below provides some insights regarding the type of fuel replaced by geexchange in retrofits in recent years.

Figure 9



⁹ For a detailed provincial analysis please consult: *“Comparative Analysis of Greenhouse Gas Emissions of Various Residential Heating Systems in the Canadian Provinces”*, Canadian GeoExchange Coalition, April 2010. For an overview, consult *“Retrofitting for Emissions Savings in North America: Residential Heating Options in the Canadian Provinces”* by Ted Kantrowitz and Denis Tanguay. IEA Heat Pump Centre Newsletter, Vol. 28, No 2/2010. International Energy Agency, pub. Borås, Sweden.

At about 64 %, oil and other fossil fuel switching clearly dominates the Canadian average for the retrofit market. The replacement of central electric heating systems, electric baseboard and existing geexchange systems represent roughly 36 % of total installations. Provincial breakouts, which are presented later in this report, are useful in understanding provincial energy market structure.

System Type, Price and Cost

Another market characteristic of national and provincial interest relates to installations by loop type. The data gleaned from the **CGC Market Survey 2008-2009** and data from the CGC system database are fairly consistent. Based on the sample size used we also believe with a high degree of confidence that the data sets validate each other. The table below is therefore an accurate representation of the markets nationally.

Table 5
System Installations by Loop Types - Canada (%)

	2003	2004	2005	2006	2007	2008	2009
Closed, vertical loop	36,1	36,5	36,0	34,2	34,2	34,3	34,1
Closed, horizontal loop	49,4	47,2	50,7	47,0	52,4	51,7	52,5
Close, pond / lake loop	2,1	3,8	3,5	4,2	5,3	5,4	5,1
Open loop, discharge to well	10,7	10,5	7,3	7,3	4,6	5,1	4,7
Open loop, discharge to surface	1,7	2,0	2,4	2,1	1,8	1,6	1,4
Direct expansion	0,0	0,0	0,0	5,2	1,8	1,8	2,2
	100,0	100,0	100,0	100,0	100,0	100,0	100,0

As we can see from Table 5, closed horizontal loops dominate residential installations in Canada. These systems accounted for 49.4 % of residential installations in 2003 and 52.5 % in 2009. The second largest segment is closed, vertical loops with 34.1 % of the installations in 2009 compared to 36.1 % in 2003. Closed pond / lake loops increased from 2.1 % market share in 2003 to 5.1 % in 2009. Open loops with a discharge to wells are relatively less popular in 2008 with a 4.7 % market share down from 10.7 % in 2003. During the same period, the share of open loops discharged to surface remained fairly the same going from 1.7 % to 1.4 % while direct expansion increased from 0 % to 2.2 %.¹⁰

These aggregated figures hide some important regional and provincial variations as we will see in the *Provincial Highlights* section of this report. System installations by loop types also tend to reflect local geology and drilling practices. Loop choice is also obviously influenced by existing regulation, particularly at the provincial level but also at the municipal level in a growing number of cases.

In recent years, the CGC has often been confronted with customers, journalists, market analysts, utilities and government officials and other industry stakeholders who were “shocked” by the high price of geexchange systems. We have often heard that the average price was well over \$ 30,000. A detailed analysis of the financials of more than 8 000 residential geexchange systems indicates that those estimates are usually overstated.

Average system price is also not often a very useful indicator as it includes variables such as home size and relative cost of local construction. On the other hand, average price per BTU-ton, a better indicator, is biased by design practices. A market where systems are designed at 100 % of the

¹⁰ Direct expansion systems were obviously installed in 2003, 2004 and 2005. However, since not all industry stakeholders responded to the CGC survey in early 2009, DX installations were not reflected in the survey results for 2003, 2004 and 2005. We note a sharp decline in the market share of DX systems from 5.2 % in 2006 to 1.8 % in 2008. This reflects the fact that DX systems were deliberately and specifically excluded from the industry standard C448, and did not qualify for grants under the ecoENERGY Retrofit - Homes Program and under some utility programs. The industry survey tends to indicate that the DX industry suffered by not being included in the standard. The relatively low number of DX installations is not believed to have a significant impact on the market results presented here.

calculated heat loss capacity will obviously have a higher average price per ton than a market where systems are designed at 80 % or 75 % of the calculated heat loss capacity.

Speculation on price estimates that do not reflect market reality has always been and still is a big problem for a technology and an industry eagerly trying to remove or alleviate market barriers. “Educated guesses” have been toxic for the geoexchange industry and contributed to consolidate the general opinion that the technology belongs to a niche market of large homes. The following four scatter graphs show the price/size relation for more than 7,000 systems installed in Canada from 2007 to 2009. All loop types considered together, the average geothermal heat pump system price for Canada is \$24,455.

Figure 10

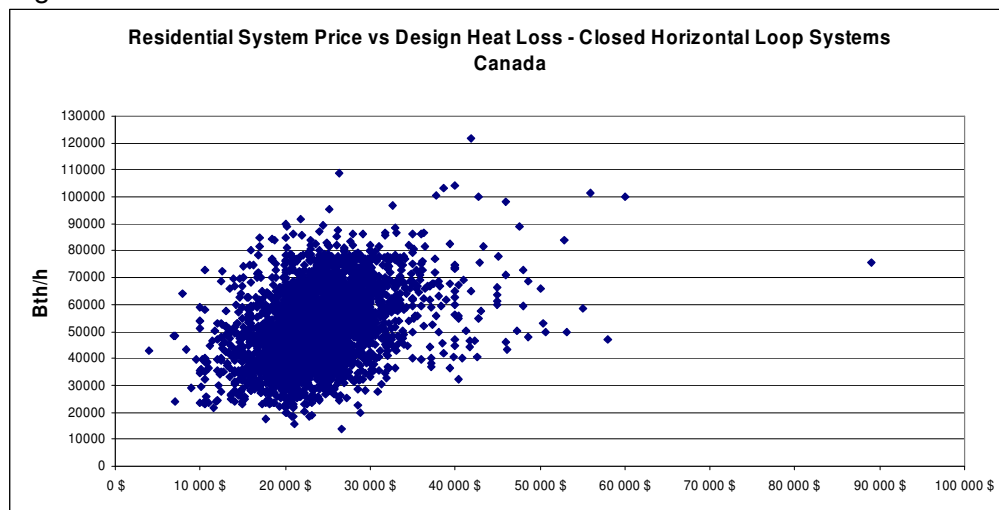


Figure 11

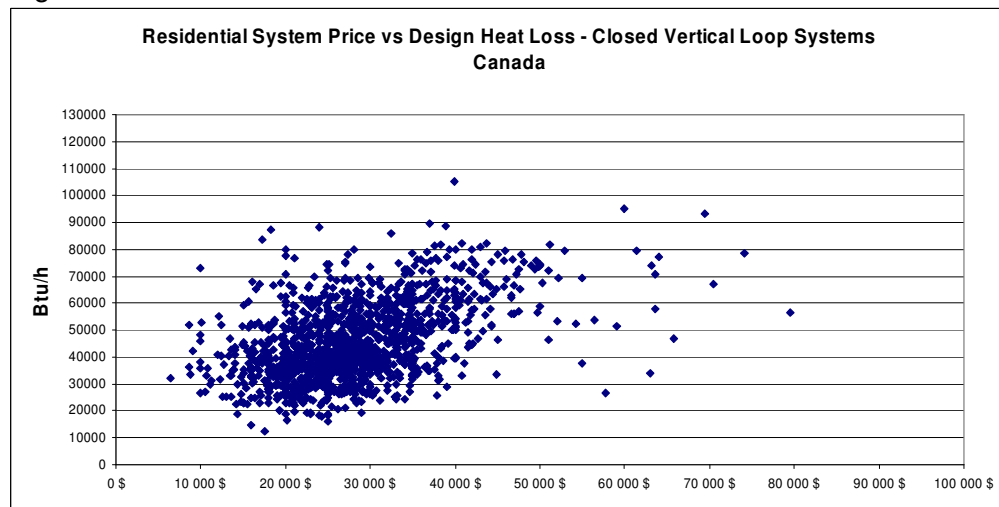


Figure 12

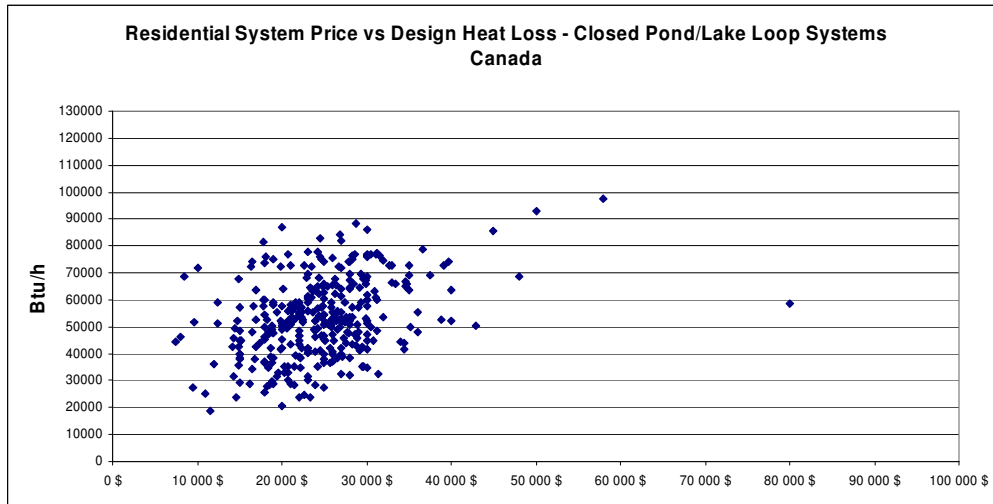
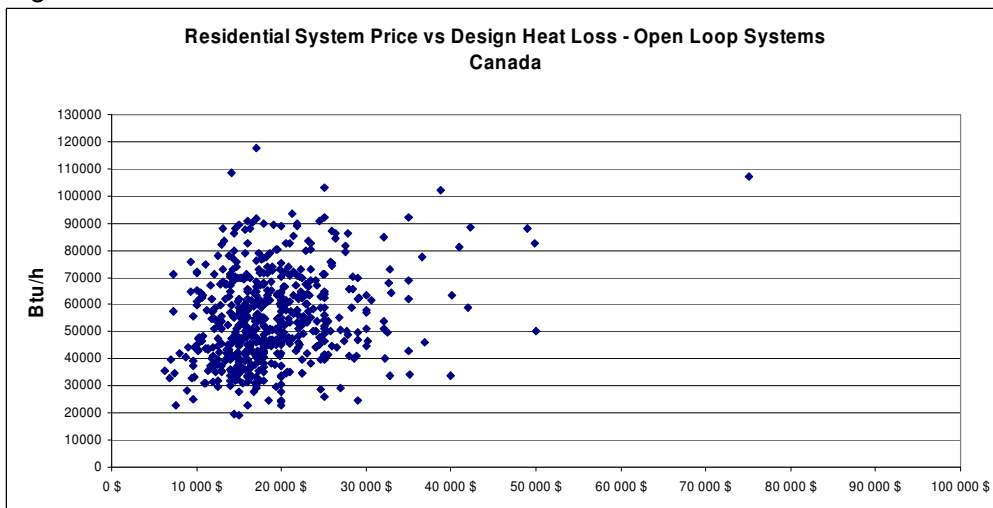


Figure 13



One of the problems with “educated guesses” stems from the fact that individuals are not making an appropriate distinction between their estimates and the real price of systems by type. For example, an open-loop is generally cheaper than a pond or a lake loop. The latter is about the same price as a closed horizontal loop. And a closed vertical loop is usually more expensive than other options. Drilling costs, differences of hundreds of feet of pipe, of hundreds of litres of heat transfer fluid, etc are significant variables for the system types cited above.

On average in Canada, a closed loop horizontal system is sold for \$ 23,941 and a closed loop vertical system goes for \$ 28,003. Based on design heat load, the average price per ton for a closed loop horizontal system is \$ 5,861, and \$ 7,837 for the closed loop vertical system. Tables 6 and 7 present key price information for horizontal, vertical and pond/lake closed loop systems by province.

The national aggregate numbers hide some interesting regional differences however. For horizontal systems, we posit that differences are mainly explained by labor costs and by relative competition in the marketplace. (This topic will be further discussed in the *Market Concentration* section below). For vertical systems, geological conditions, which have a significant impact on drilling, probably explain most of the provincial variations. The standard deviation on the provincial average prices of vertical systems may also provide some insight regarding the degree of competition in the markets. A more detailed analysis would be required to see if indeed higher prices in some provinces do reflect a lesser degree of competition in these markets.

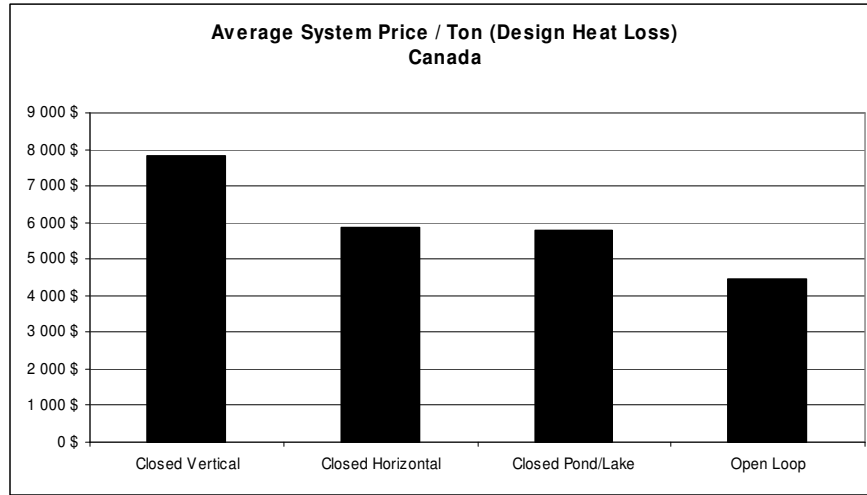
Table 6
Average System Price - Closed Horizontal Loops

	Average Price / Ton	Median	Standard Deviation	Average System Price
BC	\$5 494	\$5 151	\$1 616	\$22 689
AB	\$7 139	\$6 861	\$2 119	\$22 111
SK	\$5 736	\$5 480	\$1 527	\$21 875
MB	\$5 924	\$5 904	\$1 668	\$21 763
ON	\$5 878	\$5 578	\$1 815	\$24 244
QC	\$5 542	\$5 215	\$1 835	\$22 194
NB	\$5 838	\$5 879	\$1 763	\$20 019
NS	\$6 223	\$5 758	\$2 384	\$22 559
PE	\$6 472	\$7 226	\$1 627	\$26 874
NF	\$5 641	\$5 641	\$1 080	\$21 000
Canada	\$5 861	\$5 578	\$1 800	\$23 941

Table 7
Average System Price - Closed Vertical Loops

	Average Price / Ton	Median	Standard Deviation	Average System Price
BC	\$7 652	\$7 107	\$2 782	\$27 889
AB	\$7 316	\$7 650	\$1 934	\$30 399
SK	\$6 948	\$4 176	\$1 657	\$24 872
MB	\$6 161	\$6 187	\$1 521	\$21 712
ON	\$8 085	\$7 900	\$2 422	\$31 229
QC	\$8 678	\$8 236	\$2 960	\$27 711
NB	\$6 053	\$5 600	\$1 838	\$22 275
NS	\$8 270	\$8 940	\$2 510	\$24 570
PE	n.a.	n.a.	n.a.	n.a.
NF	\$5 695	\$5 399	\$2 025	\$21 222
Canada	\$7 837	\$6 652	\$2 579	\$28 003

Figure 14



Statistically valid information for heat pump replacement is available only for three provinces and show fairly comparable costs. Results are presented in Figure 15 and table 8 below.

Figure 15

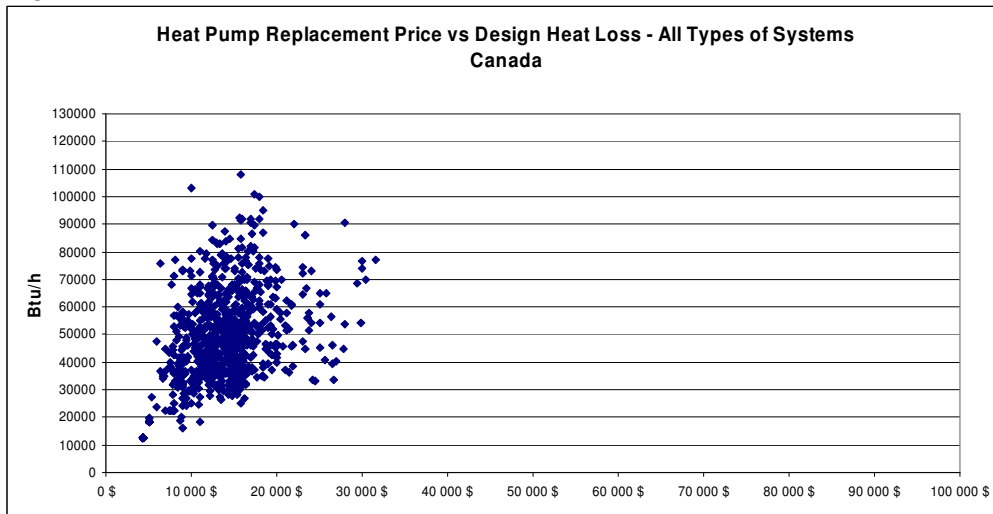


Table 8
Heat Pump Replacement Price - All Loop Types

	Average Price / Ton HL*	Average Price / Ton Capacity**	System Capacity (% HL)	Average Heat Pump Replacement Price
BC	n.a.	n.a.	n.a.	n.a.
AB	n.a.	n.a.	n.a.	n.a.
SK	n.a.	n.a.	n.a.	n.a.
MB	\$4 028	\$4 488	90%	\$14 381
ON	\$3 616	\$4 528	81%	\$13 491
QC	n.a.	n.a.	n.a.	n.a.
NB	\$3 048	\$3 265	98%	\$12 124
NS	n.a.	n.a.	n.a.	n.a.
PE	n.a.	n.a.	n.a.	n.a.
NF	n.a.	n.a.	n.a.	n.a.
Canada	\$3 612	\$4 448	81%	\$13 377

(*) Average price per tonne of calculated heat loss

(**) Average price per tonne of installed heat pump capacity

Tables 9 and 10 present system price evolution between 2008 and 2009. These tables were computed to contrast average system price per ton and average system price to system capacity (as % of calculated heat loss) for both horizontal and vertical systems. At first glance, it is tempting to conclude that there is no clear correlation between design practices (higher or lower system capacity as a % of calculated heat loss) and system price per ton.

Table 9
System Price Evolution - 2008-2009 - Closed Horizontal Loops

	2008			2009		
	System Price Per Ton	Average System Price	System Capacity (% HL)	System Price Per Ton	Average System Price	System Capacity (% HL)
BC	\$5 485	\$22 486	88%	\$5 377	\$22 522	85%
AB	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SK	\$5 551	\$20 209	92%	\$5 930	\$22 991	88%
MB	\$5 499	\$20 293	83%	\$6 221	\$22 352	88%
ON	\$5 685	\$23 440	83%	\$6 007	\$24 905	83%
QC	\$6 124	\$23 995	84%	\$5 225	\$21 497	79%
NB	\$5 041	\$18 739	85%	\$6 084	\$20 079	91%
NS	\$5 469	\$20 315	83%	\$6 882	\$24 523	81%
PE	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NF	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	\$5 721	\$23 165	83%	\$5 990	\$24 561	84%

Table 10
System Price Evolution - 2008-2009 - Closed Vertical Loops

	2008			2009		
	System Price Per Ton	Average System Price	System Capacity (% HL)	System Price Per Ton	Average System Price	System Capacity (% HL)
BC	\$7 564	\$27 351	81%	\$7 683	\$28 028	81%
AB	\$7 105	\$29 189	89%	\$9 235	\$37 654	87%
SK	\$7 079	\$24 759	93%	\$6 972	\$25 683	90%
MB	\$6 145	\$20 814	85%	\$6 450	\$22 778	84%
ON	\$7 577	\$30 172	80%	\$8 523	\$31 907	82%
QC	\$8 492	\$27 285	80%	\$8 860	\$28 436	79%
NB	\$5 856	\$22 002	86%	\$6 086	\$22 083	90%
NS	\$8 893	\$24 600	85%	\$7 646	\$24 539	92%
PE	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NF	\$6 213	\$18 515	86%	\$5 435	\$22 575	82%
Canada	\$7 531	\$27 111	82%	\$8 079	\$28 764	83%

Factors other than design practices are more likely to explain interprovincial variations in system price per ton. As an example, Québec ranks second for system price per ton for vertical loops at \$8,492. Yet, the average system capacity measure as a % of calculated heat loss is the lowest of all provinces at 79%.

Tables 9 and 10 also reveal that average system price on a per ton basis increased 4.7 % between 2008 and 2009 for closed horizontal loop systems and by 7.3 % for closed vertical loop systems. For closed horizontal loop systems, average price went up by over 20 % in both New Brunswick and Nova Scotia and by 13 % in Manitoba. More modest price increases were observed in other provinces and some price decreases were observed in Québec and British Columbia.

Average price for closed vertical loop systems increased in Alberta¹¹ by 30 %, in Manitoba (5 %), in Ontario (12.4 %) and in Québec (4.3 %) while price decreases were observed in Saskatchewan and Nova Scotia.

¹¹ The sample used for Alberta is small. Numbers should be interpreted with caution.

Market Concentration

We have seen earlier that the economic activity generated by the installation of residential geexchange systems alone in Canada amounted to more than \$202 million in 2008 and over \$220 million in 2009. Considering the growing importance of this industry in the Canadian HVAC sector, a market concentration analysis for heat pump brands and for installers / contractors is quite interesting and revealing of market conditions. Concentration ratios also reflect the potential monopoly power exercised by dominant firms and explain elements of the market dynamics within the industry itself.

Table 11
Market Share by Brand
Canada

Position / Rank	Market Share
1	34,13%
2	31,76%
3	11,43%
4	5,53%
5	2,71%
6	2,21%
7	1,85%
8	1,33%
9	1,23%
10	1,06%
11	1,02%
12	0,94%
13	0,91%
14	0,73%
15	0,69%
16	0,46%
17	0,40%
18	0,25%
19	0,21%
20	0,19%
21	0,17%
22	0,15%
23	0,14%
24	0,11%
25	0,11%

Table 12
Installers' Market Share
Canada

Position / Rank	Market Share
1	3,54%
2	2,92%
3	2,85%
4	2,81%
5	2,61%
6	2,39%
7	2,23%
8	1,89%
9	1,80%
10	1,74%
11	1,69%
12	1,32%
13	1,15%
14	1,09%
15	1,05%
16	1,03%
17	0,99%
18	0,94%
19	0,94%
20	0,94%
21	0,93%
22	0,92%
23	0,87%
24	0,87%
25	0,84%

The Canadian geexchange market is highly concentrated with the largest manufacturers located in the United States.¹² The top three geexchange heat pump brands capture in excess of 82 % of the market and the top ten brands account for 93.2 % of all ground source heat pumps sold in Canada. Of the top ten brands by market share, only three are manufactured in Canada.

¹² It is important to distinguish manufacturers from brands. For example, ClimateMaster, a wholly owned subsidiary of LSB Industries, manufactures heat pumps which are commercialized under various brands such as ClimateMaster™, Carrier™ and Bryant™. In this part of the report, concentration indices reflect market position by brand. If we were to present results by manufacturers, market concentration ratios would be yet higher.

The Herfindahl-Hirschman Index (HHI) for the 25 largest brands was measured at 0.24, which indicates a high degree of market concentration.¹³ The four-firm (brands) concentration ratio¹⁴, C₄, was found to be 82.9 and the five-firm (brands) concentration ratio, C₅, 85.6. These results all indicate a high degree of concentration.

When we look at the market share held by installers at the national level, the 25-firm HHI result is 0.008, reflecting a highly competitive market. But this theoretical “competitive” market hides some important facts about the market structure. Looking closer at those numbers, we notice that the top 10 installation companies in Canada are responsible for 25 % of all residential installations. Overall 25 installation companies capture 40 % of the residential market in Canada but very few compete with each other as they are mostly located in different regional markets.

Table 13
Comparative Concentration Ratios - Provincial Summary

	Brands			Installers		
	HHI	C4	C5	HHI	C4	C5
BC	0,23	76,0%	81,9%	0,05	34,8%	39,3%
AB	0,20	82,3%	87,1%	0,14	65,1%	72,1%
SK	0,32	88,1%	92,9%	0,16	62,9%	66,5%
MB	0,18	72,4%	80,8%	0,06	36,9%	41,6%
ON	0,28	88,7%	90,9%	0,01	16,6%	19,9%
QC	0,30	73,2%	79,2%	0,09	46,6%	51,2%
NB	0,38	95,2%	98,6%	0,12	62,2%	70,1%
NS	0,28	89,9%	95,0%	0,12	61,1%	71,1%
PE	0,55	96,3%	98,2%	0,51	90,0%	94,0%
NF	0,59	100,0%	100,0%	0,51	100,0%	100,0%
Canada	0,24	82,9%	85,6%	0,08	12,1%	14,7%

However, looking even deeper in the typical operations of companies involved in the installation of geexchange systems, we need to emphasize that installations of geexchange systems take place in regional markets rather than national ones. Installers and contractors rarely travel long distances and tend to install systems within a radius of 75-100 km from their home bases.

As such, the provincial HHI for installers, as shown in the provincial highlights section of this report, indicate that local markets are also highly concentrated. Within one province, one particular installer may have a regional quasi-monopoly over the market while in some densely populated areas, the competition is harsh. It is therefore inappropriate to draw conclusions on provincial market structures solely using national figures.

In the local and regional geexchange markets, competitive advantages can be developed because of vertical integration or quasi-vertical integration. In some cases for example, the installation company will guarantee a minimum volume of business to a specific drilling partner company. Both installer and driller are then in a position to negotiate better prices and deliver geexchange systems to customers in a more timely way. In other cases, it is now not uncommon to see larger

¹³ The Herfindahl-Hirschman Index (HHI) is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. The index involves taking the market share of the respective market competitors, squaring it, and adding them together. A HHI below 0.01 indicates a highly competitive index. A HHI below 0.1 indicates an un-concentrated index. A HHI between 0.1 and 0.18 indicates moderate concentration and a HHI above 0.18 indicates high concentration.

¹⁴ The four firm concentration ratio, C₄, indicates the sum of the industry market share held by the four largest firms. The five firm concentration ratio, C₅, indicates the sum of the industry market share held by the five largest firms.

installation companies acquire drilling equipment and do their own drilling and grouting work. These two strategies contribute to reduce the overall cost structure and improve the competitive advantage of the installation company, again usually in a limited regional market.

Competitive market advantages can also be gained through bargaining power. A larger installation company can negotiate volume rebates with their heat pump suppliers or distributors. Smaller installation companies and new dealers can't benefit from those special deals. In addition, larger installation companies specializing in geexchange installations will often have on staff one or more specialists required for an installation: refrigeration technicians, plumbers, electricians, etc. Smaller companies will usually subcontract part of the tasks, increasing their costs and therefore raising their prices and reducing their ability to compete. It is our general view that accusations of price cutting and unfair competition are, in most cases, solely a reflection of this bargaining power or of some degree of vertical integration.

Industry Capacity – Training & Accreditation

In full deployment since early 2007, the CGC-led market transformation initiative has had resounding success across Canada as we have seen earlier. As part of this initiative, hundreds of industry stakeholders have taken one or more CGC course. The following figures illustrate the number of trainees for each CGC course, by province, as of July 2010. Results are also presented on a per capita basis for ease of inter-provincial comparison.

Figure 16

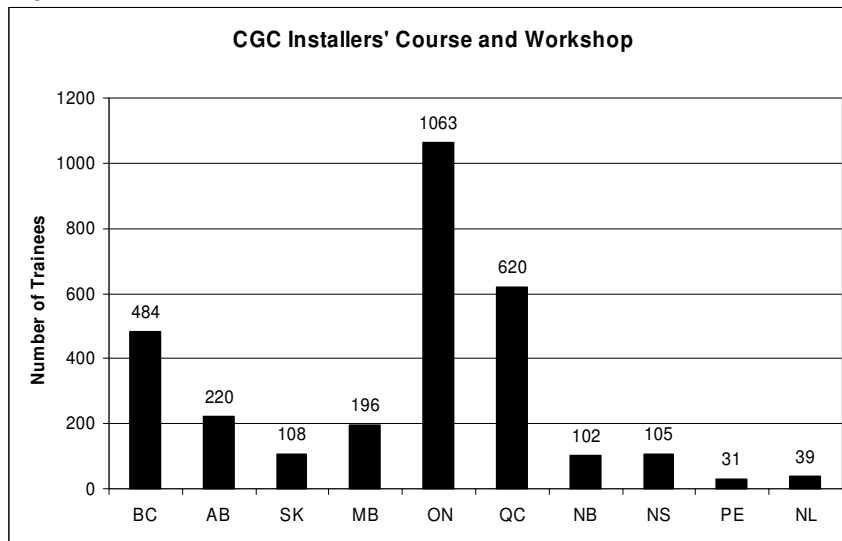


Figure 17

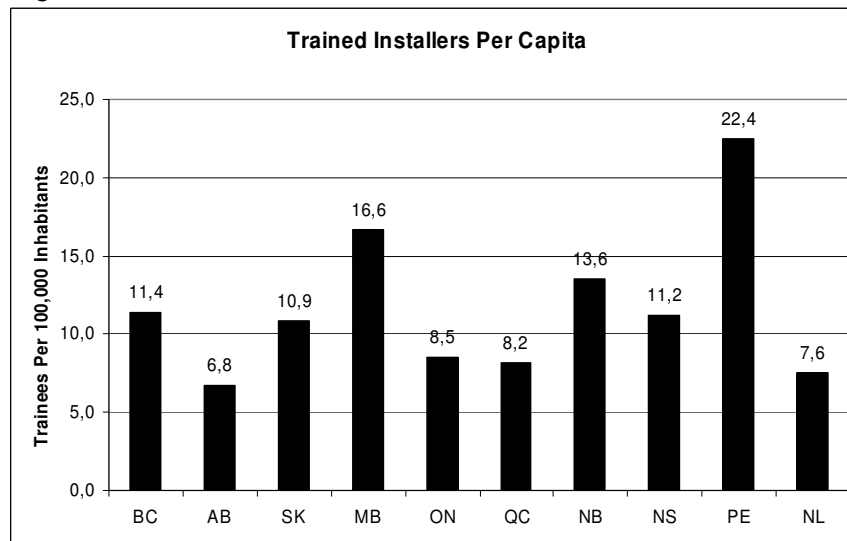


Figure 18

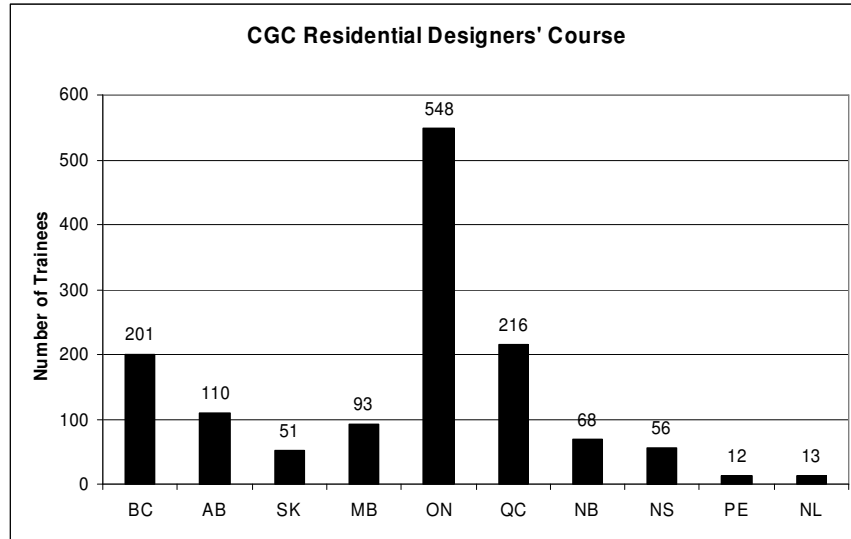


Figure 19

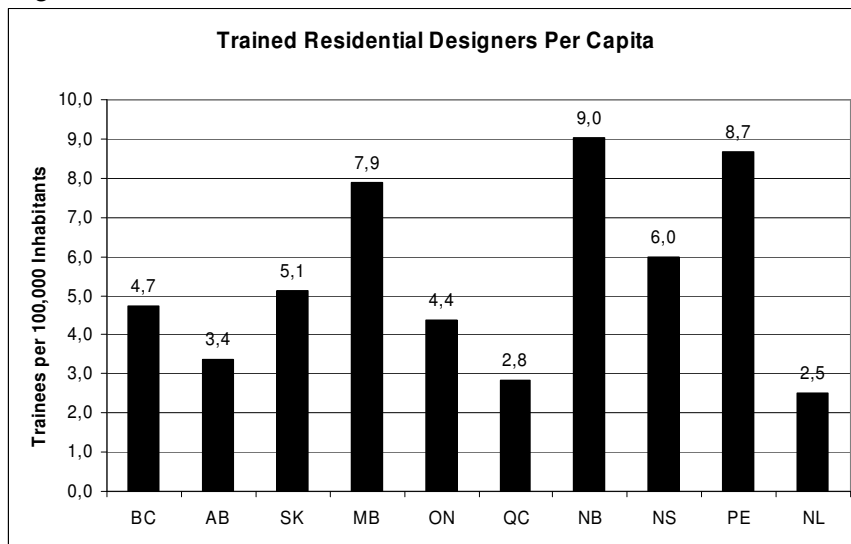


Figure 20

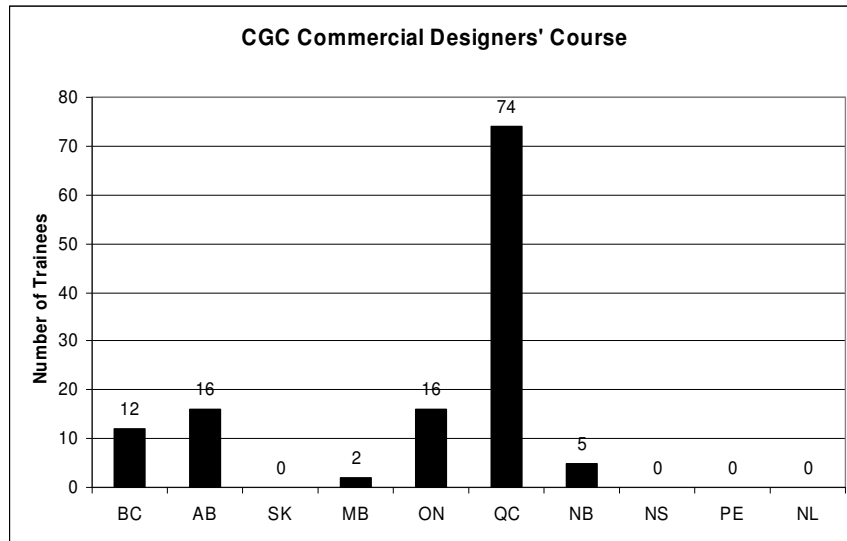
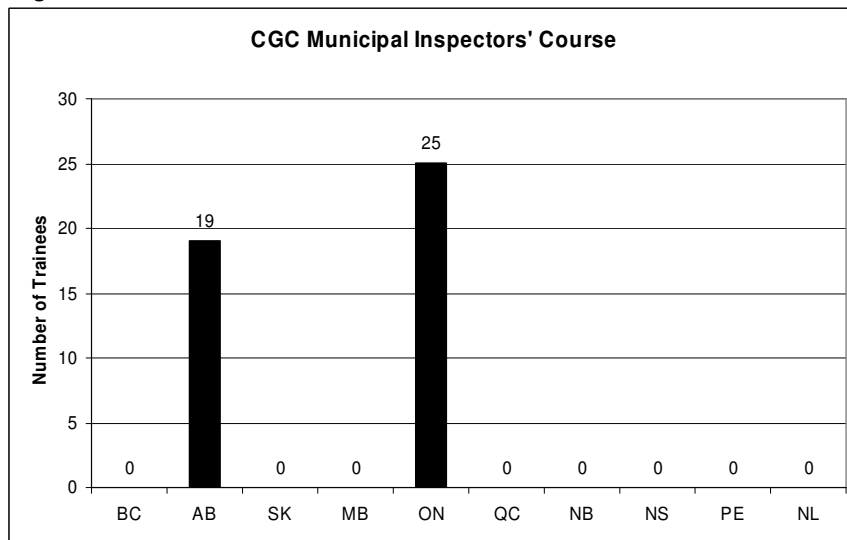


Figure 21



Through a network of training partners and independent trainers, the CGC has trained 2,968 installers, 1,368 residential designers, 125 commercial designers and 44 municipal inspectors between February 2007 and June 2010. In July 2009 CGC piloted its Direct Expansion Installation Course. The course was officially released in the Fall of 2009 with sessions offered initially in Québec and Ontario. As of June 2010, more than 100 specialists have taken the CGC DX course. The CGC courses also have also been delivered with success outside of Canada, with individuals trained in Palestine, South Africa, India, South Korea and in the United States.

Of all those who have taken CGC courses, 645 installers have applied for and received their CGC Installer Accreditation and 458 individuals have applied for and received their CGC Residential Designer Accreditation. The following figures illustrate the number of installer and designer

accreditations issued in each province as of June 2010. Results are also presented on a per capita basis for ease of inter-provincial comparison.

Figure 22

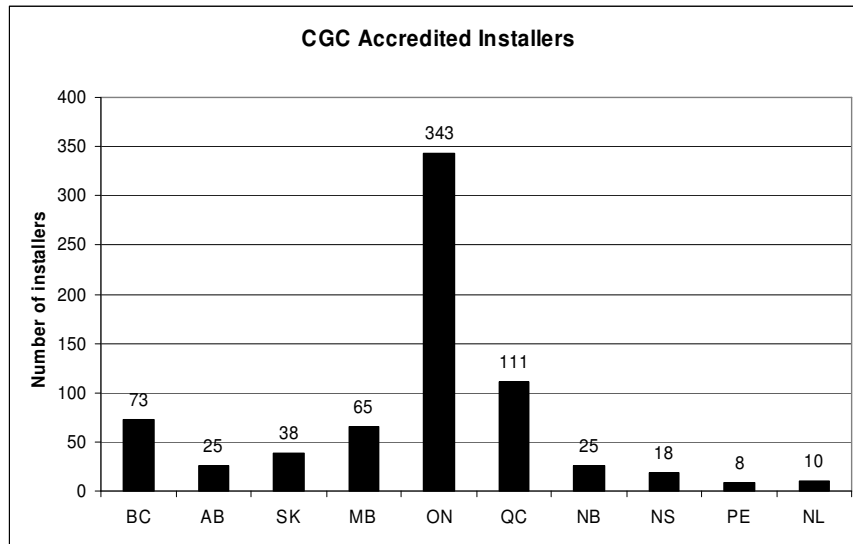


Figure 23

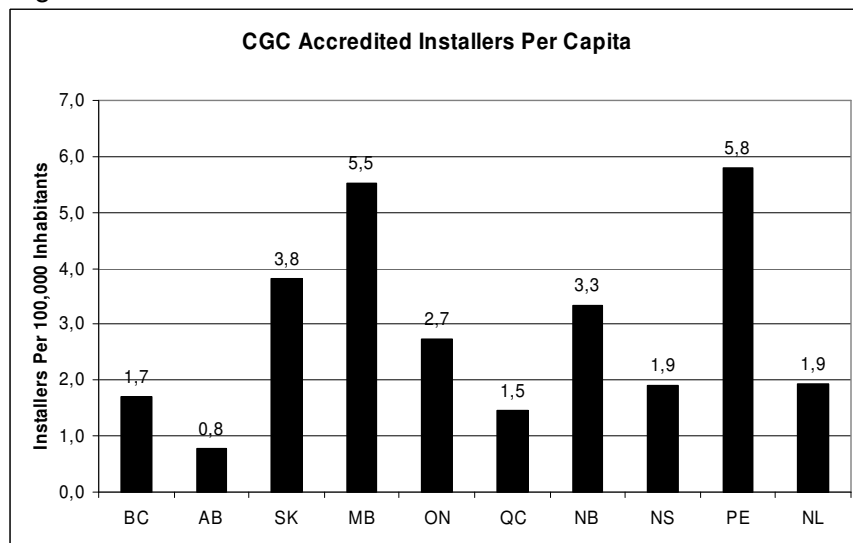


Figure 24

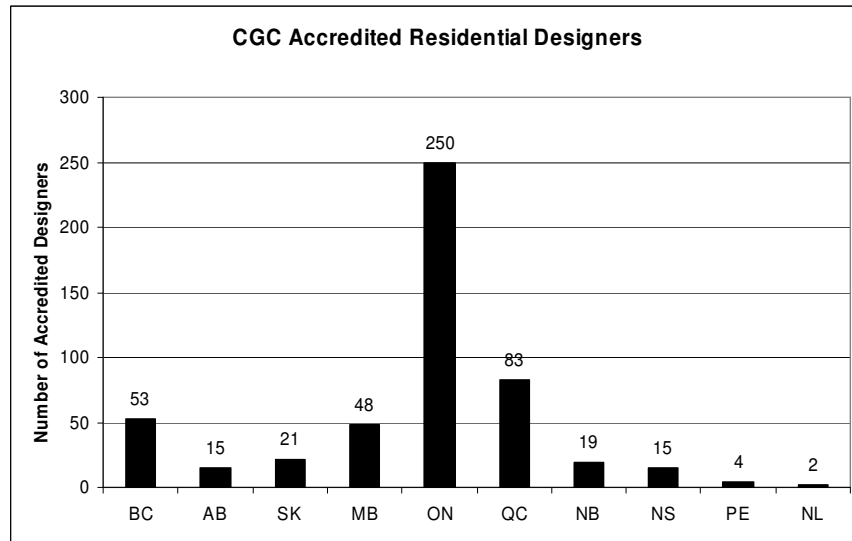
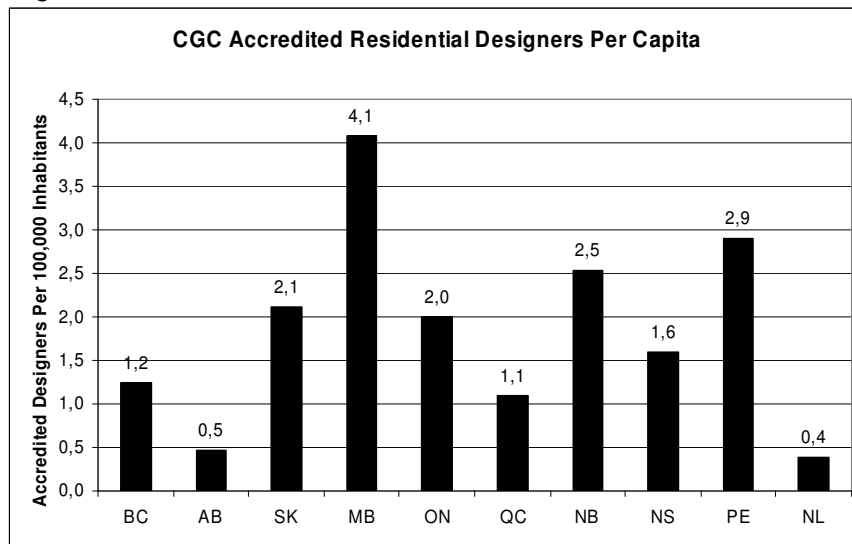


Figure 25



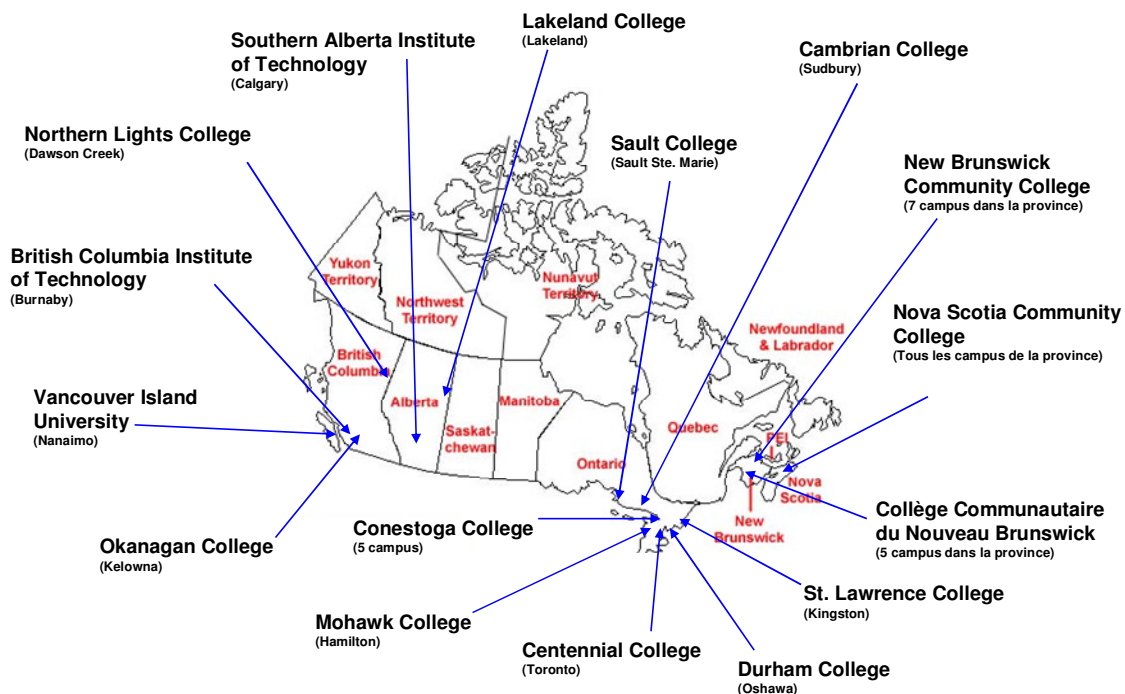
CGC's Education and Training Network

Either incorporated in college' curriculum in whole or in complementary parts, the CGC courses or recognized equivalent are essentially transferring key common knowledge to existing and new industry participants.

The following figure illustrates the CGC Academic Network, a group of colleges and public institutions with whom the CGC has signed a MOU. Together, these colleges offer standardized training recognized by the CGC for the purpose of the CGC quality program.

Figure 26

CGC's Education and Training Network*



(* CGC is currently in discussion with 11 other colleges

This education network is unique in North America and shows the openness and inclusivity of the CGC led market transformation initiative. Indeed, we believe that the geothermal heat pump industry failed to gain wider recognition in North America from 1985 to 2005 partly due to the lack of cooperation between stakeholders within the industry and also with stakeholders such as the public education network. Indeed, for close to 20 years, a virtual monopoly over training was maintained by one university in the United States with the direct or tacit support of North American major heat pump manufacturers. At the same time, a relative handful of installers dominated local markets and claimed unique knowledge but did not share it with potential competitors. This logical short-term focused approach by some individuals perverted normal competitive dynamics that would have

otherwise been expected with broader information sharing and a more active and inclusive training effort or a true national association with a long term vision. As a result of this thinking and black box mentality, Canadian industry vegetated in a steady state until 2005, while renewable energy technologies such as wind and solar, blossomed and expanded.

Things changed with the vision proposed by the CGC in 2005. Training active industry practitioners was only one of the steps towards strengthening the industry. The next natural step was to work with training institutions such as colleges and universities to advance the industry in the medium term, and CGC began that work in earnest in 2006. Though not a short term project, the black box mentality is being eroded by these efforts consistently and has already shown signs of collapsing.

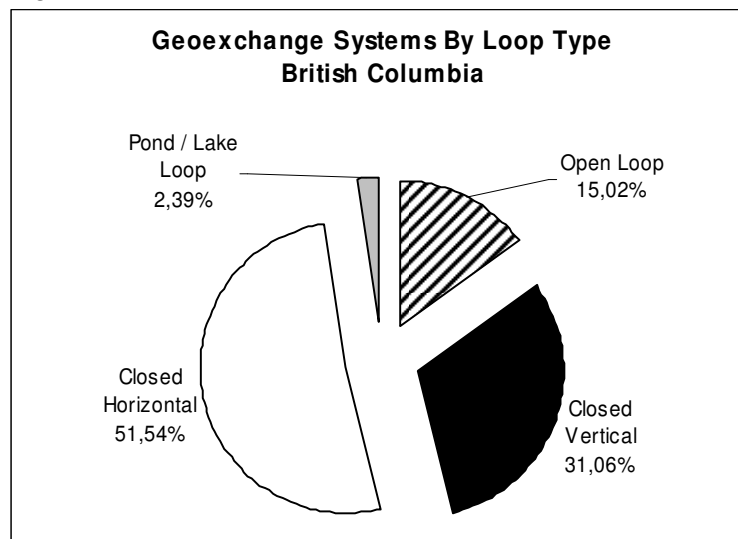
PROVINCIAL HIGHLIGHTS

British Columbia

We have seen earlier that the market for residential geexchange systems in British Columbia is heavily weighted towards new buildings (82.5 %) rather than retrofits (17.5 %). There are a number of factors that could explain this situation. It could partly be due to the age of the building stock and the heavy penetration rate of electric baseboard in existing buildings. With electric baseboards, retrofits are usually more expensive because they require the installation of new ducting systems. This characteristic applies equally to other provinces such as Québec where electric baseboards are the main source of residential heating. However, we feel that additional analysis is required to draw more accurate conclusions.

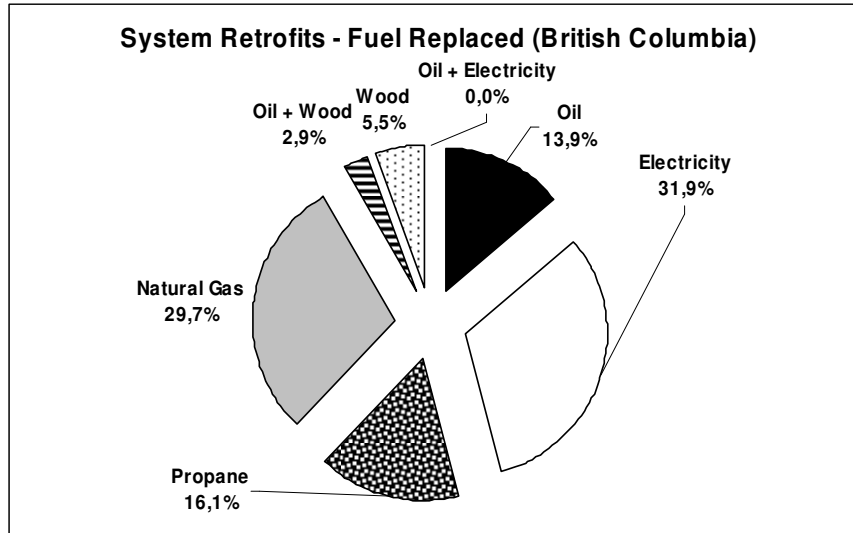
In British Columbia, about 52 % of the geexchange systems installed are horizontal closed loops and 31 % closed vertical loops. Open loops account for 15 % of the market and pond / lake loops, 2 %. In this regard, installations by loop types are comparable to the Canadian average.

Figure 27



In the retrofit market, 29.7 % of installations replace natural gas and 13.9 % replace heating oil. If we consider propane and the mix of oil and wood, about 68 % of the geexchange systems replace fossil fuels.

Figure 28



The average price of a closed horizontal geexchange system in British Columbia is \$ 22,689, or about \$ 1,300 below the Canadian average. The system price per ton of installed capacity is also lower than the Canadian average at \$ 5,494 compared to \$ 5,861 for the country.

The average system price for closed vertical systems is \$ 27,889 in British Columbia compared to \$ 28,003 for Canada. The average price per ton installed is only slightly lower than the Canadian average and stands at \$ 7,652 compared to \$ 7,837 for Canada.

Figure 29

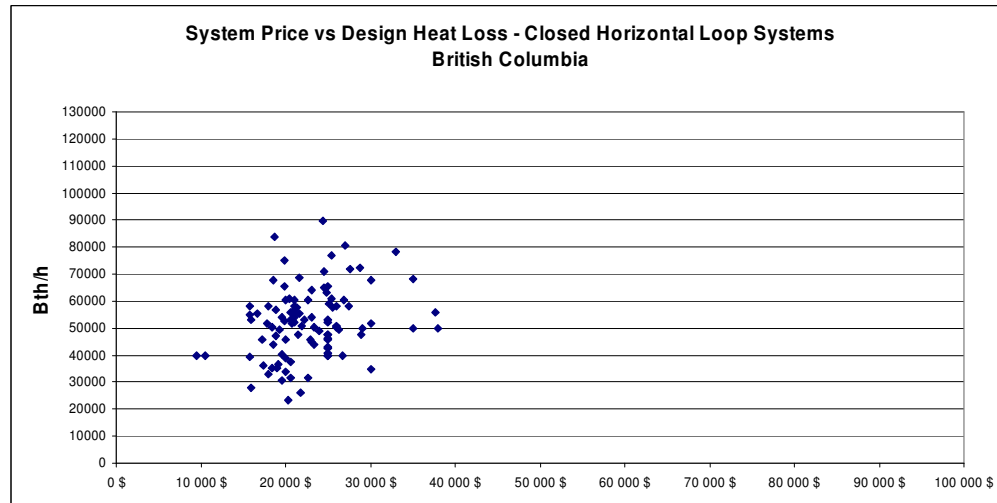


Figure 30

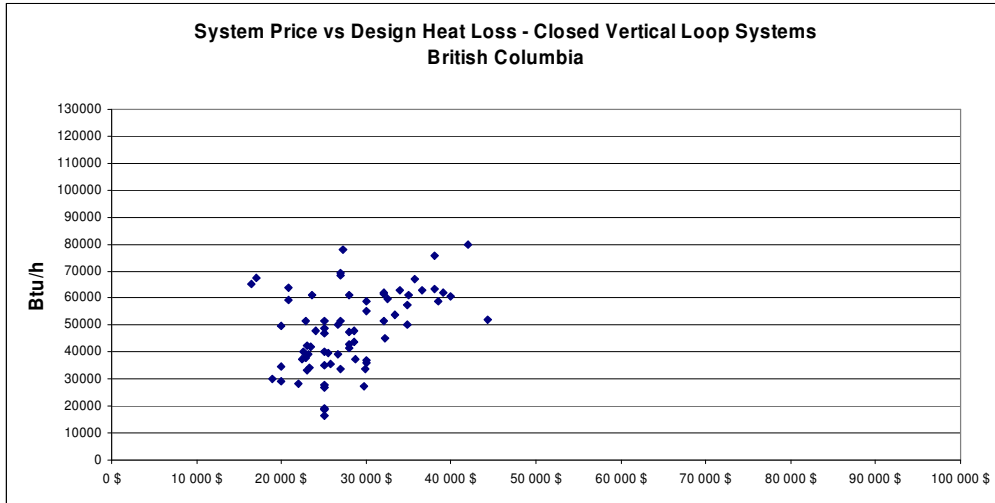


Figure 31

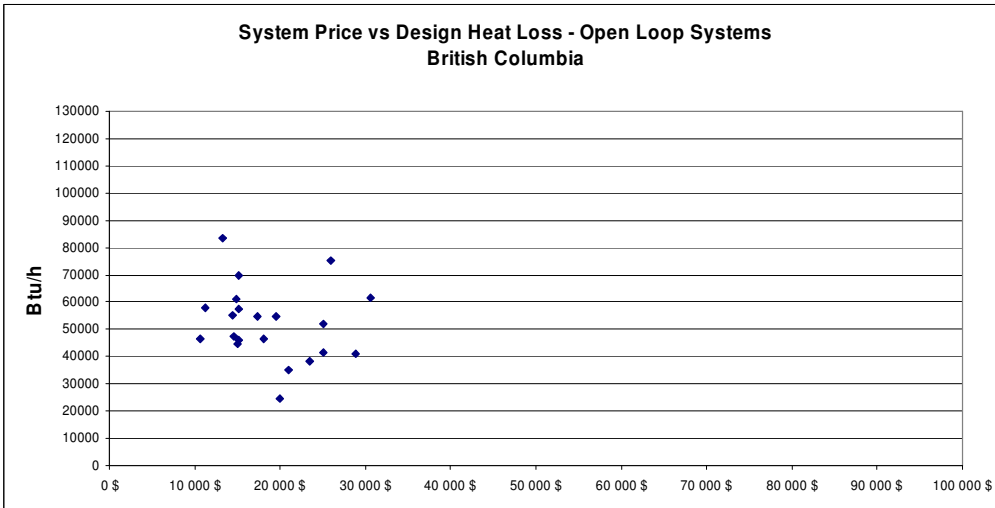


Table 14
Market Share by Brand
British Columbia

Position / Rank	Market Share
1	43,57%
2	12,28%
3	11,11%
4	9,06%
5	5,85%
6	3,51%
7	2,92%
8	2,34%
9	2,05%
10	1,75%
11	1,46%
12	1,17%
13	0,88%
14	0,58%
15	0,58%

Table 15
Installers' Market Share
British Columbia

Position / Rank	Market Share
1	10,92%
2	9,90%
3	8,53%
4	5,46%
5	4,44%
6	3,75%
7	3,75%
8	3,41%
9	3,41%
10	3,41%
11	3,07%
12	3,07%
13	2,73%
14	2,73%
15	2,39%

British Columbia also shows a fairly concentrated heat pump market. The top brand holds close to 44 % of the market and the Herfindahl-Hirschman Index (HHI) for the 15 largest brands stands at 0.23, indicating a high degree of market concentration. The concentration ratio C_4 and C_5 are at 76.0 % and 81.9 % respectively. In this regard, British Columbia has market concentration indicators for brands comparable to the Canadian average.

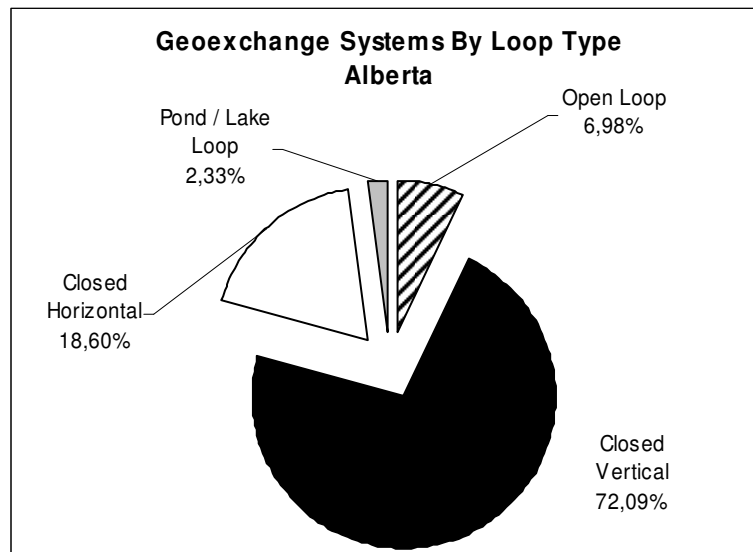
On the installers' side, the HHI stands at 0.05 which indicates an un-concentrated market. However, the C_4 and C_5 ratios show that the 4 largest installers have 34.8 % of the market and the 5 largest, 39.2 %. According to the information at our disposal, we can comfortably say that some companies are likely to benefit from a certain market power when we consider regional rather than the overall provincial markets.

Alberta

The market for residential geexchange systems in Alberta compares to British Columbia and is also heavily weighted towards new buildings (86.2 %) rather than retrofits (13.8 %). We believe that the relative price structure of various energy sources for home heating in Alberta is not favourable to a wider introduction of geexchange in the retrofit market. Subsidized natural gas prices tend to increase the relative payback of residential geexchange installations which seriously affects the competitiveness of the technology.

In Alberta, 18.6 % of the geexchange systems installed are horizontal closed loops and 72.1 % closed vertical loops. Open loops account for about 7 % of the market and pond loops for about 2.3 %. It should be noted that the sample size for Alberta is relatively small compared to other provinces. As the CGC database continues to grow, these numbers could change significantly.

Figure 32

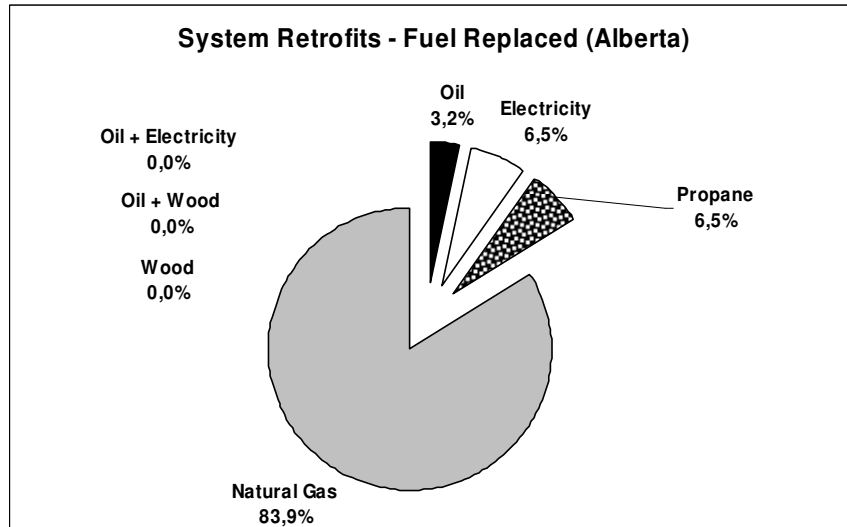


The average price of a closed vertical geexchange system in Alberta is \$ 30,399, a little more than \$ 2,400 above the Canadian average. However, the system price per ton of installed capacity in vertical installations is lower than the Canadian average at \$ 7,316 compared to \$ 7,837 for the country. Lower drilling costs, reflecting regional geology and drilling market competition, could explain this difference.

The average price of a closed horizontal geexchange system in Alberta is \$ 22,111, almost \$ 2,000 below the Canadian average. However, the system price per ton of installed capacity in horizontal installations is much higher than the Canadian average at \$ 7,139, compared to \$ 5,861 for the country.

In the retrofit market, 83.9 % of the installations replace natural gas and 6.5 % electricity. Propane is replaced in a proportion of 6.5 % and heating oil, 2.3 %. These figures essentially reflect the high penetration rate of natural gas in the residential heating market.

Figure 33



The following Figures show early data of system price versus design heat loss for closed horizontal loops and closed vertical loops in Alberta. Although the sample used in this study is small – the database for this part of the study was put together in early 2010 – we do not have any indication that the markets in Alberta are behaving any differently than in the rest of the country. The charts show what we intuitively expect: system price is going up proportionally with heating needs.

Figure 34

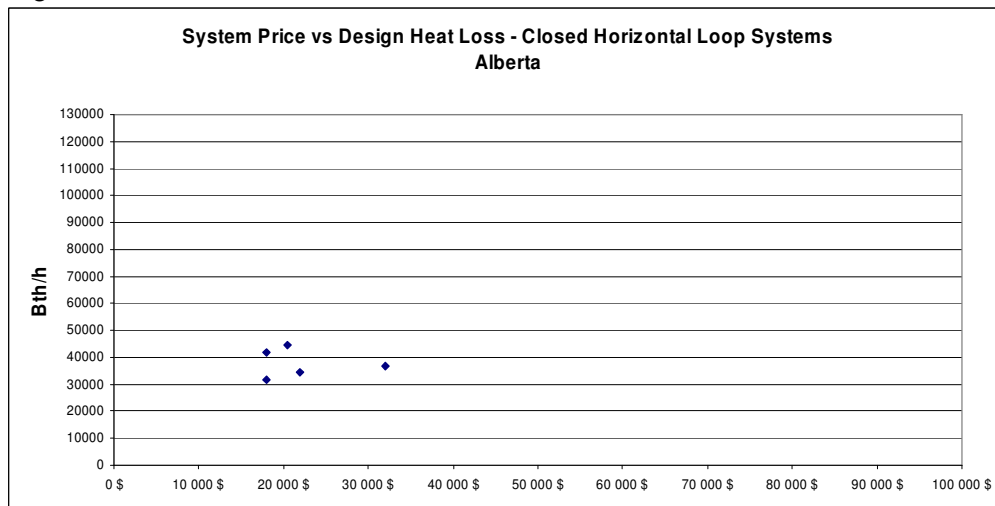


Figure 35

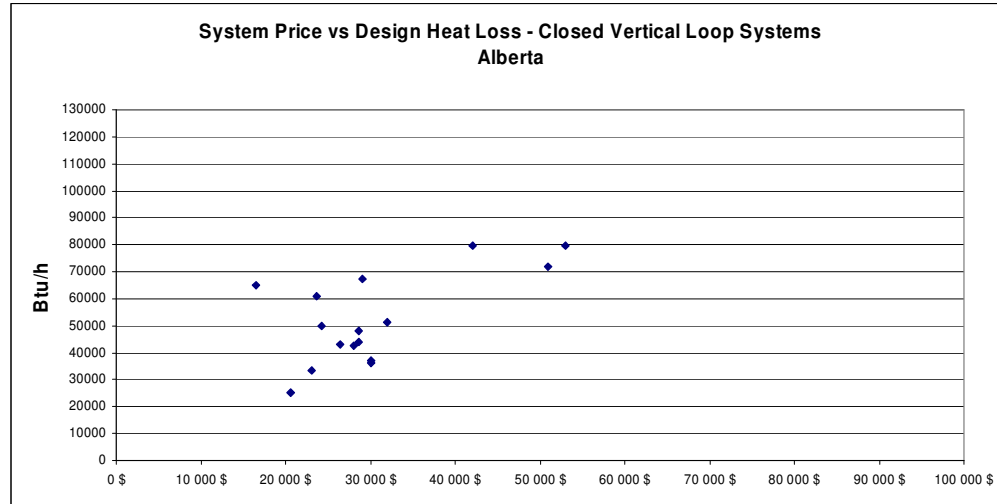


Table 16
Market Share by Brand
Alberta

Position / Rank	Market Share
1	27,42%
2	27,42%
3	17,74%
4	9,68%
5	4,84%
6	4,84%
7	3,23%
8	1,61%
9	1,61%
10	1,61%
11	0,00%
12	0,00%
13	0,00%
14	0,00%
15	0,00%

Table 17
Installers' Market Share
Alberta

Position / Rank	Market Share
1	27,91%
2	16,28%
3	11,63%
4	9,30%
5	6,98%
6	6,98%
7	4,65%
8	4,65%
9	2,33%
10	2,33%
11	2,33%
12	2,33%
13	2,33%
14	0,00%
15	0,00%

Alberta also shows a fairly concentrated market although to a lesser degree than British Columbia and under the Canadian average. The top brand hold 27.4 % of the market and the HHI for the 15 largest brands stands at 0.20, which is at the border of a moderately concentrated market and a highly concentrated market. The concentration ratio C_4 and C_5 are at 82.3 % and 87.1 % respectively. In fact, the top three brands sold in Alberta each show a solid market share, roughly in the 17-27 % range and the fourth stands at about 10 %.

Interestingly enough, on the installers' side, the HHI stands at 0.14 which indicates a moderately concentrated market. However, the C_4 and C_5 ratios show that the 4 largest installers have 65.1 % of the market and the 5 largest, 72.1 %. Concentration ratios and indices for brands and installers are relatively comparable, which is quite unique in Canada.

Saskatchewan

The market for residential geexchange systems in Saskatchewan is essentially split half and half between retrofits (54.1 %) and new buildings (45.9%), which is a few percentage points off the Canadian averages.

It is interesting to note that closed horizontal and closed vertical loops each have more or less the same penetration rate standing at 49.1 % and 49.3 % respectively. The rest of the market is split between pond / lake loops (0.7 %) and open loops (0.9 %).

Figure 36

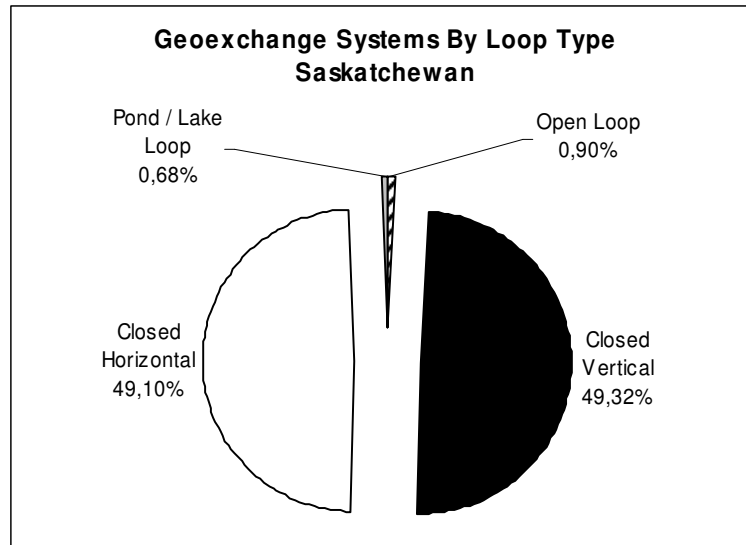
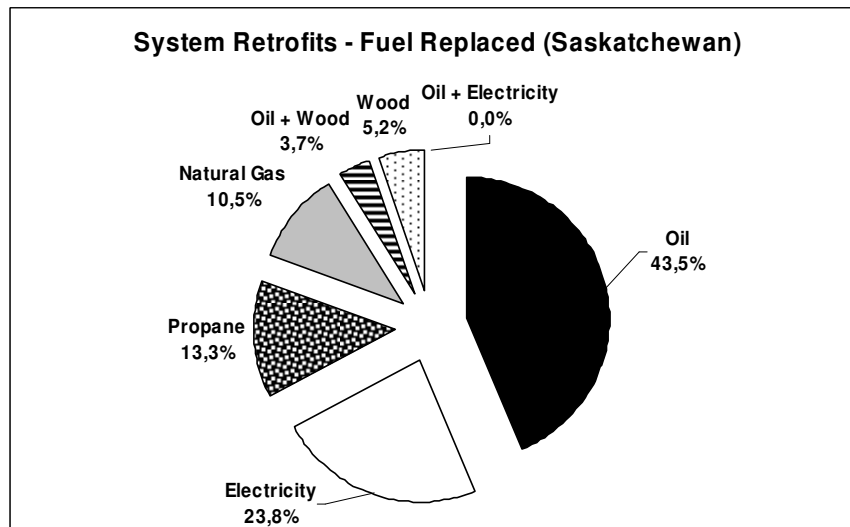


Figure 37



The analysis of fuel replaced in the retrofit market shows that fossil fuels are replaced in a proportion of roughly 71 %. The replacement of heating oil accounts for almost 44 % of all retrofits. Electric baseboards and central electric heating systems are replaced in a proportion of 24 %.

Figure 38

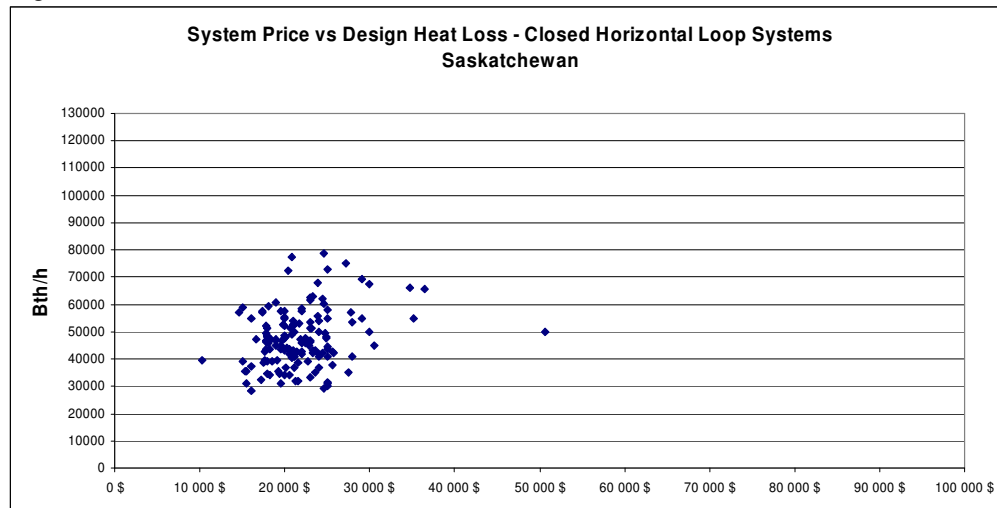
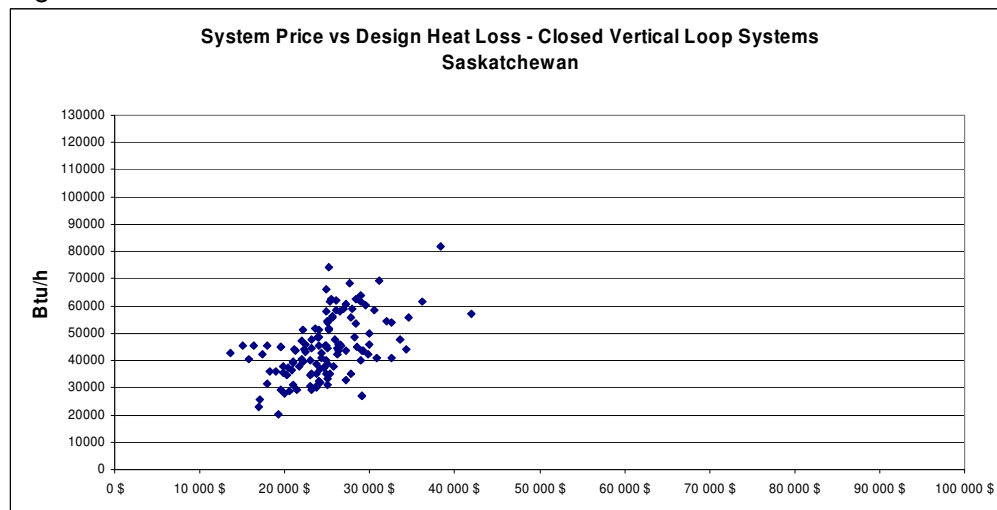


Figure 39



The average price of closed horizontal systems in Saskatchewan stands at \$ 21,875, about \$2,000 less than the Canadian average. Closed vertical systems are sold for an average of \$ 24,872, well under the Canadian average of \$ 28,003. We believe this situation can be explained by lower drilling costs in the Prairies, characteristic of the geological conditions and drilling equipment used. Most of the drilling is done in overburden. When drillers hit a rock formation, they simply move their drilling equipment and drill another borehole rather than engage in more expensive drilling in to bedrock. Drillers then continue like this until they have sufficient total borehole depth.

Market concentration indicators tend to show that Saskatchewan has highly concentrated markets for both brands and installers. In fact, the top brand in Saskatchewan has a solid market share of slightly over 50 %. The HHI for the 15 most important brands stands at 0.32 and the C₄ and C₅ indices at 88.1 % and 92.9 % respectively.

Table 18
Market Share by Brand
Saskatchewan

Position / Rank	Market Share
1	51,15%
2	20,11%
3	9,58%
4	7,28%
5	4,79%
6	2,30%
7	1,15%
8	1,15%
9	0,77%
10	0,57%
11	0,57%
12	0,38%
13	0,19%
14	0,00%
15	0,00%

Table 19
Installers' Market Share
Saskatchewan

Position / Rank	Market Share
1	35,97%
2	12,67%
3	10,63%
4	3,62%
5	3,62%
6	2,49%
7	2,26%
8	2,04%
9	2,04%
10	2,04%
11	1,81%
12	1,81%
13	1,58%
14	1,58%
15	1,58%

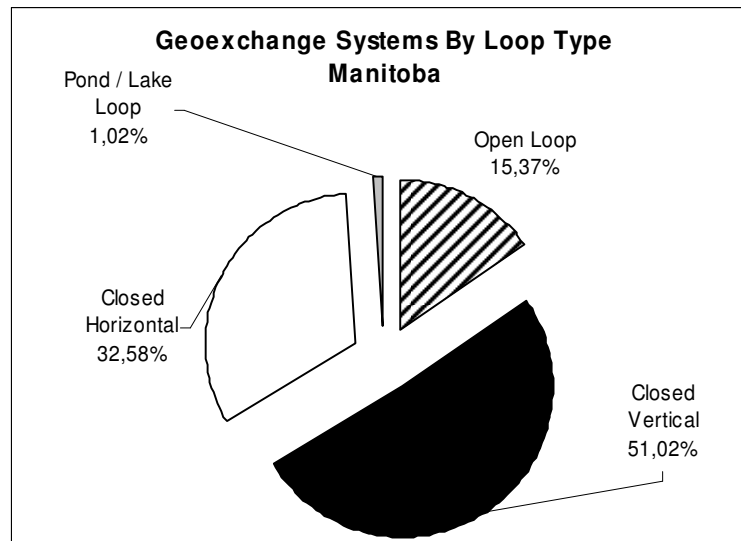
Interestingly enough, on the installers' side, the HHI stands at 0.16, at the border of a moderately concentrated market and a highly concentrated one. The largest installer holds a market share of 36 %. The C₄ and C₅ ratios stand at 62.9 % and 66.5 % respectively. We note however that there are many small installers who have a reasonable market share at between 2 and 4 %. Nevertheless, the top three installers account for roughly 60 % of the installations within the province.

Manitoba

Geothermal heat pumps in the Manitoban residential market wind up installed in new homes 56.5 % of the time and 43.5 % of the time in the retrofit market. Those numbers are higher than the national average for new homes and may reflect the availability and diversity of various financial assistance programs within the province. In addition to the ecoENERGY grant for retrofits, the province also put a tax credit in place in January 2009 (retroactive to 2007) for both retrofits and new homes installations. Similarly, the Manitoba Hydro Earth Power Loan Program, and the CGC-TD Financial Services indirect loan program may influence markets in Manitoba more than in other provinces.

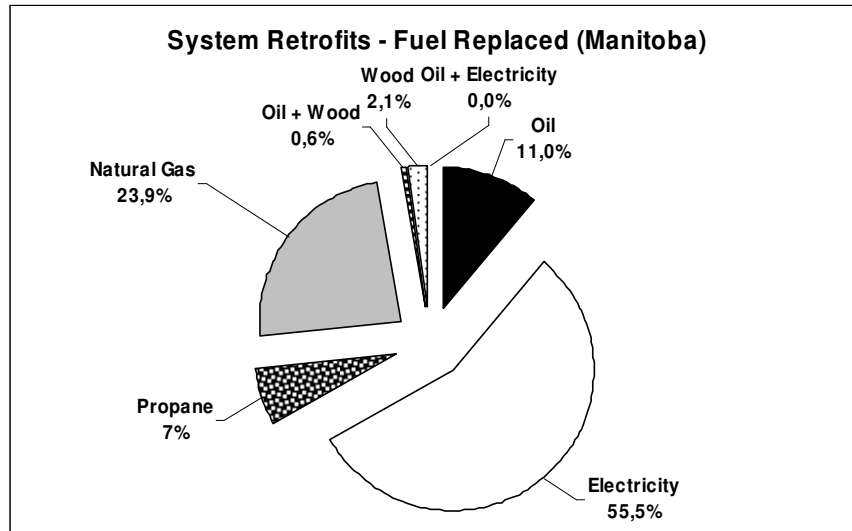
The majority of systems installed in the province are closed vertical loops in a proportion of 51.0 %. The share of closed horizontal systems is 32.6 % and 15.4 % for open loops. Pond / lake loops account for about 1 %.

Figure 40



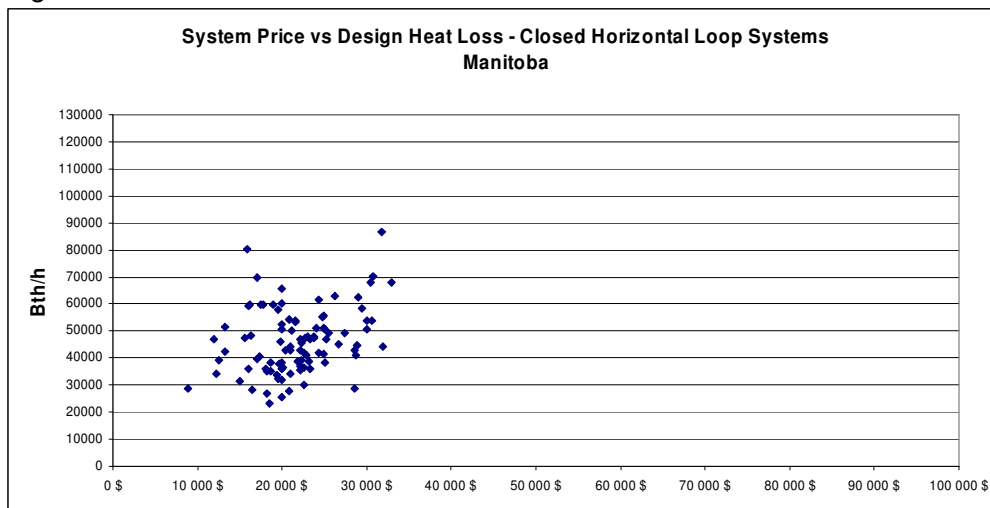
In the retrofit market, geoexchange systems displace an interesting mix of energy sources. Electricity is replaced in a proportion of 55.5 %, followed by natural gas at 23.9 %. The substitution of heating oil furnaces for geothermal heat pumps accounts for 11.0 %. All other sources displaced account for about 3 %.

Figure 41



The average price of closed horizontal systems installed in Manitoba is quite comparable to Saskatchewan at \$ 21,763, \$ 2,000 below the Canadian average. On the other hand, the average price per ton is slightly above the Canadian average and stands at \$ 5,924 compared to \$ 5,861 for Canada.

Figure 42



The average price of closed vertical systems, on the other hand are much lower than the Canadian average and is the lowest of all provinces. The average price of a closed vertical system in Manitoba is roughly \$ 21,712, much lower than the Canadian average which stands at \$ 28,003. A variety of factors may explain this situation including favourable drilling conditions – as discussed in the Saskatchewan section – or smaller systems being installed in smaller homes. This later hypothesis is somewhat sustained by the average price per ton for vertical systems which stands at

\$ 6,161. As we have seen earlier in the Canada section, design practices (particularly system capacity as a percentage of heat loss) are no different in Manitoba than elsewhere in Canada and should not be considered as a differentiating element.

Figure 43

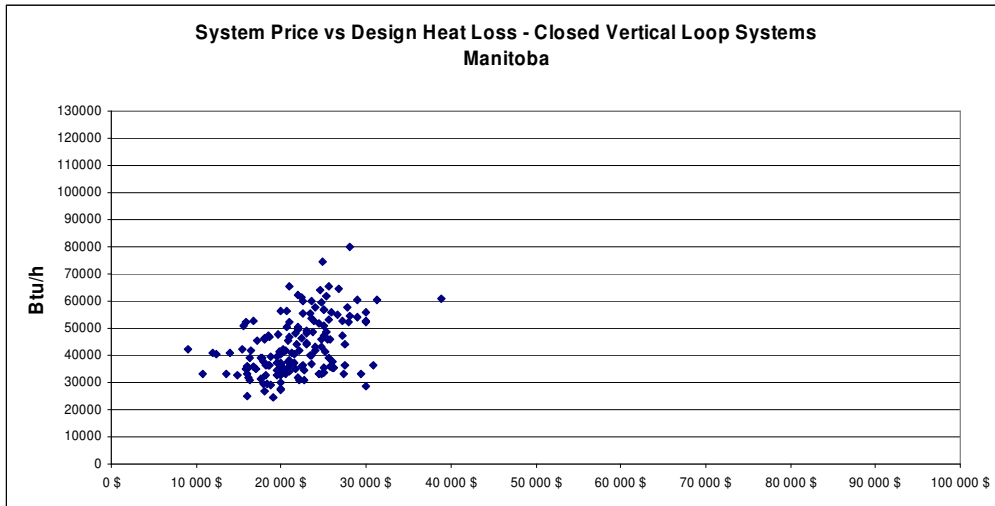
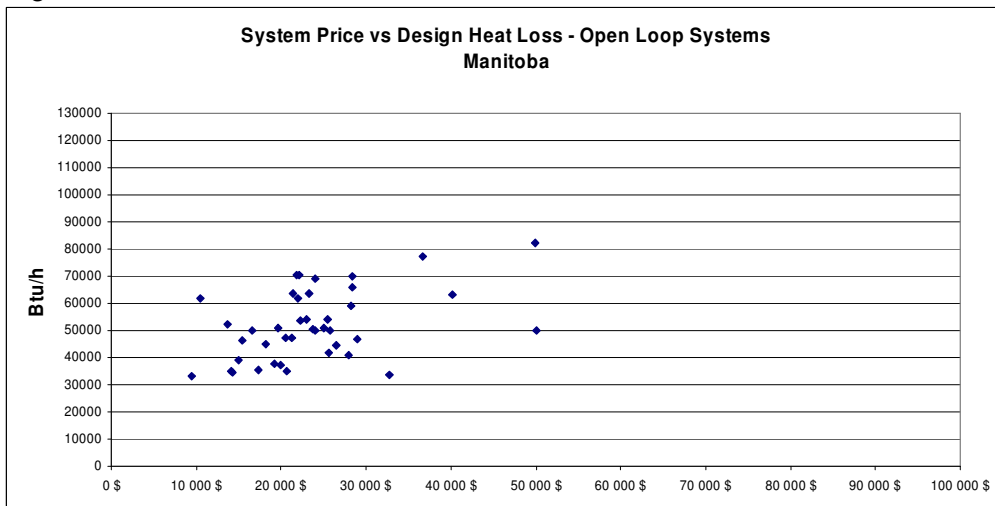


Figure 44



**Table 20
Market Share by Brand
Manitoba**

<u>Position / Rank</u>	<u>Market Share</u>
1	33,33%
2	15,51%
3	13,37%
4	10,16%
5	8,38%
6	4,46%
7	3,57%
8	3,03%
9	2,32%
10	1,25%
11	1,25%
12	0,89%
13	0,53%
14	0,53%
15	0,53%

**Table 21
Installers' Market Share
Manitoba**

<u>Position / Rank</u>	<u>Market Share</u>
1	15,78%
2	7,79%
3	6,97%
4	6,35%
5	4,71%
6	4,30%
7	3,69%
8	3,69%
9	3,28%
10	2,87%
11	2,87%
12	2,66%
13	2,66%
14	2,46%
15	2,46%

Manitoba shows a fairly concentrated market for brands. The top brand holds 1/3 of the market and the HHI for the 15 largest brands stands at 0.18, indicating a high degree of market concentration but lower than any other province. The concentration ratio C_4 and C_5 are at 72.4 % and 80.8 % respectively.

On the installers' side, the HHI stands at 0.06 which indicates a non-concentrated market. However, the C_4 and C_5 ratios show that the four largest installers have 36.9 % of the market and the 5 largest, 41.6 %.

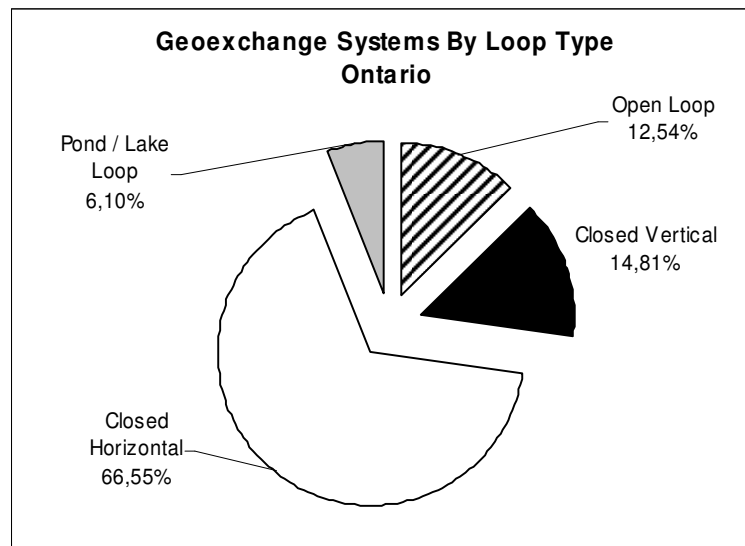
These figures may hide an interesting characteristic of the Manitoba market. While the HHI indices and the concentration ratios for brands and installers appear to be lower than in most other provinces, we note that the largest installers within the province are also selling the same line of products. This peculiar situation implies potential oligopolistic behaviour in the marketplace, where the dominant installers, each having a specific territory, competes only with installers who do not carry the same product line.

It should also be noted that Manitoba is the home of two of Canada's few ground source heat pump manufacturers. As such, these manufacturers capture a greater portion of the Manitoba market than in other provinces. However, given technical requirements outlined in the provincial government tax credit program, we believe that at least one of those manufacturers was negatively impacted in the past two or three years – most of their heat pumps did not qualify for the credit. Many dealers selling this Manitoba manufactured product have essentially been put in a situation of unfair competitive disadvantage. Some of these dealers left the geothermal heat pump industry, increasing the market shares of a handful of contractors.

Ontario

Ontario outpaces all other provinces in terms of retrofit market size and penetration rates. Geoexchange installations in existing buildings stand firmly at 66.8 % while geoexchange systems in new homes represent 33.2 % of the market. The generosity of financial assistance programs available in Ontario may explain this situation. In Ontario, the provincial government doubles the ecoENERGY grant and also extends a sales tax rebate on the installation of a geoexchange system. In total, as of April 2010, grants, rebates and federal tax credit represented more than \$ 10,000 for the installation of a geoexchange system in an existing building.

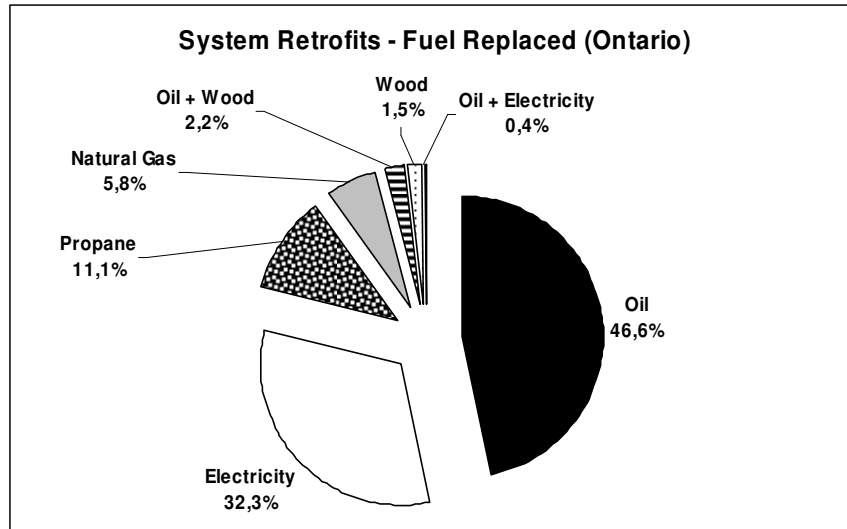
Figure 45



Ontario also has the highest penetration rate for closed horizontal loops. These systems represent 66.6 % of the market followed by closed vertical systems at 14.8 %. Open loops account for 12.3 % of the market and pond / lake loop for 6 %. An often-repeated myth that the vast majority of geothermal heat pump systems in Ontario were equipped with vertical boreholes therefore does not stand. This has major implications for the industry.

In recent years, the Ontario government was indeed heavily lobbied by some industry players to have the geothermal heat pump industry fall under Regulation 903. With less than 15 % vertical boreholes in the residential sector, it is clear that there is now a significant paradigm shift for the provincial government and a new policy and regulatory challenge.

Figure 46



A wide mix of energy sources are replaced by geothermal systems but the majority of home owners (46.6 %) are switching from heating oil. Electricity accounts for about 32.3 % of the existing building replacement sources. In addition to replacement of electric baseboard and central electric units, this category also includes the replacement of an existing ground source heat pump by a new ground source heat pump. In these cases, home owners are essentially “replacing” electricity with electricity albeit two highly efficient systems.

Figure 47

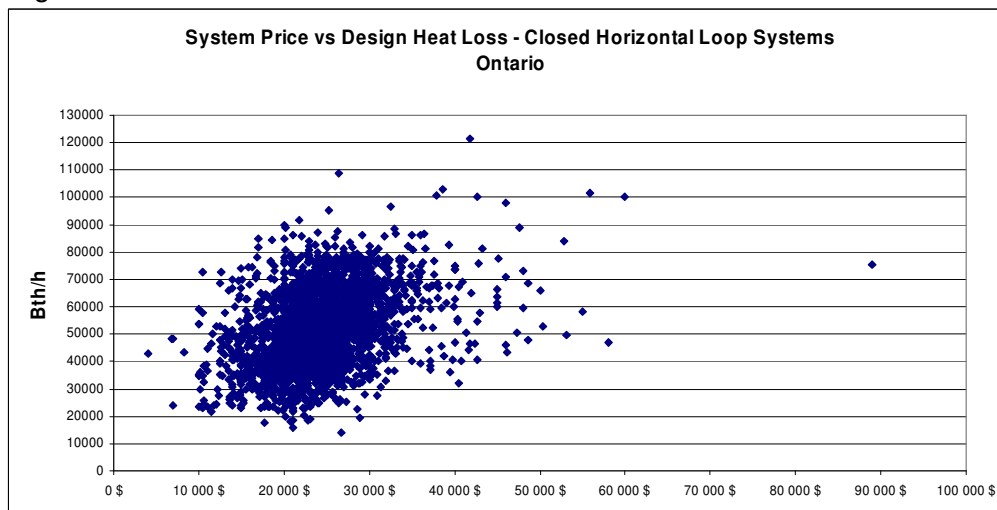


Figure 48

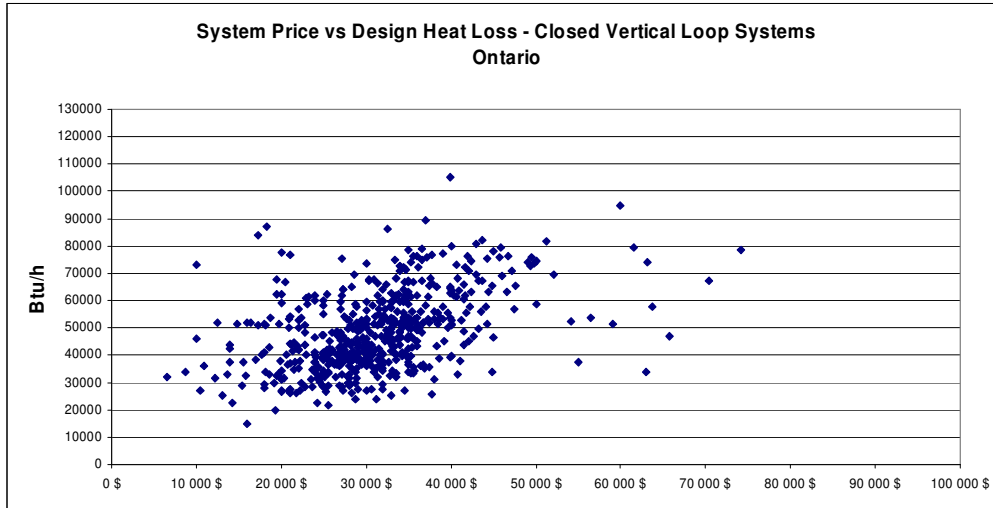
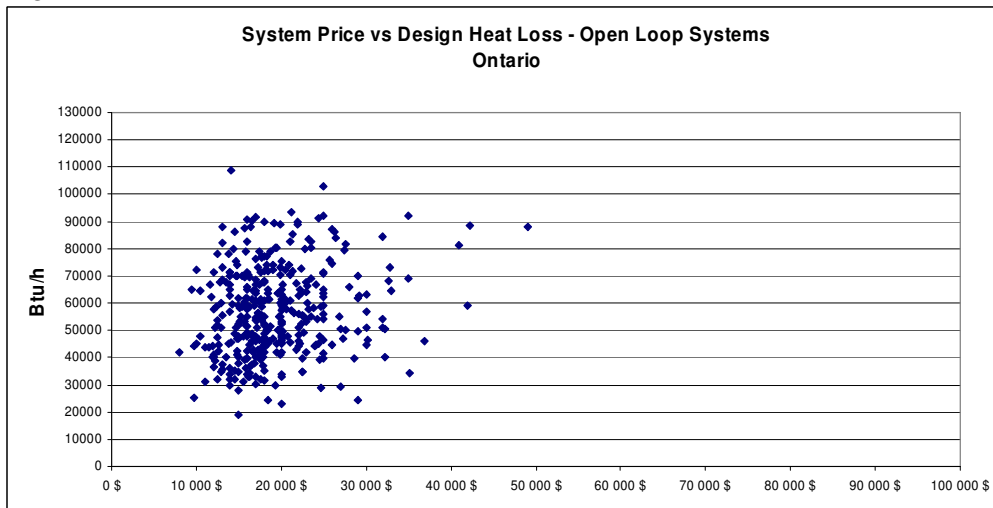


Figure 49



The average price for a closed horizontal loop in Ontario is \$ 24,244, or only \$ 300 above the national average. Average price on a per ton basis is at \$ 5,878, a few dollars off the national average of \$ 5,861. Closed vertical systems are sold at an average price of \$ 31,229 or about \$ 3,000 over the national average. The average price per ton for closed vertical system, at \$ 8,085, is slightly over the national average of \$ 7,837.

Based on brand market share, market concentration in Ontario is the highest in the country. The HHI stands at 0.28 which indicates a very high market concentration. This is confirmed by the concentration ratios, also among the highest in the country. The C_4 and C_5 ratios show that the 4 largest brands control 88.7 % of the market and the 5 largest, 90.9 %. Two brands capture 71.7 % of the market and brand number three stands with a solid 12.8 %. Although these numbers reflect market share based on a three year average, there has been some movements among the top

brands in the province. One of these key brands has lost significant market share to its competitors in the past three years. Also, some smaller players have succeeded in expanding their sales at a higher rate than the overall industry growth. More movement is anticipated on that front in the coming years as the generous grants and subsidies programs wind down. Fights for market share in a steady or declining market will obviously change the overall industry portrait within the province.

Table 22
Market Share by Brand
Ontario

<u>Position / Rank</u>	<u>Market Share</u>
1	36,68%
2	35,06%
3	12,78%
4	4,13%
5	2,28%
6	1,72%
7	1,66%
8	1,25%
9	0,82%
10	0,74%
11	0,70%
12	0,64%
13	0,27%
14	0,26%
15	0,20%

Table 23
Installers' Market Share
Ontario

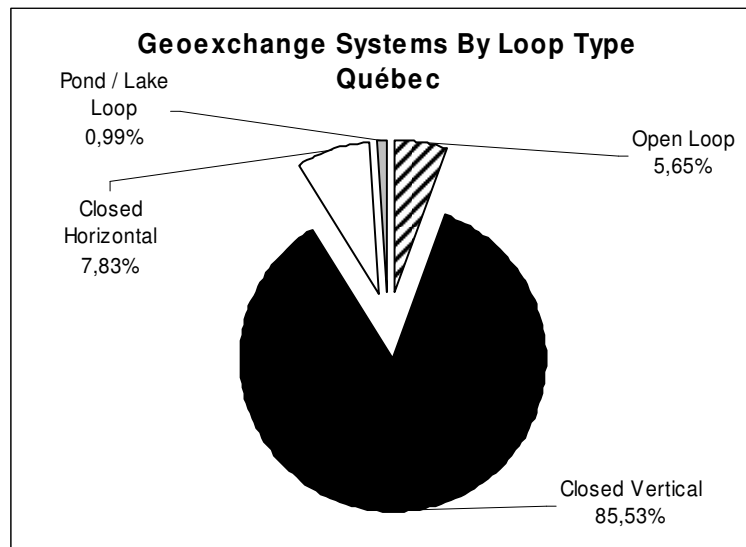
<u>Position / Rank</u>	<u>Market Share</u>
1	4,87%
2	3,92%
3	3,92%
4	3,88%
5	3,30%
6	3,05%
7	2,60%
8	2,47%
9	2,40%
10	1,82%
11	1,59%
12	1,49%
13	1,43%
14	1,42%
15	1,36%

The HHI index for installers indicates a fairly competitive market. The concentration ratios are also relatively low compared to the rest of Canada with a C₄ of 16.6 and a C₅ ratio of 16.9. The top 10 installation contractors are responsible for 32.2 % of all the geexchange installations within the province.

Québec

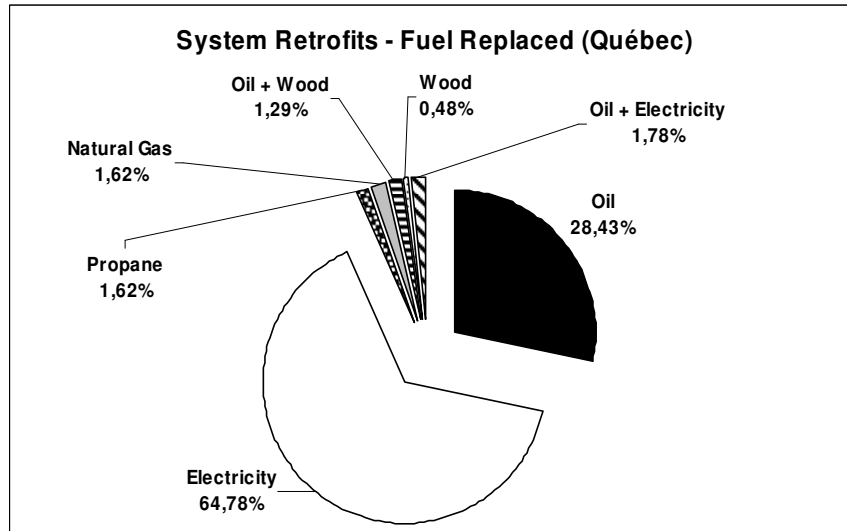
In Québec, 69.3 % of geexchange systems are installed in new homes compared to 30.7 % in existing homes. Two factors may explain this situation. First, Hydro-Québec has a \$ 2,800 grant for the installation of new geexchange systems in new homes. Also, as explained below, one installer is responsible for one-quarter of all the installations within the province. Since this dealer is particularly active in the market for new homes, his economic activities alone have a significant impact on this market segment for the entire province.

Figure 50



We also note that most of the installations in Québec are closed vertical loops with a penetration rate of 85.5 %. Given the geology and geography, this is not a big surprise. Closed horizontal loops account for 7.8 % and pond / lake loops and open loop, for 1.0 % and 5.8 % respectively.

Figure 51



In Québec, over 64.9 % of the geexchange systems in existing buildings replace electric baseboards and electric furnaces. Fuel switching from heating oil to geexchange is also significant with a 28.4 % market share. Switching from natural gas, propane, oil and wood, oil and electricity and wood collectively account for about 5 % of the retrofit market.

Figure 52

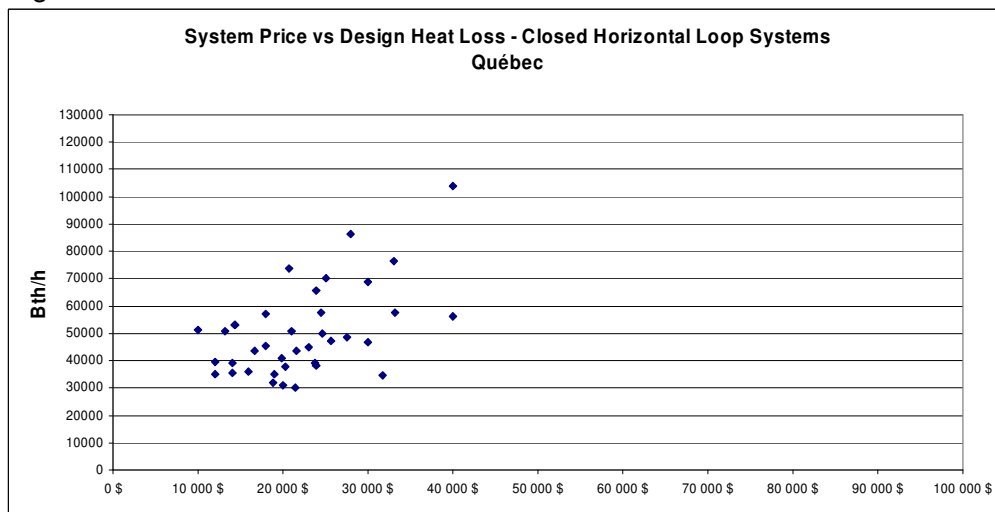


Figure 53

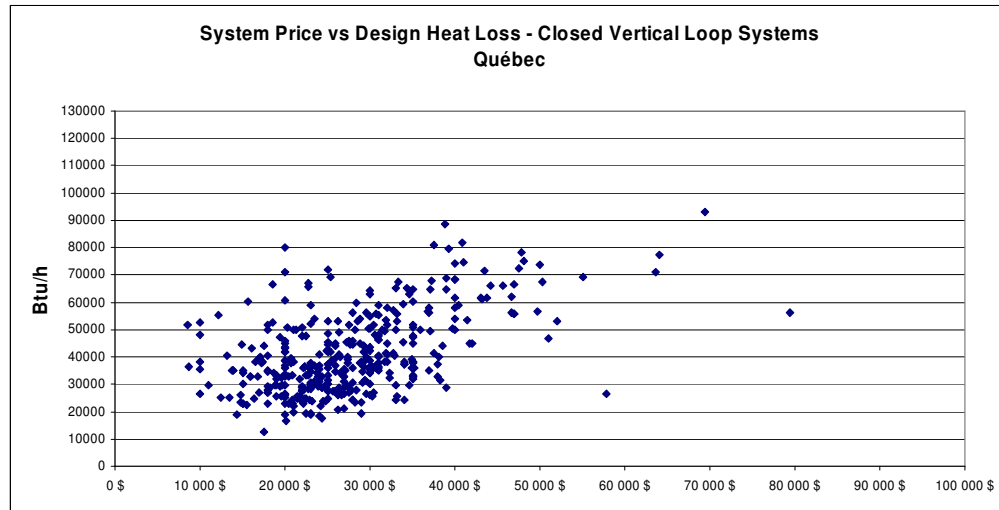
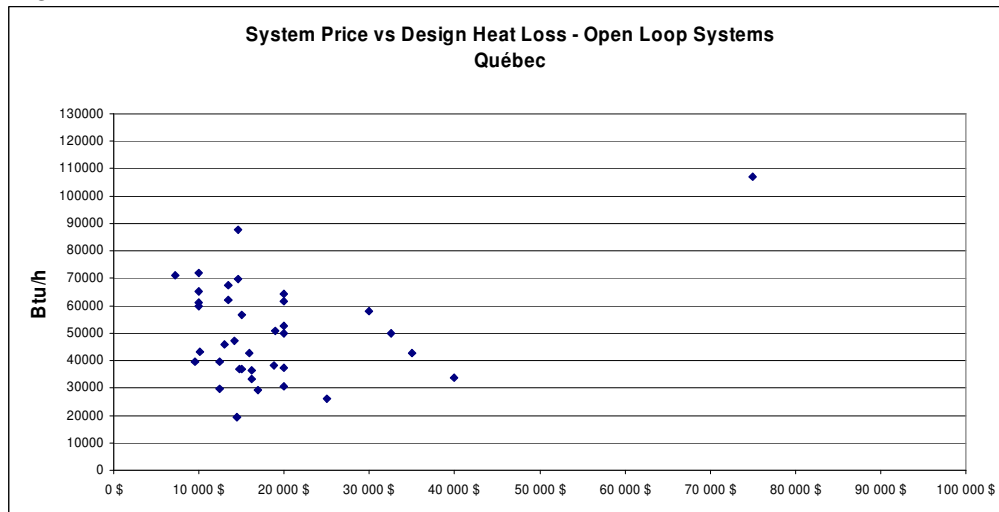


Figure 54



The average price of closed horizontal systems is below the Canadian average, at \$ 22,194. The average price per ton is also below the Canadian average at \$ 5,542 compared to \$ 5,861 for Canada. The average price of closed vertical systems is slightly below the Canadian average and stands at \$ 27,711. However, the average price per ton for closed vertical loops is \$ 8,678, the highest among all provinces.¹⁵

¹⁵ Further work is required to better assess this market segment. However, when we look at the average system price per ton, and consider the average depth of vertical boreholes in the province, we note that Québec has one of the lowest average depths and the highest system price per ton. The numbers presented here for Québec are therefore underestimating the price per ton when adjusted for borehole depth. Further analysis is required to explain this peculiar situation.

Table 24
Market Share by Brand
Québec

Position / Rank	Market Share
1	52,48%
2	7,36%
3	6,83%
4	6,56%
5	5,94%
6	4,96%
7	4,79%
8	2,75%
9	1,95%
10	1,33%
11	1,33%
12	0,98%
13	0,98%
14	0,44%
15	0,27%

Table 25
Installers' Market Share
Québec

Position / Rank	Market Share
1	24,68%
2	8,23%
3	7,83%
4	5,85%
5	4,66%
6	3,67%
7	3,07%
8	2,97%
9	2,97%
10	2,78%
11	2,38%
12	2,28%
13	2,28%
14	2,18%
15	1,68%

The HHI for brands in Québec is also very high at 0.30. We note that one brand captures close to 52.5 % of the market while no other brand has more than 10 % market share. The C4 and C5 ratios stand at 73.2 % and 79.2 %, also indicating a high degree of market concentration.

The HHI for installers is also the highest in Canada with a value of 0.09, indicating a moderately concentrated market. However, as we can see in Table 25, one installer alone has a market share of 25 % for the entire province. The top four installers hold 46.6 % of the market and the top five, 51.2 %. In reality, market concentration is much higher than indicated by these figures. As mentioned above, most dealers operate within a radius of 75-100 km from their business home base. In some cases, regional installers can potentially capture market shares well over 75 %.

New Brunswick

In New Brunswick geexchange systems are installed in new homes in a proportion of 49.6 % and 50.4 in existing homes. Interestingly enough, we find a very high proportion of open loops (46.3 %) in the province. Closed horizontal loops follow with 26.0 % of the market and closed vertical with 27.1 %. We do not have any particular explanations for this situation. Further research and analysis is required to fully validate this information.

Figure 55

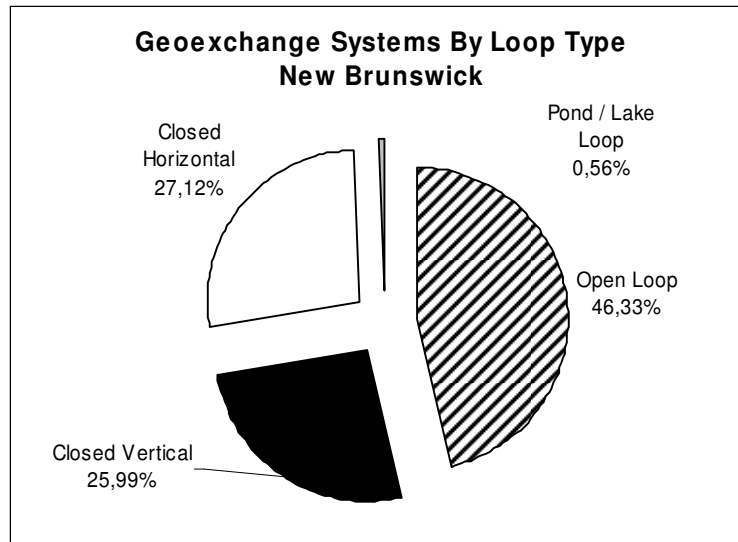
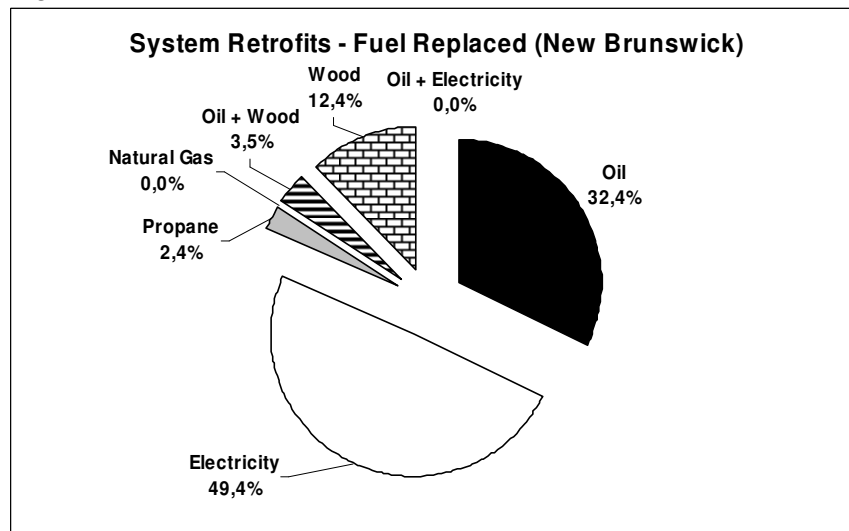


Figure 56



In New Brunswick, heating oil systems are replaced in a proportion of 32.4 % while electric baseboards and furnaces account for about half the system retrofits. Interestingly, fuel switching from wood to geexchange as a main source of heating, represents a significant 12.4 %. Propane and a combined wood / oil systems account for the balance.

Average system price for both closed horizontal and closed vertical loops are significantly lower than anywhere else in Canada. Average system price for closed horizontal systems is \$ 20,019 compared to \$ 23,941 for Canada, or about 20 % below the national average. However, the average price per ton for closed horizontal loop is almost exactly on the Canadian average at \$ 5,838.

Figure 57

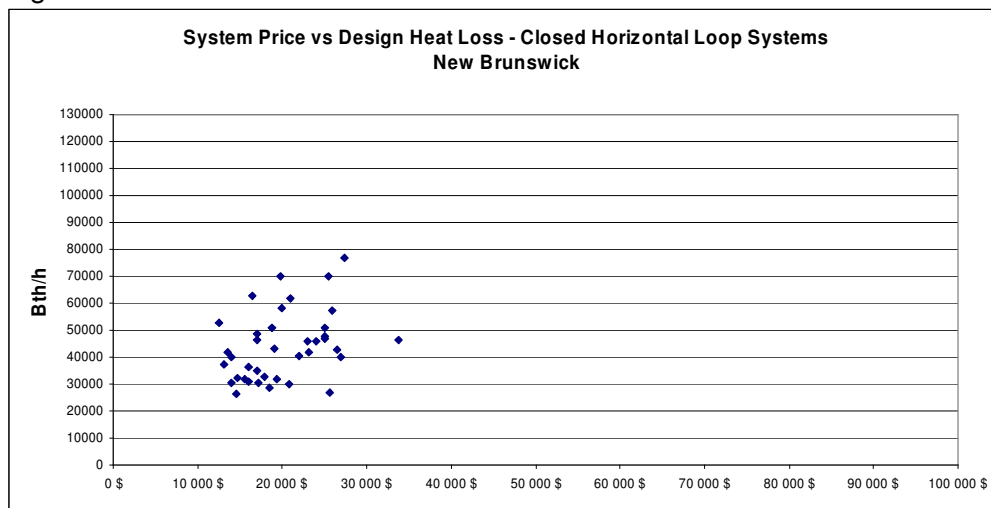
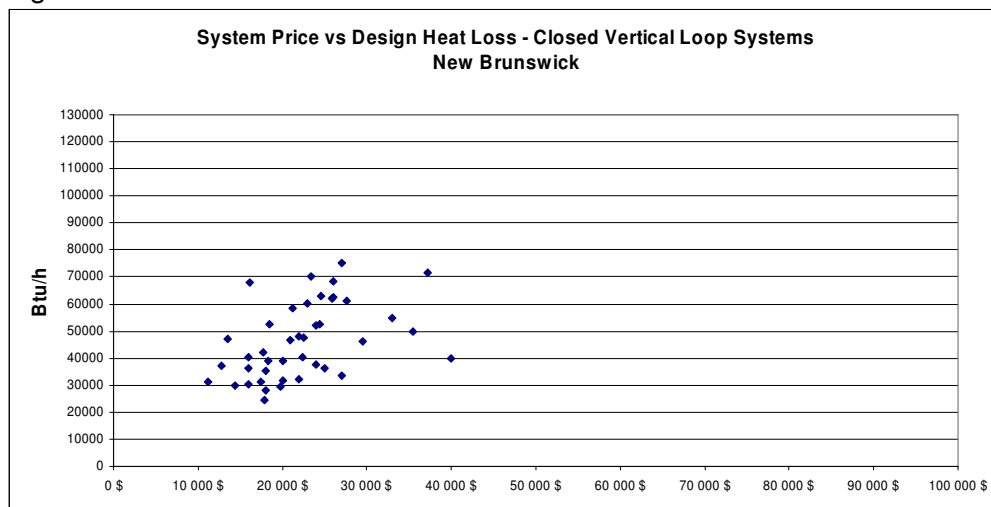


Figure 58



Average price of closed vertical loops stands at \$ 22,275 significantly lower than the average for Canada. On a per ton basis, the average price is the lowest in Canada or 30 % below the national average. Other than the sample size which may have an effect on those figures – although we

believe our sample to be statistically significant – there are no technical or geographical explanations for this situation. It is nevertheless interesting to observe that for vertical loops, two neighbouring provinces, Québec and New-Brunswick, have respectively the highest and the lowest price per ton of all Canadian provinces. Further analysis may eventually provide more insight on this particular issue.

Table 26
Market Share by Brand
New Brunswick

<u>Position / Rank</u>	<u>Market Share</u>
1	51,92%
2	31,73%
3	6,73%
4	4,81%
5	3,37%
6	0,96%
7	0,48%
8	0,00%
9	0,00%
10	0,00%
11	0,00%
12	0,00%
13	0,00%
14	0,00%
15	0,00%

Table 27
Installers' Market Share
New Brunswick

<u>Position / Rank</u>	<u>Market Share</u>
1	20,34%
2	18,08%
3	15,25%
4	8,47%
5	7,91%
6	4,52%
7	3,39%
8	2,82%
9	2,26%
10	2,26%
11	1,69%
12	1,13%
13	1,13%
14	1,13%
15	1,13%

The brands' market share in New Brunswick shows that two brands capture almost 84 % of the units sold. At 0.38, the HHI is the highest of all provinces. At 95.2 % and 98.6 %, the C₄ and C₅ concentration ratios are also the highest among all provinces.

On the installation side, a HHI of 0.12 indicates a moderately to highly concentrated market. The C₄ and C₅ concentration ratios, respectively at 62.2 % and 70.1 %, indicate that only a handful of installers are responsible for the majority of the installations within the province.

Nova Scotia

Data for Nova Scotia show a solid rate of 68.5 % of geexchange technology going in to new homes, the highest in Canada after British Columbia and Alberta. The reader should be cautious with these figures as the sample size for Nova Scotia was relatively modest.¹⁶

In Nova Scotia, about two-thirds or 64.4 % of installations are closed horizontal loops followed by closed vertical at 35.6 %. Open loops account for 8.9 % and pond loops 1.1 %.

Figure 59

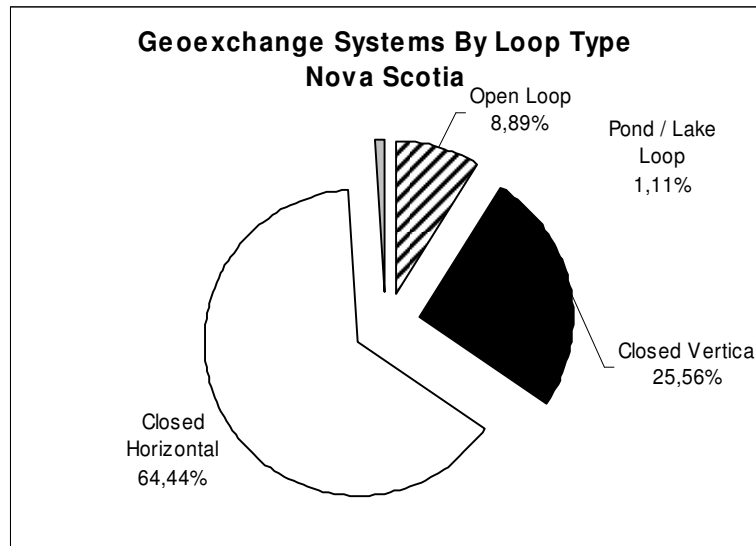
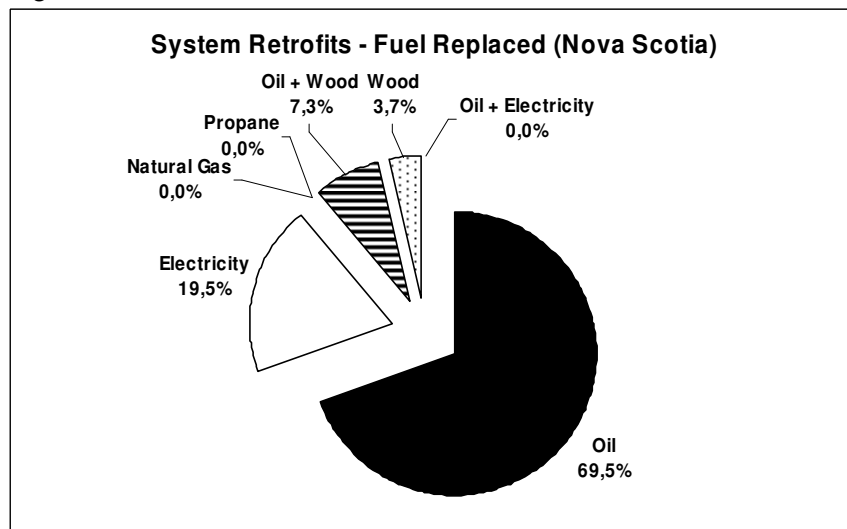


Figure 60



¹⁶ The technical analysis of more system retrofits as well as more data collected through company qualifications surveys will undoubtedly change the figures presented here.

Fuel switches from heating oil to geexchange represent 69.5 % of installations in the province, while retrofits from electricity to geexchange account for 19.5 %. Retrofits from wood and wood / oil combination represent 11.0 % of the market.

Average system price for closed horizontal systems in Nova Scotia is much lower than the Canadian average at \$ 24,570. However, average price per ton is about 6 % higher.

Figure 61

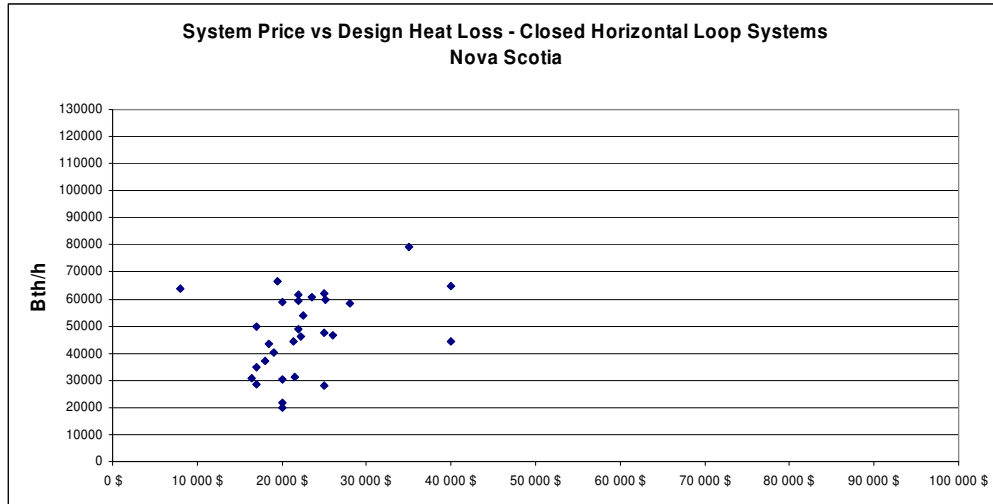
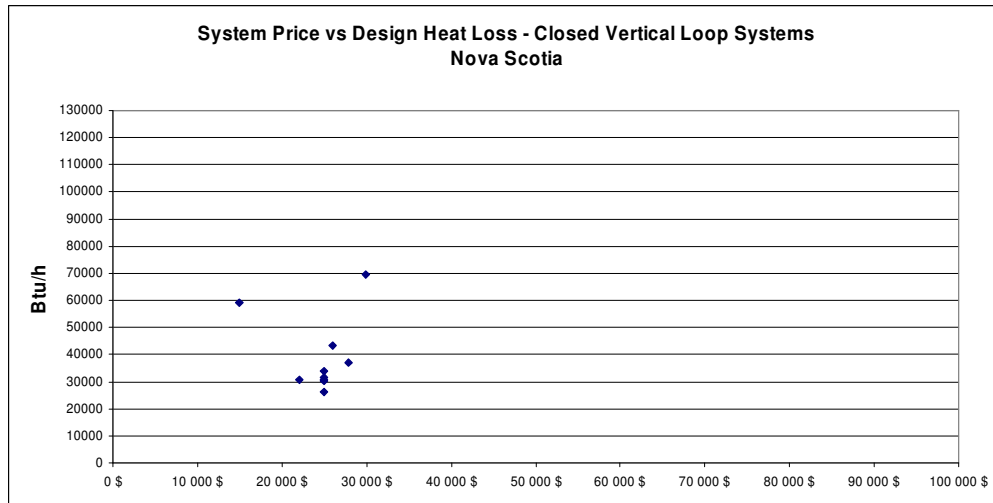


Figure 62



The average price of closed vertical systems is about 6 % lower than the Canadian average, but when considered on the average price per ton basis, it is 6 % higher. This may reflect smaller average home size.

Table 28
Market Share by Brand
Nova Scotia

Position / Rank	Market Share
1	39,39%
2	31,31%
3	12,12%
4	7,07%
5	5,05%
6	3,03%
7	1,01%
8	1,01%
9	0,00%
10	0,00%
11	0,00%
12	0,00%
13	0,00%
14	0,00%
15	0,00%

Table 29
Installers' Market Share
Nova Scotia

Position / Rank	Market Share
1	16,67%
2	15,56%
3	15,56%
4	13,33%
5	10,00%
6	10,00%
7	6,67%
8	4,44%
9	3,33%
10	1,11%
11	1,11%
12	1,11%
13	1,11%
14	0,00%
15	0,00%

Finally, the information we have indicates highly concentrated markets both from the brands' and installers' perspective. The two largest brands are essentially splitting more than 70 % of the units sold in the province which is reflected in a HHI of 0.28. C_4 and C_5 concentration ratios are also very high at 89.9 % and 94.6 %. All indicators show a very high degree of market concentration.

The situation is also similar on the installer side with a HHI of 0.12 and C_4 and C_5 ratios of 61.1 % and 71.1 % respectively. This reflects the small number of installers considered in the analysis at the time this report was prepared. We expect the market concentration indicators to go down as the CGC database is more populated for Nova Scotia installations. However, we believe that the top five or six installers will likely be responsible for about 80 % of the installations, even as the sample expands.

Prince Edward Island / Newfoundland & Labrador

At the time this report was prepared, CGC didn't have enough information to confidently perform a statistically meaningful analysis of the markets in Prince Edward Island and Newfoundland & Labrador. After review and discussion, we concluded that the sample at our disposal was simply not large enough to be representative.

The reader may refer to some of the aggregate figures presented in the Canada section of this report for some market highlights. Training and accreditation figures also provide some useful information.

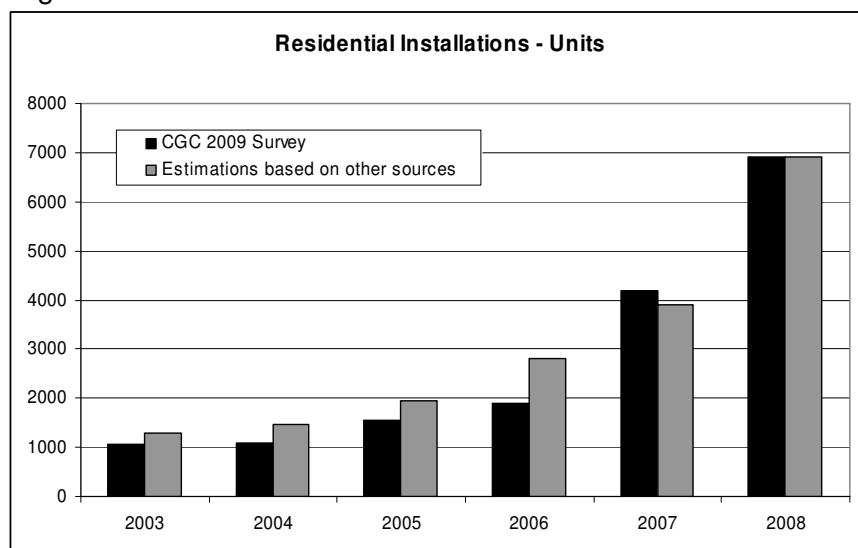
Governments and utilities interested in obtaining market information for these two provinces are invited to contact CGC staff.

APPENDIX 1 – METHODOLOGY

A number of sources were used in the preparation of this report. One of the most significant is the **CGC Market Survey 2008-2009** conducted in early 2009¹⁷. This survey was conducted anonymously and monitored by KPMG. In total, 66 questionnaires were completed by installation companies representing 25 % to 30 % of the residential geothermal heat pump markets. Through this survey, CGC collected key information over 6 years on sales, tonnage and number of units sold. Key information was also obtained on the types of systems installed (open loop, closed loop, etc.) as well as a split between new built and retrofits. Data was collected and computed by province but in many cases, the number of returned surveys was not significant enough regionally to complete a provincial analysis. Other sources were used to better characterize individual provincial markets.

However, although the sample was small, the information was extremely useful for cross referencing and cross validation purposes. At the national level, we believe that this sample, representing close to 30 % of the estimated Canadian market is likely to be the best data set ever collected for the geoexchange industry. The historical timeframe of the survey – 2003 to 2008 – was also very valuable for our analysis of market trends and size. Unfortunately, this survey alone was not very useful to qualify the markets for residential and commercial and industrial installations.

Figure 63



Before performing a detailed analysis for this report, we thought it wise to validate the survey results with estimates gathered from other sources of information (listed below). In doing so, we independently reconstructed a historical series for residential installations for the years 2003 to 2008 using a number of unrelated sources. As we can see in Figure 63, the growth trends follow the same pattern in both cases. This exercise and resulting agreement gave us confidence in our survey results as well as confidence in the quality of our other sources.

¹⁷ The survey conducted in February 2009 was partially financed by Natural Resources Canada through a project contribution agreement. We would like to thank them for their participation in this CGC project.

Another key source of information for this report is the in-house database created by the CGC through a voluntary market survey filed by companies applying for CGC company qualification. As of June 2010, more than 400 companies have sought and received their qualification. Essentially, all the major installers active in Canada provided data which can then be used for cross referencing with the results of the **CGC Market Survey 2008-2009**. With this survey, the CGC has compiled key market data on the following market segments:

- Average number of designs per year since in business
- Projection for the next year, the next 3 years, and the next 5 years
- Average number of installations per year since in business
- Projection for the next year, the next 3 years, and the next 5 years
- Split between residential, commercial and developers' installation
- Split between retrofit, new-build and home additions installations

This database is unique and provides a comprehensive snapshot of the Canadian geoexchange industry.

In addition, since the beginning of the **ecoENERGY Retrofit – Homes Program** and other utility programs, the CGC has collected technical and economic information on thousands of residential systems installed in Canada both in new and existing homes. A sample of about 8,000 was used in the preparation of this report, with information collected on more than 20 key parameters. This information is essential to qualify the markets in areas such as average cost, borehole depth, types of loops, geological and ground water conditions, etc. This database is unique in North America and most likely in the world. As of June 2010, technical information on more than 12,000 systems has been collected.

CGC also used published data from the Energy Information Administration under the Department of Energy in the United States. This source is extremely useful to estimate the size of the Canadian markets through the analysis of US ground source heat pump exports, as about 90 % of all ground source heat pump units sold in Canada were thought to come from the US.

Other sources were also useful and helped confirm conclusions reached with the analysis of the previously mentioned sources. A market analysis performed by an independent consulting firm for the CGC in early 2009 provided qualitative information by regional markets and proved to be another excellent validation tool for quantitative sources. The **CGC Market Survey 2006-2007** was also used to validate some sales figures obtained in the **CGC Market Survey 2008-2009**. Finally, older studies prepared for Natural Resources Canada in 1999, 2003 and 2004 provided complementary information on market shares for major manufacturers.