

# Final Report

## Survey of Active Solar Thermal Collectors, Industry and Markets in Canada (2009)



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(SAIC Canada)  
Renewable Energy and Climate Change Program**

*Report presented to:*  
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## **EXECUTIVE SUMMARY**

This report is a summary of a survey of the Canadian solar thermal industry conducted in the period December 2009 to March 2010, covering the 2009 calendar year.

The survey results show continued growth in the Canadian solar thermal industry, with 2009 total revenue (domestic plus export) of \$21.3 million, an increase of 13% over the \$18.8 million reported in 2008. This is the seventh consecutive year that this survey has indicated that the total revenue earned by the Canadian solar thermal industry has grown over the previous year. In 2009 the strongest growth was experienced by air collectors (primarily unglazed); this sector sold 30% more collector area in 2009 than in 2008. Growth in other collector types was mixed, with some declining in total area sold, but most segments experienced revenue growth (refer to Table 1).

In recent years, two clearly identifiable trends have emerged. Ontario has continued to extend its leadership in total market (from 40% to 45% to 47% and now 53% of the total Canadian market, by revenue, from 2006 through 2009; see Figure 8), and sales of glazed liquid collectors have grown from about 10% of the market in 2006 and 2007 to 40% in 2009 (see Figure 12, by revenue).

Optimism within the industry remains strong, with roughly two of every three companies expecting to grow beyond their 2009 sales, and roughly half of these companies anticipating very strong annual growth rates, exceeding 40% (refer to section 3.5).

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## 1 INTRODUCTION

This report provides results of a survey of active solar thermal collectors, industry and markets in Canada. The survey was commissioned by Natural Resources Canada (NRCan), and was undertaken by SAIC Canada. The survey covered the 2009 calendar year. This survey is a continuation of a series of surveys going back to 2002.

NRCan's Renewable Energy Deployment Initiative (REDI) was launched in April 1998 to stimulate the demand for cost-effective renewable energy heating and cooling systems, and to help create a sustainable market for those systems. In 2006, the REDI program was superseded by the ecoENERGY for Renewable Heat program. Active solar thermal systems, including air and water heating, represent two of the types of renewable energy technologies presently supported by Natural Resources Canada's ecoENERGY program<sup>1</sup>. Solar thermal systems have the potential to play a considerable role in the implementation of a greenhouse gas emission reduction plan for Canada.

In part, this survey was undertaken in support of Canadian contributions to the solar heating market survey of the Solar Heating and Cooling Program of the International Energy Agency (IEA).

Solar thermal collectors are the key component of active solar energy systems. These collectors absorb energy from the sun's rays and convert it into thermal energy that can be used for water and space heating and cooling. Collectors are designed to meet the specific temperature requirements and climate conditions of each use.

The purpose of this study was to survey the Canadian active solar thermal collector industry to obtain data for the 2009 calendar year. The main objectives of the study were:

- To capture comprehensive and reliable information on market size and industry trends, including Canadian sales and revenues, import and export, and employment figures.
- To estimate delivered thermal energy and displaced CO<sub>2</sub> emissions of all active solar thermal systems operating in Canada.
- To analyze and report obtained data for publication and wider dissemination.

The Canadian solar thermal industry is a diverse, growing industry active across Canada, with roots going back to the mid-1970's. Five distinct types of solar collectors were sold in Canada during the surveyed period:

1. Unglazed, liquid collectors;
2. Unglazed, air collectors;
3. Glazed, liquid collectors;

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<sup>1</sup> For more information, visit the ecoENERGY for Renewable Heat website, <http://www.ecoaction.gc.ca/ECOENERGY-ECOENERGIE/heat-chauffage/index-eng.cfm>

4. Evacuated tube liquid collectors, and;
5. Glazed, air collectors.

Survey respondents were asked a series of questions, some about total sales of any type of solar thermal collector, and some questions seeking more detailed information on the breakdown of sales by these five types of collectors.

The survey results show continued strong growth in the Canadian solar thermal industry, with 2009 revenue of \$21.3 million, an increase of 13% over the \$18.8 million reported in 2008.

### **1.1 Comparisons to 2008 and earlier surveys**

Throughout this report, comparisons are made to data from the 2008 and earlier surveys. While these comparisons accurately compare the survey results between this and other years, the reader should be cautioned that the identity of companies responding to the survey has varied over the years. In 2008 and 2009, 31 and 29 companies responded to the survey, respectively. However, only 20 companies responded in both years. While the report authors have attempted to compensate for changes in the makeup of responding companies, the changes in the identity of those who respond does introduce some uncertainty in comparisons between years.

The reader should also be aware that the authors of this report are not aware of which companies have responded to the survey in any particular year. To protect commercially sensitive information, the report authors are presented with aggregated data only, prepared by the survey team staff. Staff members of the Renewable Energy and Climate Change Program within SAIC Canada have no access to either the individual survey responses or the identity of companies that submit responses.

## **2 SURVEY PROCESS**

### **2.1 Survey Development and Distribution**

In November 2009, a bilingual survey questionnaire was sent to over one hundred companies in Canada thought to be active in the solar thermal industry. This time, for the first time, the questionnaire was distributed by e-mail, and could readily be completed and returned by e-mail. The majority of the companies were then contacted by phone (at least twice; many times in a few cases), to ensure they had received the questionnaire, and to encourage them to respond.

A copy of the questionnaire can be found in Appendix A.

### **2.2 External Data Sources**

In addition to the data received from survey respondents, data from external sources was sought, either to supplement or verify the survey data.

#### *2.2.1 Energy Information Agency and Pool & Spa Marketing*

Both the U.S. Energy Information Agency (EIA) and Canadian Pool & Spa Marketing (PSM) magazine have regularly reported on solar collector sales in Canada. Both focus on pool type unglazed collectors, albeit for different reasons. PSM is, quite naturally, only interested in solar equipment as it affects swimming pools and hot tubs – primarily liquid unglazed collectors. The EIA is interested only in the activities of the U.S. solar thermal industry, and their exports. Since over 94% of U.S. collector exports are unglazed solar collectors (“low temperature”, in their terminology), it is reasonable to conclude that virtually all of the collectors reported as exported to Canada are unglazed.

The EIA data is usually published about one year after the conclusion of the period studied. Thus the most recent data available is for 2008, when they report exporting 74,800 m<sup>2</sup> of solar collectors to Canada, an increase of 57% over their 2007 exports of 47,700 m<sup>2</sup>.

In most recent years, PSM has published their estimate of sales of solar pool heating equipment. If PSM intends to continue this practice, they have not yet published this data for 2009. However, they have published general information on the status of the Canadian pool and spa markets, which indicated that the building permits for pools declined by 12% from 2008 to 2009 (from 9,952 to 8,721 permits), and that 19% fewer hot tubs were manufactured in 2009 versus 2008 (22,625 to 27,800 units). These numbers reveal that 2009 was generally a poor year for the industry (to be expected, considering the general downturn in the global economy), and this may indicate that sales of solar pool heating equipment would also decrease.

### **2.3 Estimated Data Capture Rate**

When this survey series began, it was clear when comparing survey responses to other public data – and when factoring in the number of recipients of the survey questionnaire who did not complete the questionnaire – that the survey did not capture all of the Canadian solar thermal industry. To compensate for this incomplete data set, the report authors estimated data capture rates for the various industry segments, and then modified some of the survey data accordingly. The estimated data capture rates were included in each report.



For this report, a high number of recipients have responded, and no public data could be found that would indicate that the responses to the survey missed any substantial part of the solar thermal industry. Thus in this report the data capture rate is assumed to be 100% across all sectors. That is, the values reported in the report are directly from the survey responses, without adjustment.

Even given the above conclusion, there is limited evidence that sales of liquid-unglazed (swimming pool type) collectors may have been somewhat greater than revealed by this survey, but no conclusive evidence could be found to support this hypothesis.

### 3 SURVEY RESULTS

#### 3.1 Industry Characterization

The following three figures provide an idea of the type of companies responding to the survey. Figure 1 shows that this year 41% (12 of 29) of respondents manufacture solar collectors; this is both the highest percentage in the history of this survey series, and twelve collector manufacturers is the highest number ever reported. This appears to be an indication that the steady growth of the Canadian market, at least partially spurred by stable government incentives, has been successful in encouraging the industry to invest in Canada.

The 2009 data shows a sharp decline in respondents that import both collectors (from 25 to 17%) and other components (from 28 to 17%). This may indicate that Canadian manufactured products are becoming more readily available in the marketplace.

Figure 1 does show that the majority of survey respondents (62%) maintain at least some involvement in direct retail sales. This high level of participation in retail sales likely indicates that solar thermal collectors and systems are considered “specialty” items, best sold through a short, independent supply chain, rather than through conventional retailers.

**Figure 1: Sector involvement within the solar thermal industry**

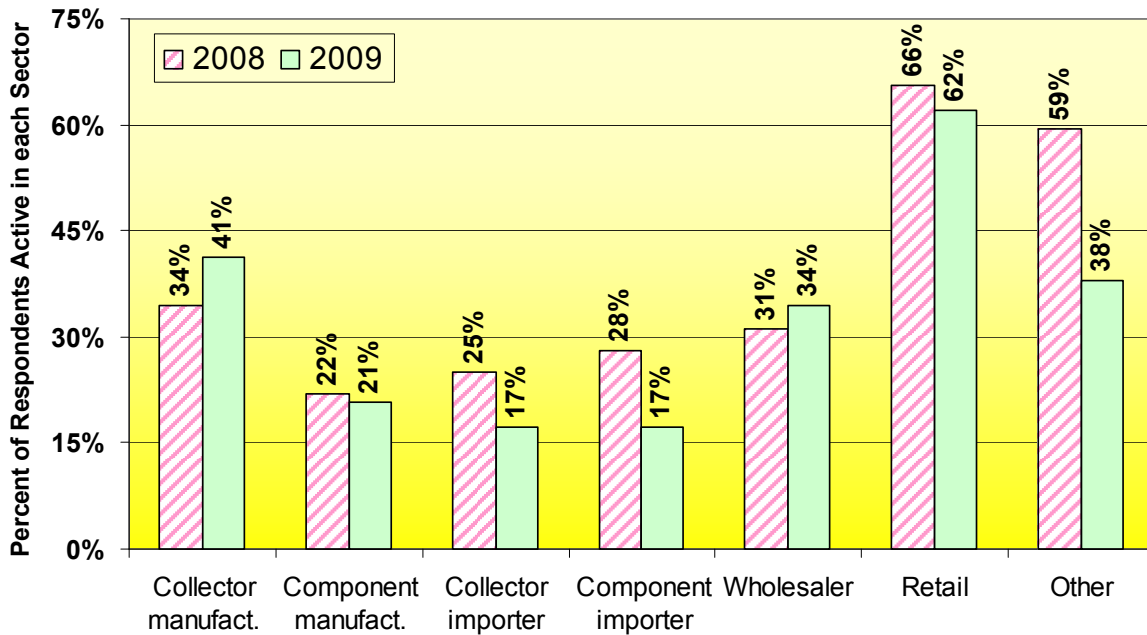
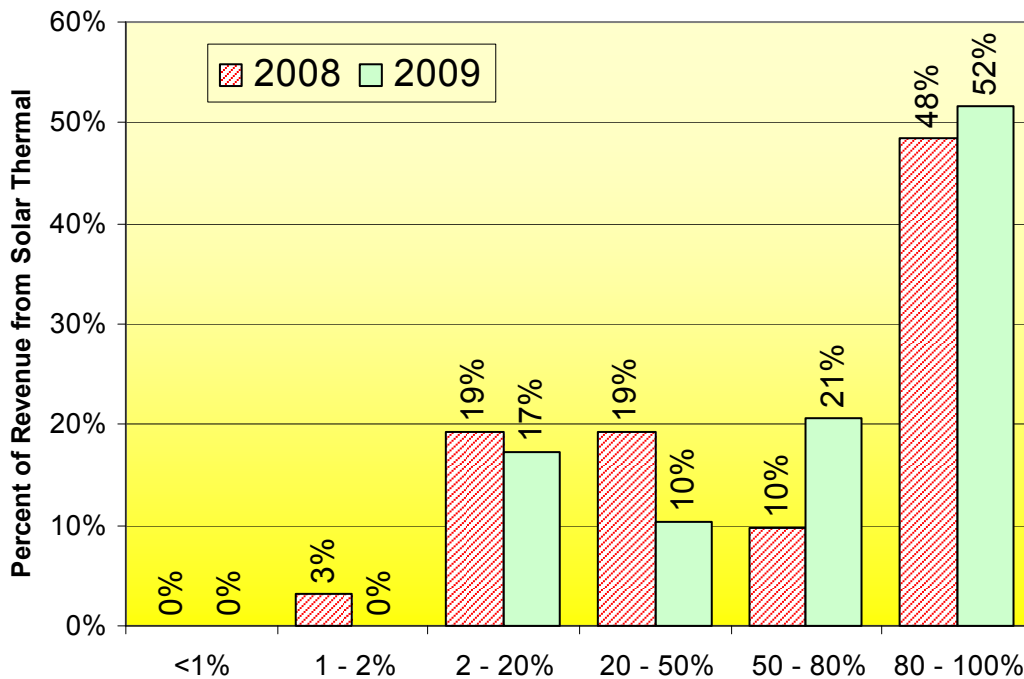


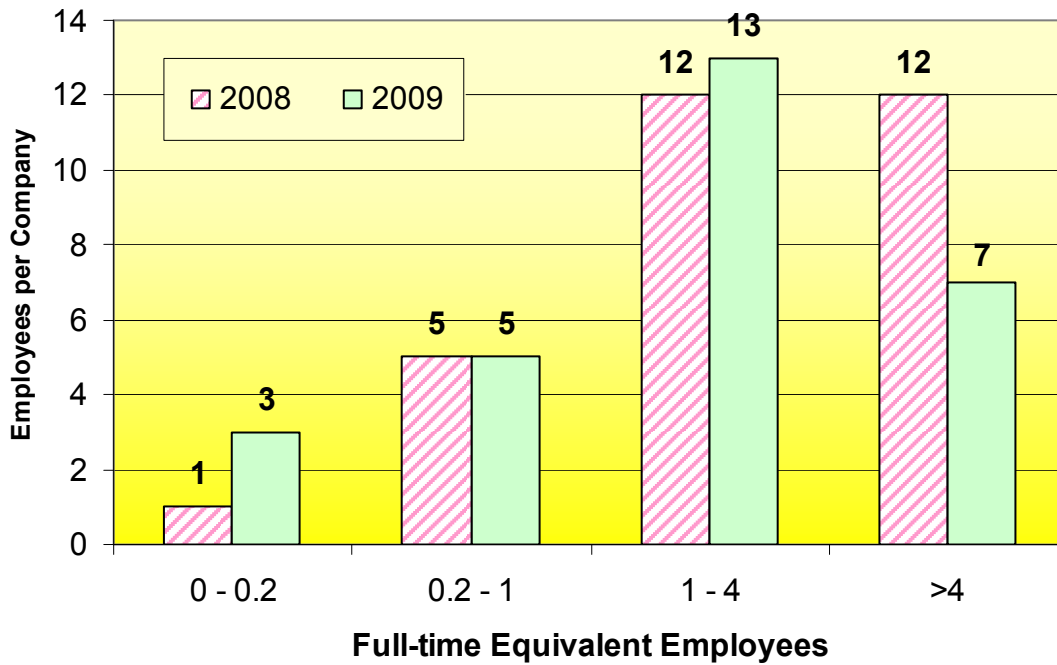
Figure 2 reveals that half of the survey respondents are specialized companies operating almost wholly within the solar thermal sector, deriving over 80% of their corporate revenue from solar. In 2009, fully 73% of respondents derived at least half of their total corporate revenue from solar thermal activities.

Similarly, Figure 3 reveals that 25% of all respondents have more than four full-time employees, down from 40% in 2008. The total number of person-years of employment in the solar thermal industry, as reported by respondents was 157, or an average of more than 5.6 employees per respondent, and marginally lower than the 168 reported in 2008 (although 2008 had two more companies reply to this question). Peak employment was reported as 195 employees, identical to 2008 (but with fewer respondents this year). Note that total employment in the Canadian solar thermal industry is likely much higher than this, because this survey was not designed to capture all those working at the retail sales and installer level.

**Figure 2: Solar thermal revenue as a percent of total corporate revenue**



**Figure 3: Number of employees per company engaged in solar thermal activities**



### 3.2 Industry Size and Growth

Table 1 contains industry sales figures for 2009. This table reveals healthy revenue growth from 2008 (14%), while simultaneously showing a modest decrease in the total area of collectors sold (-7%).

- Total industry revenue has increased from \$18.8 to 21.3 million (14%).
- Total area of collectors sold decreased from 184,329 to 171,279 m<sup>2</sup> (-7%).
- Revenue from domestic sales increased from \$13.1 to 16.6 million (27%).
- Revenue from export sales decreased from \$5.7 to 4.8 million (-16%).

A more detailed review of the data reveals that for respondents that completed the survey in both 2008 and 2009 (20 common respondents); the revenue growth rate in 2009 was 17%, just slightly better than the survey average of 14%.

**Table 1: Solar collector sales by type, 2009**

***Domestic Sales***

Collector Type	Thermal Capacity (MW)	Collector Area (m2)	Revenue (\$1,000's)
Air glazed	0.6	792	388
Air unglazed	31.7	45,331	4,945
Liquid evacuated	0.8	1,083	1,346
Liquid glazed	6.4	9,186	6,988
Liquid unglazed	51.1	73,026	2,903
<b>Total</b>	<b>90.6</b>	<b>129,418</b>	<b>16,570</b>

***Export Sales***

Collector Type	Thermal Capacity (MW)	Collector Area (m2)	Revenue (\$1,000's)
Air glazed	0.6	810	538
Air unglazed	2.0	2,813	432
Liquid evacuated	0.5	675	900
Liquid glazed	2.1	3,069	1,717
Liquid unglazed	24.1	34,494	1,191
<b>Total</b>	<b>29.3</b>	<b>41,861</b>	<b>4,778</b>

***Total Sales***

Collector Type	Thermal Capacity (MW)	Collector Area (m2)	Revenue (\$1,000's)
Air glazed	1.2	1,602	926
Air unglazed	33.7	48,144	5,377
Liquid evacuated	1.3	1,758	2,246
Liquid glazed	8.5	12,255	8,705
Liquid unglazed	75.2	107,520	4,094
<b>Total</b>	<b>119.9</b>	<b>171,279</b>	<b>21,348</b>

Figure 4 shows the rate of growth of the domestic market, by collector area, for each of the five types of solar thermal collectors. Because of the relatively small sample size, the precise year-over-year growth rates should be taken with caution. This graph shows that air unglazed collectors were the only collector type that saw growth in sales, by collector area, in the domestic market in 2009.

**Figure 4: Annual domestic sales growth by collector type (m<sup>2</sup>)**

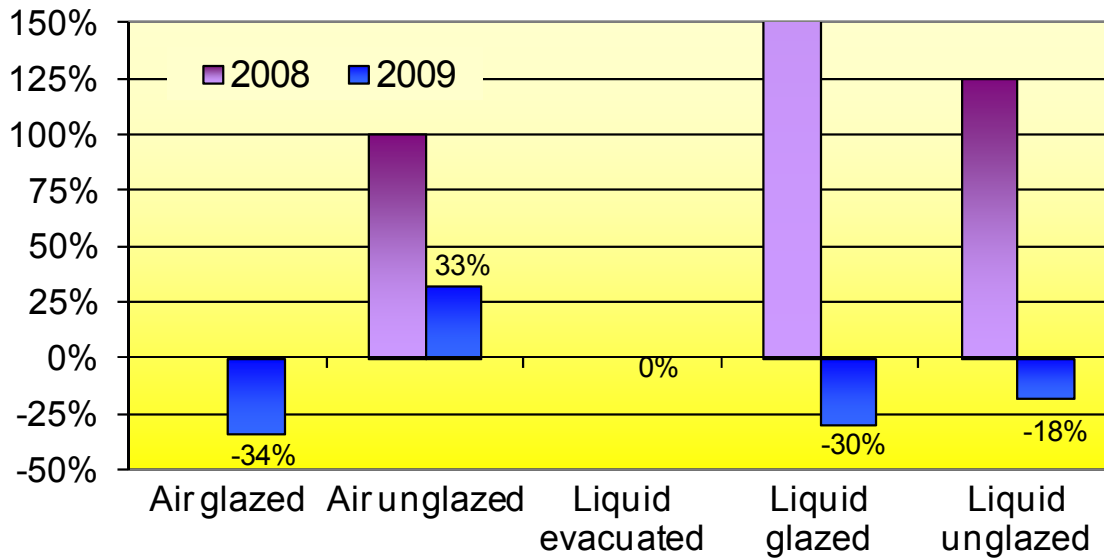
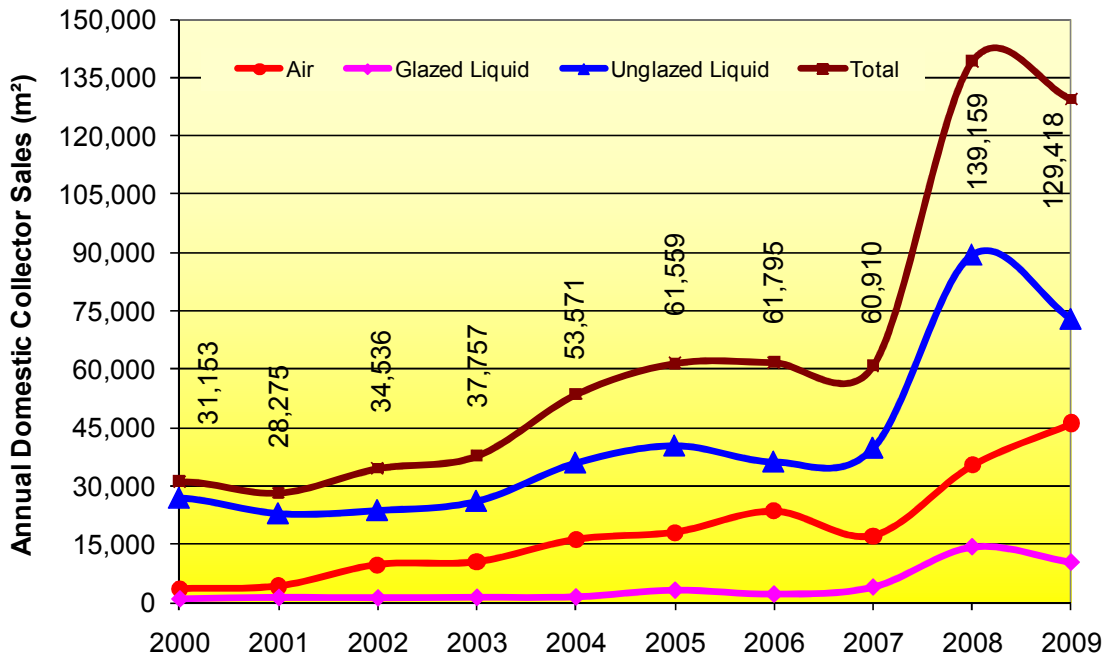
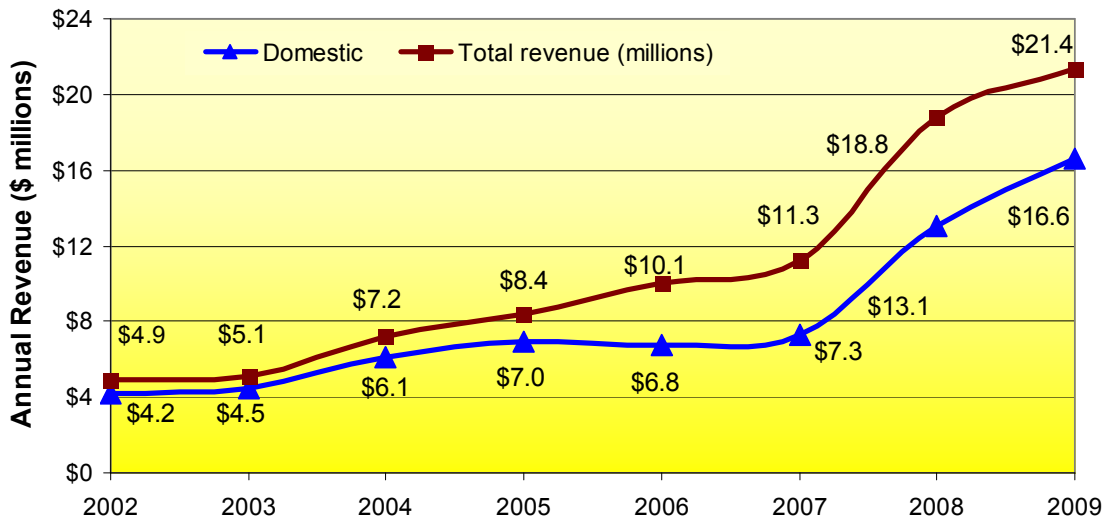


Figure 5 and Figure 6 provide a history of domestic solar collector sales in Canada over the past 10 years, and a history of revenue growth for the eight years since the inception of this survey series. Both show consistent, strong growth over the years, although there is a slight decrease in sales by collector area in 2009, over the record sales experienced in 2008. In terms of revenue, 2009 saw a new record for total sales of \$21.4 million.

**Figure 5: Ten-year history of domestic collector sales (m<sup>2</sup>)**



**Figure 6: Canadian solar thermal industry revenue growth**



### 3.3 Applications of Solar Thermal Technology

Table 2 provides a summary of end-use application by collector type. There are only moderate changes in these applications from 2008. Unglazed liquid collectors are used almost exclusively for residential swimming pool heating, and air-based collectors are used

almost exclusively for space heating. There is a strong divergence between glazed and unglazed air collectors, where the unglazed are sold into the Industrial/Commercial/Institutional (ICI) sector, and the glazed air collectors are used in residential applications.

As in previous years, the glazed liquid and evacuated tube collectors have the broadest range of applications. In 2009 both of these were employed roughly equally in the residential and ICI sectors, confirming the move into the ICI sector which was only 17% in 2006, 30% in 2007, and 46% in 2008, before a slight decrease to 40% in 2009. Within the ICI sector, this is the first year that the “process heat” category has exceeded 1% for any collector type, accounting for 15% of the evacuated tube collector market and 2% for the glazed liquid collectors.

**Table 2: Solar heating applications (by revenue), by sector and collector type**

Revenue by Sector	Liquid			Air	
	Unglazed	Glazed	Evacuated	Unglazed	Glazed
Residential	99%	60%	61%	1%	38%
Industrial/Commercial/Institutional (ICI)	1%	40%	22%	99%	62%
Unknown	--	--	17%	--	--

Revenue by Solar Heating Application	Liquid			Air	
	Unglazed	Glazed	Evacuated	Unglazed	Glazed
Residential pool heating	99%				
Residential domestic water heating		58%	42%		2%
Residential space heating		1%	6%	1%	36%
Residential combined space and water heating		1%	13%		
ICI pool heating	1%				
ICI domestic water heating		38%	1%		
ICI process heat		2%	15%		
ICI space heating			1%	99%	62%
ICI combined/other			5%		
Unknown	--	--	17%	--	--



### 3.4 Geographic Distribution

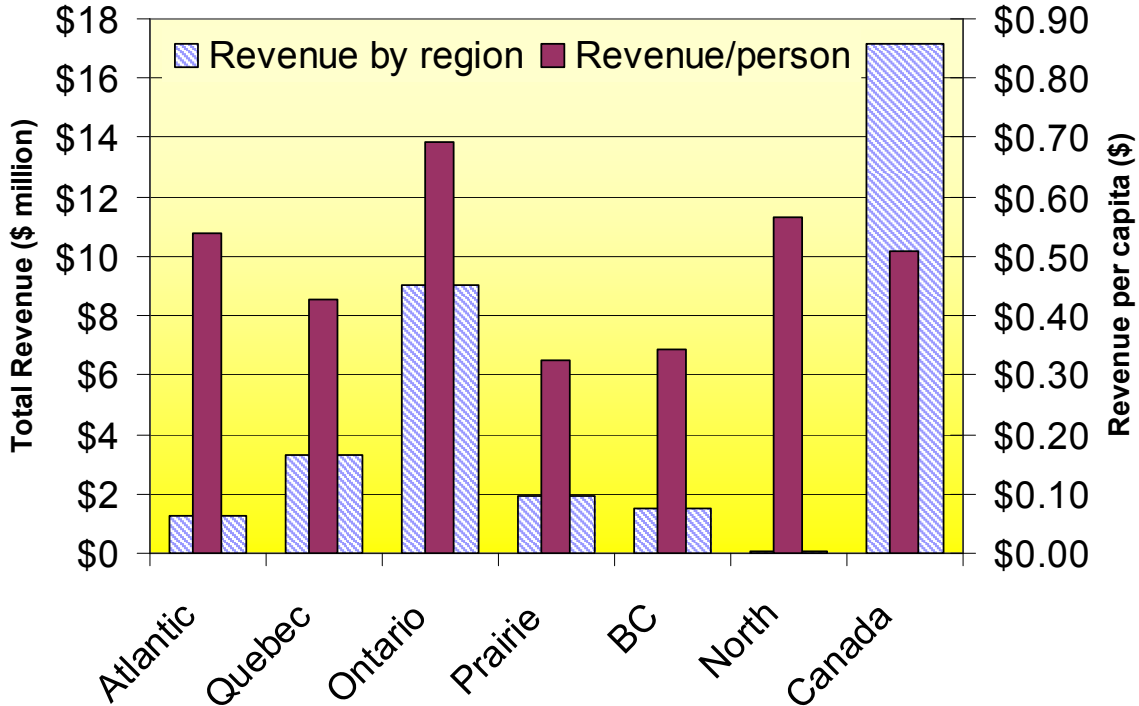
#### 3.4.1 Domestic Sales

In 2009, solar thermal collectors were installed in all areas of Canada, including the North. On a *per capita* basis, Canada-wide industry revenue has increased 34%, from \$0.38 per person in 2008 to \$0.51 in 2009 (see Figure 7). All regions saw increased sales over 2008, except the Prairies, which experienced a 13% decrease in revenue from 2008. Ontario and the Atlantic experienced the healthiest growth, with Ontario exceeding half of the total Canadian market for the first time (53%, see Figure 8).

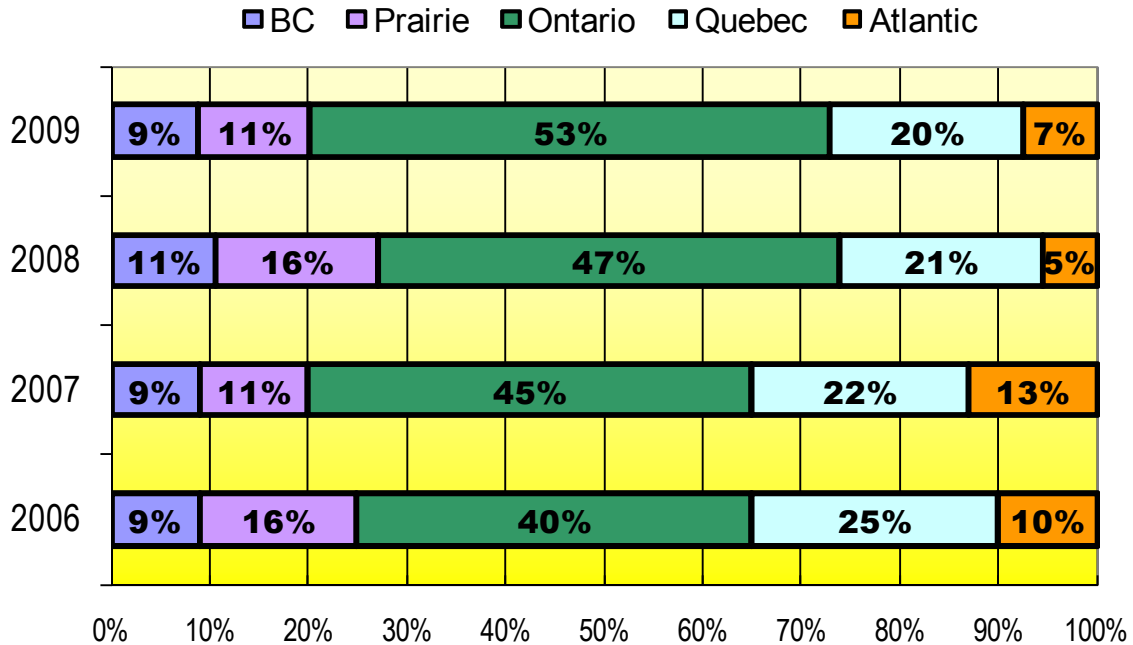
Due to an increase in the number of survey respondents reporting sales in the North, this is the first year that the data can be released, while still protecting the confidentiality of respondents. As shown in Figure 7, total sales volume is small, but the North trails only Ontario in *per capita* sales, at \$0.57/person.

It is noteworthy that sales of all five collector types are reported in every region of Canada, except the Prairies, where no air glazed sales were reported and the North, where neither air glazed nor liquid unglazed collector sales were reported.

**Figure 7: 2009 regional solar collector sales, by population**



**Figure 8: Regional distribution of domestic market (by revenue)**



### 3.4.2 Exports

Canada continues to export solar thermal collectors in considerable quantities, exporting approximately 41,000 m<sup>2</sup> (no change from 2008), valued at \$4.6 million (down 19% from \$5.7 million in 2008). As can be seen from Table 3, approximately 94% by revenue (93% by collector area) was exported to the United States, with minimal exports to Europe and Central and South America. Sales to Europe fell particularly steeply, from \$630,000 to \$180,000. As with 2008, all five major types of collectors were exported (Table 4). The distribution of export sales among the different collector types varied substantially between 2008 and 2009, although liquid glazed and liquid unglazed ranked first and second, respectively, in both years.

**Table 3: Regional distribution of solar exports (by revenue)**

Distribution of Solar Exports	2008	2009
United States	84%	94%
Central and South America	4%	2%
Europe	11%	4%
Asia	1%	--
Africa	--	--
Australia	--	--
<b>Total</b>	<b>100%</b>	<b>100%</b>

**Table 4: Exports by collector type (by revenue)**

Exports by Collector Type	2008	2009
Air, glazed	20%	12%
Air, unglazed	14%	5%
Liquid, evacuated tube	13%	20%
Liquid, glazed	31%	37%
Liquid, unglazed	22%	26%
<b>Total</b>	<b>100%</b>	<b>100%</b>

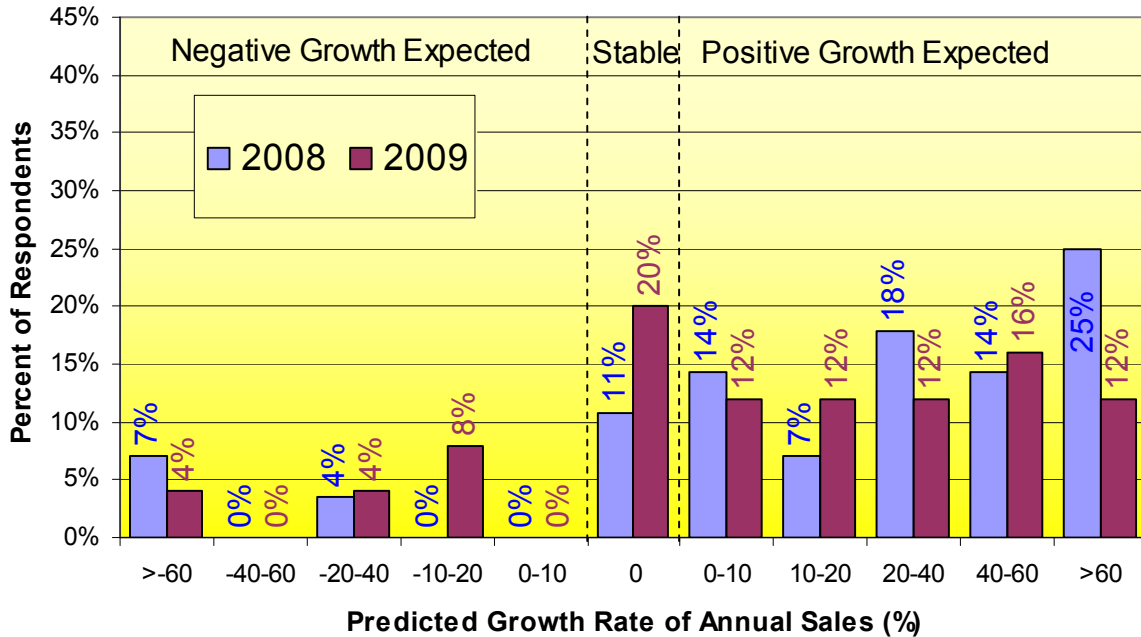
### 3.5 Anticipated Sales Growth

The recipients were asked to estimate how future sales revenue would relate to their 2009 solar revenue. Figure 9 shows the range of responses, both from this survey and the previous survey (2008).

While both surveys show optimism of future growth, respondents this year were somewhat less optimistic than last year. When respondents' replies were weighted by the amount of revenue derived from solar thermal activities, the 2008 respondents expected an annual future growth rate of 84%, whereas the 2009 respondents expect an annual growth rate of 31%. Perhaps just as telling, the number of companies that expect either no growth or a decline has increased from 0% in 2007, to 20% in 2008, and then to 26% for 2009.

While industry optimism may be declining, it is still very strong. Figure 9 shows that almost two-thirds of the respondents expect their sales revenue to increase beyond 2009 levels, with more than one-third of all respondents predicting growth rates in excess of 40% per annum.

**Figure 9: Estimate of future sales growth**



### 3.6 Sales of Packaged Systems

A new question was added to the survey this year (Q12), asking if vendors sold packaged solar systems, either for domestic hot water (DHW) or swimming pool heating, within Canada. A total of twelve respondents indicated that they sold such packaged systems, with results shown in Table 5.

**Table 5: Domestic Sales of Packaged Systems**

	Packaged DHW Systems	Packaged Pool Heating Systems
Number of systems sold	1,641	2,498
Average collector area per system (m <sup>2</sup> )	5.7	6.7
Total collector area (m <sup>2</sup> )	9,314	16,769
Total revenue from packaged systems	\$ 6,819,307	\$ 654,480
Average revenue per system	\$ 4,156	\$ 262

Based on these results, packaged solar DHW systems make up the majority of the market segment consisting of liquid glazed and evacuated collectors, accounting for roughly 58% of this market segment, by both revenue and collector area. Conversely, the packaged pool heating systems are only a relatively small portion of the total market for liquid unglazed collectors, accounting for only 16% of the market segment, by both revenue and collector area.

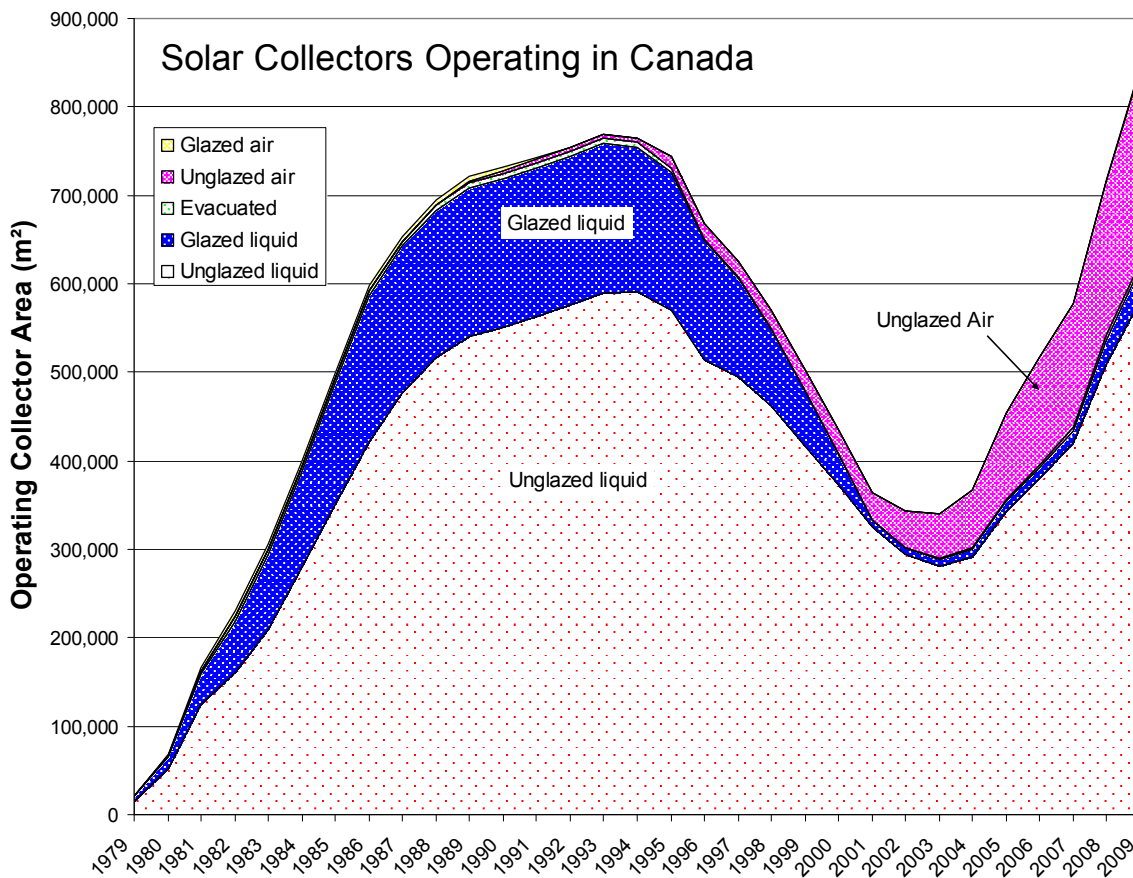
## 4 ESTIMATE OF AVOIDED GREENHOUSE GAS EMISSIONS

### 4.1 Background

Estimating GHG emissions avoided due to solar thermal installations in Canada is a complex issue that involves estimating the operational effectiveness of all solar heating systems in Canada, the fuel that they displace, and the location of the systems within Canada, among other variables. These variables cannot all be known with precision. With the support of the IEA, Weiss *et al* developed a methodology for estimated GHG avoidance, using a system of reference solar heating systems. This methodology was adopted, with some modifications, for use on earlier Canadian data, and is described in detail in a previous report (ref 1). A summary of the reference system definitions follows.

Figure 10 shows a historical record of installed, operational solar collectors. This data – showing 846,000 m<sup>2</sup> of solar collectors operating in Canada at the end of 2009 – was used in calculating the amount of GHG's avoided due to the use of active solar thermal energy in Canada.

**Figure 10: History of Operating Solar Thermal Systems in Canada**



## 4.2 Reference System Definitions

Weiss developed four reference systems in his work on estimating avoided GHG emissions, but only three of these four were applicable within Canada. We have chosen to use the same three systems, albeit with some adjustments to reflect the Canadian market, plus a fourth – commercial air.

Residential DHW – This system is identical to Weiss' solar domestic hot water systems for single family houses in Canada. It represents a typical solar DHW preheat system consisting of two 4' x 8' (6 m<sup>2</sup>) glazed solar collectors, 150 L/d hot water usage<sup>2</sup>, with a 300 L hot water storage tank. Commercial marketing material indicates that each system will produce about 50% of the energy required for hot water in a home, on an annual basis.

Commercial Water – This system is essentially a new name for Weiss' solar domestic hot water systems for multi-family houses and district heating, retaining many of its features. This incorporates all larger scale systems with glazed, liquid collectors, covering applications from institutional or multi-residential DHW, to municipal indoor pool heating, to process water at car washes, laundries or other facilities. As with Weiss, the reference system consists of 50 m<sup>2</sup> of collectors, 2,000 L/d hot water draw and a 2,500 L storage tank.

Residential Pool – This system is identical to Weiss, except that the collector area has been reduced from 200 m<sup>2</sup> to 25 m<sup>2</sup>, to more closely reflect the Canadian market (5-6 nominal 4' x 12' collectors per system). This reduction in size has little impact on the GHG analysis, but it does affect the calculation of the number of systems. Note that this reference system covers all unglazed, liquid-type collectors, and thus does include seasonal municipal or resort pools, which may have collector areas of 50 – 300 m<sup>2</sup>. However, these commercial pools constitute well below 5% of the Canadian market, and they do perform similarly to the more common residential pools.

Commercial Air – This is a new reference system, based on the successful use of unglazed air collectors for preheating ventilation and makeup air in industrial, commercial and agricultural (livestock barns) applications. Within Canada, this is a strong market sector, and cannot be ignored. System sizes vary widely from below 50 m<sup>2</sup> to 10,000 m<sup>2</sup>. For a reference system we have selected 200 m<sup>2</sup>, because it is within the size range for both agricultural and industrial/commercial/institutional sectors, and should provide a reasonable estimate of the mean size of all systems.

## 4.3 GHG Emission Avoidance Calculations

Table 6 shows the calculations used to estimate the GHG emissions avoided due to all solar thermal systems operating in Canada at the end of 2009. The value of 60,297 tonnes of CO<sub>2</sub>e avoided in 2009 is 21% higher than the value reported in 2008, indicating that the healthy growth in the solar thermal industry is significantly impacting GHG emissions in Canada.

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<sup>2</sup> The 150 L/d hot water usage used by Weiss is probably low for Canadian practice, but we chose to keep this value for consistency with international reports. Using a larger hot water draw (~225 L/d is more typical of actual hot water usage in Canada) would have increased the estimate of GHG avoided, but since residential DHW heating systems are a small segment of the Canadian market, the overall effect would be small.

**Table 6: Analysis of avoided GHG emissions, using four reference systems, 2009**

Parameter	Residential DHW	Commercial Water	Residential Pool	Commercial Air
Collector type	glazed	glazed	unglazed	unglazed air
Collector area (m <sup>2</sup> )	6	50	25	200
Annual yield per system (GJ/a)	9.9	82.1	19.4	422
Specific annual yield (GJ/a-m <sup>2</sup> )	1.64	1.64	0.78	2.11
Displaced fuel mix (%)				
• Oil (73 kg of CO <sub>2</sub> /GJ)	4%	15%	1%	5%
• Natural gas (50 kg of CO <sub>2</sub> /GJ)	50%	75%	63%	50%
• Propane (60 kg of CO <sub>2</sub> /GJ)	--	5%	--	40%
• Electricity (151 kg of CO <sub>2</sub> /GJ)	46%	5%	12%	5%
• Heat pump (38 kg of CO <sub>2</sub> /GJ)	--	--	24%	--
• No fuel	--	--	--	--
Blended CO <sub>2</sub> avoided (kg of CO <sub>2</sub> /GJ)	97	59	59	60
Annual CO <sub>2</sub> avoided (t/a-system)	0.96	4.84	1.14	25.3
Annual specific CO <sub>2</sub> avoided (kg/a-m <sup>2</sup> )	160	97	46	127
Estimated system life (years)	15/20	15/20	15/20	30
Total operating collector area (m <sup>2</sup> )	26,138	17,426	582,351	220,338
Calculated number of systems	4,356	349	23,294	1,102
Total annual CO <sub>2</sub> avoided (t/a)	4,182	1,687	26,555	27,873
Total annual CO <sub>2</sub> avoided, all types (t/a)	<b>60,297</b>			

The 60,297 tonnes of GHG emissions avoided due to solar thermal installations in Canada is equivalent to removing more than 12,000 mid-size cars from Canadian roads, or the total GHG emissions of more than 2,600 Canadians<sup>3</sup>.

#### 4.4 Forecast GHG Emission Avoidance from Collectors sold in 2009

An alternative view of GHG emission avoidance - and one that is more representative of the current sales rate of solar thermal systems, rather than past sales - is to estimate the total GHG's that will be avoided over the operating life of systems installed in the current year. Applying the same calculations in the previous section to the 129,418 m<sup>2</sup> of collectors installed in Canada during 2009, leads to the conclusion that 269,305 tonnes of CO<sub>2</sub> equivalent will be saved over the lifetime of these systems (using a 20 year expected life for all water systems and a 30 year life for commercial air systems).

<sup>3</sup> "Human Activity and the Environment: Annual Statistics – 2007 and 2008" Statistics Canada, March 2009. This report indicates that the per capita GHG emissions from a typical Canadian are 23 tonnes per annum, and that a typical mid-size car driven 25,000 km each year emits 5 tonnes of GHG's.

Since the solar industry earned 16.6 million dollars in revenue from domestic sales in 2009, this means that one tonne of CO<sub>2</sub> is saved for every \$62 of revenue (neglecting any service and repair revenue that may be earned over the life of the systems).

Depending upon climatic conditions and displaced fuel data in the country of use, it is likely that the solar collectors exported from Canada during 2009 will be responsible for avoiding approximately 85,000 tonnes of CO<sub>2</sub> equivalent, during their operating life.



## 5 CONCLUSIONS

The Canadian solar thermal industry has shown sustained growth through the early years of the twenty-first century, with continued revenue growth in 2009 (13%), despite a slight decline in year-over-year sales by collector area (-7%).

Figure 11 shows the 2009 market share, by collector type, against three different metrics. Note that while unglazed swimming pool collectors constitute more than 60% of the total collector area sold, they are responsible for a much lower fraction of industry revenue (19%) due to their low cost, and a lower proportion of GHG savings (25%), due to their short operating season. From a dollar per tonne of GHG reductions, air collectors are superior, as they account for 65% of all GHG reductions, while earning only 30% of the industry revenue.

**Figure 11: 2009 market share by Area, Revenue and GHG Savings**

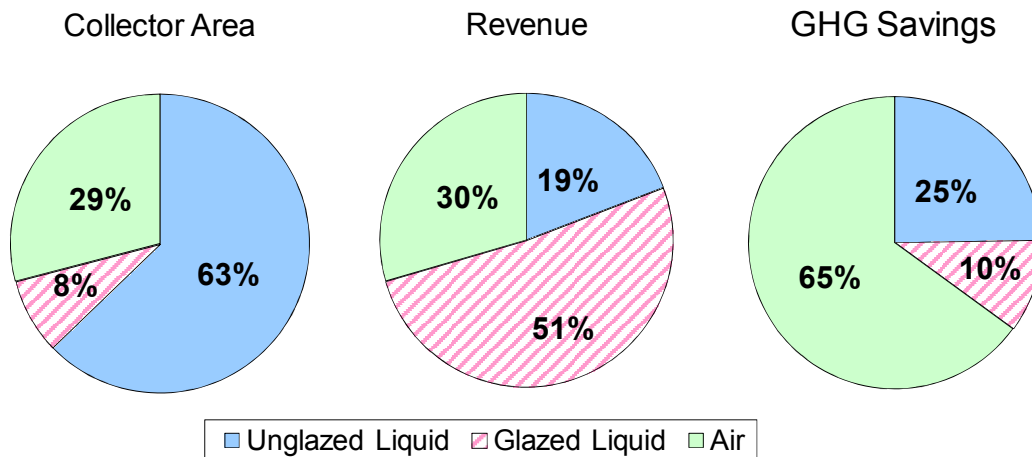
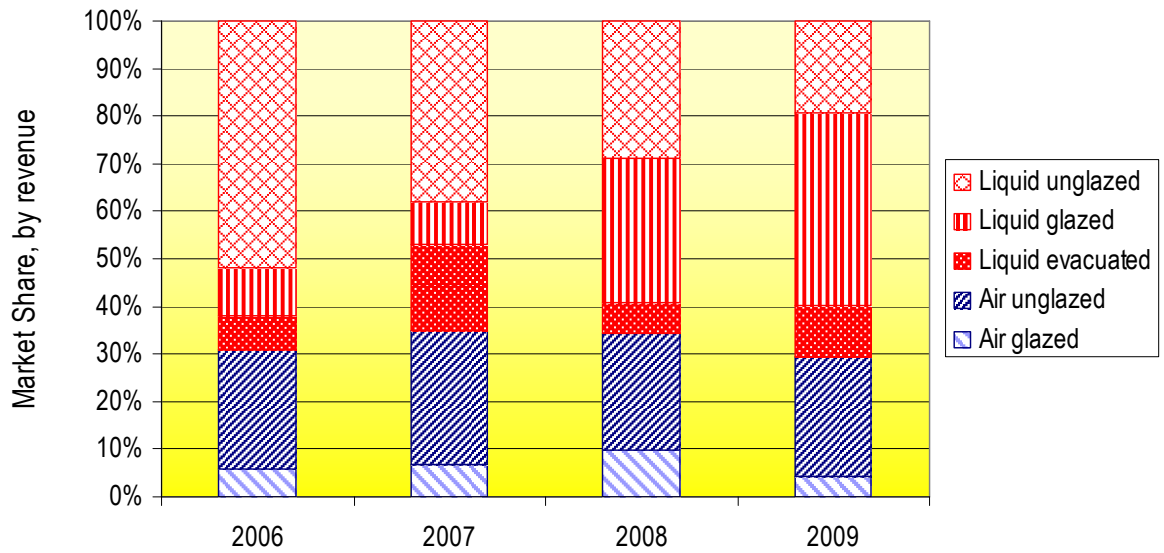


Figure 12 summarizes recent changes in the market of the five collector types, by revenue. Note that while the overall division between air and liquid collectors has remained nearly constant, with 1/3 from air collectors and 2/3 from liquid collectors, there have been noticeable shifts in market share. In liquid collectors, the rapid growth in sales of glazed and evacuated tube collectors has resulted in a steady decline, proportionally, of unglazed collectors from more than 50% of the total market in 2006 to less than 20% in 2009. Another observation from Figure 12 is that, over this four year period, the market for liquid glazed collectors has been the fastest growing market segment, growing from 12% in 2006 to 40% in 2009, by revenue.

**Figure 12: Recent changes in market share of five collector types (domestic plus export sales, by revenue)**



## 6 REFERENCES

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## **APPENDIX A – Survey Questionnaire**

The following pages contain a copy of the 12 questions asked of survey recipients. The appendix contains the questions in English, although the questionnaire was distributed in both French and English.