

Final Report

**Survey of Active Solar Thermal Collectors,
Industry and Markets in Canada (2006 and 2007)**



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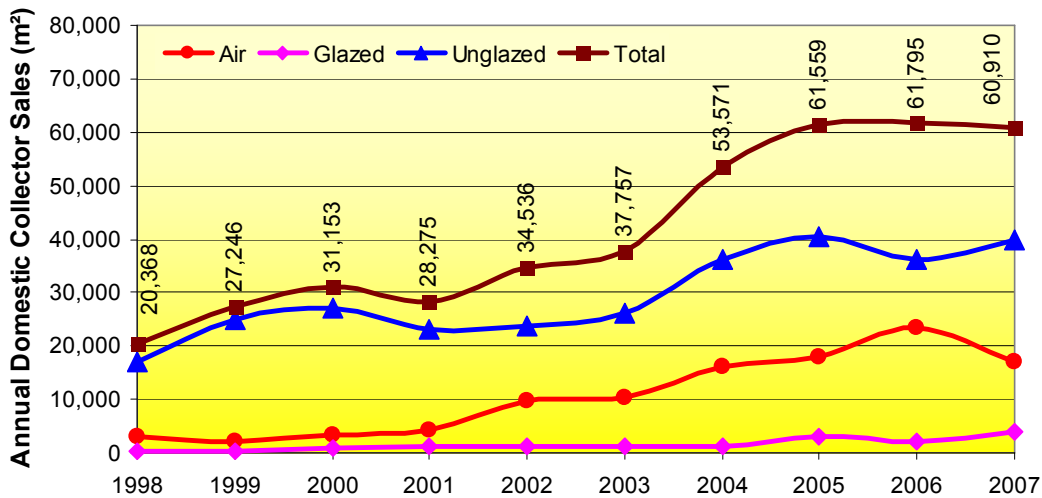
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EXECUTIVE SUMMARY

This report is a summary of a survey of the Canadian solar thermal industry conducted in the period December 2007 to January 2008. This survey, which covers the 2006 and 2007 calendar years, is the most recent in a series that goes back to 2002. The table and chart below show estimated annual domestic sales in 2006 and 2007, based on survey responses. From the perspective of the total area of solar collectors installed in Canada, the industry sales appear relatively flat over the three year period 2005 – 2007. The chart shows the growth of solar collector sales (m²) over the past ten years.

Collector Type	Collector Area (m ²)	
	2006	2007
Air glazed	38	128
Air unglazed.	23,441	17,056
Liquid evacuated	712	2,385
Liquid glazed	1,312	1,462
Liquid Unglazed	36,292	39,879
Total	61,795	60,910



However, the industry does continue to grow strongly, with total revenues increasing strongly over this same period, by an average of 16% annually:

2005 - \$8,385,000

2006 – \$10,067,000

2007 - \$11,264,000

Revenue growth is based largely on a growing exports and growth in the higher cost types of modules, specifically evacuated tube collector sales. These are the most costly types of collectors, on a \$/m² basis, and also the type with the fastest growing sales figures during the survey period.

A slightly different picture of industry growth arises if the view is restricted only to the respondents that have completed all surveys from 2002 through 2007. These companies, which represent more than half of the industry's total revenue, reported year-over-year revenue growth of 44% and 20% in 2006 and 2007, respectively.

Optimism within the solar industry continues, with every company surveyed predicting further growth in 2008 and 2009.

Solar thermal systems in Canada continue to substantially decrease the amount of greenhouse gases generated in Canada. The estimated 544,000 m² of solar collectors operating in Canada during 2007 (up from 419,000 m² in 2005) avoided the release of 37,932 tonnes of CO₂ into the Canadian atmosphere during 2007 (up from 27,383 tonnes in 2005). This is a rate of increase of 17% per year. Furthermore, the 60,910 m² of solar thermal collectors that were installed in 2007 will reduce Canada's GHG emissions by 127,655 tonnes over their predicted 20 – 30 year life.

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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), in 2007 and was undertaken by SAIC Canada. The survey covered the 2006 and 2007 calendar years. 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 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 (ASTSs), including air and water heating, represent two of the types of renewable energy technologies (RETs) presently supported by Natural Resources Canada's ecoENERGY program. These ASTSs can play a considerable role in the implementation of the climate change 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 2006 and 2007 calendar years. 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 CO₂ 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;
4. Evacuated tube liquid collectors, and;
5. Glazed, air collectors.

In earlier surveys in this series, evacuated tube collectors and glazed air collectors both had sales sufficiently small that releasing their sales figures risked the confidentiality of the survey respondents. For this reason, their sales data had been combined with glazed liquid and unglazed air collectors, respectively. However, both of these products have experienced market growth, and for the first time they are reported in their own distinct categories in this report.

As the solar collector designs are diverse, so are the applications. The latter include residential and commercial swimming pool heating, heating of ventilation and makeup air in industrial buildings, commercial buildings and livestock barns, heating of potable hot water in any style of building, from single family homes to large office complexes. Newer applications are coming into use, including residential space heating via radiant floor heating systems.

2 SURVEY PROCESS

2.1 Survey Development and Distribution

The bilingual survey questionnaire used for 2006 and 2007 was identical to the one used for the 2005 survey, except that it covered two years rather than one.

The survey was mailed out to 180 recipients (roughly the same as the 188 in 2005, although there were both additions and deletions). Both to focus the survey effort, and to reduce the cost, there was no follow-up with the bulk of the recipients - most of whom were thought to be smaller retailers. However, a group of companies was targeted for personal follow-up. This group consisted of all companies that completed any of the previous surveys, as well as companies thought to be involved in manufacturing or wholesale distribution.

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

2.2 Survey Response Rate

Twenty-one completed surveys were received. Although this represents only 11.7% of the 180 surveys issued, it does appear to represent a significant portion of the larger companies that were specifically targeted for follow up, and the results compare favourably with the previous surveys. With respect to the six categories listed below, the number of 2006/2007 respondents in each group was very similar to the two previous surveys. This would indicate that many of the larger industry players have responded to the survey, and that a similar cross section of the industry has been captured as in previous surveys.

Of the twenty-one companies that completed this survey, eight have now completed all three surveys in this series. In each of the six years surveyed, these eight companies accounted for more than 50% of the total reported revenue. Thus comparing only these companies allows for direct year-to-year comparison of a significant sample.

2.3 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.

Both the U.S Energy Information Agency (EIA) and Canadian Spool & Spa Marketing (PSM) magazine have reported regular growth in Canadian sales of solar collectors over the past few years, including annual growth rates of 4% and 158%, respectively, in 2006*. The EIA data includes all types of solar collectors exported to Canada; traditionally, the vast majority have been unglazed collectors. The PSM data includes only unglazed collectors used for pool heating, and has been calculated based on PSM's report of retail sales revenue. There is no obvious explanation of why the EIA and PSM values for 2006 differ so widely. They do use very different methodologies, and the EIA data does not include collectors manufactured in Canada, or imported from countries other than the U.S.

* Neither the EIA nor PSM had published data for 2007 when this report was issued.

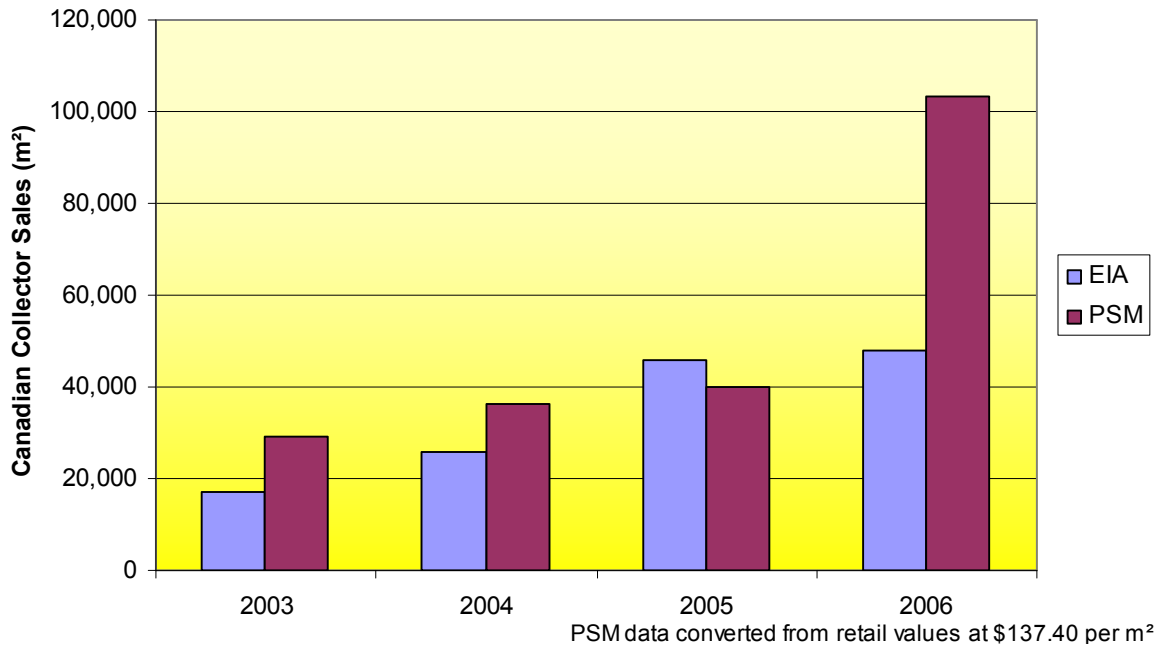


Figure 1: Collector sales from independent sources (m²)

It is worth noting that, even with the 158% annual increase in solar pool heating sales in 2006, PSM does not appear to be suggesting that solar is gaining significant market share from natural gas or heat pump pool heaters, as PSM reported that both of these sectors also experienced growth in 2006, albeit at more modest annual growth rates of 10% and 13%, respectively.

2.4 Estimated Data Capture Rate

To properly estimate the size of the total solar thermal industry in Canada from the survey results, it is necessary to estimate the data capture rate of the survey. The data capture rate is separate from the survey response rate discussed in the preceding section. The survey response rate is based on the number of forms completed, with all businesses given equal weight, and can be accurately counted. The data capture rate is an estimate – never a count – of the fraction of the available data which was captured by the survey process. In effect, it is a weighted average of the survey response rate, where each business receives a weighting in accordance with its volume of business. The procedure of estimating the data capture rate in this survey is complicated by the fact that there are at least three distinct market segments – and specialized businesses to serve them – within the solar thermal industry. Table 1 lists the three business segments, and the estimated data capture rate for each.

Table 1: Estimated data capture rates by business segment/collector type

Business Segment	Description	Collector Types	Estimated Data Capture Rate
Solar air heating	Heating of ventilation air. Primarily for commercial applications, with some residential.	Unglazed & glazed air	100%
Outdoor pool heating	Heating of seasonal use, outdoor pools. Primarily residential, but including some seasonal use commercial facilities.	Unglazed liquid	40%
General water heating	A wide range of applications including residential domestic hot water, indoor pool heating, and commercial water heating applications	Glazed liquid, Evacuated	80%

The data capture rates estimated in Table 1 are the same as the previous report in this series (2005) for solar air heating (100%) and general water heating (80%). The current survey captured a higher percentage of the outdoor pool heating segment (40%) than the previous survey (<10%).

In estimating the above data capture rates, the survey team reviewed historical data on the Canadian solar thermal industry, as well as current data from other sources, along with the survey completion rate. The justification for these data capture rates can be summarized as follows:

- **Solar air heating:** This segment of the industry is uniquely strong in Canada, compared to other nations, so most collectors installed in Canada are manufactured and sold by a very small number of Canadian-based companies. A review of the 2006 and 2007 data reveals that it is likely that all major companies active in this sector completed the survey.
- **Outdoor pool heating:** This segment of the industry is very diverse, with much of the product distribution going through pool industry channels, rather than “solar companies”. There are several major manufacturers in both the U.S. and Canada, with shipments going both ways across the border. Our response rate from this industry appears low, so for this segment of the industry we have relied on sources of information outside of this formal survey process (U.S. EIA survey of solar exports, PSM magazine), using this other data to supplement the survey responses.
- **General water heating:** This segment of the industry uses a mix of Canadian-made collectors, from a handful of manufacturers, and imported collectors from several sources. Distribution is primarily through specialty “solar” channels. Comparing the survey data to other information sources (e.g. knowledge of larger installations) leads

us to believe that we have captured the majority – but by no means all – of this sector.

Important Note

In the body of this report, ***all*** quantified information (e.g. area of collector shipments; value of sales) have had the estimated data capture rates from Table 1 applied, to adjust from the raw survey data.

3 SURVEY RESULTS

3.1 Industry Characterization

Figures 2, 3 and 4 provide information on the type of companies active in the solar thermal industry in Canada, specifically those that responded to this survey. Many are active in several sectors within the solar industry (Figure 2). Roughly half of the respondents appear to be specialized “solar” companies that derive the bulk of their income from solar thermal activities (Figure 3), although roughly one third of respondents indicated that they earn more than 80% of their revenue from other sectors, with solar thermal being a “sideline”. One third of respondents indicated that they employ no more than a single full-time equivalent person in the solar industry (Figure 4). 2007 also saw seven respondents that employed more than four employees in the solar sector, the first time that this number has been above five.

Figure 2: Sector involvement within the solar thermal industry

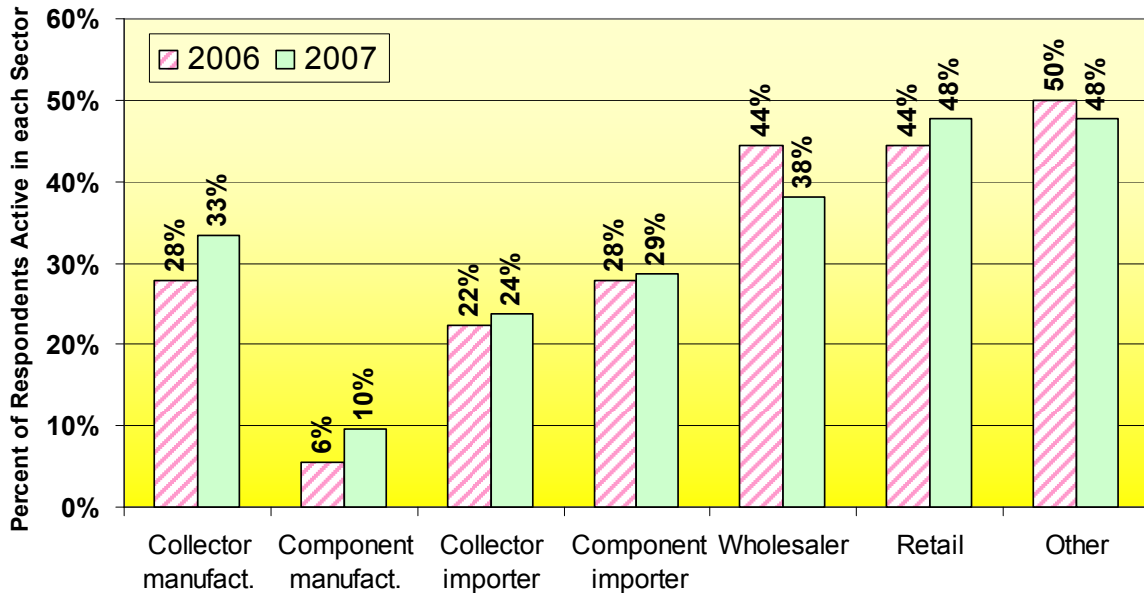


Figure 3: Solar thermal revenue as a percent of total corporate revenue

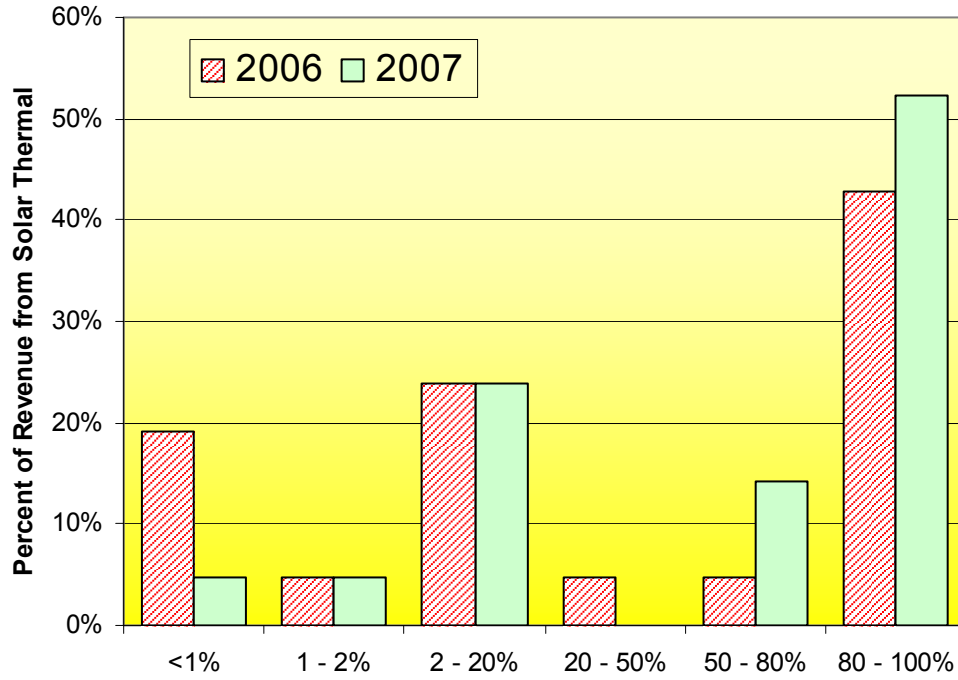
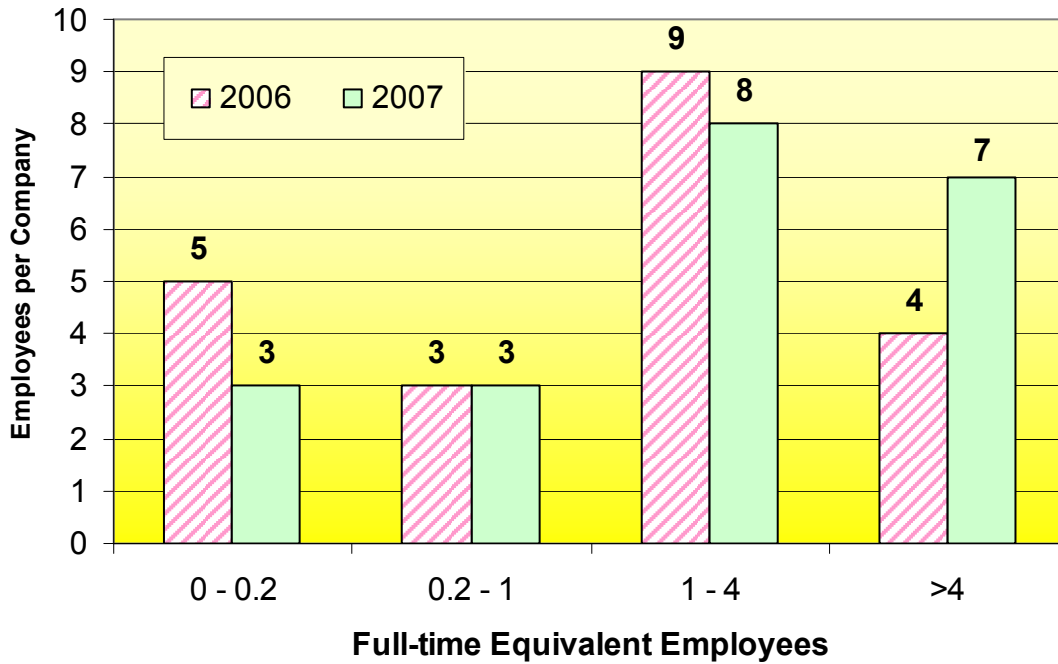


Figure 4: Number of ST employees per company



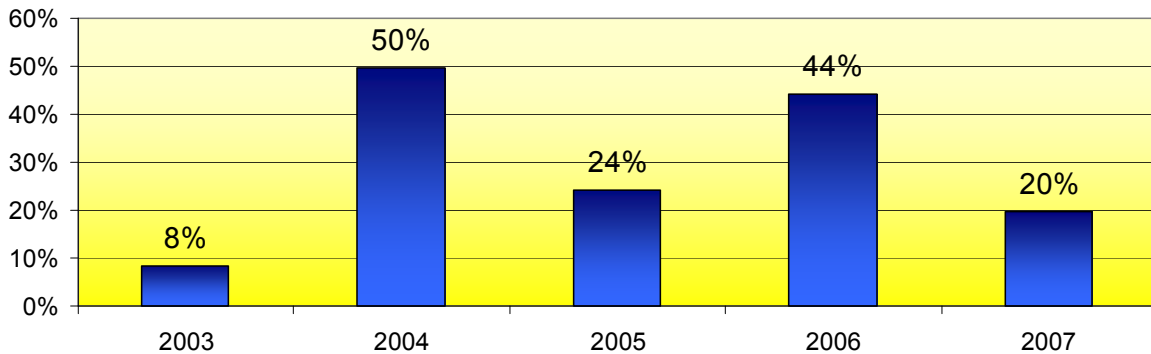
3.2 Industry Size and Growth

Table 2 contains industry sales figures for 2006 and 2007. While the total area of collector sales into the domestic market have been relatively flat in the 2005 to 2007 period (see Figure 7), the Canadian industry has still experienced healthy growth over the past two years. From 2005 to 2007:

- Total industry revenue has increased from \$8.39 to \$11.16 million (15% per year);
- Total collector sales by area increased from 76 to 91 thousand m² (10% per year);
- Revenue from domestic sales increased from \$6.97 to 7.28 million (2% per year);
- Revenue from export sales increased from \$1.41 to 3.99 million (68% per year).

Also of note is that sales of liquid evacuated and air glazed collectors in this survey period were both sufficiently large and diversified that they can be reported separately for the first time, without risking the confidentiality of individual respondents. Of particular interest is that, in 2007, domestic sales of liquid evacuated collectors exceeded that of liquid glazed collectors, in both area and revenue.

Figure 5: Annual revenue growth rates, common respondents



To some extent, it is more accurate to judge the growth rate of the industry by analyzing only those respondents who have replied to every survey since 2002. Restricting the analysis to this subset of common respondents yields the annual industry growth rates shown in Figure 5. Collectively, these common respondents represent over half the total industry revenue, and thus form a representative, consistent sample on which to judge industry growth.

Figure 6 shows the annual growth rates of collector sales, by each type of collector. The very large growth rates of air glazed and liquid evacuated collectors are due more to their newness in the market, than to large sales volumes.

Table 2: Solar collector sales by type, 2006 and 2007

Domestic Sales

Collector Type	Thermal Capacity (MW)		Collector Area (m ²)		Revenue (\$1,000's)	
	2006	2007	2006	2007	2006	2007
Air glazed	0.03	0.1	38	128	\$ 30	\$ 75
Air unglazed	16.4	11.9	23,441	17,056	\$ 2,139	\$ 1,907
Liquid evacuated	0.8	1.7	712	2,385	\$ 674	\$ 1,906
Liquid glazed	2.9	4.9	1,312	1,462	\$ 551	\$ 606
Liquid unglazed	25.4	27.9	36,292	39,879	\$ 3,402	\$ 2,783
Total	45	47	61,795	60,910	\$ 6,795	\$ 7,276

Export Sales

Collector Type	Thermal Capacity (MW)		Collector Area (m ²)		Revenue (\$1,000's)	
	2006	2007	2006	2007	2006	2007
Air glazed	0.09	0.3	646	1,280	\$ 561	\$ 671
Air unglazed	2.4	9.4	2,911	11,989	\$ 378	\$ 1,271
Liquid evacuated	0.0	0.8	64	228	\$ 51	\$ 143
Liquid glazed	0.0	0.0	1,791	3,781	\$ 451	\$ 404
Liquid unglazed	87.2	46.5	44,118	13,279	\$ 1,832	\$ 1,498
Total	90	57	49,530	30,557	\$ 3,271	\$ 3,988

Total Sales

Collector Type	Thermal Capacity (MW)		Collector Area (m ²)		Revenue (\$1,000's)	
	2006	2007	2006	2007	2006	2007
Air glazed	0.11	0.4	684	1,408	\$ 590	\$ 746
Air unglazed	18.8	21.3	26,352	29,045	\$ 2,517	\$ 3,178
Liquid evacuated	0.8	2.4	776	2,613	\$ 725	\$ 2,050
Liquid glazed	2.9	4.9	3,103	5,243	\$ 1,002	\$ 1,009
Liquid unglazed	112.6	74.4	80,410	53,158	\$ 5,233	\$ 4,281
Total	135	103	111,325	91,467	\$ 10,067	\$ 11,264

Figure 6: Annual domestic sales growth by collector type (m²)

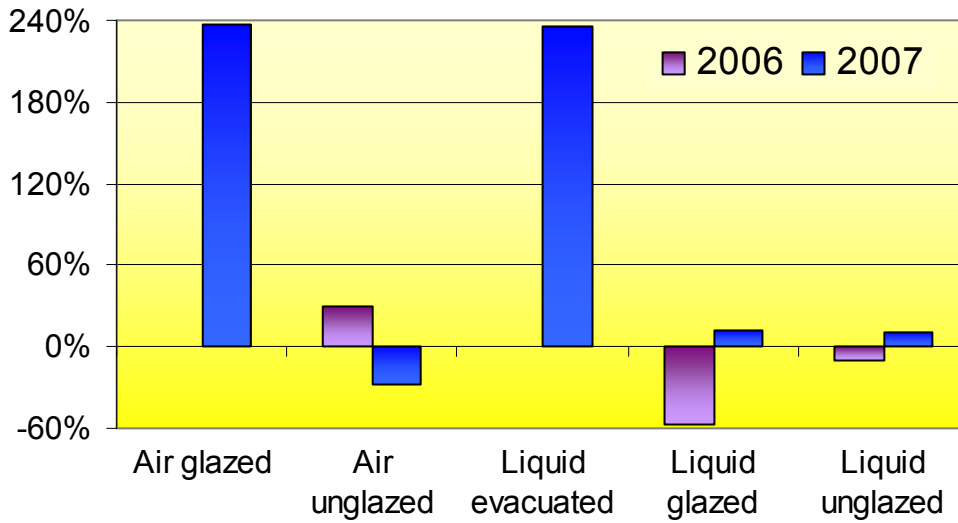
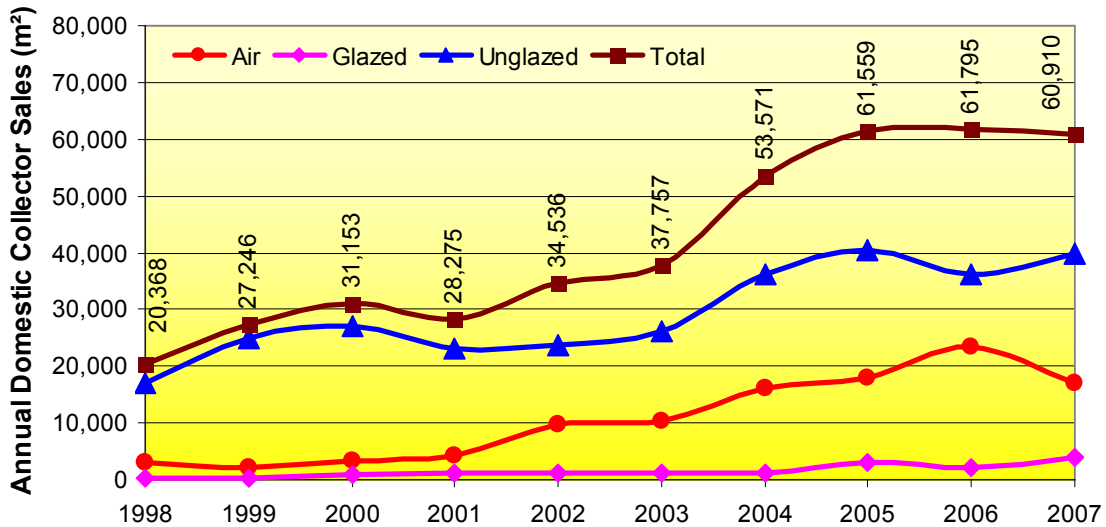


Figure 7: Ten-year history of domestic collector sales (m²)*



* For this figure, glazed and unglazed air collectors are combined as “air”, and liquid glazed and evacuated tube are combined as “glazed”.

3.3 Applications of Solar Thermal Technology

Respondents were asked to provide details of the types of systems where solar collectors were being employed. Table 3 provides the breakdown by sector and by application. Only major applications are listed; namely, those that were responsible for more than 5% of the reported revenue (in either 2006 or 2007), for that particular collector type.

The data shows that unglazed liquid collectors have a very clear market focus – residential swimming pool heating – while the air collector market is concentrated on ICI space heating. For glazed and evacuated tube collectors, over 80% of sales were for domestic water heating systems, in both residential and commercial buildings.

The only noteworthy trend revealed by this data is that air heating collectors are making increasing inroads into the residential market. In the preceding two-year period, only 8% of air collector revenue was earned from residential sales; this value has grown to 20% during the two-year period of the current survey.

Table 3: Major solar heating applications (by revenue), by sector and collector type

Revenue by Sector	Unglazed		Glazed/Evac.		Air	
	2006	2007	2006	2007	2006	2007
Residential	99%	99%	83%	70%	21%	20%
Industrial/Commercial/Institutional (ICI)	1%	1%	17%	30%	79%	80%

Revenue by Solar Heating Application	Unglazed		Glazed/Evac.		Air	
	2006	2007	2006	2007	2006	2007
Residential pool heating	99%	99%				
Residential domestic water heating			63%	58%		
Residential space heating			12%	7%	21%	20%
Residential combined space and water heating			8%	5%		
ICI domestic water heating			17%	30%		
ICI space heating					63%	70%
ICI combined/other					16%	10%

3.4 Geographic Distribution

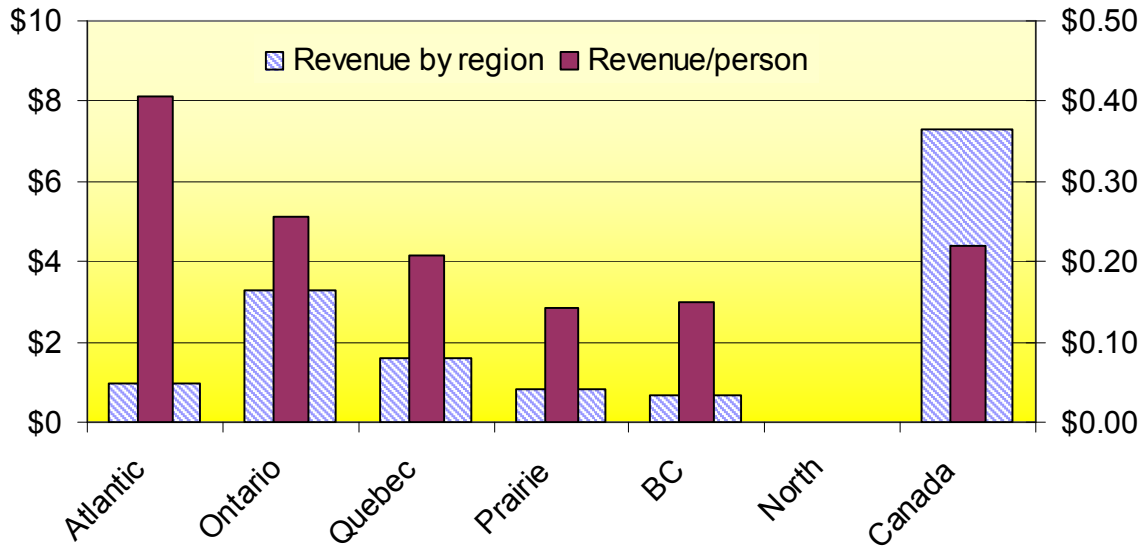
Table 4 shows the distribution of solar collector sales within Canada, by revenue. Figure 8 shows the same data, also expressed on a population basis. This data reveals substantial markets in all regions of Canada, except the north. Since no northern companies completed the survey, this should not be taken as conclusive evidence that there is no market in Canada's northern territories. It is also noteworthy that while there is a substantial market for solar collectors in Ontario, Ontario residents are near the national average on a *per capita* basis.

On average, each Canadian spent 22¢ on solar thermal collectors in 2007, equal to the 2005 amount. This is a clear indication that the solar thermal market in Canada is not yet well developed.

Table 4: Distribution of sales within Canada

	Region	Sales (\$1,000)	Sales (%)
2006	Atlantic	\$ 680	10%
	Ontario	\$ 2,718	40%
	Quebec	\$ 1,699	25%
	Prairies	\$ 1,087	16%
	BC	\$ 611	9%
	North	--	--
	Total	\$ 6,795	100%
2007	Atlantic	\$ 946	13%
	Ontario	\$ 3,274	45%
	Quebec	\$ 1,601	22%
	Prairies	\$ 800	11%
	BC	\$ 655	9%
	North	--	--
	Total	\$ 7,276	100%

Figure 8: 2007 solar collector sales, by population



3.4.1 Exports and Imports

Canadian exports of solar collectors have grown substantially over the past two years, reaching values of \$3.27 and 3.99 million in 2006 and 2007, respectively (from Table 2). This is a very substantial increase over the \$1.41 million reported in the 2005 survey. In 2007 the industry reported that 35% of its total revenue was earned from export sales, the highest fraction since these surveys began in 2002. As shown in Table 5, the majority of exports are to the United States, but the Canadian solar industry is actively developing markets in most regions of the world. Table 6 shows that the Canadian industry reported exports of all types of solar collectors, except liquid glazed collectors.

Table 5: Regional distribution of solar exports (by revenue)

Distribution of Solar Exports	2006	2007
United States	78%	91%
Central and South America	8%	5%
Europe	12%	3%
Asia	2%	1%
Africa	--	--
Australia	--	<1%
Total	100%	100%

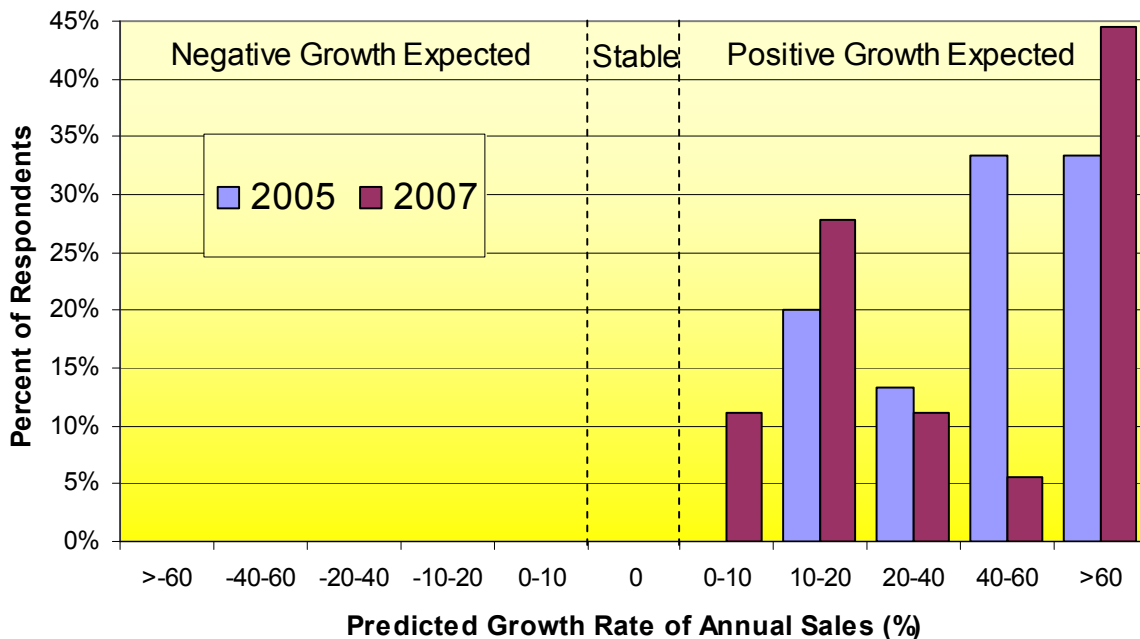
Table 6: Exports by collector type (by revenue)

Exports by Collector Type	2006	2007
Air, glazed	32%	23%
Air, unglazed	42%	58%
Liquid, evacuated tube	--	<1%
Liquid, glazed	--	--
Liquid, unglazed	25%	19%
Total	100%	100%

3.5 Anticipated Sales Growth

Optimism continues strong within the Canadian solar thermal industry, with all survey respondents expecting that their own business will increase in the near term. A comparison with the 2005 survey indicates that, while there has been little overall change in the expectations of growth, there has been some polarization in the industry, with almost 45% of respondents expecting annual growth rates above 60%, and 39% expecting growth between 0 and 20% per annum. Figure 9 shows the range of survey responses, indicating a strong expectation of growth over the next two years.

Figure 9: Anticipation of future sales growth in 2005 and 2007



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 an historical record of installed, operational solar collectors. This data – showing 544,000 m² of solar collectors operating in Canada at the end of 2007 – was used in calculating the amount of GHG's avoided due to the use of active solar thermal energy in Canada.

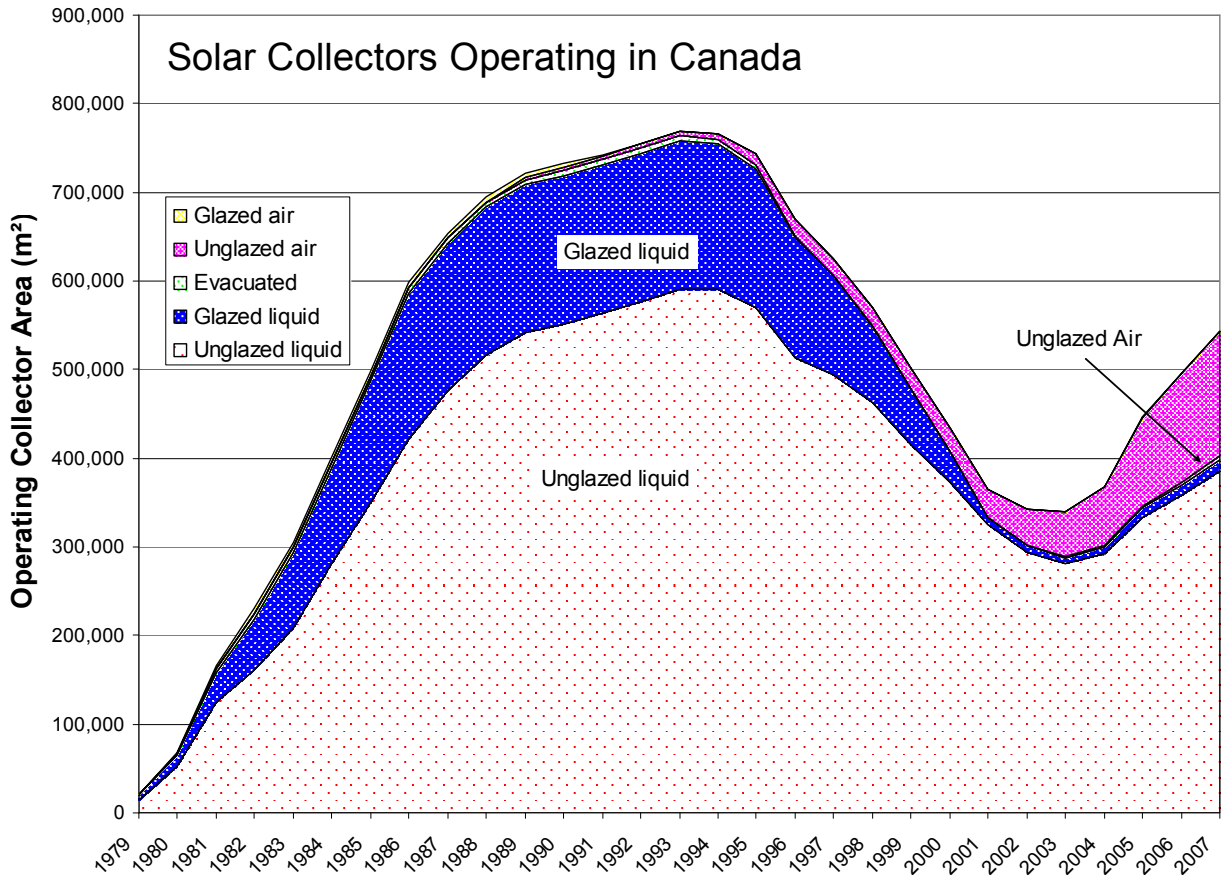


Figure 10: History of Operating Solar Collectors in Canada

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 m²) glazed solar collectors, 150 L/d hot water usage*, 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 m² 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 m² to 25 m², 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 m². 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 m² to 10,000 m². For a reference system we have selected 200 m², 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 7 shows the calculations used to estimate the GHG emissions avoided due to all solar thermal systems operating in Canada at the end of 2007.

* 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 DHW heating systems are a small segment of the Canadian market, the overall effect would be negligible.

Table 7: Analysis of avoided GHG emissions, using four reference systems, 2007

Parameter	Residential DHW	Commercial Water	Residential Pool	Commercial Air
Collector type	glazed	glazed	unglazed	unglazed air
Collector area (m ²)	6	50	25	200
Annual yield per system (GJ/a)	9.9	82.1	19.4	422
Specific annual yield (GJ/a-m ²)	1.65	1.64	0.78	2.11
<u>Displaced fuel mix (%)</u>				
• Oil (73 kg of CO ₂ /GJ)	4%	15%	1%	5%
• Natural gas (50 kg of CO ₂ /GJ)	50%	75%	63%	50%
• Propane (60 kg of CO ₂ /GJ)	--	5%	--	40%
• Electricity (151 kg of CO ₂ /GJ)	46%	5%	12%	5%
• Heat pump (38 kg of CO ₂ /GJ)	--	--	24%	--
• No fuel	--	--	--	--
Blended CO ₂ avoided (kg of CO ₂ /GJ)	97	59	59	60
Annual CO ₂ avoided (t/a-system)	0.96	4.84	1.14	25.3
Annual specific CO ₂ avoided (kg/a-m ²)	160	97	46	127
Estimated system life (years)	20	20	20	30
Total operating collector area (m ²)	13,017	4,949	384,809	140,889
Calculated number of systems	2,170	99	15,392	704
Total annual CO ₂ avoided (t/a)	2,083	479	17,547	17,822
Total annual CO ₂ avoided, all types (t/a)	37,932			

4.4 Forecast GHG Emission Avoidance from Collectors sold in 2006 and 2007

An alternative view of GHG emission avoidance - 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 60,910 m² of collectors installed in Canada during 2007, leads to the conclusion that 111,948 tonnes of CO₂ 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). The equivalent lifetime savings for 2006 installations would be 127,655 tonnes of CO₂ equivalent.

Since the solar industry earned just over seven million dollars in revenue from domestic sales in 2007, this means that one tonne of CO₂ is saved for every \$65 of revenue. Depending upon climatic conditions and displaced fuel data in the country of use, it is likely that the solar collectors exported from Canada during 2007 will be responsible for avoiding another 50,000 tonnes of CO₂ equivalent, during their operating life.

5 REFERENCES

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APPENDIX A – Survey Questionnaire