Making Solar Air Heating Mainstream

1. Introduction

The Canadian Solar Industries Association (CanSIA) is a national trade association representing the solar industry throughout Canada. Our mission is to develop a strong, efficient, ethical and professional Canadian solar industry that is able to provide innovative solar energy solutions and play a major role as the world transitions to a low carbon future.

The scope of this paper is to recommend a strategy that will animate the market for solar thermal air heating in Ontario and help affect the market transformation to “clean heating”. Solar air heating is a leading clean energy technology that has its commercial origins in Ontario. It offers a very compelling business case in terms of its potential to contribute to economic growth, clean energy production, cost effective GHG abatement, as well as export potential around the world.

To ensure significant immediate uptake, CanSIA recommends establishing a prescriptive program for solar air heating (and could be combined with solar water heating) systems to drive uptake in the retrofit market for commercial, industrial, institutional, multi-residential, and agricultural buildings. This would take the form of an up-front capital incentive to establish market clarity and spur immediate interest again in solar heating. This paper details our proposal for a 5-year program in-line with the implementation schedule for the first Climate Change Action Plan (CCAP) with a total budget of $135-185 million.

A solar heating program model previously existed in the province in the form of the very successful Ontario Solar Thermal Heating Incentive (OSTHI) Program and a similar structure could be easily re-implemented under the CCAP. This program operated from 2007-2010 and led to Ontario becoming the solar thermal capital of Canada, with close to 1,000 large solar heating systems installed on a wide variety of buildings. Ontario has a very strong base in solar air heating because of the origins of the SolarWall® technology in the province (the original solar air heating invention that shaped the global industry). Overall solar heating is well established in Ontario, and will provide a strong contribution to bringing carbon-free heating into the mainstream and accomplishing the province’s GHG reduction targets.

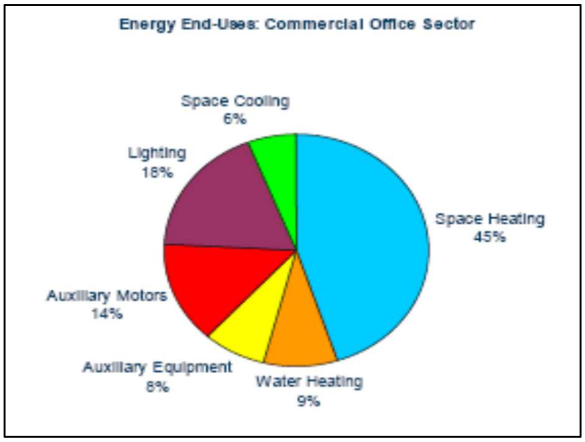
2. The Need for Clean Heating

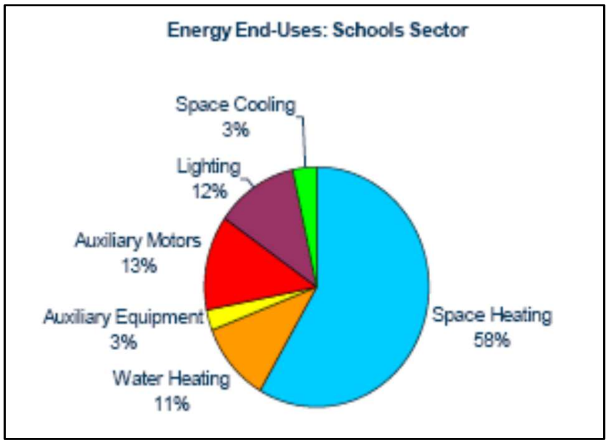
The CCAP identified “decarbonizing heating” as a central goal. Given that the majority of heat-related GHG emissions today, and in the future, originate from the existing building stock, it is imperative to focus on retrofitting existing commercial, institutional and industrial buildings with non-emitting sources of heating. The path to mainstream “clean heating” is viable, and solar heating technologies will be an essential component to this strategy.

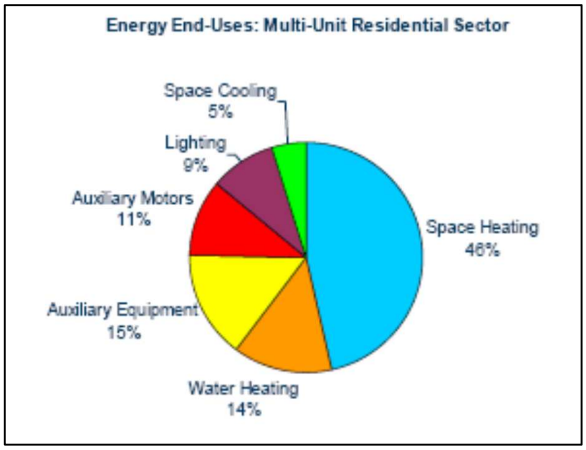
Making Solar Air Heating Mainstream

Solar air heating technologies address the largest usage of building energy in Ontario, which is indoor space and process heating. Heating typically represents over 50-60% of a building's energy load, and currently the majority of this energy is generated using fossil fuels (natural gas and propane).

Solar air heating technologies generate heat energy onsite and displace between 20-50% of a building's heating load, and corresponding GHG emissions. The figures below were developed by PricewaterhouseCoopers LLP for the City of Toronto, and clearly show the potential for meaningful use of solar air systems in Ontario, especially urban and suburban settings.







3. Solar Thermal Heating Technologies Overview

Solar thermal heating is typically ranked as the most cost-effective type of renewable energy technology because of its high energy production and low capital costs. The 2009 report by the C.D. Howe Institute entitled 'Going Green for Less: Cost Effective Alternative Energy Sources' also noted that solar thermal technologies provide the most cost-effective way to reduce greenhouse gas (GHG) emissions. As well, solar thermal systems provide on-site energy generation, so there are no transmission losses and the integration into the building is relatively straightforward. Solar thermal systems can be used to heat water or to heat air, as described below.

Solar Air Heating is an Ontario-success story, as it is currently the only renewable energy technology used around the world with its origins in Ontario. It is a mature technology that has been successfully applied in thousands of projects across Canada and the United States, with especially strong uptake in Ontario. There are about 5 million square feet of solar air heating systems in operation in North America alone, representing about 250 MW of thermal energy and 100,000 tonnes of GHG displacement each year.

Solar Air Heating technologies use sunlight primarily to heat large volumes of ventilation air or for space heating or process heat applications. It addresses the largest use of energy for buildings in Ontario, which is indoor heating. The technology also improves indoor air quality and improves animal health in agricultural applications. The systems are usually wall-mounted and are building integrated, which means they become part of the exterior façade. They are easily applied in retrofit applications over an existing wall, or in new construction systems would double as the exterior wall. Systems can range in size from 1,000ft^2 up to 50,000 ft^2, with most typical systems being between 2,000ft^2-6,000ft^2.

The Canadian solar air heating industry is the world leader, with Ontario having a large percentage of the world's most innovative building-integrated solar air heating projects, in applications such as factories, multi-residential housing, water treatment plants, schools, hospitals, commercial buildings, vehicle maintenance garages, airports, poultry barns, universities and recreation facilities. Systems offset the daytime heating load, which is when most commercial and industrial buildings are occupied.

Solar Water heating involves heating water with sunlight that is then used for domestic hot water or commercial applications, such as universities, hospitals, community centres or pools. Solar water heating for commercial and industrial applications was supported by the Ontario Solar Thermal Heating Incentive (OSTHI) Program and projects in Ontario from 2007-2010 received an incentive of about \$50/ft^2. This report does not contain specific data on solar water heating, but CanSIA supports the idea of a general solar heating program similar to OSTHI, which would include both heating technologies.

4. OSTHI Program 2007-2010; the Creation of a World-Class Industry in Ontario

In Canada and Ontario, solar air heating is the most widely used solar thermal technology in the commercial, industrial, and agricultural sectors as a result of its cost-benefit metrics and widespread applicability.

Ontario has a clear success story in solar thermal policy; the Ontario Solar Thermal Heating Incentive Program (OSTHI) ran from 2007-2010 and supported close to 1,000 solar air and solar water heating technologies in the commercial, industrial and agricultural sector.

The program was prescriptive and had a straightforward structure detailed below:

1. Incentive were paid up-front to the end user on a per square foot (or per square metre) basis for eligible solar collectors.

2. ALL commercial, industrial, institutional, and agricultural buildings were eligible, in either retrofit or new build.

3. The required application forms are included here as Appendix B, and could be used as a model for a new program.

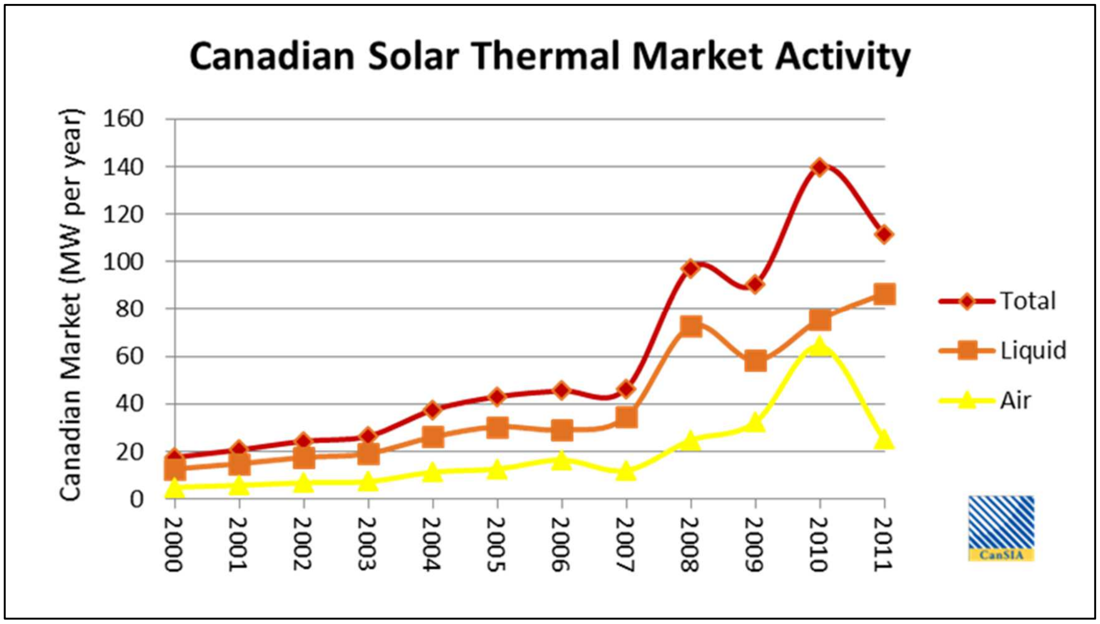
4. A RETScreen® or a SWIFT (Solar Wall International Feasibility Tool) analysis had to be submitted along with the application which would detail the size of the proposed project, the energy performance, and the GHG reductions. (Note: RETScreen® and SWIFT are programs developed by Natural Resources Canada (NRCan) that are based on monitored data)

5. The end user would receive an acceptance letter from the program, and then they had a certain period of time in which to complete the project.

6. Close out documents included a certification from the end user that the system had been installed and all associated costs had been paid. A commissioning report had to be completed by a P.Eng. verifying the installation and showing the square footage of the project in order to calculate the final incentive that would be paid to the end user.

The program functioned extremely well; it was straightforward and easy to administer, and it was successful in creating significant project uptake. (And it has been cited as a model by the US Solar Energy Industries Association in discussion with several States on Solar Thermal Programs)

The results from the OSTHI Program are clear and illustrative; the solar heating market developed significant momentum and capacity from 2007 to 2010 due to this program. Solar air heating deployment in Canada peaked in 2010 at over 60MW, of which over 40MW was in Ontario. The industry capacity went from around 10 MW in 2007, to over 20 MW in 2008, to close to 40 MW in 2009, and then over 60 MW the peak year of 2010. The growth was the result of the OSTHI Program, and when the program ceased to exist in 2011, the industry capacity declined immediately and has remained at a much lower level.



4.1 Other Considerations

Government Objectives	Relevance of Solar Air Heating
Performance	50-60 peak thermal watts/ft^2; or 1.5 - 3.5 GJ/m^2 per year Heats air up to 55° C above ambient for daytime heating Solar energy conversion up to 80% No maintenance and 30+ year lifespan Recaptures building wall heat losses Increases effective insulation value up to R 50 Reduces cost of increased ventilation
Clean Heating	Systems offset 20-50% of conventional heating demand Clean heat energy is generated on-site, thereby reducing reliance on natural gas pipelines / electrical grid

	Reduce use of natural gas, heating oil & propane
GHG Reduction	Targets large percentage of fossil-based energy required for conventional heating Offsets ~1 ton of CO2 for every 50-70ft^2 of collector per year, or 30 tons of CO2 for every 50-70ft^2 over the system's lifespan.
Job Creation	Local industry for solar air heating in Ontario means that majority of solar air heating systems installed here are made-in-Ontario from components that are also sourced in Ontario, thereby creating local employment. Systems are site-built and create local employment in a cross section of industries including engineering, metal fabrication, contracting, installation, sales, components, marketing and distribution
Applicability to Building Stock	Suitable for all types of commercial, industrial, government, multi-residential, military & agricultural buildings Easily integrated in retrofit applications Systems are often specified to remediate older buildings, especially multi-residential buildings Systems are typically wall-mount, but can also be applied to the roof. In new construction solar air heating systems double as the exterior façade

5. Recommendations

For solar air heating to become commercially viable again in Ontario for retrofit applications, a payback of approximately 5 years is required. This means that the following incentive is required to achieve an average payback range of between 5-10 years in different system applications. CanSIA recommends that all commercial and industrial building types be eligible for funding, as that is the most efficient way to scale a market. Restricting building types would thwart the ability of the industry to expand the quantity of viable applications. The table below represents average values for required incentive level, avoided GHGs and the cost per avoided tonne of GHGs for an average building.

Average Total Installed Cost per square foot (ft^2) in Ontario	**Required Incentive per square foot (ft^2)**	**Average GHG Displacement for Solar Air Collectors Tonnes / ft^2 / year**	**Cost per Tonne of GHG Avoided**
Current Range: \$50-60/ft^2	\$26/ft^2	1 tonne / 50-70 ft^2 / year	\$50

*Assume we can drive some immediate economics of scale with a program in place, we are targeting average installed cost of **\$52/ft2.**

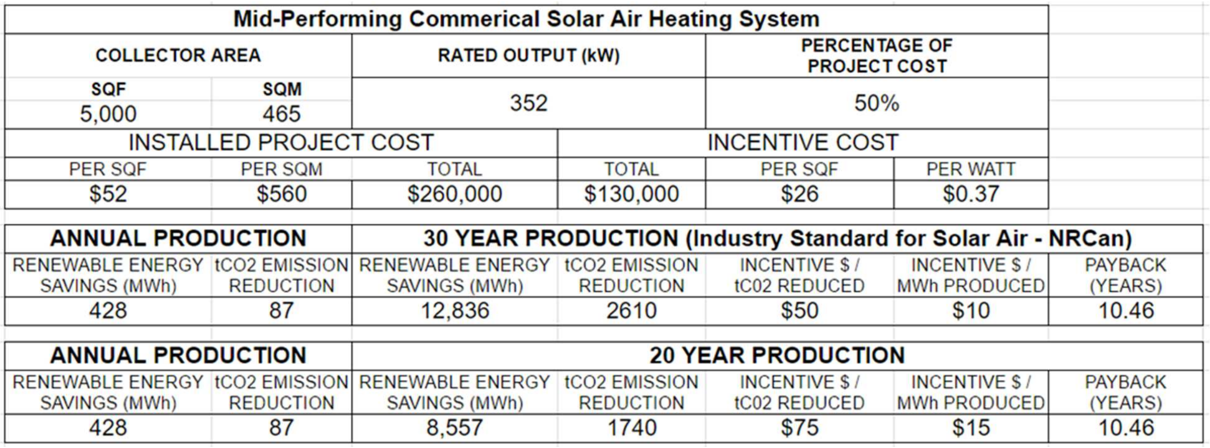
*CanSIA assumes this cost will decline roughly 20% to around \$41/ft^2 in 5 years.

Below are four RETScreen® summaries of typical solar air heating projects in Ontario. These values and the more detailed tables below show more specific examples of building types and the expected paybacks periods, avoided GHGs, and cost per avoided tonne of GHGs for those building types. The incentive level of \$26/ft^2 has been maintained for all building types.

1. Mid-Performing Commercial - Payback 10.46 Years
2. High-Performing Commercial - Payback 8.11 Years
3. Mid-Performing Industrial - Payback 6.49 Years
4. High-Performing Industrial - Payback 5.02 Years

This illustrates the range of energy production, costs, GHG savings, and the payback metrics assuming the incentive of \$26/ft^2.

Making Solar Air Heating Mainstream

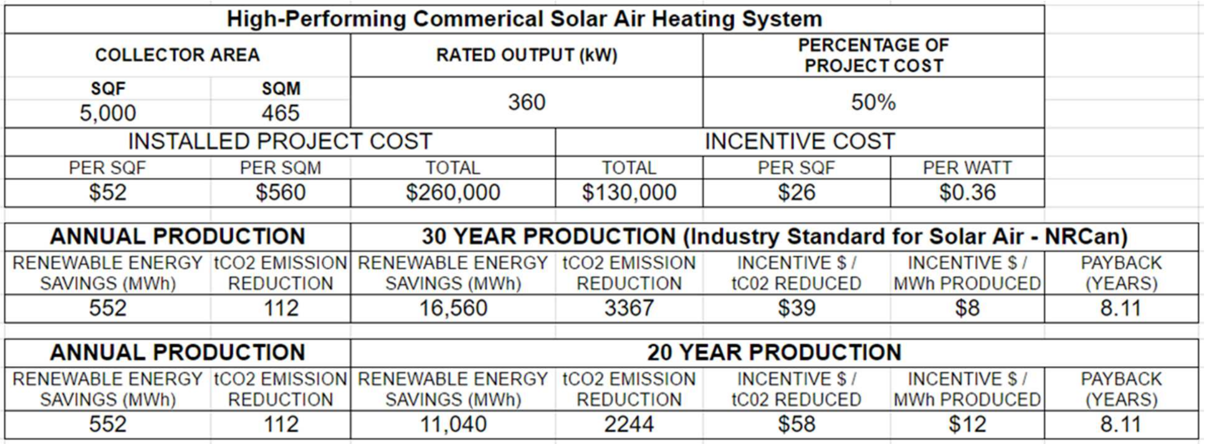


Mid-Performing Commerical Solar Air Heating System			
COLLECTOR AREA		RATED OUTPUT (kW)	PERCENTAGE OF PROJECT COST
SQF	SQM		
5,000	465	352	50%

INSTALLED PROJECT COST			INCENTIVE COST		
PER SQF	PER SQM	TOTAL	TOTAL	PER SQF	PER WATT
$52	$560	$260,000	$130,000	$26	$0.37

ANNUAL PRODUCTION		30 YEAR PRODUCTION (Industry Standard for Solar Air - NRCan)				
RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	INCENTIVE $ / tC02 REDUCED	INCENTIVE $ / MWh PRODUCED	PAYBACK (YEARS)
428	87	12,836	2610	$50	$10	10.46

ANNUAL PRODUCTION		20 YEAR PRODUCTION				
RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	INCENTIVE $ / tC02 REDUCED	INCENTIVE $ / MWh PRODUCED	PAYBACK (YEARS)
428	87	8,557	1740	$75	$15	10.46



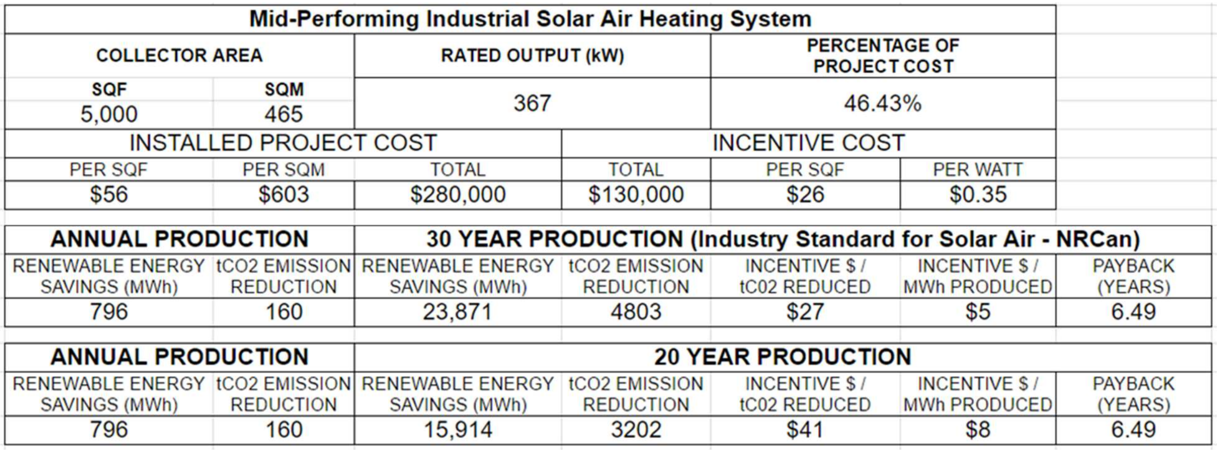
High-Performing Commerical Solar Air Heating System			
COLLECTOR AREA		RATED OUTPUT (kW)	PERCENTAGE OF PROJECT COST
SQF	SQM		
5,000	465	360	50%

INSTALLED PROJECT COST			INCENTIVE COST		
PER SQF	PER SQM	TOTAL	TOTAL	PER SQF	PER WATT
$52	$560	$260,000	$130,000	$26	$0.36

ANNUAL PRODUCTION		30 YEAR PRODUCTION (Industry Standard for Solar Air - NRCan)				
RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	INCENTIVE $ / tC02 REDUCED	INCENTIVE $ / MWh PRODUCED	PAYBACK (YEARS)
552	112	16,560	3367	$39	$8	8.11

ANNUAL PRODUCTION		20 YEAR PRODUCTION				
RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	INCENTIVE $ / tC02 REDUCED	INCENTIVE $ / MWh PRODUCED	PAYBACK (YEARS)
552	112	11,040	2244	$58	$12	8.11

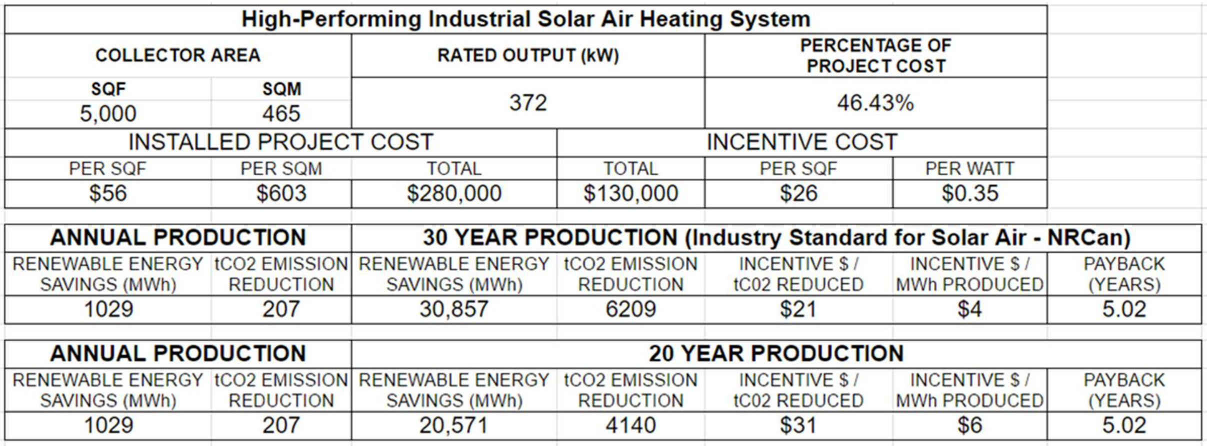
Making Solar Air Heating Mainstream



Mid-Performing Industrial Solar Air Heating System					
COLLECTOR AREA		RATED OUTPUT (kW)		PERCENTAGE OF PROJECT COST	
SQF	SQM	367		46.43%	
5,000	465				
INSTALLED PROJECT COST			INCENTIVE COST		
PER SQF	PER SQM	TOTAL	TOTAL	PER SQF	PER WATT
$56	$603	$280,000	$130,000	$26	$0.35

ANNUAL PRODUCTION		30 YEAR PRODUCTION (Industry Standard for Solar Air - NRCan)				
RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	INCENTIVE $ / tC02 REDUCED	INCENTIVE $ / MWh PRODUCED	PAYBACK (YEARS)
796	160	23,871	4803	$27	$5	6.49

ANNUAL PRODUCTION		20 YEAR PRODUCTION				
RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	INCENTIVE $ / tC02 REDUCED	INCENTIVE $ / MWh PRODUCED	PAYBACK (YEARS)
796	160	15,914	3202	$41	$8	6.49



High-Performing Industrial Solar Air Heating System					
COLLECTOR AREA		RATED OUTPUT (kW)		PERCENTAGE OF PROJECT COST	
SQF	SQM	372		46.43%	
5,000	465				
INSTALLED PROJECT COST			INCENTIVE COST		
PER SQF	PER SQM	TOTAL	TOTAL	PER SQF	PER WATT
$56	$603	$280,000	$130,000	$26	$0.35

ANNUAL PRODUCTION		30 YEAR PRODUCTION (Industry Standard for Solar Air - NRCan)				
RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	INCENTIVE $ / tC02 REDUCED	INCENTIVE $ / MWh PRODUCED	PAYBACK (YEARS)
1029	207	30,857	6209	$21	$4	5.02

ANNUAL PRODUCTION		20 YEAR PRODUCTION				
RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	RENEWABLE ENERGY SAVINGS (MWh)	tCO2 EMISSION REDUCTION	INCENTIVE $ / tC02 REDUCED	INCENTIVE $ / MWh PRODUCED	PAYBACK (YEARS)
1029	207	20,571	4140	$31	$6	5.02

Solar air heating offers a very compelling case in terms of its potential to help Ontario achieve cost-effective displacement of GHG emissions, with an average cost around $50/tonne assuming the government investment of $26/ft^2 of collector area. As can be seen in the tables above, the type of building, the volume of air that requires heating, and the number of time that air is cycled through the building via ventilation systems affects the payback term at an incentive level of $26/ft^2. CanSIA does not recommend limiting the types of building that could take advantage of the solar air heating incentive, however. Allowing all building types to access the incentive allows the market to determine the best applications for solar thermal systems. At first, deployment will likely be focused on high-performing commercial and industrial buildings, as well as applications within the agricultural sector and multi-tenant residential. As costs decline through the mechanisms outlined later in this paper, other building types will deploy the technology with greater frequency.

6. Deployment Potential and Impacts

6.1 $185 Million 5 Year Program: Solar Air Heating & Solar Water Heating

With support mechanisms reinstated for solar air heating, it is reasonable to assume similar rates of growth that were experienced during 2007-2010 with the OSTHI Program in place. Potential deployment scenarios over 5 years are detailed below. We assume declining incentives in Years 3-5. Uptake assumptions, associated incentive payments, and associated avoided GHGs are summarized in the table below.

	Solar Air Capacity Potential each Year (MW)	**Installed Square Footage of Solar Air Collectors each Year (ft^2)**	**Solar Air Total Incentive Investment @ $26/$ft^2$ ($ Million)**	**Solar Air GHG Offset Estimates (tonnes) Per Year***[1]
Year 1	20 MW	400,000	$10.4 M	5,700 - 8,000
Year 2	40 MW	800,000	$20.8 M	11,428 - 16,000
Year 3[2]	60 MW	1,200,000	$28.8 M	17,142 - 24,000
Year 4[3]	80 MW	1,600,000	$35.2 M	22,800 – 32,000
Year 5[4]	100 MW	2,000,000	$40 M	28,570 – 40,000
Total Solar Air Heating	**300 MW**	**6,000,000 ft^2**	**$135 M**	**~85,000-120,000**
5 Year Program Total			**$185 M**	

*The 5 year program total has been increased by $50 million to account for an associated solar water heating incentive in commercial applications, as was available under the OSTHI Program previously.

It is important to also note that the air heating deployment summarized in the table above is expected to avoid approximately 2.5 – 3.6 megatonnes of GHGs over the life of the systems.

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[1] * Assuming average offset of 1 tonne of CO_2/ 50-70ft^2 of solar collector area

[2] Assume incentive could be declined to $24/ft2 in Year 3

[3] Assume incentive could be declined to $22/ft2 in Year 4

[4] Assume incentive could be declined to $20/ft2 in Year 5

7. The Pathway to Mainstream Solar Heating After 2021

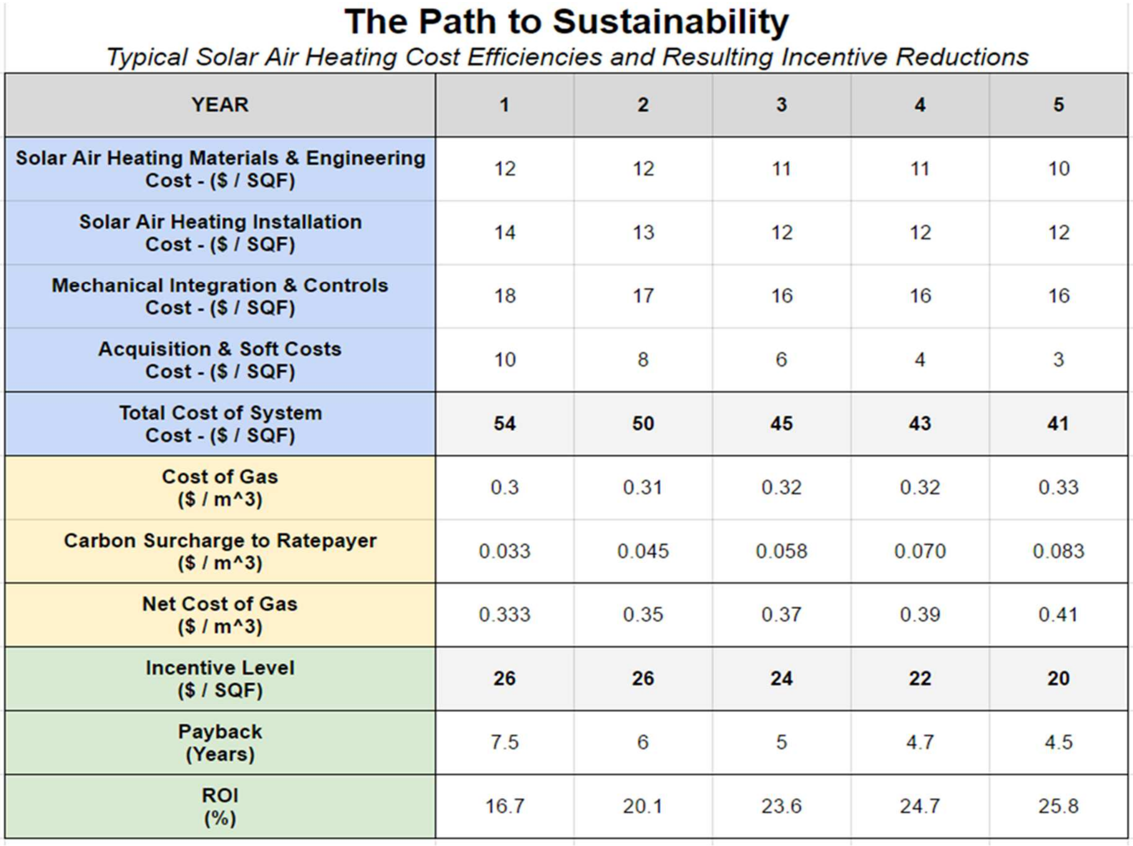
CanSIA expects that by the end of this programming, the market conditions will be such that the industry can begin to be self-sustaining with average paybacks approaching 5 years in retrofit applications. Below are some key consideration for 2022 and beyond.

7.1 For New Construction

The Ontario Building Code will need to specify a certain percentage of on-site renewable energy generation. This will mean that clean energy systems will become required on all new buildings and therefore no external financial support would be needed.

Also the costs to integrate any of the solar technologies into new buildings are significantly less than in retrofit, so solar will become an automatic solution to the new codes. The building envelope will become an energy generator; with solar air heating on walls producing heat energy, and solar PV and solar water heating on roofs generating electricity and hot water.

7.2 For the Existing Building Stock



The Path to Sustainability

Typical Solar Air Heating Cost Efficiencies and Resulting Incentive Reductions

YEAR	1	2	3	4	5
Solar Air Heating Materials & Engineering Cost - ($ / SQF)	12	12	11	11	10
Solar Air Heating Installation Cost - ($ / SQF)	14	13	12	12	12
Mechanical Integration & Controls Cost - ($ / SQF)	18	17	16	16	16
Acquisition & Soft Costs Cost - ($ / SQF)	10	8	6	4	3
Total Cost of System Cost - ($ / SQF)	**54**	**50**	**45**	**43**	**41**
Cost of Gas ($ / m^3)	0.3	0.31	0.32	0.32	0.33
Carbon Surcharge to Ratepayer ($ / m^3)	0.033	0.045	0.058	0.070	0.083
Net Cost of Gas ($ / m^3)	0.333	0.35	0.37	0.39	0.41
Incentive Level ($ / SQF)	**26**	**26**	**24**	**22**	**20**
Payback (Years)	7.5	6	5	4.7	4.5
ROI (%)	16.7	20.1	23.6	24.7	25.8

The table above takes the average payback numbers of all 4 system types previously discussed, which is 7.5 years, and then shows the decline in the payback years based on the increasing costs of gas and the decreasing total system cost.

The objective is for the solar air heating industry to scale in a meaningful way under this program in the next 5 years so that market factors such as economies of scale, market awareness, carbon pricing and third party financing can coalesce to create the circumstances under which continued government support will not be required after 2022. The path to self-sufficiency is to be able to achieve average paybacks of under 5 years.

7.3 Declining Costs

Most solar air heating systems are made of steel, and therefore follow the world commodity price. With the market scaling contemplated here, mitigation against future price increases in steel will be possible and some economies of scale will be achieved.

Solar heating deployment will also lead to labor efficiencies; the industry knows that installation costs decline once installers have acquired familiarity with systems. This occurs when a market starts to scale, and examples of this exist within the US Military market for solar air heating.

7.4 Increased Market Awareness

Consumers and investors will be familiar with solar heating as the technology starts to enter the mainstream (similar to solar PV). Building owners, engineers and architects upgrading their existing energy system or in any new-builds will be aware of benefits of solar heating. This will significantly decrease soft costs associated with selling systems, as is detailed above.

7.5 Third Party Financing

Widespread financial support from government agencies across the world encouraged third party investment models and economies of scale which created downward pressure on PV prices. With similar support for solar heating, these third party investment models would become financially viable. This will spur rapid growth and create newfound cost efficiencies in the solar heating market. When the payback period is around 5-6 years, it will start to attract third party financing. Increased exposure to solar air heating projects will decrease the risk profile of the investment and build investor confidence, ensuring a self-sustaining and animated marketplace to continue the growth.

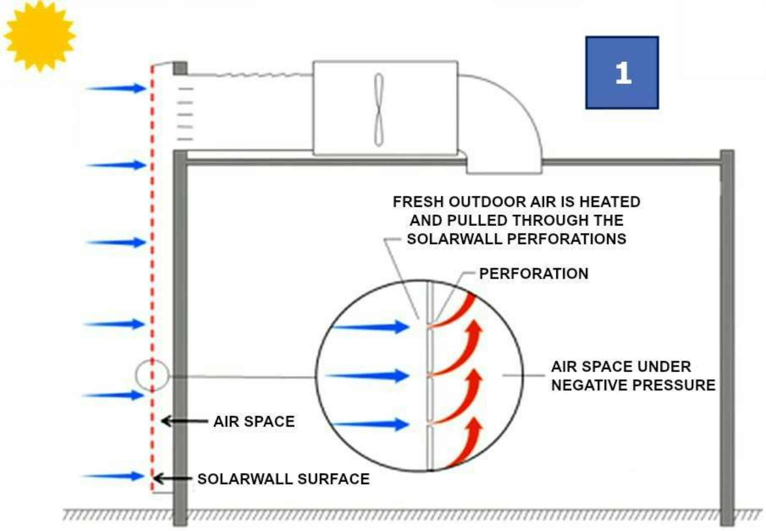
8. Conclusion and Summary of Recommendations

Solar air heating should feature prominently within the programs put in place by the CCAP. Solar air heating is a technology that can be deployed on commercial, industrial, agricultural, multi-residential and institutional buildings, making it an ideal solution for deployment on a wide range of building types identified as priorities within the CCAP.

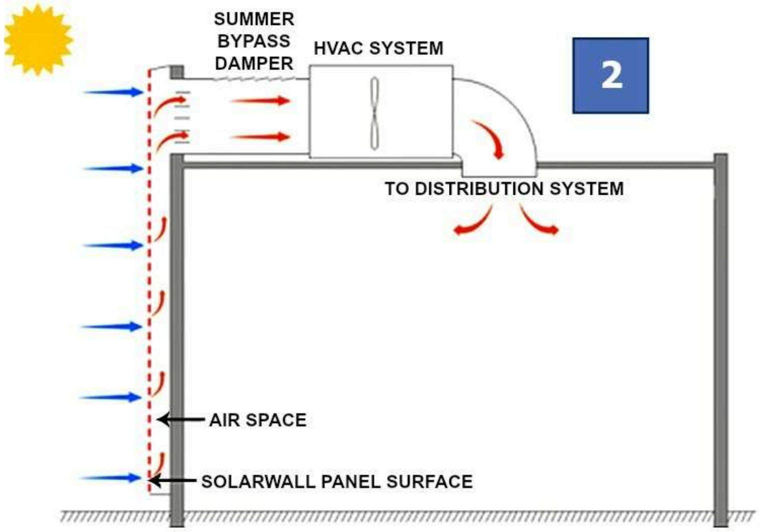
Making Solar Air Heating Mainstream

Ontario has a successful pedigree with solar thermal technologies through the OSTHI Program, which supported the construction of solar air and water thermal systems in Ontario between 2007 and 2010. A program with similar parameters could easily be re-introduced under the CCAP in order to affect significant market uptake of solar thermal technology. CanSIA recommends a solar thermal program be introduced via the CCAP which would set an incentive level of $\$26/ft^2$ in place for at least 5 years. With a total program budget of approximately $185 million CanSIA estimates that the CCAP could incent the installation of up to 6,000,000 square feet of solar thermal facilities offsetting between 85,000 – 120,000 tonnes of GHGs per year at an estimated cost of $50/avoided tonne. Investing in solar thermal heating through the CCAP will allow the market to scale in Ontario and drive costs down, which will reduce the need for an incentive over time.

Appendix A:
Solar Air Heating
How it Works



The solar air heating collector is installed on the exterior of the building. The metal system is heated by solar radiation from the sun. The building's ventilation fans create negative pressure in the air cavity behind the collector, drawing in the solar-heated fresh air through perforations in the panels.



The air entering into the building is heated anywhere from 16-55°C above ambient – depending on the solar radiation and time of day. This significantly reduces the building's daytime heating load. The solar heated fresh air is ducted into the building via a connection to an HVAC intake or fans and is distributed throughout the building via the conventional distribution system.

Solar Air Heating was honored in 2014 as being one of **the *9 best energy inventions of the past two centuries by American Society of Mechanical Engineers (ASME)***.

It was considered to be the breakthrough invention that created the global industry over the past 20+ years. It remains the only building-integrated clean energy technology – now used in thousands of commercial, industrial and agricultural applications around the world – that effectively addresses the huge amount of energy used for space and process heating.

United States Department of Energy

Rated in the top two percent of energy related inventions.

Natural Resources Canada

“The simplest, most efficient and least expensive way to preheat outside air for industrial and commercial applications.”

Windsor Housing Authority

“This system works! We are saving money because the gas heaters haven’t been on.”

Plant Management & Engineering Magazine

“Solar success story. The long time dream of economically harvesting the sun’s power as a reliable heating source for structures has risen to the high noon of practical reality.”

Examples of companies using Solar Air Heating:

FedEx
U.S.ARMY
Walmart
SHISEIDO
NASA
BOMBARDIER
Ford
TOYOTA
3M

Appendix B:

Ontario

ONTARIO SOLAR THERMAL HEATING INCENTIVE (OSTHI)

Consent and Release Form

Name of Applicant Organization: ____

Mailing Address: ____

____

____

Contact Person: ____

Telephone Number: (________) _______________________________________

Facsimile Number: (________) _______________________________________

Email Address: ____

By signing this Consent and Release Form, the Applicant:

1. Confirms to the Ministry of Energy (Ontario) that the Applicant is an ICI Entity situated in Ontario and the truthfulness and accuracy of information included in its application;
2. Agrees that if selected to receive an incentive under OSTHI, shall have the equipment that is funded through OSTHI be installed in its facilities located in Ontario;
3. Authorizes NRCan and consents to NRCan sharing with the Ministry of Energy (Ontario):
   - **a.** any and all of the information submitted in its application;
   - **b.** if selected to be a Recipient, any information that is provided to NRCan as required by the Contribution Agreement between NRCan and the Recipient; and
   - **c.** information and material of the Applicant (or later the Recipient, if applicable) and its project for solar heating equipment, that is created, developed or received by NRCan in the administration of ecoENERGY for Renewable Heat (collectively referred to as “the Applicant’s Information”);
4. Acknowledges that any of the Applicant’s Information in the custody or control of the Ministry of Energy (Ontario) may be required to be released in accordance with *The Freedom of Information and Protection of Privacy Act* (Ontario); and
5. In consideration of having its application received and considered by NRCan and the Ministry of Energy (Ontario) and other good and valid consideration, releases both Her Majesty the Queen in right of Canada and Her Majesty the Queen in right of Ontario, their respective Ministers, employees, appointees, agents and assigns from any liability, including costs arising out of the sharing of the Applicant’s Information between NRCan and the Ministry of Energy (Ontario).

Name of Authorized Person (please print) ____

Position of Authorized Person ____

Signature of Authorized Person ____________________________ Date __________________

dd / mm / yyyy

ecoENERGY for Renewable Heat

SOLAR AIR HEATING SYSTEM
APPLICATION FOR THE DEPLOYMENT INCENTIVE

Please print

IMPORTANT

1. Payment will be made only for expenses incurred after the signing of a contribution agreement, with the exception of expenses for feasibility, permits, design and simulations, which may be incurred in advance of the signing of a contribution agreement.

2. Missing information will delay the processing of your application.

SECTION 1 – APPLICANT INFORMATION - owner of installed system and intended recipient of NRCan funding.

☐ Mr. ☐ Mrs. ☐ Ms.		
First Name:	Last Name:	
Title:	Preferred Language: ☐ English ☐ French	
Business/Institution Name:		
Mailing Address:		
City:	Province/Territory:	Postal Code:
E-mail Address:	Telephone: ( )	Cellphone: ( )
Fax: ( )	GST No.:	Corporate Registration No.:

For technical information about the solar system, who should Natural Resources Canada contact?

☐ Applicant ☐ Project Manager ☐ Supplier ☐ Installer ☐ Designer/Engineer

For information about the project status, who should Natural Resources Canada contact?

☐ Applicant ☐ Project Manager ☐ Supplier ☐ Installer ☐ Designer/Engineer

SECTION 2 – PROJECT MANAGER (if different from Applicant)

First Name:	Last Name:	
Title:	Preferred Language: ☐ English ☐ French	
Business/Institution Name:		
Mailing Address:		
City:	Province/Territory:	Postal Code:
E-mail Address:	Telephone: ( )	Cellphone: ( )
Fax: ( )		

SECTION 3 – ENERGY END-USER - complete this section ONLY if the Applicant is an Energy Service Company (ESCO)

First Name:	Last Name:	
Title:		
Business Name:		
Mailing Address:		
City:	Province/Territory:	Postal Code:
E-mail Address:	Telephone: ( ) Cellphone: ( )	Fax: ( )

Select as many of the following options as apply regarding the nature of the ESCO arrangement:
☐ the ESCO will sell only solar energy to the end user
☐ the energy end-user will lease-to-own the solar equipment
☐ another ESCO arrangement is in place: please specify

A copy of the ESCO contract is attached to this application (required if an ESCO arrangement is in place)

SECTION 4 – SYSTEM SUPPLIER

First Name:	Last Name:	
Business Name:		
Mailing Address:		
City:	Province/Territory:	Postal Code:
E-mail Address:	Telephone: ( ) Cellphone: ( )	Fax: ( )

SECTION 5 – SYSTEM INSTALLER (if different from System Supplier)

First Name:	Last Name:	
Business Name:		
Mailing Address:		
City:	Province/Territory:	Postal Code:
E-mail Address:	Telephone: ( ) Cellphone: ( )	Fax: ( )

SECTION 6 – SYSTEM DESIGNER (if different from System Supplier)

First Name:	Last Name:	
Business Name:		
Mailing Address:		
City:	Province/Territory:	Postal Code:
E-mail Address:	Telephone: ( ) Cellphone: ( )	Fax: ( )

SECTION 7 – PROJECT LOCATION

1. Project Location (if address is different than Applicant):

Business/Institution Name:

Street Address:

City:

Province/Territory:

Postal Code:

2. Is the building owned by the Applicant (i.e. Project Location)? ☐ Yes ☐ No If not, describe the relationship of the Applicant to the building owner (Project Location). Please attach proof of permission to proceed on a building not owned by the Applicant.

3. Nature of business/institution (e.g. farming, manufacturing, etc.). Please specify.

4. Purpose of the building: Must select one

☐ Farm building; ☐ Motel; ☐ Hotel; ☐ Bed and breakfast; ☐ Office building; ☐ Educational facility; ☐ Manufacturing plant;
☐ Retail outlet; ☐ Recreational facility; ☐ Warehouse / storage facility; ☐ Condominium corporation; ☐ Apartment building;
☐ Hospital; ☐ Seniors' home; ☐ Garage; ☐ Laboratory;
☐ Other (please describe):

Building footprint (area): _____________m^2 x Building height: _____________m = Building volume: _____________m^3

5. Describe any shading that may affect sun exposure to the solar collectors at any time of year (e.g. adjacent buildings, tall trees).

6. Does the Project Location have access to either the North American natural gas pipeline network or an electrical power grid?
☐ Yes ☐ No

SECTION 8 – SOLAR SYSTEM – GENERAL

Is the solar system part of a larger project? ☐ Yes ☐ No

Is the solar system a: ☐ New installation ☐ Retrofit ☐ Expansion

What is the commissioning date of the solar system only (i.e. when put into service)? Month _________ Day _____ Year ________

Will the solar system benefit from any other government funding program (municipal, provincial/territorial, federal)?

☐ Yes ☐ No If yes, what is the estimated funding amount? $____________

Please provide details on any other funding program involved.

Does the solar system include any used and/or recycled components? ☐ Yes ☐ No

If yes, list the used and/or recycled components.

Percentage use of the solar system:

____% direct space heating

____% make-up air heating

____% ventilation air heating

____ % destratification

____ % industrial process heat

____ % other – please specify: ____

The above must total 100%.

SECTION 9 – SOLAR SYSTEM – ENVIRONMENTAL ASSESSMENT

1. Select as many of the following options that apply:

- ☐ increase the footprint or height of the building by more than 10%
- ☐ increase the footprint of the building by 25 m² or more
- ☐ involve any construction within 30 m of a body of water
- ☐ involve the likely release of a polluting substance into a body of water

If you have checked any of the above, an environmental assessment will be required. (See *Terms and Conditions*)

SECTION 9A – SOLAR SYSTEM – TECHNICAL

<u>Energy Load</u>

Estimated annual heating load to which the qualifying solar system will contribute: _______ (GJ/year)

Expected contribution of the solar system: _______(%)

If load is not known, what is the annual energy cost? ___________ ($/year)

<u>Estimated Annual Savings</u>

Solar system energy output: ____________ (GJ/year)

Auxiliary heating system annual efficiency: ____________(%)

Displaced energy: ___________ (GJ/year) = *[energy output] ÷ [auxiliary heating system annual efficiency*]

Type(s) of fuel being displaced (e.g. light fuel oil, propane, gas): _________________

Current unit cost of fuel(s) being displaced: _____________ ($/GJ)

Displaced energy savings: ______________ ($/year) = [*displaced energy x unit cost*]

Collector

Individual collector gross dimensions:

Length: __________ (m) x Width: _________ (m) = Gross area:_____________ (m^2)

Number of collectors: _________

Total collector gross area: __________(m^2)

Collector manufacturer: ____________________________________ Model: ______________________________

Collector Type: Must select one ☐ Unglazed transpired ☐ Unglazed back-pass ☐ Glazed

Collector slope: ___________ (degrees from horizontal)

Collector azimuth (orientation): ___________________ (degrees east or west of south)

Total collector design flow rate: ______________________ (litres/second)

Heading Load

What is the minimum supply air temperature? _____________ (°C)

What is the maximum useful air temperature? _____________ (°C)

Is there a bypass damper? ☐ Yes ☐ No

If yes, quote the bypass temperature: ______________(°C)

Operating Schedule of System

Detail the specific daily hours of operation of solar system over an average week.

What is the annual operation? First month: ________________________ Last month: ________________________

Mandatory Requirements:

- Attach a sketch of the solar system including the dimensions of the collector layout and the interface with the auxiliary and distribution systems.
- Attach a simulation output from one of the computer programs below showing expected performance, input assumptions, geographical location used, etc.

Link for SWIFT - http://www.canren.gc.ca/prod_serv/index.asp?CaId=98&PgId=564#a_solar_products

Link for RETScreen http://www.retscreen.net/

Link for TRNSYS - http://sel.me.wisc.edu/trnsys/

SECTION 10 – COST BREAKDOWN (excluding GST & PST)

Costs indicated here will be considered as final.

Solar Air Heating System Components (do not include used equipment)	**Cost** (excluding GST & PST)
Collectors	
Collector rack and/or support components	
Ducting from collector to interface with auxiliary heater	
Insulation on eligible ducting (i.e. ducting from collector to interface with auxiliary heater)	
Dampers	
Collector fan(s)	
Photovoltaic components used to power solar system equipment	
Solar system controller	
Equipment Cost Subtotal	
Solar Air Heating System Project Soft Cost	
Project feasibility, design and simulation	
Permits (exclusively for solar system installation)	
Project management	
Installation labour	
Shipping	
Commissioning	
Other (specify)	
TOTAL SOLAR SYSTEM COST:	

TOTAL SOLAR SYSTEM COST PER m^2 OF COLLECTOR AREA: $______________ /$m^2$

IMPORTANT: MISSING INFORMATION WILL DELAY THE PROCESSING AND APPROVAL OF YOUR APPLICATION.

SECTION 11 – SIGNATORY

The Application must be reviewed and signed by the Applicant.

I have read the *Terms and Conditions* for eligibility for the ecoENERGY for Renewable Heat incentive. I understand that no incentive payment will be made unless Natural Resources Canada decides to enter into a Contribution Agreement. I certify that the information given in this application is correct and complete. I understand that the incentive does not constitute a warranty for endorsement by the Government of Canada, and that all legal liabilities remain with manufacturers, suppliers and installers of qualifying systems, and not with the Government of Canada.

In order to receive an incentive, the system installed must be as described in the application.

Print Name: ____
Applicant

Signature: ____ Date: Month_______Day______Year___________
Applicant

Mail this completed application form to:

ecoENERGY for Renewable Heat
Renewable and Electrical Energy Division
Natural Resources Canada
615 Booth Street, Room 150
Ottawa ON K1A 0E9

For more information, contact:

E-mail:ecoENERGYRHP@NRCan.gc.ca
Tel.: 1-877-722-6600, Option 2 (toll-free)
Fax: 613-943-6517

<u>Checklist for Attachments:</u>

☐ A copy of the ESCO contract (if applicable)

☐ A sketch of the solar heating system including the dimensions of the collector layout and the interface with the auxiliary and distribution systems.

☐ A simulation output from one of the computer programs listed in Section 9A showing expected performance, input assumptions, geographical location used, etc.

Ontario Applicants:
☐ A signed OSTHI Consent and Release Form