Enersol Solar Products | June 27, 2014

Greenhouse Gas (GHG) Reduction Project Verification Report

Verification Body:

KUZUKA
wake up·emerge·grow

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INTRODUCTION

Enersol Solar Products Inc. (Enersol) is a manufacturer of roof-mounted solar panels used to heat water in above-ground or in-ground swimming pools. For heated pools, Enersol's solar panels result in reduced greenhouse gas (GHG) emissions compared to the common alternative which is a fossil-fuel heater (e.g. natural gas, propane). Enersol's former owner retains ownership of all GHG reductions from Enersol systems installed between 2002-2011, and is pursuing a listing of these reductions on the CSA CleanProjects registry.

The services of Kuzuka Ltd. (Kuzuka) were retained to conduct a verification with a reasonable level of assurance of the GHG assertions associated with the Enersol GHG reduction project, to satisfy the third-party verification requirements of the CSA CleanProjects registry. The objective of the verification is to confirm data, controls and processes supporting the emission reduction calculations as presented in the GHG Report and corresponding GHG Assertion according to the procedures set out in ISO 14064-3[1]. Additional objectives include confirming that the GHG Report and corresponding GHG Assertion conformed to the requirements and principles of ISO 14064-2[2] and are without material discrepancies.

This final report is intended to provide the project proponents with details about the verification conducted by Kuzuka and is organized into the following subsections:

- Verification Objective and Details;
- Verification Criteria;
- Verification Plan (including results of data quality and data management assessments);
- Verification Statement;
- Verification Body Profile, including review of qualifications and conflict of interest procedures.

[1] CAN/CSA-ISO 14064-3, *Greenhouse gases — Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions*

[2] CAN/CSA-ISO 14064-2, *Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring, and reporting of greenhouse gas emission reductions or removal enhancements*

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1. VERIFICATION OBJECTIVE AND DETAILS

1.1 Project Title

Enersol Greenhouse Gas Emission Reductions via Solar Pool Heating

1.2 Project Start Date

The project start date has been verified as January 1, 2002.

1.3 Verification Site Visit

No site visits at Enersol solar pool heater installations were deemed necessary for this verification. The verification was conducted through numerous telephone interviews with the project proponents, a detailed review of project GHG information, and assessment of a solar water heater energy simulation model utilized in the project.

1.4 Expected Lifetime of the Project

The GHG emission reductions associated with this project have been verified as those occurring from January 1, 2002 to December 31, 2011.

1.5 Type of GHG Emission Reduction Project

The GHG emission reduction project is from solar water heating systems (renewable energy).

Lead Verifier Stephen Boles is an accredited Greenhouse Gas Verifier with the California Air Resources Board and is a contract GHG verifier with a ISO 14065-approved accreditation body. Stephen has completed the Canadian Standards Association course entitled Greenhouse Gas Verification using ISO 14064. Stephen has led dozens of GHG verification engagements for clients in a range of industry sectors. Stephen is a certified Environmental Professional recognized by the Canadian Environmental Certification Approvals Board.

1.6 Verification of Appropriateness of Methodology

The quantification methodology applied is the Clean Development Mechanism (CDM) methodology for small scale projects *''I.J. Solar water heating systems (SWH) Version 1.0*[3]*''*. The

[3] http://cdm.unfccc.int/methodologies/DB/GX9DV8QFP9X8BNR5GI1UUJD55EJ03A

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CDM methodology has been thoroughly reviewed and verified as appropriate, and it has been properly applied in the Enersol GHG Emission Reduction via Solar Heating Pool project.

The GHG emission reductions generated in this project have been determined to be additional to the baseline (business-as-usual) scenario. The CDM methodology defines the baseline as heaters powered by fossil fuel or electricity (for retrofit projects) or heaters that are powered by a fuel source typical of new construction (for new pool projects). Approximately 95% of Enersol installations for this GHG reduction project are in Ontario and Canada's western provinces, where natural gas is the primary fuel used for pool heaters[4].

1.7 Legal Land Description of the Project

The solar heating systems are located on private residences or commercial swimming pool locations throughout Canada. The system location can be tracked if the homeowner completes and returns the warranty information. However, the majority of homeowners do not return the warranty cards. Each year, the number of systems, the size of the systems (in terms of collector area) and the province are tracked through shipping information. All of this information has been verified in this verification engagement.

1.8 Verification of Ownership of GHG Emission Reductions

The emission reductions generated by this project were originally property of Enersol Solar Products. Enersol was sold to Enerworks in 2012, however, all ownership of emission reductions are retained by the original owner, Colleen Simmons and her new company Crimson Lane. Crimson Lane has requested and paid for the preparation of all project documents, project validation and verification. The wording of the warranty card distributed to each customer (verified in this engagement) assigns ownership of emissions reductions associated to the implementation of their system to Enersol.

[4] http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/canmetenergy/files/pubs/Residential_Pool_solarWaterHeating_ENG.pdf

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1.9 Reporting, Monitoring, and Verification Details

Because less than 10% of warranty cards are returned each year, this method of determining the size and number of systems installed each year would be incomplete and inaccurate. The alternative method chosen was to use data extracted annually from the Enersol financial database on the number and size of panels and number of systems kits shipped to each customer. From this data, the calculation of the total emission reductions for each project year were performed using an Excel spreadsheet which incorporates the raw sales data above. The sales data was provided by Enersol Solar Products' Colleen Simmons. These data are collected by Enersol Solar Product with the accounting management system ''Quickbooks', and were subject to annual financial reviews by Enersol's accountant.

Due to the lack of a site-specific monitoring plan to confirm the continued operation of installed Enersol water heaters, the project proponents have incorporated a 2% decay rate to the annual GHG emission reductions beginning in the fourth year after installation to account for system failures or removals.

This verification report (dated May 23, 2014) pertains to the Enersol solar water heater GHG reduction project and the related Enersol project report (dated April 30, 2014) and GHG assertion. This verification report will be publicly posted on the CSA CleanProjects website.

1.10 Verification Summary

Table 1 on the following page shows the GHG emission reductions for the 10 year period.

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Vintage Year	Cumulative Emission Reductions [t CO2e]	Emission Reductions CO2 [t CO2e]	Emission Reductions CH4 [t CO2e]	Emission Reductions N2O [t CO2e]
2002	5,716.8	5,715.8	-0.036	1.028
2003	6,868.1	6,866.9	-0.043	1.236
2004	7,190.4	7,189.1	-0.045	1.294
2005	6,427.1	6,426.0	-0.040	1.156
2006	5,785.4	5,784.4	-0.036	1.041
2007	5,500.7	5,499.8	-0.035	0.990
2008	5,641.6	5,640.6	-0.035	1.015
2009	4,361.7	4,361.0	-0.027	0.785
2010	2,148.3	2,148.0	-0.014	0.386
2011	616.6	616.4	-0.004	0.111
Total	50,256.8	50,248.1	-0.316	9.041

Table 1 – GHG Emission Reductions by type [t CO2e]

Based upon the defined scope of this verification, Kuzuka has concluded with a reasonable level of assurance that the Enersol GHG reduction project, including its GHG report and GHG assertion of 50,256.8 tonnes of CO_2e reduced, are materially correct and are a fair representation of GHG data and information. In addition, Kuzuka has concluded that the GHG reduction project has been prepared in accordance with the requirements of ISO 14064-2.

1.11 Roles and Responsibilities

VERIFICATION TEAM (KUZUKA LTD.)

Stephen Boles (Lead Verifier)

- Bachelor of Science (Geography)
- Master of Science (Natural Resources Management)
- CSA ISO 14064-3 training course
- Accredited GHG Verifier with California Air Resources Board
- Contract GHG Verifier with SAI Global (ISO 14064 accreditation body)
- Certified Environmental Professional (EP) with Canadian Environmental Certification Approvals Board

Contact info: sboles@kuzuka.com

Stephanie Whitney (Independent Reviewer)

- Bachelor of Applied Science (Environmental Engineering)
- Master of Environment and Business
- Professional Engineer (PEng)
- CSA ISO 14064-3 training course and CSA ISO 14064-2 training course

Contact info: swhitney@kuzuka.com

PROJECT PROPONENTS

Below is a list of project participants and their roles and responsibilities.

Name and Contact Info	Role	Responsibility
Colleen Simmons, Enersol Solar Products, 3 Cedar Trail Cambridge, ON, Canada N3C 2V4 Phone: 905-719-0410	Project Proponent, past principal of Enersol, owner of emission reductions	- Providing technical details about components - Provide annual shipping data about number, size and location of systems
Emil Breza, P.Eng. BrezaWorks & Consulting Inc. 3723 Mountainview Rd. Beamsville, ON, Canada L0R 1B2	Project Representative	Overall project management and technical services to the project
Evan Jones, P.Eng.,GHG-V 3P Analysis and Consulting, 78 Balmoral Drive, Guelph ON N1E 3N6 Phone: 519-763-6967 Email: evan.jones@eajonesgue.com	Consultant to Project Representative	- Development of Project Document - Completing application to CSA CleanProject Registry - Preparation of estimated and actual GHG emission reduction calculations - Co-ordinating the validation and verification of the project

2. VERIFICATION CRITERIA

Verification of the Enersol solar water heater GHG reduction project and the related Enersol project report and GHG assertion has been conducted with the following criteria:

- conformance with the requirements and principles of ISO 14064-2;
- the data supporting the GHG calculations have sufficient controls to be considered fair and accurate and without material discrepancy;
- the calculations supporting the GHG assertion are sufficiently accurate to be considered fair and accurate and without material discrepancy;
- there are no competing claims to the ownership of the GHG Project and the resulting emission reductions or removals.

2.1 Scope of Verification

Project Boundary:

The project boundary is defined as the number of Enersol solar water heating systems sold to private residences or commercial swimming pool locations in Canada. The emission reductions generated by this project were originally property of Enersol Solar Products. Enersol was sold to Enerworks in 2012, however, all ownership of emission reductions are retained by the original owner, Colleen Simmons and her new company Crimson Lane. The wording of the warranty card distributed to each customer (verified in this engagement) assigns ownership of emissions reductions associated to the implementation of their system to Enersol.

Project Methodology and Baseline Selection:

The Clean Development Mechanism (CDM) proposes a series of methodologies for the quantification of emissions for GHG projects. The CDM methodology for small scale projects ''*I.J. Solar water heating systems (SWH) Version 1.0*[5]'' was adapted for this project. This category comprises the installation of residential SWH systems that displaces fossil fuel that would otherwise have been used to produce hot water which is very similar to the Enersol Solar

[5] http://cdm.unfccc.int/methodologies/DB/GX9DV8QFP9X8BNR5GI1UUJD55EJ03A

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Products' swimming pool heating project. Both retrofit and new construction projects are included in this category.

The baseline scenario is the alternative scenario that would most likely occur in the absence of the project. According to the selected methodology the baseline scenario for retrofit projects is the operating water heating system and fuel source or electricity that existed immediately prior to the start of the SWH project activity. As for new construction projects, the baseline scenario is the system and fuel source (fossil fuel or electricity) assumed to be used for water heating and demonstrated to be typical of new construction in the region of the project activity at the time of the start of the project activity. Fossil fuel combustion (natural gas or propane) was identified as the baseline scenario for this project.

Description of the GHG Project:

The project technology uses rubber-based heating panels that heat water using solar thermal energy. The service being delivered by the system is to heat swimming pool water to a comfortable temperature during the summer pool season. According to Natural Resources Canada, there is sufficient solar energy for solar pool heaters to function without backup from May through September[6]. A reduced swimming pool season of 14 weeks was selected as a conservative assumption for this project.

Heating systems are sized based on the size of the pool being heated and the normal rule of thumb is that the panel size is one half of the surface area of the pool. The heating systems use the existing pool circulation pump for moving the water through the panels.

Each individual solar heater installation consists of the following major design components:

- Solar heat transfer panels and manifolds
- Pool pumping system
- Additional piping to connect the panels to the pool pumping system
- Control system components (Control box, 3 port valve, actuator, sensors, wiring)

[6]An introducton to solar pool heating systems.
http://www.energyalternatives.ca/PDF/An%20Introduction%20to%20Solar%20Pool%20Heating%20Systems.pdf

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Water is circulated from the pool up onto the roof where it is heated in the solar panels. Each panel is constructed of a manifold (or header) made of PVC plastic and heat collector tubing made of extruded EPDM (ethylene propylene diene monomer) rubber.

GHG Sources, Sinks, Reservoirs:

The GHG sources, sinks, and reservoirs for the baseline and project scenarios are described in Table 2 and Table 3, respectively.

Types of GHG:

The types of GHG quantified in this project are carbon dioxide, methane, and nitrous oxide.

Time Period:

The GHG emission reductions associated with this project occurred from January 1, 2002 to December 31, 2011. This represents the time period from the commencement of Enersol solar water heater sales to the time the Enersol company was sold by the project proponent.

2.2 Materiality

A materiality threshold of 5% was applied in this verification.

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1. SSR	2. Description	3. Controlled, Related or Affected
Upstream SSRs Before Baseline Operation		
B1a Steel Manufacturing	Includes all emissions associated with the production of steel and copper used in the manufacture of components of the pool heating system. GHG emissions arise from the combustion of fossil fuels required for raw material acquisition and manufacture. GHG emissions are also generated during the transportation of the raw materials to the manufacturing plant or facility.	Related
B1b Copper Manufacturing		Related
B2 Manufacture of Pool Heating Equipment	Includes all activities involved in the manufacture of components needed for constructing and operating the solar pool heating system. GHG emissions arise from the combustion of fossil fuels required for manufacturing of each of these project components.	Controlled
B3 Circulation Pump Manufacturing	The pool circulating pump and associated control components will generate emissions during the manufacturing.	Related
B4 Transportation to Site	GHG emissions result from the combustion of fuels during transportation of baseline equipment to the site.	Controlled
B5 Construction on Site	The installation of the pool heating system will require the use of electricity and other energy.	Controlled
Upstream SSRs during Baseline Operation		
B6 Fossil Fuel Extraction / Processing and Delivery	Includes all emissions associated with the production, processing, transportation and distribution of natural gas and propane used to heat swimming pools.	Related
B7 Electricity Generation	Includes all fossil fuel combustion activities involved in the off site generation & distribution of grid electricity needed for operating the circulation pump and control system.	Related
Onsite SSRs during Baseline Operation		
B8 Circulation Pump Operation	GHG emissions related to the operation of the circulation pump (from grid supplied electricity).	Controlled
B9 Combustion of Fossil Fuel	GHG emissions related to the combustion of fossil fuel to heat the pool water.	Controlled
B10 Operation and Maintenance of Pool Heating System	Emissions from maintenance activities result from fossil fuel combustion in vehicles used for transporting maintenance personnel to and from project site.	Controlled
Downstream SSRs during Baseline Operation		
None		
Downstream SSRs after Baseline Operation		
B11 Transportation to Landfill or Recycling Centre	Emissions from disposal activities result from fossil fuel combustion in vehicles used for transporting decommissioned system to disposal site.	Related
B12 Recycling of Components	Emissions associated with the combustion of fossil fuels or electricity required to return materials to a usable raw state.	Related

Table 2 – Sources, Sinks, and Reservoirs (SSR) for Baseline Scenario

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1. SSR	2. Description	3. Controlled, Related or Affected
Upstream SSRs Before Project Operation		
P1 Steel Manufacturing	Includes all emissions associated with the production of materials that are used in the manufacture of components of the solar heating system – steel for mounting structure, plastic for piping and manifolds, EPDM rubber for solar collector surface. GHG emissions arise from the combustion of fossil fuels required for raw material acquisition and manufacture. GHG emissions are also generated during the transportation of the raw materials to the manufacturing plant or facility.	Related
P2 PVC Plastic Manufacturing		Related
P3 EPDM Rubber Manufacturing		Related
P4 Solar Panel Manufacturing	Includes all activities involved in the manufacture of components needed for constructing and operating the solar pool heating system. GHG emissions arise from the combustion of fossil fuels required for manufacturing of each of these project components.	Controlled
P5 Circulation Pump Manufacturing	The pool circulating pump and associated control components will generate emissions during the manufacturing.	Related
P6 Transportation to Site	The solar panels and mounting system needs to be transported to the site. This involves a two step process of transportation to the dealer location and then to the homeowner's site. The emissions associated with transportation (truck and/or van) will be captured in this SSR.	Controlled
P7 Construction on Site	The installation of the solar heating panels, mounting system and piping will require the use of electricity for tools.	Controlled
Upstream SSRs during Project Operation		
P8 Electricity Generation	Includes all fossil fuel combustion activities involved in the off site generation & distribution of grid electricity needed for operating the circulation pump and control system.	Related
Onsite SSRs during Project Operation		
P9 Circulation Pump Operation	GHG emissions related to the operation of the circulation pump (from grid supplied electricity).	Controlled
P10 Control System	GHG emissions related to the operation the control system and electronics (from grid supplied electricity).	Controlled
P11 Maintenance of Solar System	Emissions from maintenance activities result from fossil fuel combustion in vehicles used for transporting maintenance personnel to and from project site.	Controlled
Downstream SSRs during Project Operation		
None		
Downstream SSRs after Project Operation		
P12 Transportation to Landfill or Recycling Centre	Emissions from disposal activities result from fossil fuel combustion in vehicles used for transporting decommissioned system to disposal site.	Related
P13 Recycling of Components	Emissions associated with the combustion of fossil fuels or electricity required to return materials to a usable raw state.	Related

Table 3 – Sources, Sinks, and Reservoirs (SSR) for Project Scenario

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3. VERIFICATION PROCESS AND VERIFICATION PLAN

Kuzuka followed a 3-phase approach to perform the risk-based verification of the Enersol GHG reduction project in accordance with ISO 14064-3 with a reasonable level of assurance. All records are maintained in the verifier's project management system for a period of seven years.

- **Phase 1: Verification Planning -** The following steps were conducted in the Verification Planning phase of the project:

  1. Kuzuka issued a request for information to obtain the relevant datasets, documentation, and information needed for the verification engagement. Information that was requested is listed below:

     - Project design document (PDD);
     - Validation report;
     - Spreadsheets with the calculations used in the baseline and project scenarios;
     - Original source data that justifies assumptions made for the baseline and/or project scenarios;
     - Technical information pertaining to the solar water heaters (not included in the PDD) that is relevant to the assumptions and/or calculations used;
     - Database of Enersol solar water heater sales from 2002-2011;
     - Documentation pertaining to data quality control procedures and project monitoring procedures utilized by Enersol;

  2. Kuzuka conducted a preliminary review all data and documentation provided.

  3. Representatives from Kuzuka and the Enersol project team participated in a project 'kick-off' teleconference meeting to:

     - review the data and documentation that was provided;
     - discuss the proposed work plan and schedule of delivery;
     - finalize the parameters of the verification (e.g. materiality threshold).

  4. A Verification Plan was developed based on the information reviewed and potential risks identified in Phase 1/Step 2. As part of the Verification Plan, Kuzuka developed a risk-based sampling plan to select a representative sample of project data for which GHG calculations were investigated for accuracy. The Verification Plan (including the sampling plan) is provided as Appendix A.

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- **Phase 2: Verification Execution** - The following steps were conducted in the Verification Execution stage of the project:

1. Kuzuka conducted a review of Enersol's GHG management system and controls. This included an assessment of the procedures for collecting, processing, and consolidating GHG data. This also included an assessment of data management systems in place to ensure accuracy and quality of data used. This step was accomplished through a review of documentation provided and interviews with individuals responsible for the management of the project GHG data.

2. Kuzuka performed a desktop review of the information and data utilized in the GHG assertion, including:
   - comparison of original GHG activity data (e.g. sales records) against values utilized in GHG reduction calculations;
   - confirmation of the accuracy of GHG calculations utilized;
   - utilization of appropriate emission factors and conversion equations;
   - review of the function and output of the Enerpool solar water heater energy requirement simulation model;
   - appropriateness of assumptions made in the baseline and/or project scenarios.

A copy of the verification notes is provided as Appendix B to this report.

3. Kuzuka assessed Enersol's GHG assertion against the principles of ISO 14064-2 and the CSA CleanProjects program. A summary of the verification activities for each ISO 14064-2 principle are provided in Table 4 on the following page.

- **Phase 3: Verification Completion** - The following steps were conducted in the Verification Completion stage of the project:

1. Kuzuka prepared a final report for Enersol's internal use that describes the scope and findings of the verification. A draft report was submitted to Enersol for review and comment prior to issuance of the final report.

2. An independent review of the verification process and findings was conducted by a qualified Kuzuka staff representative (Stephanie Whitney) who was not involved with the execution of the verification.

3. Kuzuka issued a public verification statement in accordance with the requirements of the CSA CleanProjects program.

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ISO 14064-2 Principle	Verification Process
Accuracy	Verifier reviewed the accuracy of calculations and data sources (as per the sampling strategy)
Completeness	Verifier confirmed that all relevant SSRs have been considered and that exclusions have been justified
Conservativeness	Verifier confirmed that conservativeness was applied throughout the project design through the following methods: • Exclusion of certain SSRs from the baseline scenario (e.g. manufacturing of natural gas heaters), justified based on the principle of conservativeness; • incorporating a decay factor beginning in 4th year after heater installation; • applying a reduction to the first year of the baseline GHG emissions to account for partial-season installations; • moderate 14-week swimming pool season assumed; • lower minimum pool temperature of 25C assumed.
Consistency	Verifier confirmed that baseline and project scenarios can be considered an equivalent level of product/service. Verifier confirmed that the calculation methodology has been consistently applied in all project years.
Relevance	Verifier confirmed that an appropriate GHG calculation methodology was selected and applied. Verifier confirmed the reasonableness of assumptions made.
Transparency	All data sources and calculation methodology have been verified as accurately described.

Table 4 – Verification Activities to Address ISO 14064-2 Principles

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4. VERIFICATION STATEMENT

The services of Kuzuka Ltd. were engaged to conduct a verification of the greenhouse gas (GHG) emission reductions associated with the Enersol solar pool water heating project calculated in accordance with the requirements of ISO 14064-2 for the time period from January 1, 2002 to December 31, 2011.

The verification was conducted with the following criteria:

- conformance with the requirements and principles of ISO 14064-2;
- the data supporting the GHG calculations have sufficient controls to be considered fair and accurate and without material discrepancy;
- the calculations supporting the GHG assertion are sufficiently accurate to be considered fair and accurate and without material discrepancy;
- there are no competing claims to the ownership of the GHG Project and the resulting emission reductions or removals.

Scope and Parameters of Verification

The scope of the GHG verification was established prior to the verification engagement as:

Geographic Boundary: Locations of Enersol solar pool water heater installations in Canada for both residential and commercial pools.

Time Period: January 1, 2002 – December 31, 2011

Intended Users: CSA GHG CleanProjects Registry

Verification Standard: ISO 14064-3

The parameters of the GHG inventory verification were defined as:

Assertion Document: Enersol GHG Reduction Project Report (dated April 30, 2014)

Objective: For the purposes of posting on the CSA GHG CleanProject Registry, establish:

- Stated GHG reductions are true and correct over the period of time covered by the GHG report
- GHG assertion has been prepared in accordance with ISO 14064-2

Level of Assurance: Reasonable

Materiality Threshold: 5%

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Verification Process

Kuzuka conducted the verification in accordance with the requirements of ISO 14064-3: *Greenhouse gases – Specification with guidance for the validation and verification of greenhouse gas assertions*. Kuzuka reviewed the project GHG Report and associated GHG management database and evaluated them for conformity with the requirements of ISO 14064-2 with reported emissions considered free of material misstatement if found to be less than 5% on a carbon dioxide–equivalent basis. Enersol's assertion was tested according to a risk-based approach and the review of controls to manage these risks, including:

- management system and procedural review for accuracy, reliability and reproducibility;
- verification of representative sources, sinks, reservoirs, and processes;
- verification of reported GHG reductions, including the accuracy and relevancy of emission factors and conversion equations used, and the accuracy of tools used by Enersol to calculate GHG reductions; and
- Audit of a sample of original source activity data and GHG calculations. Sample included a detailed assessment of one full project year of activity data and calculations, and a review of annual totals of sales data and GHG calculations for remaining project years.

The table below contains the annual GHG reductions calculated by Enersol from 2002 – 2011:

Vintage Year	Cumulative Emission Reductions [t CO2e]	Emission Reductions CO2 [t CO2e]	Emission Reductions CH4 [t CO2e]	Emission Reductions N2O [t CO2e]
2002	5,716.8	5,715.8	-0.036	1.028
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2006	5,785.4	5,784.4	-0.036	1.041
2007	5,500.7	5,499.8	-0.035	0.990
2008	5,641.6	5,640.6	-0.035	1.015
2009	4,361.7	4,361.0	-0.027	0.785
2010	2,148.3	2,148.0	-0.014	0.386
2011	616.6	616.4	-0.004	0.111
Total	**50,256.8**	**50,248.1**	**-0.316**	**9.041**

Conclusion

Based upon the above, Kuzuka has concluded with a reasonable level of assurance that the reported GHG reductions of 50,256.8 metric tonnes of carbon dioxide equivalent, for the time period from January 1, 2002 to December 31, 2011 are materially correct and is a fair representation of GHG data and information. In addition, Kuzuka has concluded that the GHG reduction project has been prepared in accordance with the requirements of ISO 14064-2.

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Statement of Independence, Impartiality and Competence

Kuzuka Ltd. is an independent environmental services company that provides solutions to the private and public sector across North America. Kuzuka's staff of certified environmental professionals, GHG verifiers, and professional engineers have decades of combined experience providing environmental consulting and data assurance services to a range of clients in various industry sectors.

This verification has been conducted independently and to our knowledge there has been no conflict of interest.

Attestation

Kuzuka Ltd.

Stephen Boles, B.Sc., M.Sc., EP (Sustainability)
Accredited GHG Verifier (California Air Resources Board)
Lead Verifier
Kuzuka, Ltd.
Exeter, Ontario

Stephanie Whitney, B.A.Sc., MEB, P.Eng.
Independent Reviewer
Kuzuka, Ltd.
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APPENDIX A – Conflict of Interest Review

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	Yes	No	Details
Independence Remain independent of the activity being verified, and free from bias and conflict of interest. Maintain objectivity throughout the verification to ensure that the findings and conclusions will be based on objective evidence generated during the verification.	√	☐	The verification team is independent of the activity being verified and has no prior consulting or financial relationship with the client.
Ethical conduct Demonstrate ethical conduct through trust, integrity, confidentiality and discretion throughout the verification process.	√	☐	The verification team has extensive experience and training in the ethical conduct demanded in verification engagements. In addition, the verification team adheres to the Kuzuka code of conduct for verification engagements.
Fair presentation Reflect truthfully and accurately verification activities, findings, conclusions and reports. Report significant obstacles encountered during the verification process, as well as unresolved, diverging opinions among verifiers, the responsible party and the client.	√	☐	All activities and findings resulting from the verification assessment are presented in Appendix C of the verification report.
Due professional care Exercise due professional care and judgment in accordance with the importance of the task performed and the confidence placed by clients and intended users. Have the necessary skills and competences to undertake the verification.	√	☐	Skills and competencies of the verification team are described in Section 1.11 of the verification report.

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APPENDIX B – Verification Plan

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VERIFICATION PLAN
Enersol Solar Pool Water Heater GHG Reduction Project

Table 1: Verification Parameters

Project Proponent:	Enersol
Project Representative:	Evan Jones
Assertion Document:	Enersol GHG Project Report (dated April 30, 2014)
Objective:	For the purposes of posting on the CSA GHG CleanProject Registry, establish that: 1. Stated GHG reductions are true and correct over the period of time covered by the project report. 2. GHG assertion has been prepared in accordance with ISO 14064-2.
Verifier:	Stephen Boles, Kuzuka Ltd.
Independent Reviewer:	Stephanie Whitney, Kuzuka Ltd.
Scope:	**What:** GHG reductions associated with the installation of Enersol solar pool water heaters. **Where:** Locations of Enersol solar pool water heater installations in Canada. **When:** January 1, 2002 – December 31, 2011 **Who:** Intended users: CSA GHG CleanProjects Registry **How:** ISO 14064-3
Criteria:	• conformance with the requirements and principles of ISO 14064-2; • data supporting the GHG calculations have sufficient controls to be considered fair and accurate and without material discrepancy; • calculations supporting the GHG assertion are sufficiently accurate to be considered fair and accurate without material discrepancy; • there are no competing claims to the ownership of the GHG Project and the resulting emission reductions or removals.
Level of Assurance:	Reasonable
Materiality Threshold:	5 %

Table 2: Verification Schedule

TASK	COMPLETION DATE
Verification Planning	
Issuance of data request list	March 19, 2014
Data from request list provided to Kuzuka	March 25, 2014
Project Kick-off Meeting Participants: Evan Jones, Colleen Simmons (project proponents); Steve Boles (Kuzuka)	April 2, 2014
Preliminary review of GHG activity data and documentation	April 5, 2014
Preparation of Verification and Sampling Plan	April 6, 2014
Verification Execution	
Kuzuka will perform a desktop review of the following: • according to the sampling plan, compare original GHG activity data (e.g. solar water heater sales records) against values recorded in GHG reduction calculation spreadsheets; • according to the sampling plan, confirm the accuracy of GHG calculations; • review Enerpool solar water heater energy simulation model; • review of management system and controls utilized by project proponents to ensure data accuracy and quality; • utilization of appropriate emission factors and conversion equations in GHG calculations.	May 6, 2014
Enersol GHG reduction project will be assessed against the requirements and principles of ISO 14064-2 and the CSA GHG CleanProjects Registry.	May 6, 2014
Verification Completion	
Independent review of verification process and findings	May 20, 2014
Submission of draft verification report and statement to project proponents	May 21, 2014
Submission of final verification report and statement to project proponents	May 28, 2014

Table 3: Document Review List for Verification

Document	Relevant Information for Verification Project
Enersol project report (Version dated April 30, 2014)	Project description, Project methodology, Sources/Sinks/Reservoirs, Baseline and Project scenario descriptions
Validation report (Version dated March 2012)	Results of project validation conducted by Conestoga Rovers
CDM Methodology *I.J. Solar Water Heating Systems*	Reference methodology that was used in the Enersol solar pool water heating project
EnerPool model documentation (available within the EnerPool model software download)	Guidance pertaining to the design, functionality, and usage of the EnerPool solar water heating energy simulation model
CleanProjects GHG Report template	Description of project requirements and GHG report content to ensure compliance with CSA CleanProjects program
CleanProjects Verification Report template	Description of the verification requirements of the CSA CleanProjects program
Enersol GHG Calculator spreadsheets	GHG calculations, activity data (sales records), emission factors, conversion equations, data sources for defining the impact of sources/sinks/reservoirs in the baseline and project scenarios Separate GHG Calculator spreadsheets are prepared for each year of the project (2002 – 2011).
"An Introduction to Solar Pool Heating Systems" (published by NRCan)	Source of assumptions used for length of swimming pool season and minimum desired water temperature
Life Cycle GHG Emissions of Natural Gas	Source of upstream GHG emission factors associated with natural gas extraction and distribution (Baseline scenario)
LCA Methodology Report (published by World Steel Association)	Source of steel emission factors (Baseline and Project scenario)
Cradle-to-gate LCI of 9 plastic resins and 4 polyurethane precursors (prepared by Franklin & Associates)	Source of ABS and PVC emission factors (Project scenario)

Table 4: Verification Sampling Plan

DATA COMPONENT	PROPOSED SAMPLING STRATEGY
Annual GHG Calculation spreadsheets	A template GHG calculation spreadsheet format is applied to each project year from 2002 - 2011. The following sampling strategy will be used to review the accuracy of the calculation spreadsheets: 1. One project year of the template GHG calculation spreadsheets (2010) will be thoroughly verified by reviewing: • The source activity data (water heater sales) matches the original sales records; • Emission factors and conversion equations match the source documentation from which they were obtained; • Calculations of water pool heater installation area were properly applied; • Calculations of transportation distance in the baseline and project scenario were properly applied; • Calculations of GHG emissions in the baseline and project scenario were properly applied within the Detail worksheet and correctly summarized in the Summary worksheet. 2. For the remaining project years, annual totals of water heater sales will be compared to the original sales records, emission factors will be reviewed for correctness, and annual GHG reduction calculations will be verified as being correctly reported in the Summary worksheet.
Summary GHG Reduction spreadsheet (one file for all years of project)	The following calculations will be verified as accurate for each year of the project: • Application of decay factor beginning in year 4 • On-going emissions in the baseline scenario from year to year • GHGs from the annual calculation spreadsheets match the main summary spreadsheet
EnerPool model simulation output files	The EnerPool model was run for several cities across Canada using two scenarios (w/ blanket, w/out blanket). The EnerPool model will be tested to verify the simulation results of the predicted energy requirements to heat pool water that are used in the project GHG calculations.

Table 5: Preliminary Risk Assessment and Planned Verification Approach

Level of Verification Assurance	Reasonable	Materiality Threshold:	5 %		Planned Verification Approach	
Observed Potential Risk		**Potential for Material Discrepancy** (H, M, L)		**ISO 14064-2 Principle**	**Assessment Process**	**Potential Resolution**
Proper Application of EnerPool Model – The EnerPool model simulation results are used to determine the energy requirements for maintaining a minimum desired water temperature in various locations across Canada. The proper use of the EnerPool model (input parameters, assumptions) has a major impact on the Baseline scenario GHG emissions		M		Accuracy	EnerPool model will be downloaded and tested by verifier. Verifier will confirm that the project proponents have utilized realistic and conservative assumptions when defining the model's parameters, and that the output results have been properly interpreted.	EnerPool model simulation runs may have to be re-defined and re-run.
Validity of Assumptions – the project is dependent on numerous assumptions (decay factor, desired pool temperature, use of pool covers, swim season length) that impact the net GHG reductions		M		Relevance	Review of the justification of assumptions made by project proponents, including source reference data that support the assumptions To be conducted through interviews with project proponents and research conducted by verifier	To be determined following assessment of the validity of assumptions.
Data Accuracy – Consistency and accuracy of GHG calculation spreadsheets		M		Accuracy	As per the sampling plan, thoroughly review the consistency and accuracy of GHG calculation spreadsheets	GHG calculation spreadsheets may have to be corrected.
Data Quality - Consistency and accuracy of emission factors used		M		Accuracy	Review the source of emission factors used in the baseline and project scenarios	Emission factors may have to be updated.

APPENDIX C – Verification Notes

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ENERSOL SOLAR POOL HEATING GHG REDUCTION PROJECT

Verification Working Notes

Red font are comments made by verifier that indicate potential issues that require resolution.

Green font are comments made by verifier that indicate a potential issue has been resolved.

Blue font are comments made by project proponents is response to verifier comments.

REVIEW OF PROJECT DESIGN DOCUMENT (PDD)

OBSERVATIONS	RECOMMENDED REMEDIAL ACTIONS	VERIFIER INITIALS	IND. REVIEWER INITIALS
Section 2.5 (page 5): - the CSA CleanProject guidelines state that project location should be specified (lat/long) and details on the ownership should be clearly established - Section 2.5 of the PDD should be enhanced to describe in more detail how the specific locations of the project installation sites are determined and tracked - Material from Section 2.16 of the PDD should be moved to this section	**In April 2 teleconference, E Jones and C Simmons stated that this section of PDD would be revised to include warranty card information and other descriptive locational information** **Issue resolved in Version of PDD dated April 28, 2014.**	SB	SW
Section 2.6 (page 6): *"Before the project was initiated, existing swimming pools had fossil fired heating systems and new swimming pools were not designed with heating systems."* - What does it mean that new swimming pools were not designed with heating systems before the project was initiated? Section 2.6 of the PDD should be revised to make this sentence clearer.	**In April 2 teleconference, E Jones and C Simmons stated that this section of PDD would be re-worded for improved clarity** **Issue resolved in Version of PDD dated April 28, 2014.**	SB	SW

OBSERVATIONS	RECOMMENDED REMEDIAL ACTIONS	VERIFIER INITIALS	IND. REVIEWER INITIALS
Section 2.9 (page 7): - The CSA CleanProject guidelines state "The assertion should disaggregate each of the individual GHG types (CO_2, CH_4, N_2O, SF_6, HFCs, and PFCs) where reductions or removals are achieved." - Section 2.9 of the PDD should be revised to include the breakdown of reductions by GHG type	**In April 2 teleconference, E Jones and C Simmons stated that this section of PDD would be revised to include a disaggregation of relevant GHGs** **Issue resolved in Version of PDD dated April 28, 2014.**	SB	SW
Section 2.10 (page 8): - Please describe how the assumed disassembly/removal rate of 2% per year beginning in year 4 was determined. Industry knowledge? Published data? Customer feedback? Best guess?	In April 2 teleconference, E Jones and C Simmons stated that warranty has not been claimed for a full system failure, showing that systems are mechanically sound and a 2% failure rate is conservative. Also the fact that the crediting period (maximum 10 years) immediately follows the water heater installation reduces the likelihood of mechanical failure during that timeframe. **Verifier accepts rationale for 2% removal rate.**	SB	SW
Section 2.15 (page 10): - date of Validation should be added to the table	**To be included in revised PDD** **DONE**	SB	SW
Section 3 (page 11): - explain why the temporal range defined in the baseline is from 2005 – 2012. Should be 2002 – 2011 to match the project timeline	**To be corrected in revised PDD** **Issue resolved in Version of PDD dated April 28, 2014.**	SB	SW
Section 3 (page 12): - the barriers assessment states that electric-powered heating systems are "not common practice in most areas of Canada and USA" - the US EIA's *2009 Residential Energy Consumption Survey* reports that electricity is the power source for approx. 25% of heated pools in USA - 25% is not an insignificant amount – how would the exclusion of electric-powered heaters impact the Baseline conditions? - NRCan *Solar Pool Heating Buyers Guide* states that nat gas is the fuel of choice in Ontario and west, while electric heat pumps are common in east of Ontario due to less nat gas availability	In April 2 teleconference, C Simmons stated she will contact some Canadian industry colleagues to try to get data on % of electric vs natural gas heaters in Canadian market Approx 95% of Enersol installations are in Ontario and western provinces, where natural gas could be assumed to be the primary fuel used. **Verifier accepts assumption that baseline scenario will use 100% natural gas heaters.**	SB	SW

OBSERVATIONS	RECOMMENDED REMEDIAL ACTIONS	VERIFIER INITIALS	IND. REVIEWER INITIALS
Table 5 (page 16): - Why was the life cycle production of the solar cells not included as one of the Upstream Related SSRs in the project scenario?	In April 2 teleconference, E Jones and C Simmons explained that Enersol does not use a PV solar system with cells, it uses a thermal solar system which is basically a series of rubber tubes that get hot and the water heats up as it runs through it. **Upstream Related SSRs in baseline scenario are acceptable as defined in draft PDD.**	SB	SW
Section 5 (page 25), P2b: - Please re-check the calculations that arrived at the ABS piping weight per installation of 36.63 kg. An on-line calculator I used (http://asm.matweb.com/tools/weight-calculator.asp) provided a piping weight about 25% of that calculated by Enersol when using the same dimensions of ABS	**E Jones recalculated the piping weights of both ABS and PVC input materials. New calculations are very close to the values obtained from the on-line calculator tool.** **No further modifications required for the calculation of ABS and PVC piping weights.**	SB	SW
Section 5 (page 26), B1a and B2a: - The assumed shipping weight of conventional heating systems is 100 kg. The baseline scenario includes two materials (steel and copper) with an assumed weight per installation of 25 kg of each material. Please provide a justification for the remaining 50 kg of material that has not been accounted for	In April 2 teleconference, E Jones and C Simmons explained that only the 2 major components of the baseline have been included to minimize baseline GHG in the interest of conservativeness**. PDD will be revised to specify that the other baseline components have not been quantified.** **Issue resolved in Version of PDD dated April 28, 2014.**	SB	SW
Section 5 (page 26), B6: - Request made to obtain the source documentation (TEAM GHG Protocol for Wind Projects) used to derive the upstream natural gas emission factors	**E Jones provided a different document that will be used to derive the upstream natural gas emission factors. The new document is a report prepared by ICF for Canadian Natural Gas Initiative that summarizes numerous natural gas life cycle assessments.** **Verifier accepts revised document as the source of upstream natural gas emission factors.**	SB	SW
Section 5 (page 27), Table 8: - Justify the selection of 400,000 BTU/h as the default heating capacity for the baseline - Justify the selection of 60% default efficiency for the baseline	Refer to assessment of EnerPool model	SB	SW

OBSERVATIONS	RECOMMENDED REMEDIAL ACTIONS	VERIFIER INITIALS	IND. REVIEWER INITIALS
Section 5 (page 27): - Justify the assumption of no solar heating – how does the model account for the impact of passive solar heating in the baseline?	In April 2 teleconference, E Jones and C Simmons explained that passive solar heating would be applicable to both baseline and project scenarios and therefore would cancel out and be a non-issue. **Verifier accepts the rationale provided.**	SB	SW
Section 5 (page 28): Here it states the decay factor of 2% begins in the third year after install. In section 2.10 it states the decay factor begins in year 4.	Recommend using consistent terminology pertaining to decay factor throughout PDD. **E Jones to update PDD.** **Issue resolved in Version of PDD dated April 28, 2014.**	SB	SW
Section 7.1 (page 29): Check why the GHG emission reductions reported in table on page 29 are different than those in Table 1	**In April 2 teleconference, E Jones confirmed that he would check the GHG emission reductions reported and correct in the revised PDD.** **Issue resolved in Version of PDD dated April 28, 2014. Please fix the text and table that are not centered on page 32 of revised PDD.**	SB	SW
Section 6 (page 28): - Check whether Enersol has financial audit reports conducted for the annual pool heater sales which are the primary source of activity data used in the calculation of GHG emission reductions	In April 2 teleconference, C Simmons stated that no official financial audits have been conducted, but annual year-end taxes and income statements prepared by accountant. Also financial due diligence was conducted when the sale of the company took place **Verifier accepts quality of the financial activity data as described. Name of accountant has been added to PDD.**	SB	SW
Page 25 and Page 26: Units of transportation-related GHG emission factors need to be changed.	**The units of transportation emission factors should be changed from 'kg CO2e per kg-km' to 'kg CO2e per t-km'.** **Issue resolved in Version of PDD dated April 28, 2014.**	SB	SW

REVIEW OF ENERPOOL MODEL

OBSERVATIONS	RECOMMENDED REMEDIAL ACTIONS	VERIFIER INITIALS	IND. REVIEWER INITIALS
Verifier desired evidence of validation of the accuracy of EnerPool model. Natural Resources Canada website where EnerPool model is freely available for download to the public does not provide any documentation on the testing or validation of the model.	On April 16 verifier had a telephone conversation with Bruce Sibbitt, Professional Engineer employed by Natural Resources Canada, who led a project several years ago to validate EnerPool Version 3. Bruce said that the model was validated against field data from three outdoor residential pools in Montreal, Etobicoke and Vancouver. The results of the validation testing were a very close predictive capability of EnerPool of real-life data. In addition to Mr. Sibbitt's comments, a document entitled *RETScreen International Solar Water Heating Project Analysis* was reviewed. This document describes the RETScreen model's solar pool water heating component, and provides details of validation and testing that was performed. The document describes the performance of RETScreen's solar pool water heating model against both field data and results of the EnerPool model. Results of the field data, EnerPool, and the RETScreen model were all highly correlated. **Verifier accepts the testimony of Mr. Sibbitt and the RETScreen document as evidence of the accuracy of the EnerPool model.**	SB	SW
The use and application of the EnerPool model by the project proponents was reviewed against the project parameters described in the PDD. *Issue 1: Natural Gas Heater Specifications* - Justify the selection of 400,000 BTU/h as the default heating capacity for the baseline - Justify the selection of 60% default efficiency for the baseline	The EnerPool model provides data on the total energy that is required (in GJ) by a nat gas heating system to maintain the minimum water temperature desired. The specifications of the nat gas heating system (efficiency, heating capacity) do not have an impact on the model's determination of total energy required. However, the total energy requirement computed by EnerPool should be converted into a natural gas consumption total using an assumed heater efficiency value (recommend high efficiency for conservativeness). **80% used in revised calcs.; recommend 90%**	SB	SW

	Current new pool heater technology does achieve 90% plus combustion efficiency. This technology was not readily available during the performance period of the project. The rated heater combustion efficiency should be downgraded for other losses to arrive at an overall heater efficiency. Pool heaters are typically atmospheric boilers and not condensing gas designs and typically struggle to reach efficiencies above 80%. **Verifier accepts rationale for using an assumed gas heater efficiency value of 80%.**		
The use and application of the EnerPool model by the project proponents was reviewed against the project parameters described in the PDD. *Issue 2: Desired Water Temperature*	The EnerPool model's prediction of energy requirements is very sensitive to the minimum desired water temperature that is defined. The US DOE states that typical residential pool temperatures are 78 – 82 Fahrenheit (25.5 – 28 Celsius). NRCan specifies a typical minimum desired pool temperature of 27.5 Celsius. The original version of the PDD specifies an 'input water temperature' of 20 Celsius, which is significantly lower than the publications listed above specify should be used. A lower water temperature will under-estimate the natural gas energy requirements of the baseline. **In April 23 teleconference with E Jones the following issues were determined:** - **Table 7 (page 27) of PDD will be changed from 'Input Water Temperature' to 'Minimum Desired Water Temperature'. Issue resolved in Version of PDD dated April 28, 2014.** - **The minimum desired water temperature will be raised from 20 Celsius to 25 Celsius. Issue resolved in Version of PDD dated 04/28/2014**	SB	SW
The use and application of the EnerPool model by the project proponents was reviewed against the project parameters described in the PDD. *Issue 3: Swim Season Length*	The EnerPool model's prediction of energy requirements is very sensitive to length and timing of the swimming season, as the months of May and Sept. require much more energy from natural gas heaters than June - Aug. The original version of the PDD specifies a swimming	SB	SW

	season of June 1 – September 30. **In April 23 teleconference with E Jones it was decided that the swimming season used in this project would be reduced to June 1 – September 15 to align closer with expected pool usage in Canada. Issue resolved in Version of PDD dated April 28, 2014.**		
The interpretation of the EnerPool model output by the project proponents was assessed.	In the calculations of baseline GHG emissions, the project proponents have been using the 'Annual Cost of Energy' output from the EnerPool model to estimate natural gas usage. However, the verifier assumes that EnerPool's 'Annual Cost of Energy' output includes an estimate of costs pertaining to energy transport and delivery in addition to the cost of the energy itself. Thus this model output is not an appropriate estimate of natural gas consumption. As an estimate of natural gas energy requirements, the verifier recommends that the project proponents use the 'Auxiliary Energy' total from the Energy Summary table that is provided at the end of the EnerPool report. Total energy requirement should be converted to a NG consumption total using an assumed heater efficiency value (recommend high efficiency for conservativeness). **80% heater efficiency used in revised calculations. Recommend that this be increased to 90% in the interest of conservativeness and to align with current heater technology that commonly achieves efficiency rates of 90% or higher.** **Current new pool heater technology does achieve 90% plus combustion efficiency. This technology was not readily available during the performance period of the project. The rated heater combustion efficiency should be downgraded for other losses to arrive at an overall heater efficiency. Pool heaters are typically atmospheric boilers and not condensing gas designs and typically struggle to reach efficiencies above 80%.** **Verifier accepts rationale for using an assumed gas heater efficiency value of 80%.**	SB	SW

REVIEW OF CALCULATION SPREADSHEETS AND EMISSION FACTORS

OBSERVATIONS	RECOMMENDED REMEDIAL ACTIONS	VERIFIER INITIALS	IND. REVIEWER INITIALS
Emission factors from Upstream SSRs of both the baseline and project scenarios were reviewed. *Baseline and Project Emission Factor (Steel)*	Project uses emission factors published in the World Steel Association's LCA report. **Original document was obtained by verifier and accuracy of EFs was confirmed.**	SB	SW
Emission factors from Upstream SSRs of both the baseline and project scenarios were reviewed. *Baseline Emission Factor (Copper)*	Project uses emission factors for 'Secondary Copper Production', obtained from the EcoInvent database. **The emission factors used in the project were similar to those reported by an independent source (European Copper Institute LCA) reviewed by verifier.**	SB	SW
Emission factors from Upstream SSRs of both the baseline and project scenarios were reviewed. *Project Emission Factor (ABS)*	Project uses emission factors for ABS production, obtained from the US LCI database, and originally developed in a report by Franklin and Associates. Original source document was obtained by verifier. Table 10-5 of report specifies a ABS emission factor of 3.805 kg CO2e / kg ABS, which is approximately 50% higher than the value used in the Enersol calculation spreadsheets. **Recommend revising calculation spreadsheets with an ABS emission factor of 3.805 kg CO2e / kg ABS.** **ABS emission factor updated as recommended.**	SB	SW
Emission factors from Upstream SSRs of both the baseline and project scenarios were reviewed. *Project Emission Factor (PVC)*	Project uses emission factors for PVC production, obtained from the US LCI database, and originally developed in a report by Franklin and Associates. Original source document was obtained by verifier. Table 9-5 of report specifies a PVC emission factor of 2.419 kg CO2e / kg PVC, which is approximately 60% higher than the value used in the Enersol calculation spreadsheets. **Recommend revising calculation spreadsheets with a PVC emission factor of 2.419 kg CO2e / kg PVC.** **PVC emission factor updated as recommended.**	SB	SW

OBSERVATIONS	RECOMMENDED REMEDIAL ACTIONS	VERIFIER INITIALS	IND. REVIEWER INITIALS
Emission factors from Upstream SSRs of both the baseline and project scenarios were reviewed. *Project Emission Factor (Rubber / EPDM)*	Project uses emission factors for 'Synthetic Rubber (EPDM) Production', obtained from the EcoInvent database. A LCA report on building materials prepared by The University of Michigan was reviewed. The emission factors for rubber reported by U Michigan are approx. 40% less than those used in the project. **The verifier accepts the emission factors used in the project based on the principle of conservativeness.**	SB	SW
Emission factors for Fossil Fuel Combustion were reviewed.	Original source document (Environment Canada National Inventory Report) was obtained by verifier and accuracy of emission factors was confirmed.	SB	SW
Emission factors for Fossil Fuel Production were reviewed.	The document that was used for Natural Gas production emission factors in the original PDD (TEAM GHG Protocol for Wind Projects) was replaced by a report prepared for Canadian Natural Gas Initiative (CNGI) that summarizes numerous natural gas LCAs. According to the CNGI LCA report, the upstream sources of GHG in conventional natural gas production are 14.7 kg CO2e/GJ. **Calculation spreadsheets should be updated with the upstream natural gas GHG impacts from CNGI LCA report.** **Issue resolved in revised calculation spreadsheets. EF for upstream nat gas changed to 0.56 kg CO2e/m3, calculated from (14.7 kg CO2e/GJ) / (26.25 m3/GJ).**	SB	SW
Emission factors for Transportation-related GHG were reviewed.	Emission factors for transportation GHG were derived using data from a number of sources (NRCan reports, CSA, Environment Canada). All source data were checked and accuracy was confirmed.	SB	SW

OBSERVATIONS	RECOMMENDED REMEDIAL ACTIONS	VERIFIER INITIALS	IND. REVIEWER INITIALS
Calculations in 'SSR Summary' worksheet were reviewed.	All calculations were verified as accurate with the following exceptions: 1. **Cell G8 (activity data for P3 Rubber GHG) is incorrect. The value should be the total area of rubber per installation, with the calculation then accessing the area-based emission factor from the 'P3 EPDM Rubber' worksheet.** **To arrive at GHG emissions for rubber, the area of each collector is calculated (column S in Detail worksheet), then multiplied by emission factor per m2 of collector (columns S, T and U in Detail worksheet)** **Approach verified as accurate** 2. **Cell H8 (activity data for P6 Transportation) is incorrect. The value should be the kg-km per installation (121.1 kg shipping weight x 100 km distance = 12,100 kg-km per install), with the calculation then accessing the emission factor from the Transportation worksheet.** **To arrive at GHG emissions for transportation, the shipping weight of each collector is calculated by the area of the panel multiplied by the rubber density (column V in Detail worksheet), then multiplied by the transportation emission factor per t-km column** **Approach verified as accurate** 3. **Cell E19 (activity data for Copper) is incorrect. Should be 25 kg to match the assumed weight of copper described in the PDD.** **Corrected in revised version of calculation spreadsheets.**	SB	SW

	In addition to the calculation discrepancies listed above, the following issues were also observed: **1. The calculations are currently structured so that the first year of the baseline scenario assumes a full year of pool usage and natural gas consumption. A more conservative approach is recommended that would assign a partial year of pool use and natural gas consumption (e.g. July & August) in the first year to account for the fact that installations could occur at any time during the season.** **I ran an analysis of how many m2 of pool panels were shipped, by date, for calendar year 2006. The majority of panel area (~75%) was shipped by the end of June which supports a 25% reduction in the first year of baseline scenario.** **The first year of the baseline scenario has been reduced by 25% in revised version of calculation spreadsheets to account for installations occurring after start of season.**		
Calculations in 'SSR Summary' worksheet were reviewed.	**2. Confirm the area of rubber that is associated with each installation. The description of rubber area and weight on page 7 of revised PDD should be checked for accuracy and changed if necessary. As described on page 7 of PDD a typical installation would be 78 m2, which is four times larger than the average from the sales data.** **Rubber area is calculated on an order-by-order basis, based on the area of the panel size and the density of the panels in kg/m2. In 2011, the average rubber area per installation is approx. 20 m2 per install, based on the total area of panels sold (approx. 14,000 m2) for 700 installations.** **Size of typical installation revised.**	SB	SW

Calculations in 'Detail *Year*' worksheet were reviewed.	All calculations were verified as accurate with the exception of the following: **Column I of the Detail worksheet provides a description of the item that was sold. The sales where multiple panels were sold in one unit (e.g. rows 1055-1099 of 2011 Detail) should have the area of the collector (Column O) multiplied by 3. This will impact the natural gas in the baseline scenario, and the rubber and transportation components of the project scenario.** **We are aware that we have understated the area of some solar systems. However, the labour to go through the many rows of the data to correct these cases is not warranted. Leaving these as they are will understate the emission reductions and are in keeping with the principle of conservativeness.** **Verifier accepts the approach utilized.**	SB	SW
Calculations in 'Summary *Year*' worksheet were reviewed.	The following calculations were verified as accurate: • Application of decay factor beginning in year 4 • On-going emissions in the baseline scenario from year to year • GHGs from the annual calculation spreadsheets match the main summary spreadsheet	SB	SW
Output from EnerPool model was compared against values in ConversionFactors worksheet.	All values in ConversionFactors worksheet matched the EnerPool model output files.	SB	SW