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VOLUNTARY EMISSION REDUCTION - VER

Verification Report for Solar Home Light Systems

In Rural Karnataka, India

Vintage 2008

Systems implemented by
SELCO Solar Light Pvt. Ltd., India

Report commissioned by
The CarbonNeutral Company, UK

Verification by
Aurore Projects and Services, India



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Introduction

Aurore Projects and Services has been commissioned by **The CarbonNeutral Company** to carry out an independent verification of carbon emission reductions contributed by solar home light systems in rural Karnataka, supplied and maintained by **SELCO Solar Light Pvt. Ltd., India**. The report covers the emission reductions generated by installations beginning January 2002 up to December 2008 for the monitoring period 1st January 2008 to 31st December 2008.

This report presents findings of the physical and documentary assessment of the installations and **Aurore's** certification opinion.

The monitoring results contained in SELCO's monitoring report, "Monitoring Report SHLS 2008", have been reviewed and verified by Aurore, which established that the monitoring methodologies for CO₂ emission reductions were appropriate and have been applied. The documentation can thus be deemed rigorous, complete and transparent.

a. Objective

The purpose of this verification exercise is to objectively review:

- i) Carbon emission reductions from the installations as documented and presented by SELCO
- ii) Completeness, consistency and accuracy of the data

b. Scope

The scope covers verification of emissions reduction from anthropogenic sources of greenhouse gases. They include:

- i) The verification of appropriate systems and processes that are in place to record solar light installations and their maintenance.
- ii) The evaluation of emissions reduction data to conclude whether reported CO₂ emissions reduction data are stated fairly.

c. Description of project activity

Sector:	Solar PV Installations
Project Parties:	SELCO Solar Light Pvt. Ltd. The CarbonNeutral Company
Project Entity:	SELCO
Title of Project:	Solar Home Light System Project.
Location of Project Activity:	Rural Karnataka, India.
Project crediting period:	January 2008 to 31st December 2008

SELCO India is an Energy Service Provider (ESCO). Formed in 1995, it is a private enterprise that seeks to sell and service solar electric home lighting systems in those parts of India (the rural sector) that lack access to regular and reliable electricity. Headquartered in Bangalore, India, SELCO India presently has 150 employees.

SELCO's core business is designing, selling, installing and servicing solar electric lighting systems. The systems are made affordable to the rural poor through financial instruments

such as bank loans and micro-finance credits. The whole process is termed as the emission reductions project from which TCNC has purchased VERs.

A typical system comprises a solar photovoltaic (PV) panel, a battery, a charge controller (to regulate the charging of the battery from the panel) and a number of energy efficient lights (typically four 7W compact fluorescent lights or 11w for bigger systems). SELCO has designed lighting units that suit various types of houses and needs.

Prior to SELCO's intervention, households in rural areas that were not serviced by electricity used kerosene lamps to provide lighting.

Kerosene is a petroleum distillate that produces CO₂ emissions when burned. Many rural households also use automobile batteries to power household appliances. These batteries have to be periodically transported to special charging stations for recharging. Typically, these recharging stations use electricity from the grid, although some run on diesel powered generators. Solar powered systems provide emission free, affordable, sustainable power to electric lights and small appliances, thereby displacing kerosene and offering a potential alternative. The latter was taken as the baseline scenario for the project. Most of the solar lighting systems have been installed in rural households with no electricity. SELCO also sells solar light systems to local entrepreneurs, who then provide portable lighting options for street vendors on a rental basis.

A total of 1,863 PV systems had been installed during 2008. To date, 9,805 systems have been installed, resulting in a total of **2,971** tons of CO₂ equivalent of emissions reductions for the period 2008 as part of this project.

d. Methodology for Determining Emission Reductions

Emissions reductions are determined by calculating the reduction in CO₂ emissions when kerosene lamps are lit. The baseline case assumes that in the absence of PV systems, lighting would be provided by kerosene lamps. Baseline emissions were calculated by estimating the amount of CO₂ emissions per household per year. These were based on certain assumptions regarding the number of kerosene lamps used per household, CO₂ emissions from kerosene combustion and fuel consumed by the lamp.

SELCO and TCNC have entered into three separate Emission Reduction Purchase Agreements (ERPAs). Together, all three ERPAs cover the project's emission reductions. The VER delivery schedule for each of these is outlined below, together with the total delivery for all three contracts. The right hand column lists the number of solar system installations required to fulfill the delivery schedule. As per the PDD, this is based upon emission reductions of 0.3721 tCO₂ per system per year with a ten percent buffer. The project baseline has been determined by Trexler and Associates Inc. of Portland, USA. The buffer caters for under-delivery by the project and ensures a conservative slant to the calculation of emission reductions.

This monitoring report covers all three contracts, with the emission reductions monitored being the entire emission reductions associated with the sale of solar systems.

Vintage Year	2004 Contract	2005 Contract	2006 Contract	Total VERs	Total Installations, Year 2008	Total Installations, cumulative
2008	0	1,005	1,930	2,971	1,863	9,805

Verification Methodology

a. Assessment

The verification process covered the data, processes and assumptions for the computation of emission reductions from the project. The verification team consisted of:

- **Erik Conesa**
- **Minhaj Ameen**
- **Hemant Lamba**
- **Tejas Ousep**
- **Tom Bristow**

The verification work included:

- i. Supervising that the number of PV systems sold during 2002 to 2008 that qualify for VER credits matched with the figures in the Monitoring Report. The key pre-requisite being that the site should be in an off-grid area where kerosene / fossil fuel is the primary light source.
- ii. Ensuring that systems included in the monitoring report are in good working order. For this matter, Aurore chose, out of 2 branches, 5 sites each. Out of these, 2 sites from each branch would be picked out by SELCO to be verified.
- iii. Studying the processes to ensure accurate recording of system installations and proper functioning of these systems.
- iv. The intensive consideration of robust data, methods and assumptions used in the calculation of emissions reduction.

b. Assessment activities

i. Office based review:

Aurore reviewed the following documents:

- SELCO's monitoring report for the vintage years 2008. (Monitoring Report SHLS 2008)
- Spreadsheet from SELCO detailing solar PV module details, date of installation and warranty card numbers for all sites that qualify for carbon credits.
- Invoices to verify owner, date, size and location of the installation.
- Warranty cards regarded as the document of ownership and containing all the relevant details regarding the system. It is also the proof that the carbon offset benefits from the system are owned by SELCO

The verification team engaged in discussions with the staff at regional offices to get a feel for working practices, particularly relating to customer support and service.

ii. Site visits:

Erik Conesa and Tom Bristow visited three regional offices located in the Western Ghats range of Karnataka. Terrain conditions made it difficult to conduct site visits in some of the sites of the district of Sullia. Furthermore, some of the sites couldn't be visited due to logistics. However, all attempts were made to visit as many diverse sites as possible.

The site visits entailed around 1,500 Km's of travel by bus to get to the three regional offices and around 700 Km's by car in local travel to visit sites from these regional offices.

Office	Dates	Visits planned	Visits made	Sites included in the report	SELCO staff involved
Bangalore	9 th March 2009	-	-	-	Prasanta Biswal Manager Innovations SELCO Head Office Ravikanth Branch Manager Jaiswamy Customer Support Executive
Udupi	10 th March 2009	11	11	11	Prasanta Biswal Manager Innovations SELCO Head Office Guruprakash S. Branch Manager Subramaniam Customer Support Executive
Puttur	11 th to 12 th March 2009	9	7	7	Guruprakash S. Udupi Branch Manager Krishnarag Branch Manager Sudhakar Sales Executive
Sullia	12 th to 13 th March 2009	18	14	14	Guruprakash S. Udupi Branch Manager Radhakrishna Branch Manager Ashok Sales Executive
Total		38	32	32	

Year of installation	2002	2003	2004	2005	2006	2007	2008	Total
Sites Visited	4	3	2	5	8	2	8	32

Pictures were taken of the system components during site visits. Pictures of the panels, charge controllers and batteries were easy to take in most cases. Pictures of the owner/user in front of the Solar light systems were also taken as evidence that the system was working and to serve as owner ID.

The owner/user was also asked some questions relating to the system - its performance and how it met their lighting needs.

The pictures from the site and customer records are in a separate document - Appendix A.

iii. Site Visit Findings

- All users seemed very happy with the performance of the system and the service they received from SELCO staff, who command the respect of celebrities. The systems had allowed many users, such as bidi makers, to increase their allowances.
- Most systems were found fully functional and in perfect working condition. All batteries were found to be well maintained. Systems installed since 2003 and 2002 were found to be well maintained despite not being under warranty.
- System performance was undermined to some degree during the four monsoon months when the skies are overcast on most days. Additionally, it was also noticed that users were taxing the system with other domestic applications, such as mobile chargers, land phones or radios, thereby draining the battery more quickly.
- The use of fossil fuels – Kerosene for lighting was found to be non-existent in most houses. However, users were forced to resort to kerosene use for lighting and even cooking in the monsoons, when their batteries were empty and firewood was wet.
- Most systems comprised of a 40 watts solar panel, 60 Ah flooded Battery and 4 7w lights. There were also larger systems in many places with a 75 watts solar panel, 110 Ah flooded battery and 4 11w lights.

iv. Regional Office findings

- The staff of the regional offices is a highly committed group. SELCO has inculcated the ethos of customer service and understanding throughout the organization. They have consistently managed to service systems in remote areas which are difficult to access and sometimes involve traveling by jeep along unsound and steep dirt roads, or by foot over long distances.
- Maintenance records are in standard format and filed in proper order since 2004, reflecting a commitment to efficient and consistent record keeping.
- Service contracts were registered for a few customers only, as the vast majority cannot afford a service contract. However, SELCO service staff pays courtesy calls when in a certain area, looking into minor repairs and allowing poor customers to pay for these random services as and when they can. Many times refreshments or a cooked meal would be accepted gratefully in exchange. Over time the relations between customer and service provider have extended into friendships.
- The service area covered by the SELCO branches here is about 80kms radius.

c. Assessment of Emission Reduction Calculation

The purpose of project monitoring is to establish the number of emission reductions generated by the project in the given vintage year.

In order to do this, the number of solar systems in operation for the year must be determined. Two elements are required here:

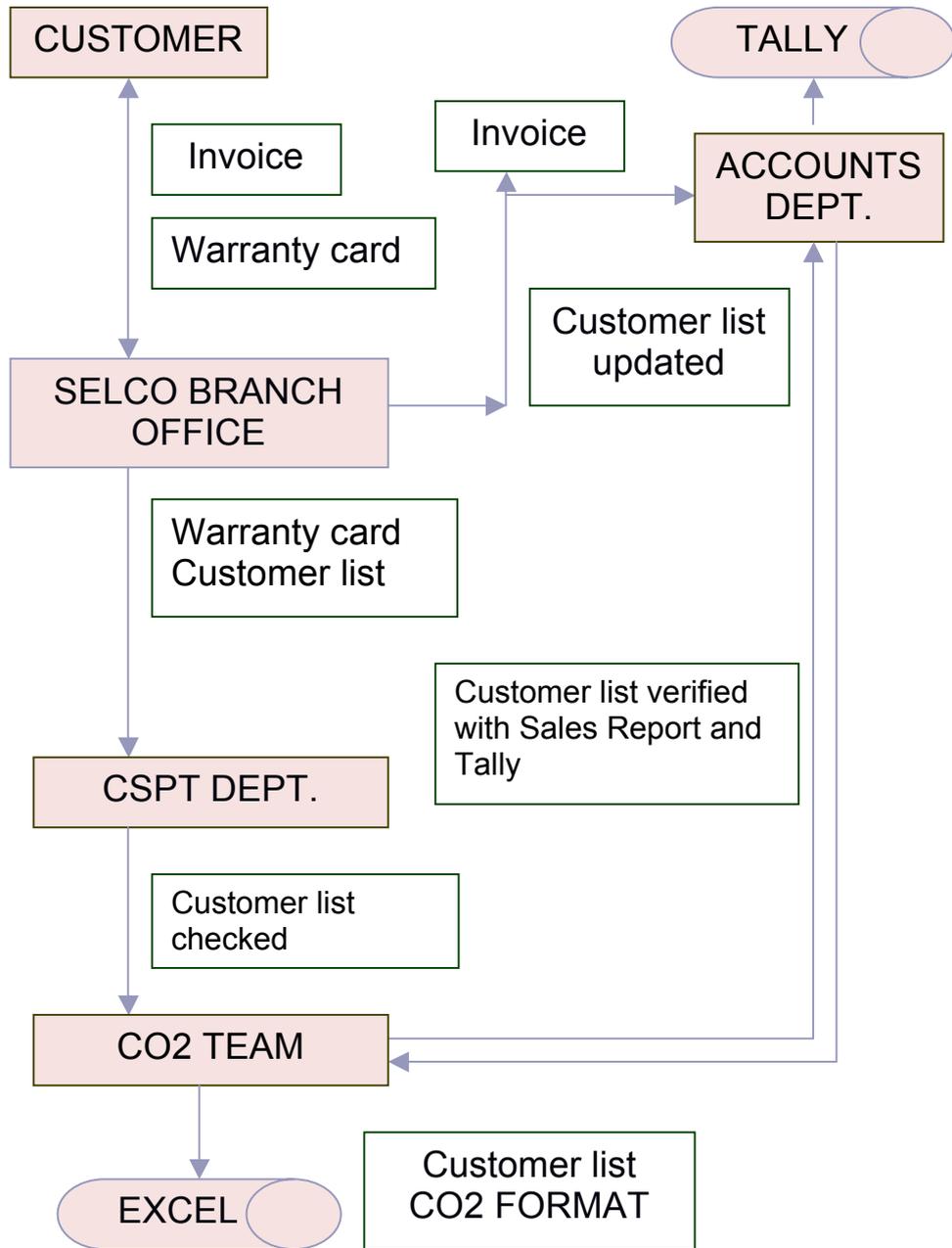
1. The number of solar systems sold in the given vintage year. The carbon credit generation model assumes that solar systems are sold evenly across the year so that, on average, half the systems are in use during the year.
2. The number of solar systems sold prior to the given vintage year and still in operation. SELCO provides a five year warranty with its solar systems and it is assumed that systems five years or earlier are operating if no warranty claims have been made. Once purchased, the systems deliver 'free' lighting, so there is every reason to believe

customers will do their utmost to ensure the system continues to function and, if not, to make a warranty claim. For systems older than five years, there are two scenarios useful for benchmarking –having a service contract or not. If the customer has entered into a maintenance contract, SELCO will be able to monitor whether the system continues to be operational or not. If the customer does not enter into a maintenance contract, SELCO will not know whether the system continues to be operational. The ten percent buffer discussed in section I.d. accounts for system failure within the project. This is deemed a reasonable approach since systems have an expected life-span of 20 years. The emissions reduction project contains few systems that are older than five years and without a maintenance contract. Thus, every customer has a strong incentive to keep their systems operational.

The accompanying spreadsheet lists all sales of solar systems, with customer name, customer address and date of sale. To ensure confidentiality, customer names have not been included in this monitoring report.

Each customer is entitled to a warranty card and an invoice. These two documents form the basis for collating information on customers. Each Warranty Card has information about the customer and site where the system has been installed, Module Wattage with Serial No., Date of Installation and the warranty of the system. During the warranty period the system is serviced twice a year. Every system serviced is recorded in a document referred to as the “Service Record”. Warranty Cards, invoices and service records are generated by the branch that had installed the system and sent to the Customer Support (CSPT) Department for recording entries. A copy of these documents is kept at the branch also. The CSPT Department verifies the Customer list against the Warranty Cards received before being sent to the CO₂ Team at SELCO. The information is copied to the CO₂ format. These are then verified at the Accounts HO. A document and data flow diagram below shows the process by which customer information is collated. As part of the Monitoring, a sample is identified each year and audits conducted. These audits along with the service records, together determine the operational status of a system; ensuring that it is still being used and working well. The audit gets reflected eventually in the customer feedback form.

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d. Emission Reductions Calculation for Vintage Year 2002-2008

Vintage Year	2004 Contract	2005 Contract	2006 Contract	Total VERs	Total Installations, Year 2007	Total Installations, cumulative
2008	0	1,005	1,930	2,971	1,863	9,805

Credit Vintage No. of Units	2004 Contract	2005 Contract	2006 Contract
2002	-	-	-
2003	-	-	-
2004	-	-	-
2005		-	-
2006		-	-
2007		-	1,863
2008		-	1,863
2009		-	1,863
2010		-	1,863

Emission reductions for the vintage year 2008 are calculated as follows:

Units installed prior to 2008 and operational in 2008 =	7,942
Units installed in 2008 =	1,863
Total number of units operational in 2008 (average) =	$7,942 + 1,863/2$
=	8,873.5
Emission reductions per unit =	0.3721 tCO ₂
Total emission reductions for vintage year 2008 =	$8,873 * 0.3721$ tCO ₂
=	3,301.8
For buffer =	$3,301.8 * 90%$
Total emission reductions for vintage year 2008 =	2,971

Verification findings

a. Corrective Action Requests

- There were four installations connected to grid power during 2008. Specifically 25 days before verification dates. However, even in such instances, the availability of grid power is mostly unreliable and restricted to only a few hours per day. So users turn to their solar systems for most of the time. During the four months of the monsoon season, due to the terrain conditions, the situation is even worse, and it is expected to affect the grid connections for the entire monsoon period, meaning that households will have to depend only on the installed solar systems. A decision needs to be taken as to whether these can still qualify for carbon offset.
- It is suggested that SELCO works on making their database consistent, by, for example, cleaning up the data, filling up the blanks spaces and homogenizing the information. While analyzing installation records, small typos in warranty card numbers were spotted in the 2002 to 2007 records. SELCO is in the process of implementing MIS system in coming months. It is recommended that SELCO uploads this information in the new system and rectifies the typos before next verification.

b. Completeness of monitoring

The working of systems was completely monitored. Please refer to the pictures in Appendix-A.

c. Evidence provided for determining Emission Reductions

The survey confirmed that emission reduction figures tally with that of the field study and show a clear differential in kerosene consumed, then and now.

d. Accuracy of Emission Reduction Calculation

The project baseline has been determined by **Trexler and Associates** Inc. Portland, USA. The buffer caters for under –delivery by the project and takes therefore a conservative approach to emission reduction calculations.

e. Management System and Quality Assurance

The systems of management at SELCO Solar Light Pvt. Ltd. have been verified as have been the proper documentation of all related records.

f. Assessment of Emission Reduction Calculation

The calculations were reviewed in detail for the year 2008 for accuracy and methodology. Standard calculation methods were followed as shown in the previous section.

Verification Statement

Monitoring Period: 1st January 2002 to 31st December 2008

Emission reductions: 2,971 tons of CO₂ equivalents

We obtained all information and explanations considered necessary by us in order to reasonably assure that the amount of emission reductions - from SELCO - for the given period, prepared on the basis of the **Monitoring Report**, are stated fairly and correctly.

The assessment included

- Collection of evidence supporting the reported data
- Checking whether the provisions of the Monitoring plan in the PDD were consistently and appropriately applied

Certification Statement

In our opinion, based on processes and procedures conducted, emission reductions proposed by SELCO for all installations beginning 1st January 2002 to 31st December 2008, is materially correct. The information and data on installation are fairly stated and the emission reductions were calculated correctly on the basis of approved monitoring methodology.

On this basis, Aurore systems is able to certify that the project is in full compliance with reported emission reductions achieved by SELCO for installations since 2002 for the period beginning 1st January 2007 to 31st December 2008 is **2,971 tons of CO₂ equivalents**.

22th August 2009

Hemant

Hemant Lamba