

**VER Verification Report
for
Solar Home Light Systems Project in Rural Karnataka, India**

Implemented by SELCO Solar Light Pvt. Ltd., India



**Verification of 2002-2006 vintage
Verified by:**



AURORE PROJECTS & SERVICES
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I. Introduction

AuroRE Projects and Services had been approached by **The CarbonNeutral Company** to carry out an independent verification of carbon emission reductions through solar home light systems in rural Karnataka supplied and maintained by **SELCO Solar Light Pvt. Ltd.**, India. The report covers fresh installations during January 2006 to December 2006 and vintage installations from Jan 2002 onwards. This report presents findings of the physical and documentary assessment of the installations and **AuroRE's** certification opinion.

The monitoring results have been reviewed and verified by Aurore and it has been established that the monitoring methodologies for the CO₂ emission reductions have been applied. Hence the documentation is complete and transparent.

a. Objective

The purpose of this verification exercise is to objectively review:

- i) Carbon emission reductions from the installation as documented and presented by SELCO
- ii) The data reported are complete, consistent and accurate.

b. Scope

The scope covers verification of emission reduction from anthropogenic sources of greenhouse gases as proposed in (VCS) Voluntary Carbon Standard.

- To verify that appropriate systems and processes are in place to record solar light installations and their maintenance.
- To evaluate emission reduction data and express a conclusion on whether the reported CO₂ emission 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:	Fresh installations from January 2006 to December 2006. Vintage installations from January 2002

SELCO India is an Energy Service Provider (ESCO). It is a private business formed in 1995 to sell and service solar electric home lighting systems in areas of India that lack access to reliable electricity. Headquartered in Bangalore, India, SELCO India presently has 170 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.

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). SELCO has designed lighting units that suit various types of houses.

Prior to SELCO's intervention, households in rural areas that are not serviced by electricity grid typically 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 must be periodically transported to special

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charging stations for recharging. Typically, these recharging stations use electricity from the grid, although some use diesel powered generators. Solar powered systems provide emission free, affordable, sustainable power to electric lights and small appliances and displace the use of kerosene. The latter was taken as the baseline scenario for the project. Most of the solar lighting systems have been installed in rural households where there is no electricity. SELCO has also sold systems to local entrepreneurs, who provide lighting for street vendors on a rental basis.

In 2006, a total of 1000 PV systems have been installed in the market. To date, 6900 systems have been installed. A total of **2143.26** tons of CO₂ equivalent of emissions reductions have been reported from the project.

d. Methodology for Determining Emission Reductions

Emission reductions were determined by calculating the reduction in CO₂ emissions when kerosene lamps were burned. 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 based on the assumptions of the number of kerosene lamps 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. 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 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, Portland, USA. The buffer caters for under-delivery by the project and ensures a conservative approach 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 2002	Total Installations, cumulative
2002	169	-	-	167.44	1000	1000
2003	485.59	-	-	485.59	900	1900
2004	786.99	167.44	16.74	971.17	2000	3900
2005	1077.5	502.33	61.1	1640.93	2000	5900
2006	1217.31	837.22	88.73	2143.26	1000	6900

II. Verification Methodology

The verification process covered the data, models and assumptions for the computation of emission reductions from the project:

The assessment

Verification team:

Hemant Lamba
Minhaj Ameen
Hemant Shekhar
Tejas Joseph

- i) Number of PV systems sold and their size in 2006
- ii) Number of systems installed
- iii) Project activities associated with emissions and emission reductions protocols used to estimate or measure emission reductions
- iv) First location description, **Sullia**: Remote hill areas accessible by small 4 wheel drives / motorbikes and some distance of walking. Main income is from coconut & betelnut plantations on slopes.
Second location description, **Udipi**: Remote areas accessible by 4 wheel drives / motorbikes and some distance of walking. Main income is from coconut & cashew plantations on dry soil.
- v) Current usage of these systems is mostly for lighting. Overall customers were very happy and have stopped using kerosene completely, including for wood fire cooking purpose and insect repellants.
- vi) The data, method and assumptions used to calculate the emission reduction.

Assessment activities

a. Review of documentation:

Auroville reviewed,

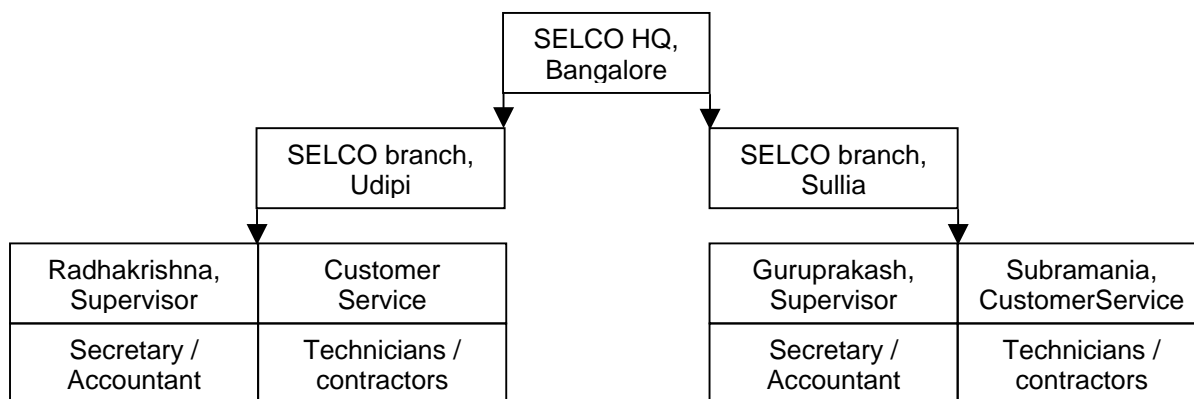
- SELCO's monitoring report for the vintage years 2002-2006:

[Click box to review report](#)

- SELCO's spreadsheets detailing invoices, customer records, date of installations, warranty cards, module numbers, and feedback forms

b. Site visit:

Hemant Shekhar visited sites Sullia & Udipi on dates 14th & 15th Jan.2008. During the visit the following people participated in the interview process: Radhakrishna, Guruprakash, Subramania.



The main topics covered in the discussion were:

Maintenance records These were in standard format and filed in proper order since 2004, reflecting a commitment to efficient and consistent record keeping.

Service contracts These were registered for a few customers only because the vast majority cannot afford a service contract. However, SELCO service staff pays courtesy calls in various areas, looking into minor repairs and allowing poor customers to pay for these random services as and when they can.

Upgrades Up-gradation of systems and accessories is an option taken up by very few due to obvious economic factors. Most of the customers are low income beneficiaries who simply do not have the money to consider up gradations or scale-ups.

Training Imparting training to technicians is not a problem as the present systems (technology & design) have not changed since many years.

Area The service area covered by the SELCO branches here is about 80kms radius.

The following three pages contain data and photographs from the sites visited:

SELCO VER Verification Report for vintage Jan. 2002 to Dec. 2006

No.	Customer name	Address	Branch	Date Installed
871	K.Vamana Gouda	Kunchadka house,Po &vi:Aletti, Sullia,ph:232244	Sullia	12/04/2006
887	Seetamma	Maidhavi Kan House, Allety, Sullia M.NO: 9449484396	Sullia	30/09/2006
891	Shankar Naik	S/o Aitha Naik, Elikala House, Aletty, Sullia	Sullia	22/11/2006
870	Krishna Naik	S/o Sankappa Naik, Baddadka house, Po & Via Aletty, Sullia, ph:264119	Sullia	31/03/2006
867	Janardhana (not available)	S/o Sadashiva Udiyara,Batoli,Kallapalli, ph:264162	Sullia	31/03/2006
963	Bharathiya Vikas Trust	A/c Krishna Poojary,S/o Basava Poojary, Chatremane,Mavinakadlu,Kullanje	Udupi	15/08/2006
964	Bharathiya Vikas Trust	A/c Devi Poojary,W/o Narayan Mavina Kodllu,Kullnle,Kundapur	Udupi	16/08/2006
906	Bharathiya Vikas Trust	A/c Santhyavathy Poojary,W/o manjunath, Chatrimane,mavinkodln,Kundapur	Udupi	30/10/2006
965	Bharathiya Vikas Trust	A/c Gulabi,W/o Sannjeeva Chetri,Kullunji, Kundapur	Udupi	16/08/2006
954	Bharathiya Vikas Trust	A/c Vishwanath Banger, Pragathi nagar, Padav, Badagubettu,Alevoor,Udupi	Udupi	28/07/2006

No.	WC no.	Make	Serial	Wattage/Lights	Warranty period (panel/bat/elect)	RURAL (Yes/No)
871	989	SELCO	Db 050917639	40Wp /5lights X7W	10/3/1	Yes
887	2544	SELCO	56240602	60Wp /6lights X7W +radio	5/3/1	Yes
891	2551	SELCO	54900602	60Wp /6lights X7W	5/3/1	Yes
870	987	SELCO	Db050917662	40Wp /5lights X7W	10/3/1	Yes
867	984	SELCO	Db 050917585	40Wp /4lights X7W (not verified)	10/3/1 (not verified)	Yes
963	1046	SELCO	40660601	20Wp /3lights X7W	5/3/1	Yes
964	1047	SELCO	41260601	20Wp /2lights X7W +1light X5W	5/3/1	Yes
906	117	SELCO	6034129	20Wp /2lights X7W +1light X5W	5/3/1	Yes
965	1048	SELCO	41420601	20Wp /2lights X7W +1light X5W	5/3/1	Yes
954	1037	SELCO	DB051218122	40Wp /4lights X7W+1fan	5/3/1	Semi rural

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No.	Remarks (condition of system/upgradation)	Location (battery/panels)
871	Good condition. System is robust. One year free service was provided and owners trained to top-up lead-acid battery water.	On shelf in room / Terrace
887	Good condition. System is robust. One year free service provided and owners trained to top-up lead-acid battery water. Warranty period for panel reduced by supplier side.	Inside room, battery on floor / Tiled roof
891	Good condition. One year free service and owners trained to maintain lead-acid battery. Warranty period for panel reduced by supplier side.	Inside unprotected room / Tiled roof
870	Ok condition. One year free service was provided. Found connections loose due to drunk husband.	Inside room / Tiled roof
867	Owner not home. Panel good condition. Outside light good condition.	Not known / Tiled roof
963	Good condition. System is robust and requires no maintenance. One year free service provided and owners trained to top-up lead-acid battery water. Warranty period for panel reduced from supplier side.	On shelf in room / Terrace
964	Good condition. One year free service was provided and owners trained to maintain lead-acid battery. Warranty period for panel reduced from supplier side.	On shelf in room / Terrace
906	Good condition. One year free service was provided and owners trained to maintain lead-acid battery. Warranty period for panel reduced from supplier side.	On shelf in room / Terrace
965	Good condition. One year free service was provided and owners trained to maintain lead-acid battery. Warranty period for panel reduced from supplier side.	On shelf in room / Terrace
954	Good condition. One year free service was provided and owners trained to maintain lead-acid battery. Warranty period for panel reduced from supplier side.	On shelf in room / Terrace

No.	Replaced what? / Usage hours per day	Maint. Response time
871	4 kerosene, 1 petromax gas lamps / 4 hours	2 days (one call for electronics relocation)
887	5 kerosene lamps / 4 hours	2 days
891	5 kerosene lamps / 4 hours, 1 light for 6 hours	1 day (owner has cell phone)
870	3 kerosene lamps / 4 hours	Not known
867	Not known	2 days (not verified)
963	3 kerosene lamps / 3 hours	1 day, as SELCO customer service person is local resident.
964	3 kerosene lamps / 4 hours	1 day, as SELCO customer service person is local resident.
906	1 kerosene lamp / 3 hours	1 day, as SELCO customer service person is local resident.
965	2 kerosene lamps / 3 hours	1 day, as SELCO customer service person is local resident.
954	2 kerosene lamps / 3 hours evening + 3 hours early morning	1 day

SELCO VER Verification Report for vintage Jan. 2002 to Dec. 2006



UDIPI



Clockwise top-left: Customer, SELCO branch office, Kerosene offset night market, typical customer site battery+charge controller installation, typical tile roof solar PV mounting.

Clockwise top-left: Installation records, SELCO branch office, Service records, Customer relationship, Complaints register, healthy children.

SULLIA



Complaint Register		Complaint Register		Complaint Register	
No.	Description	Date	Status	No.	Description
1
2
3
4
5
6
7
8
9
10



c. Assessment of Emission Reduction Calculation

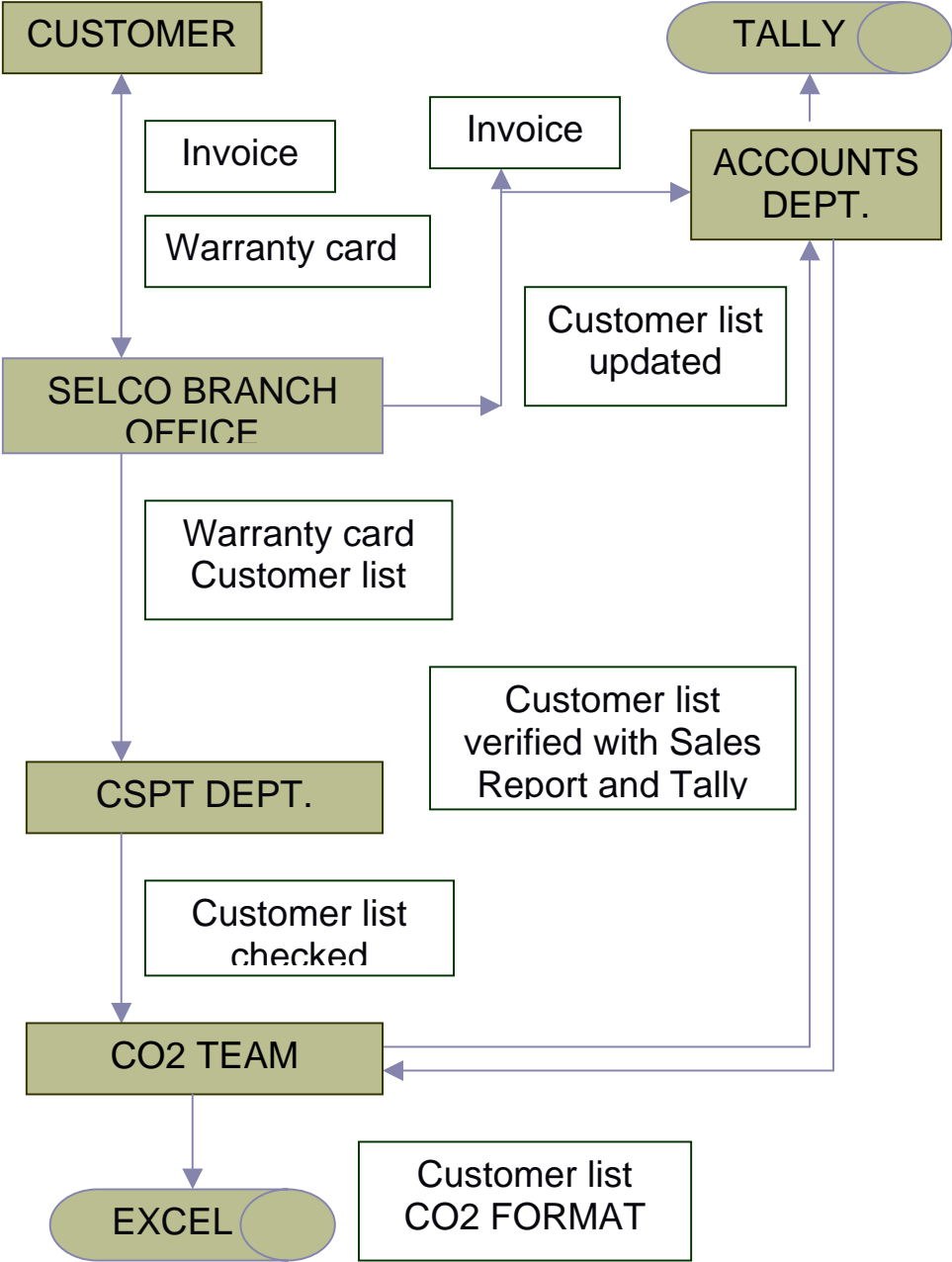
The purpose of project monitoring is to establish the number of emission reductions generated by the project in the given vintage year.

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 younger are operating if no warranty claim has 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 to make a warranty claim if not. For systems older than five years, there are two scenarios. 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, and the customer has every incentive to keep their system operational.

The accompanying spreadsheet lists all sales of solar systems, with the customer name, customer address and date of sale. For reasons of confidentiality, customer names are not 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 service is recorded in a document named service record. Warranty Cards, invoices and Service Records are generated by the branch, which has installed the system and are sent to the Customer Support (CSPT) Department for records. A copy of these documents is maintained at the branch also. The CSPT Department verifies the Customer list against the Warranty Cards received and sent to CO2 Team. The information is copied to the CO2 format. These are then verified at the Accounts HO. A document and data flow diagram below indicates the process of collating Customer details. As part of the Monitoring, a sample is identified each year and audits conducted. This audit and service records together ensure the system is still being used and working properly. The audit results in a customer feedback form.



Emission Reductions Calculation for Vintage Year 2002-2006

Year 2006

Vintage Year	2004 Contract	2005 Contract	2006 Contract	Total VERs	Total Installations, Year 2006	Total Installations, cumulative
2006	1217.31	837.22	88.73	2143.26	1000	6900

	Credit Vintage No. of Units	2004 Contract	2005 Contract	2006 Contract
	2002	0	0	0
2003	0	0	0	-
2004	0	0	0	-
2005			0	-
2006			1000	-
2007			1000	-
2008			1000	-
2009			1000	-
2010			1000	-

Emission reductions for the vintage year 2006 are calculated as follows:

Units installed prior to 2006 and operational in 2006	= 5900
Units installed in 2006	= 1000
Total number of units operational in 2006 (average)	= $5900 + 1000/2$
	= 6400
Emission reductions per unit	= 0.3721 tCO ₂
Total emission reductions for vintage year 2006	= $6400 * 0.3721$ tCO ₂
	= 2381.44
	= $2381.44 * 90%$ (for buffer)
Total emission reductions for vintage year 2006	= 2143.26

III. Verification findings

a. Open Issues from Validation and/or Previous Verifications

No open issues were found. CARs and FARs verification complete.

b. Completeness of monitoring

The working of systems was completely monitored. Please refer the pictures in previous section.

c. Evidence provided for Data on 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. has been verified and all related records documented. Team member responsibility was examined and was found to be as per monitoring plan.

f. Assessment of Emission Reduction Calculation

The calculations were reviewed in detail for the years 2002 to 2006 for accuracy and methodology. Standard calculation methods were followed as shown in the previous section.

IV. Verification Statement

Reporting Period: Vintage January 2002 to December 2005

Fresh: January 2006 to December 2006

Emission reductions: 2143.26 tons of CO2 equivalents

We planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that the amount of SELCO emission reductions for the given period, prepared on the basis of the **Monitoring Report**, are fairly stated.

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

Based on process and procedures conducted, in our opinion, emission reduction proposed by SELCO for Vintage January 2002 to December 2005, Fresh: January 2006 to December 2006 is materially correct. The information and data on installation are fairly stated and the emission reduction 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 the Voluntary Carbon Standard version 1, and the reported emission reductions achieved by SELCO during this period is 2143.26 tons of CO2 equivalents.

15 February 2008



Hemant Lamba