Stichting Solar Cooking
Nederland

Presentation of a FairClimate/ICCO project

1. Project title

Integrated Solar Cooking (ISC) Project

Introduction, production and use of solar and other sustainable energy devices for daily cooking, food processing and water pasteurization.

2. Location of the project

Mbarara District, South West Uganda, East Africa
Project activities are initially concentrated in the following villages and refugee settlements in the vicinity of Mbarara City, the capital of Mbarara District: Kikokwa village, Biharwe village, Ruharo village and the refugee settlements of Orukiga and Nyakivale.
Each village and refugee settlement has a population of about 5,000 (average size of one household is 6 persons). This is in total 30,000 households for 4 villages and two refugee settlements. Expansion towards 17,600 households will at a later stage (after two years) also take place in other villages in the same Mbarara District.

3. Project duration

The project starts in 2009 and will last 7 years.

4. Name of organization implementing the project

Solar Connect Association (SCA), a registered NGO in Kampala, Uganda
Contact person: Mr. Kawesa Mukasa, executive director
SCA has 6 permanent employees, 13 instructors from the targeted villages and refugee settlements and 3 volunteers. The head office of SCA is in Kampala, SCA has a district office in Mbarara City.

5. Background of SCA

SCA is involved in the conservation of forests through the promotion and introduction of solar cookers, solar dryers, hay baskets and other energy saving devices like wood

efficient stoves. SCA trains people, especially rural women, how to make and how to use solar cookers as well as generate some income from activities related to the use of locally made solar and other energy saving devices. SCA was formed in 1994 and has promoted solar cookers and dryers since then.

6. Justification of the project

Quite a number of households in the targeted villages and refugee settlements continue to use firewood for their daily cooking purposes. This means that the process of deforestation is going on and women still experience the physical risks of collecting firewood or spend half of their monthly income on buying wood or charcoal for cooking.

The introduction of solar cookers and other energy saving devices in the targeted project area started in 2007. Many women, about 4,000 households, in the targeted locations have already expressed their interest and are developing daily habits in using the CooKit, the most simple solar cooking device, and a hay basket, thus saving a lot of money and time. In addition, efficient wood stoves, like the Lorena stove and the Rocket stove, and efficient charcoal stoves reduce the smoke and use only a little wood or charcoal.

Apart from a consolidation of the present families, solar cooking and the introduction of other energy saving cooking devices will be extended to another 2,000 households in the targeted communities during the first year of the project. Subsequently there will be a progressive increase of cooking devices during the course of the 7 years of the project life.

The schools in the targeted villages also face a firewood crisis, whereby the fuel wood price increases every three months. Firewood saving devices will reduce the costs of feeding students, initially in a secondary school of 400 students and a primary school of 300 children and later also in the other schools in the targeted project locations.

7. Planned project activities

- Consolidation of solar cooking, the use of other energy saving cooking devices and food processing activities and water pasteurization in the 4 project villages and refugee settlements.

- Transformation of one or two village communities into integrated solar cooking model villages.

- Extension of integrated solar cooking/food processing activities to communities in other targeted villages and refugee settlements.

- Introducing sustainable energy technologies to schools and the training of staff, teachers and upper class students on how to contribute to the conservation of the environment by using sustainable sources of energy.

- Public promotion and awareness activities on solar cooking, the use of other energy saving technologies for cooking and food processing and water pasteurization at district and village level.

- Monitoring and evaluation and development of measures to turn SCA into a completely independent and self supporting service organization.

8. Expected results of the project

- Extension of solar cooking and related activities in the four targeted villages and refugee settlements, reaching 4,400 households during the first project year and a total of 17,600 households by the end of the project life of 7 years. Two villages have become Integrated Solar Cooking model villages. Data have been collected which give insight in integrated solar cooking awareness, motivation and the actual use of solar cooking and other energy saving cooking devices.

- All ISC instructors and staff members are qualified trainers and are able to organize and implement integrated solar cooking training programmes and promotion activities, including the use solar cookers, hay baskets and wood/charcoal efficient stoves. There are agreed integrated solar cooking qualifications for instructors and staff.

- A central place, the Solar Connect Resource Centre, for the promotion of integrated solar cooking and the production of solar cookers and other energy saving cooking and food processing devices has been established in Mbarara City.

- Solar cooking devices (in this case parabolic cookers) and wood efficient stoves have been installed in at least two schools in the targeted project area. Subjects like the prevention of deforestation, the use of available sustainable sources of energy as well as practical lessons in solar cooking have become an integral part of the school programme.

- SCA staff at national and district level are qualified in providing training and advisory and consultancy services in the field of establishing an integrated solar cooking and water pasteurization program, food processing and the production of solar cookers and other energy saving cooking devices.

9. Cooperation with Solar Cooking Foundation The Netherlands

Solar Cooking Foundation The Netherlands (SCN) provides technical assistance to the project: the training of instructors and staff, the transfer of know how with regard to solar cooking technologies, capacity building and institutional strengthening. SCN has also mediated in securing the necessary financial support of the project during the years

2007 and 2008. Sources are donations (private and institutional) and additional funding from the donor agencies Wild Geese, ICCO and NCDO, all from the Netherlands. Contact person: Ms. Clara Thomas, chairwoman of the board (info@solarcooking.nl)

10. Estimate of GHG emission reductions as a result of the project

10.1 Baseline data

Main objective of the project is the adoption of solar energy and other energy saving technologies for cooking food, food preservation and water pasteurization by an increasing number of households in both rural and urban areas. As a result the daily consumption of fuel wood, and thus also the emission of green house gases, will be reduced dramatically. In this section an effort is made to quantify these reductions.

Starting point is the traditional way of cooking, i.e. using a simple three stone fire place in a closed environment, causing a lot of smoke. A substantial amount of energy from burning the wood (or charcoal) is lost in the open air. The environment friendly and economically attractive alternative to this traditional way of cooking is the use of a solar cooker in combination with a hay basket during sunny days (no fuel wood consumption) and the use of a wood efficient stove, also in combination with a hay basket, during cloudy or rainy days (up to 60% reduction of fuel wood consumption).

In rural areas fire wood is the most commonly used energy source for cooking. The wood is either collected individually from forests, mostly by women and children, or bought from traders. These traders collect the wood from the forests and take it to the villages, tied into bundles. In a few cases (approximately 10%) households in villages use charcoal for cooking. The charcoal is bought from charcoal producers/traders. In urban areas the use of charcoal is more widespread.

The following calculation of overall household reductions in fuel (wood and charcoal) consumption are deduced from field testing. Wood and charcoal were weighed using a digital hanging scale with 0.01 kg accuracy. Charcoal was weighed in polyethylene bags of negligible weight; wood was tied into bundles with a cord and weighed.

Introduction of a solar cooker (e.g. the CooKit) in combination with a hay basket

- Base-line situation: using a traditional three stone fire place, the average household (6 persons) consumption of, usually wet, fuel wood is 13.11 kg per day. The dry fuel wood equivalent would be 6.55 kg per day.

- Solar cookers save 100% fuel wood whenever they are used. Average number of sunny days a solar cooker can be used in a year: 180 days (conservative estimate).

- Average wood saving per household, using a solar cooker (CooKit): 1.18 ton per year (dry fuel wood).

- When used as cooking fuel, each ton of dry fuel wood produces a average of 1.66 ton CO2 gas and small amounts of CH4 (methane) and N2O (together 0.14 ton CO2 equivalent). In total therefore 1.8 ton CO2. The average annual reduction in dry fuel wood consumption of 1.18 ton per family would therefore correspond to a reduction in greenhouse gas emissions of 2.124 ton of CO2 (see also Annex 1).

Introduction of an improved wood stove in combination with a hay basket

- Base-line situation: using a traditional three stone fire place, the average household consumption of, usually wet, fuel wood is 13.11 kg per day. The dry fuel wood equivalent would be 6.55 kg per day.
- Average household consumption of, usually wet, fuel wood, using an improved wood stove, is 5.51 kg per day. Dry wood equivalent would be 2.75 kg per day.
- Average wood saving per household, using an improved wood stove would be 3.8 kg per day (dry fuel wood).
- Average number of cloudy or rainy days an improved wood stove is used: 185 days
- Average wood saving per household, using an improved wood stove: 0.7 ton per year (dry fuel wood).
- When used as cooking fuel, each ton of dry fuel wood produces a average of 1.66 ton CO2 gas and small amounts of CH4 (methane) and N2O (together 0.14 ton CO2 equivalent). In total therefore 1.8 ton CO2. The average annual reduction in dry fuel wood consumption of 0.7 ton per family would therefore correspond to a reduction in greenhouse gas emissions of 1.26 ton of CO2 (see also Annex 1).

Introduction of improved charcoal stove in combination with a hay basket

- Base-line situation: using a traditional metal stove, the average household consumption of charcoal is 3.08 kg per day.
- Average household consumption of charcoal, using an improved charcoal stove, would be 1.96 kg per day.
- Average charcoal saving per household, using an improved charcoal stove is therefore 1.12 kg per day
- Number of days per year an improved charcoal stove is used: 185 days
- Average charcoal saving per household, using an improved charcoal stove: 0.207 ton per year
- Each ton of charcoal has been *produced* in a manner which produces an average of 2.87 ton CO2e. When used as *cooking fuel*, each ton of charcoal produces an average of 3.40 ton CO2. The total green house gas (GHG) emission associated with one ton of non-renewable charcoal burnt as a domestic cooking fuel is therefore 6.27 ton CO2.
- The average annual reduction in charcoal consumption of 0.207 ton per family would therefore correspond to a reduction in greenhouse gas emissions of 1.3 ton of CO2.

10.2 Account of GHG emission reductions

Based on calculated baseline data and observed and quantified reductions in CO2 emission as a result of the introduction of solar energy and other energy saving technologies for cooking, projections are made of GHG emission reductions over a 10 year period for an increasing number of participating households (from 4,400 households in year 1 to 27,500 households in year 10).

The introduction and adoption of integrated solar cooking methods means that an increasing number of households will change their traditional way of cooking, using fuel wood and a three-stone fire place, and switch to a more economical and environment friendly way of integrated cooking using a solar cooker, in combination with a hay basket, during sunny days (estimated at 180 days/year) and a wood efficient stove, also in combination with a hay basket, during cloudy and rainy day (estimated at 185 days/year). This would result in the following reductions of fuel wood consumption and subsequent GHG emission reductions.

Solar cookers in combination with hay baskets

Daily reduction of (dry) fuel wood per household	6.55 kg/day
Average number of "solar days" per year	180 days
Annual reduction of (dry) fuel wood per household	1.18 ton/year
Reduction of GHG per household per year	2.124 ton CO2e/year

Wood efficient stoves in combination with hay baskets

Daily reduction of (dry) fuel wood per household	3.8 kg/day
Average number of "solar days" per year	185 days
Annual reduction of (dry) fuel wood per household	0.7 ton/year
Reduction of GHG per household per year	1.26 ton CO2e/year

Year	House-holds	Solar cooker/ Hay basket Wood red./year (tons)	Solar cooker/ Hay basket GHG red./year (tons)	Wood saving stove/Hay basket Wood red./year (tons)	Wood saving stove/Hay basket GHG red./year (tons)	Total GHG red./year (tons)
1	4,000	4,720	8,496	2,800	5,040	13,536
2	6,000	7,080	12,744	4,200	7,560	20,304
3	8,000	9,440	16,992	5,600	10,080	27,072
4	10,000	11,800	21,240	7,000	12,600	33,840
5	12,000	14,160	25,488	8,400	15,120	40,608
6	14,000	16,520	29,736	9,800	17,640	47,376
7	16,000	18,800	33,984	11,200	20,160	54,144
8	18,000	21,240	38,232	12,600	22,680	60,912
9	20,000	23,600	42,480	14,000	25,200	67,680
10	25,000	29,500	53,100	17,500	31,500	84,600

As mentioned before a small number of households in rural areas (estimated at about 10%) use charcoal instead of wood for their daily cooking needs. Changing their cooking habits, meaning a switch to solar cooking and the use of a charcoal efficient stove (like the Rocket stove), both in combination with the use of a hay basket, would result in the following reductions of charcoal use and subsequent GHG emission reductions.

Solar cookers in combination with hay baskets

Daily reduction of (dry) fuel wood per household	6.55 kg/day

Average number of "solar days" per year 180 days
Annual reduction of (dry) fuel wood per household 1.18 ton/year
Reduction of GHG per household per year 2.124 ton CO2e/year

Charcoal efficient stoves in combination with hay baskets
Daily reduction of charcoal per household 1.12 kg/day
Average number of "solar days" per year 185 days
Annual reduction of charcoal per household 0.207 ton/year
Reduction of GHG per household per year 1.3 ton CO2e/year

Year	House-holds	Solar cooker/ Hay basket Wood red./year (tons)	Solar cooker/ Hay basket GHG red./year (tons)	Charcoal saving stove/Hay basket Charcoal red./year (tons)	Charcoal saving stove/Hay basket GHG red./year (tons)	Total GHG red./year (tons)
1	400	472	850	83	520	1,370
2	600	708	1,274	124	780	2,054
3	800	9,440	1,699	166	1,040	2,739
4	1,000	1,180	2,124	207	1,300	3,424
5	1,200	1,416	2,549	248	1,560	4,109
6	1,400	1,652	2,974	290	1,820	4,794
7	1,600	1,880	3,398	331	2,080	5,478
8	1,800	2,124	3,823	373	2,340	6,163
9	2,000	2,360	4,248	414	2,600	6,848
10	2,500	2,950	5,310	518	3,250	8,560

Overview GHG emission reductions

	From traditional cooking, using fuel wood, to integrated solar cooking		From traditional cooking, using charcoal, to integrated solar cooking		
Year	Households	Total GHG red./year (tons)	Households	Total GHG red./year (tons)	Grand Total GHG emission red./year (tons)
1	4,000	13,536	400	1,370	14,906
2	6,000	20,304	600	2,054	22,358
3	8,000	27,072	800	2,739	29,811
4	10,000	33,840	1,000	3,424	37,264
5	12,000	40,608	1,200	4,109	44,717
6	14,000	47,376	1,400	4,794	52,170
7	16,000	54,144	1,600	5,478	59,622
8	18,000	60,912	1,800	6,163	67,075
9	20,000	67,680	2,000	6,848	74,528
10	25,000	84,600	2,500	8,560	93,160

Note: The inclusion of at least two schools, located in the targeted project area, would result in an additional reduction of firewood consumption of 214 tons of wood per year or a reduction of GHG emission of 385 tons of CO2e per year. Over a 10 year period this would mean an additional reduction of firewood of 2,140 tons of wood or a reduction of GHG emission of 3,852 of CO2e.

Crediting or project period is 7 years. The annual average over the crediting period is a GHG emission reduction of about 37,250 tons of CO2. While the project is for 7 years,

it is estimated that more households will adopt renewable and sustainable energy technologies to cook food and pasteurize drinking water.

11. Analysis of the dangers and corresponding risks of not reaching the mentioned targets: main considerations for establishing the additionality of the project

Cost barriers. In the absence of the proposed project activities, the participants will choose the cheaper alternative of continued use of the current three stone fireplace/stove with much higher GHG emissions, simply because they are not wealthy enough in cash terms and would thus not be able to afford the higher price of renewable technologies for cooking (solar cookers, hay baskets and fuel efficient stoves).

Prevailing practice barrier. Habitual use of traditional three stone stoves imposes a strong influence on the baseline scenario, resulting in a continuation of the use of inefficient traditional open fires and charcoal stoves. A lack of awareness and know how can be overcome by the implementation of promotion campaigns, followed by a programme of continued education and follow-up training and evaluation.

Institutional barriers: lack of managerial resources, organizational capacity, financial resources and capacity to absorb new technologies. The widespread introduction of solar cooker, hay baskets and efficient wood and charcoal stoves into the market requires considerable input in the form of business development capacity, financial investment, management skills, technical training and new technology absorption capacity. All these resources are very scarce in the project area, a situation which poses a severe obstacle to the introduction of solar cookers, hay baskets and improved wood and charcoal stoves.

The proposed carbon funding is targeted carefully through building local capacity for widespread market dissemination, through the establishment of customer follow up systems and through the instalment of proper quality control systems to remove the barriers described above.

12. Concluding remark

The project is to become a model for other districts and probably neighbouring countries. It should also be noted that the population growth is at 3.8% per year in Uganda. So using renewable energy technologies to cook food, pasteurize drinking water and process foods would go a long way to reduce the amount of firewood collected from the forests, while at the same time avoiding significant quantities of CO2 from being emitted into the atmosphere.

Kampala, Uganda/Blaricum, the Netherlands, November 2008

Kawesa Mukasa / Henk Crietee

Annex 1

Indicators that give an idea of emission reductions through renewable energy technologies.

Saving wood for cooking, heating and industrial processes where wood is collected from the forest.

Wet fuel wood > average 25% of weight carbon
Dry fuel wood > average 50% of weight carbon
0.9 conversion factor for portion of carbon that is oxidised
44/12 = 3.67 conversion factor CO2C > CO2 gas
1 ton dry wood burnt would produce 0.5*0.9*3.67 = 1.66 ton CO2

Methane:
16/12 = 1.33 conversion factor CH4 > CH4 gas
0.004 conversion factor for carbon transformed into CH4
So 1 ton dry fuel wood produces 0.004*1.33 = 0.00532 tons CH4
0.00532 tons CH4 is equivalent to 0.112 ton CO2 (traps 21 times as much warmth as CO2)

N2O
44/28 – 1.57 conversion factor N2O N > N2O gas
0.0000552 conversion factor for nitrogen transformed into N2O
So 1 ton dry fuel wood produces 0.0000552*1.57 – 0.000087 tons N2O
0.000087 tons N2O is equivalent to 0.027 ton CO2 (traps 310 times as much warmth as CO2)

Conclusion:

1 ton dry fuel wood produces 1.66 + 0.112 + 0.027 = 1.799 or 1.8 ton CO2 and CO2 equivalent

Source: HIVOS paper titled Monitoring and Verification of projects of the Climate Fund