SolarEdison for Students

List of Team Members

1. Sreeja Nag (Team Leader and main contact)
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   Background: Sreeja is a 2009-10 MIT-Total Energy Fellow and have been chosen to attend the Clinton Global Initiative University 2010. She has worked with SELCO on the integration of the IDEO Human Centric Design toolkit and the SELCO's education initiative to come up with ideas to renewable energy to enhance the quality of education in rural schools. She spent 6 weeks during IAP 2010 working with the Innovations Lab in Bangalore. She implemented individual, expert and group interviews and in-context immersions in the rural schools of Hoskoti Taluka, Hegar Devan Kote, Balle Hadi, Bagamandala and education oriented NGOs, before coming up with a detailed design plan. Sreeja has a Bachelors and Masters degree from the Indian Institute of Technology, Kharagpur, India with a concentration in Electrical Engineering.
2. Ananth Aravamudan
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   Background: Ananth is an electronics engineer trained at Bangalore University. He has more than 15 years of experience in the product R&D sector at reputed companies like Siemens, Lucent Technologies and MindTree. His primary areas of focus have been wireless communications equipment and medical devices. Prior to joining SELCO, Ananth headed the Medical Electronics group at MindTree R&D services. Ananth moved to SELCO in 2009, with the goal of applying his product development knowledge to the social entrepreneurship as well as renewable energy sector. Along with Dr. Anand Narayan, he started the SELCO Incubation Labs, with a view to develop affordable products primarily in the renewable energy sector for people from poor and under-served communities.
3. Jagadish Katkar
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   Background: Jagadish is involved in assessing energy needs of rural areas and field-testing innovative prototypes. In 2009, he started an Ecotourism centre in Dandeli forest as part of the six months Project work for Deshpande Fellowship programme on "Social Entrepreneurship" where he indentified a Gowli tribal village to promote nature sensitive tourism and conduct nature camps. He has a diploma in Rural Development and has worked as a school coordinator with the Akshara Foundation, where he was involved in implementing education development programs in Government primary schools. Earlier, Jagadish worked as social worker with Shishu Mandir School, where he was involved in coordinating activities of women self help groups and conduct rural camps for students. .

Project Summary

We started off with the basic purpose of improving the affordability of solar study lighting for the students in rural schools. We were guided by SELCO's philosophy on viewing affordability along 3 axes: (1) Upfront cost, (2) The total cost of ownership (TCO) which includes running and maintenance costs and (3) Flexibility in spreading payment over time. Most firms catering to Bottom of the Pyramid markets take a narrow view of affordability and restrict their efforts to bringing down (1) upfront costs but in the process, quality is compromised leading to higher (2) TCO. Seldom is any effort made to provide (3) flexibility in payment schedules. Low quality products have been proven to kill the market in the long run, as disgruntled users start spreading negative feedback about the products. Our design challenge aimed at finding a go-between of all 3 factors while keeping light quality as a non-negotiable parameter. An analysis of solar light costs clearly shows that 50-60% of the cost of a solar light goes towards the solar panel that is supplied along with the light. This lead to the evolution of our core concept:

- Supply high quality lights to students, but maintain the charging station (i.e. solar panels) at their schools.
- Provide portable batteries or power packs that they can carry with them and charge at school.
- The students pay for the lights and batteries, but the school, via sponsors or later via government grants, pays for the charging station.

Project Description

Lack of electricity infrastructure is one of the main hurdles in the development of rural India. As of 2004 there are about 80,000 unelectrified villages in the country. Of these villages, 18,000 could not be electrified through extension of the conventional grid. Development of cheap solar technology is considered a potential alternative that allows an electricity infrastructure comprising of a network of local-grid clusters with distributed electricity generation. On an education front, in India, one of the biggest bottlenecks we face is the lack of good primary education – we have >200 million illiterate women alone. Children still drop out of school before reaching high school either due to lack in motivation or to defend the otherwise lost opportunity had they worked instead or cultural reasons, especially for women. Performance is below average due to the lack of resources, especially electric lights at home, which renders the long period of time from sunset through night useless for aspiring students. For students from these unelectrified areas, kerosene lamps are the only source of light to study in dark and its dim light, smoke and heat irritates eyes. This causes tears and students are not able to focus on studying for a more than half an hour. Our research zone was focused in the rural areas of Karnataka, India. The Planning Commission of India quotes that Karnataka has 356 unlectrified villages, and about 4 times that number has an extremely erratic supply. Excerpts from the Annual Status of Education Report for the state of Karnataka, India by the Pratham foundation are attached which prove the above facts for 2009. While this reflects on primary and middle school, further statistics reveal that more than 25% students drop out after 10th grade and the number is much for girls.

Our aim was to address both these above problems (energy shortage and poor education) with a sustainable solution. The community partner is SELCO Solar Light Pvt. Ltd., Bangalore, Karnataka, India via the Public Service Centre Internship, IAP 2010 to address the above issues. Our solution system aims to provide cheaper energy to homes in exchange for sending their kids to school. This is primarily because higher education is viewed as a lost opportunity cost of making the most of kids' labor. To counter this, the system should be such that the reasons/economics of *not* sending kids to school or allowing them to study as enumerated in my detailed report must be *weighed out* by the interests in cheaper, better and easier energy. By the use of our system, schools and school-going children will be energy providers of their household. We envision success like the midday meal system which was a huge success because it increased attendance as the child was bringing in food for the family by eating a meal on his own account (http://en.wikipedia.org/wiki/Mid-day_Meal_Scheme).

To come up with an exact design, we used the Human Centric Design (HCD) toolkit, made by IDEO that offers techniques, methods, tips, and worksheets to guide community servers to make social innovations via a bottom-up approach. The initial model design we came up with to address both these problems was one that addressed home-study in rural areas without regular power grid supply. The model has three important components, a centralized solar charging system, pocket size battery and LED study lamp. The centralized solar powered charging system is installed in the school. Each student is provided with a pocket size, light weight battery and a LED study lamp. The battery and LED lamp can be attached or detached with a connecting plug. The LED lamp is placed at home where students Study at night. The pocket size battery which is smaller than the size of a pencil box is carried to the school in the morning by the students every day. At school the batteries are charged by the centralized solar charging system. In the evening when it is time to go back home, kids carry the charged battery to home. At home when it is time for studying in the night, the students fix the battery to LED lamp with the help of connecting plug. A completely charged battery will provide light for 3 hours a day with 2 days autonomy. The LED study lamp light is much brighter than the kerosene lamp and more suitable for studying at night. Other than being cost-effective, scalable and a provider of clean, bright sufficient light for all students in the school to study at home the most important factor was this: To charge the batteries the students need to attend school every day. This will encourage and improve attendance of students in school. The model is pictorially presented in Appendix B.

The direct and indirect advantages of this scheme are:

1. The cost of the light to the student gets reduced by half, with no compromise on quality. This means that many more students can come under the umbrella of the scheme. Clearly, with good quality lights at home, their ability to study, do homework and eventually perform improves greatly.
2. The system lobbies for a sustainable solution to rural India's energy needs since independent solar charging system which does not require grid electricity. It is a scalable model which can be replicated in the schools of unelectrified areas throughout India.
3. The student must attend school regularly to charge his or her light, which results in improved attendance.
4. The quality of charging improves significantly thanks to the use of large, professionally installed solar panels (as opposed to self-installed small panels which are supplied with solar lights)
5. The family of the student experiences the benefits of better lighting at home. The system does not emit harmful smoke or heat like a kerosene lamp and provides clean, bright sufficient light for all students in the school and their families.
6. Given the leverage that the school and the classmates have on a student (a parallel can be drawn with the JLG's or Joint Liability Groups in the Micro Finance Institution world), there is scope for experimentation on the payment schedules of the students. The business model is such that the now-reduced cost of lights can be split up into term-wise installments. In future, even rental models could be considered. While down-payment instead of rentals saves the risk of the child defaulting and selling the lamp, it faces the impediment of those who live on a day-to-day basis (at ~$2-3/day) not buying the system at all.

Right now, this system is being prototyped in small-scale i.e. with 21 makeshift SELCO lamps in one candidate school, namely Government Primary School, Bagamandala. Initial feedback is already available and some photographs attached in Appendix C. The right hand photos show kerosene light usage and the left hand side shows our system's usage. The disadvantage of the prototype is that the light and battery are fixed and the kids need to carry both light and battery to school.

We would like to follow this technical demonstration up with a full-fledged model in some schools of Bagamandala and Hegar Devan Kote. As an audience estimate, 72 students out of 153 are from unelectrified homes in Government High School, Karike and 39 students out of 164 are from unelectrified homes in Government Primary School, Bagamandala. This would entail setting up a robust business plan (tradeoffs to be decided between installments/down-payment/rental schemes), developing a robust technical design (as per the system specifications: watertight batteries, overcharge/discharge protection, autonomy to ensure charging even on rainy days and stable bases), a scalable charging station at the school to cater to all the students who wish to use the system, allocating duties to teachers to help students charge their batteries daily, setting up a security system so as to make the school charging station available during holidays, provide for frequent (on the order of every 6 months) SELCO maintenance checks and developing incentive schemes for teachers/schools so that many more would adopt the system. Once this basic design is implemented, ports in the battery for different types of chargeable devices can also be introduced depending on the market. Examples of these are mobile charging ports, mosquito repellants and radio-battery chargers. It is a widespread observation that while most of rural India views electric lights as a luxury, mobile phones and radios are seen as necessary communication/entertainment devices. Introducing cleaner, healthier light as go-along with the usual energy needs of rural households could force the community to raise their standard of living and soon they would be ready to buy only lights – similar to the way mobile phones took India by a wave, and as the demand increased, sales increased, prices dropped and so on in feedback.

The possible metrics or track indicators to measure success could be:

1. Sales of the products (Level 1 – technical success)
2. Surveys of acceptance among students, school, parental community (Level 1 – technical success)
3. Attendance to school (Level 2 – personal culture success)
4. Pass statistics and performance in standard board exams (Level 2 – personal culture success)
5. Continuation higher education (Level 3 – community culture success)
6. Nature of the jobs pursued after completion of education (Level 3 – community culture success)

This step is critical because if this model is able to show positive impact as per the metrics, we can present its success to the Karnataka State Education Department as a proposal to design and implement an Energy scheme/Policy through which this model can be replicated in more unelectrified villages. While we want to start off with support from sponsors and prizes, the large-scale impact of this system can be felt when the Government can be roped in and this will be facilitated only if the former is successfully implemented.

APPENDIX A: Karnataka Education Statistics

KARNATAKA *RURAL*

ALL ANALYSIS BASED ON DATA FROM 27 OUT OF 27 DISTRICTS

Annual Status of Education Report ASER 2009 RURAL Facilitated by PRATHAM

SCHOOL ENROLLMENT AND OUT OF SCHOOL CHILDREN

TABLE 1: % CHILDREN IN DIFFERENT TYPES OF SCHOOLS 2009

Age group	Govt.	Pvt.	Other	% Out of school: Not in School	Total
AGE: 6 -14 ALL	79.4	16.8	0.7	3.2	100
AGE: 7-16 ALL	77.2	16.8	0.7	5.3	100
AGE: 7-10 ALL	80.9	16.8	0.9	1.4	100
AGE: 7-10 BOYS	80.0	18.0	0.7	1.2	100
AGE: 7-10 GIRLS	81.9	15.6	1.0	1.6	100
AGE: 11-14 ALL	78.7	15.6	0.6	5.1	100
AGE: 11-14 BOYS	78.8	16.5	0.6	4.1	100
AGE: 11-14 GIRLS	78.6	14.7	0.6	6.1	100
AGE: 15-16 ALL	63.6	20.3	0.6	15.5	100
AGE: 15-16 BOYS	63.2	20.4	0.9	15.6	100
AGE: 15-16 GIRLS	64.2	20.4	0.3	15.2	100

NOTE : 'OTHER' includes children going to madarssa and EGS.
'NOT IN SCHOOL' = dropped out + never enrolled.

CHART 1: TRENDS OVER TIME
% CHILDREN OUT OF SCHOOL BY AGE GROUP AND GENDER 2006-2009

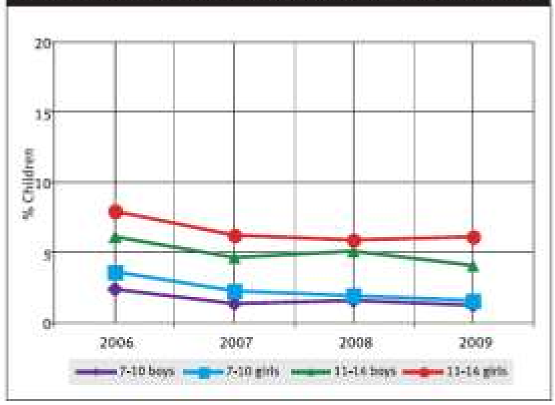


CHART 2: TRENDS OVER TIME
% CHILDREN AGE 6-14 ENROLLED IN PVT. SCHOOL 2006-2009

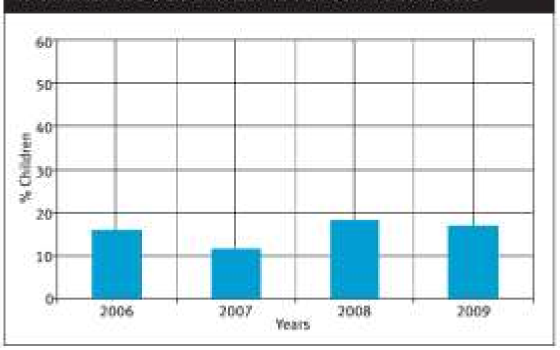


TABLE 2: SAMPLE DESCRIPTION
% CHILDREN IN EACH CLASS BY AGE 2009

STD.	5	6	7	8	9	10	11	12	13	14	15	16	Total
I	6.9	60.3	29.0	3.9									100
II	0.6	5.5	37.2	50.4	6.3								100
III	0.9		4.8	31.1	57.1	6.1							100
IV	1.2			6.4	33.0	53.7	5.7						100
V	1.2				4.9	37.0	49.8	7.2					100
VI	1.2					6.6	26.4	59.2	6.7				100
VII	2.6						6.5	34.3	48.8	6.8	1.0		100
VIII	1.6							7.6	33.6	51.1	6.0		100

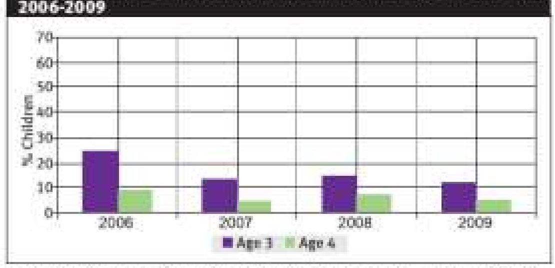
How to read the table: In Std III, 93.0% (4.8 + 31.1+57.1) children are in age group 7 to 9.

YOUNG CHILDREN IN PRE-SCHOOL AND SCHOOL

TABLE 3: % CHILDREN WHO ATTEND DIFFERENT TYPES OF PRE-SCHOOL & SCHOOL 2009

	In balwadi or anganwadi	In LKG/ UKG	In School: Govt.	In School: Pvt.	In School: Other School	Not going anywhere	Total
AGE 3	83.0	5.1				12.0	100
AGE 4	82.3	12.6				5.1	100
AGE 5	61.4	18.5	8.7	8.4	0.1	3.0	100
AGE 6	10.6	6.0	60.8	19.9	0.6	2.1	100

CHART 3: TRENDS OVER TIME
% CHILDREN AGE 3-4 NOT ATTENDING PRE-SCHOOL (ICDS OR OTHER) 2006-2009



Of the villages visited, Anganwadi/Pre-School presence has been recorded in 98.7 % villages.

APPENDIX B: Pictorial representation of the Model (photos taken in Shishu Mandir School, Bangalore)

1. Battery and LED study lamp

2. Centralized solar charging System at school

3. Charging battery at school

4. Connecting battery to LED Study lamp at home.

APPENDIX C: Photographs comparing our systems lights to regular kerosene lights