# LIGHTING UP LIVES...

## Solar energy shows the way

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The recently released Global Status Report on Renewables 2007 says that grid-connected SPV (solar photovoltaics) has been the fastest growing energy technology in the world with 50% annual growth in the cumulative installed capacity in 2006 as well as in 2007. The majority of the above capacity comes from about 1.5 million homes across Germany, Japan, Spain, and the US, which have installed small PV systems (a few kilowatts to tens of kilowatts) on their rooftops, feeding the electricity into the grid through two-way meters and enjoying the benefits of net-metered electricity bills at the end of the month. Technologies such as BIPV (building integrated PV), where PV panels double up as electricity generators as well building facades, tiles, and walls by replacing the building material with aesthetically designed PV panels, have begun to get noticed by the architects and builders. This market is virtually non-existent in India which otherwise has a good track record of utilizing solar PV technology for off-grid applications ranging from power for off-shore oil and gas platforms to lighting up remote rural homes with solar home systems.

Of the total reported 25 lakh homes worldwide that use solar home systems today about 3.6 lakh are in India, second only to China which has 4 lakh solar home system users. In fact, India's early commitment to promote solar PV arose from its concerns about energy access and energy security for all. The market for solar PV continues to be relevant in such decentralized off-grid applications even after huge resources were made available under the rural electrification

schemes of the Ministry of Power and the Ministry of New and Renewable Energy. About 7.6 crore homes still use kerosene for lighting. Though lighting is not synonymous with electrification, and which by no means can be equated with energization (that includes energy for cooking, among others), it still is one of the primary amenities required by a household to step on to the socio-economic-cultural developmental ladder. This basic amenity is not provided to 56.5% of the 13.8-crore rural homes and 12.4% of roughly 5.37 crore urban homes in India, which continue to burn biomass, wax candles, and kerosene lamps, spending Rs 2 to 5 per day.

The solar lantern, a portable lighting device that uses CFL, has its own rechargeable battery inside that can be charged everyday using an 8- to 10-watt solar panel. This is an ideal device to light up homes that currently use biomass or kerosene for lighting. About 5.8 lakh solar lanterns have been distributed in India in the past 7 to 8 years under the programme of MNRE. The solar lantern with its solar panel currently costs about Rs 3200–3600 of which the user generally pays only 50%, as the remaining amount is supported through a central subsidy. It is also given free to some user categories.

However, an upfront payment of Rs 1800 often becomes a deterrant for the prospective user who can afford and probably is willing to pay smaller amounts on a daily or weekly basis. Such a scenario points to a potential microfinance market, provided the prospective user can be convinced about paying an instalment for a device that does not fetch him/her any direct income.

A solar lantern, though much cheaper compared to a solar home system, has not found much favour either with the lender or with the borrower except in a few pilots where the less expensive versions of white LED based solar lanterns are being sold to rural communities. While white LEDs and other advanced lighting technologies are going to revolutionize the lighting market, one should not forget that these technologies have to penetrate the urban market first, before they can be accepted by the rural masses.

When we shift the focus to the benefits rather than costs of switching to solar lanterns from the current options of kerosene lamp and candles (or nothing), the results are interesting. As per the National Sample Survey Organization's survey on energy consumption patterns in 2005, and TERI's rural energy projects data, a rural household consumes an average of 4 litres of kerosene per month for lighting. A total of 7.6 crore rural households would thus be consuming an average 3.6 billion litres of kerosene annually. At carbon emission intensity, or a release rate, of 2.4 kg $CO_2$ per litre of burnt kerosene, the atmosphere gets polluted by 9 million tonnes of $CO_2$ annually. This may well translate into a $90 million carbon market annually at a modest rate of $10 per tonne of $CO_2$. Quite apart from direct carbon revenue benefits, each solar lantern offers a net annual saving of Rs 1200 by way of avoided kerosene subsidies estimated at approximately Rs 25 per litre. If the cumulative subsidy amount is instead targeted at solar lanterns, it would lessen the burden on a rural household to switch to a solar lantern.

The Kasturba Gandhi Balika Vidyalaya is a flagship scheme of the government that provides hostel facilities for schools for girl children of SC/ST and OBC categories. In the

absence of reliable grid supply in most of these hostels, either the school authority, district administration, or in some cases, families of the hostel residents spend money on kerosene and candles for their wards. Provision of solar lanterns will strengthen the objectives for which these hostels have been set up, and be a good example of public–private partnership if the corporate sector came forward to equip the hostels with solar lanterns. There could be many such examples of such interventions improving health, welfare, and livelihood opportunities.

Let us now one again shift the focus, this time to the delivery and after sales service of solar systems. Who, where, how, and at what cost can deliver these services in remotest corners? Apart from the resources available through avoided kerosene subsidies, how will an initiative of lighting millions of homes using solar lanterns be financed and sustained? Let us first think from the user's perspective. A household or a rural enterprise (shop, kiosk) would probably not have a constraint in spending Rs 2 to 5 per night for the use of solar lantern, even without actually owning the device. Some may even want to rent additional lanterns if charged lanterns are available on rent within a village. Also, it cannot be assumed that a village resident can easily purchase an item worth Rs 3200. Alternately, he/she may want to spend about half that amount (Rs 1600–1800) to purchase a lantern without the solar panel and pay a daily fee for charging, if such a facility is locally available.

We are talking about a delivery and service model familiar to most rural and per-urban communities where households purchase new or recycled car batteries and charge them from the nearest battery-charging shop running either on diesel-generating set or grid electricity. This fee-for-service model is well established and thriving in most power-deficit areas. These one-stop entrepreneurial outlets offer repair, maintenance, and all other related services. If this model were to be adopted for solar lanterns, then we are talking about setting up solar-charging stations at village level, with not just solar-charging services for lanterns but also for mobile telephones, and other battery-operated devices.

A solar lantern is a powerful tool to take rural communities from darkness to light. It is also a commitment that would bind governments, corporations, the non-governmental sector, civil society, and individuals to light up a billion lives not only in India but across the globe as well.

## SPV home-lighting systems in Arunachal Pradesh

Remote villages and hamlets in Arunachal Pradesh are the best examples of communities, which are most appropriate for electrification through renewable energy resources. They are small, far away from the roads, and the people there lead generally a subsistence level of life. The MNRE has been supporting the efforts of APEDA (Arunachal Pradesh Energy Development Agency) to provide some comfort to such households with the help SPV (solar photovoltaic) home-lighting systems. About 200 remote villages have so far been covered under the RVEP (Remote Village Electrification Programme). APEDA has been implementing the projects with financial support from the ministry and has over the years, established a good network of service/maintenance technicians even in the remotest parts. The agency claims that SPV home-lighting systems have been widely welcomed by the householders and there is a vast unmet demand for such systems from other villages.