



# Light Up the World - INDIA

## Business Plan and Recommendations

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This document was prepared for the course "Social Entrepreneurship Startup," offered jointly by the Stanford Graduate School of Business and Stanford School of Engineering in Spring 2003. It is one of five final course documents; business plans were also created for the Light Up The World Global organization and subsidiaries in Mexico and China, and a technical and design document was also written. Please see <http://ses.stanford.edu/> for the most current versions of all of these reports.

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The Light Up the World Foundation is a non-profit organization, established in Calgary by Professor Dave Irvine-Haliday with the goal of providing useful, healthy, safe, reliable, rugged, affordable and environmentally friendly White Light Emitting Diode (WLED) based forms of home lighting for the poor in the developing world.

The Stanford-based team continues to work extremely closely with LUTW in order to further the joint effort to provide LED based lighting in rural India.

This document is intended as a straw-man; a working draft from which we can test and refine our hypothesis. We welcome all feedback on the enclosed material and we hope that you will be vocal in suggesting improvements. Furthermore, we expect our own thinking to develop and we hope that you will respect any changes to the plans presented here as our knowledge and experience increases.

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# 1 Executive Summary

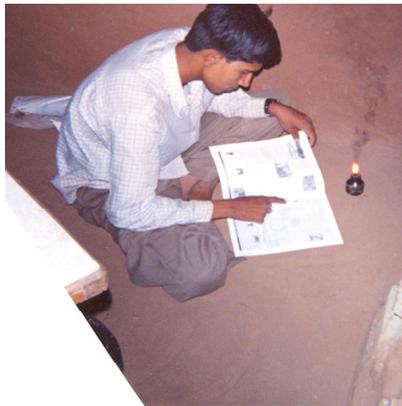
## 1.1 Description of the Business Concept and the Business

Light Up the World India has been designed as a self-sustaining business entity operating in India with the goal of developing and supporting a market for an LED/solar based household light solution. It will be a freestanding marketing organization that will work with existing manufacturers, distributors and retailers to deliver LUTW designs to the poor in India.

The initial product will be a WLED (White Light Emitting Diode) -based light that will replace kerosene as the primary source of light in poor rural homes throughout India. Power for the lighting system will be provided by photovoltaic (solar panel) technology. The initial target markets for this product will be the states of West Bengal, Rajasthan, Orissa and Uttar Pradesh.

This document presents the business plan that will see 45,000 LED lamp units distributed in the first three years of full operation, with the potential for tens (or hundreds) of thousands more to be sold in the years following. This will begin with a research-based period followed by a full-scale pilot project. The launch of the business, including the pilot, will require an investment of \$500,000.

### *The problem: The Kerosene Lamp*



### **Value proposition:**

The LUTW LED/Solar product will provide rural families with a reliable, safe source of light that exceeds the illumination of existing kerosene lamps inside the home and when outside in darkness. The light offers considerable economic savings over kerosene and a compelling proposition for families connected to the unreliable electrical grid.

LUTW-India's product will be a solar powered lamp retailing for around Rs. 1000 ( \$20) The lamp will have a White LED (WLED) luminary, use rechargeable Nickel Metal Hydride AA batteries, and come with a small photovoltaic recharging panel.

The end user needs addressed by the product are:

- More usable light in the home for reading, working and cooking
- Durable and reliable in extreme conditions
- Overcome safety and health concerns of kerosene lighting
- Eliminate reliance on regular kerosene or battery purchases

**Business Philosophy:**

A model that creates a sustainable business and relies on market forces where possible to take the product to the hands of those who most need it will achieve true proliferation of the LED light. As LED technology matures we expect to see the costs of the technology decline significantly. This business plan presents a model that will stimulate the market to coincide with these technology trends.

The long-run preferred model will see manufacturing and distribution take place through existing manufacturers and their sales channels. This model is influenced heavily by the successful approach taken by International Development Enterprises (IDE) with its treadle pumps. Key in establishing this model will be the relationships that are built with leading lighting and component manufacturers and in the existing distribution networks in India. The manufacturer would effectively 'license' the LED lamp design from LUTW. The manufacturer would produce the lamp and distribute through existing sales channels. LUTW will support the sales channel with marketing and promotional activity. In the long term, LUTW-India will not handle physical inventory nor have responsibility for the management or ownership of inventory.

In the short term LUTW must encourage manufacturers to take on the LED lamp design. Thus LUTW will initially act as 'virtual manufacturer;' subcontracting manufacture to a third party. Once the product and business concept have been proven, LUTW will make the design available to competing manufacturers that will produce and distribute the product. In doing so, LUTW will have built an industry to supply the LED lamp.

**Key Success factors:**

The success of our plan will be subject to the following:

1. Identification of critical manufacturing and distribution partners
2. Achieving critical price points of lighting solutions
3. Ongoing technology advances and subsequent reductions in LED technology costs

**1.2 Other Reports**

This plan will discuss only details of operations in LUTW-India, a subset of LUTW-Global. For more info on LUTW overall mission, management and organizational structure, growth plan, etc. see the report developed for LUTW Global.

**1.3 The Opportunity and Strategy**

Over 150million people in India are without access to electricity. The majority of these people rely on simple kerosene lamps for light. These lamps are smoky, dangerous and inefficient. India's 80,000+ rural villages suffer most from the lack of consistent, safe lighting. The most poorly served communities are in the North and East of India. Although lack of adequate light is a problem throughout the country, India is an extremely diverse and disparate country that presents a number of challenges in delivering a single lighting solution. The opportunity to take light to these 150m+ people is huge. The strategy to achieve this has the following elements:

**Manufacturing**

In the long run, LUTW-India will seek partnerships with established flashlight and electrical products manufacturers to produce and distribute the LED light system. The manufacturer will be responsible for assembly of the circuit, housing, solar panel and LED. The manufacturer will also be responsible for sourcing the components locally. Where components are sourced from a foreign supplier, LUTW may negotiate and procure these parts in bulk.

In the short term, it is unlikely that these manufacturers will pick up an untested and unproven design. To overcome this, LUTW will manage production by a contract manufacturer and will establish its own interim distribution channels. These channels should include partnerships with organizations such as IDE.

Indian manufacturers are experienced in designing and producing robust, low cost products for the Indian market and can offer a wealth of resources and expertise. However, LUTW will have to convince these manufacturers to make the initial investments in tooling, inventory, and marketing to launch a new LED-based product. This will involve a significant effort to convince the manufacturers of the functional superiority and potential for the LED based light.

### **Distribution**

LUTW will support the manufacturer in distributing the light solution through existing distribution and sales channels. Existing manufacturers already have relationships in place with distributors and retailers. The LED light will be sold through these channels and retailers.

Existing vendors and retailers will sell the product in rural communities. (These include traveling sales persons and local stores) LUTW will augment these commercial channels with additional marketing through NGOs and LUTW's local marketing organizations within the target states. During the initial phases, LUTW will underwrite a minimum sales volume (to reduce the risk for manufacturers). In subsequent phases, inventory will be owned and managed entirely by the manufacturer.

### **Marketing Strategy**

With its goal of creating and sustaining a market for LED lighting, LUTW-India must win over village communities with a demonstration of reliability both in the product but also in service and maintenance. For this reason, we recommend the use of on-the-ground marketing officers and a product warranty plan. Marketing efforts will focus on the rural poor households. LUTW-India will consist of regional offices that are dedicated to the marketing and promotion of the LED light solution. Marketing officers in each region will serve retailers and manage orders from them in the initial phases. Marketing efforts will be focused on demonstrating the benefits of the product to the consumer. These will include identification of 'power user'/early adopters who will help to create a buzz for the product.

An opportunity exists for LUTW-India to form a partnership with IDE India. IDE's significant marketing and distribution network will provide a launch pad for LUTW and would significantly reduce the costs involved in setting up, as existing IDE resources can be employed.

## **1.4 The Target Market**

India's population now exceeds 1.05BN, of which 60% continue to live in rural conditions. The LUTW light solution will be targeted at rural households that are currently dependent on kerosene for lighting. Presently around 110million families (300million individuals) rely on kerosene for some or all of their household lighting. Although around 85% of villages nationally are electrified, the extension of the electrical grid reaches fewer than 30% of rural homes. Furthermore, those homes with electricity suffer unreliable and inconsistent supply.

Kerosene and electricity supply to rural areas is often heavily subsidized, with a liter of kerosene costing anywhere between Rs. 9 (subsidized) and Rs. 20 (open market). Subsidies are not uniformly available in all regions or states.

The proposed market rollout begins with the four states with lowest levels of electrification are Rajasthan, Orissa, West Bengal and Uttar Pradesh. Our market entry strategy begins with a pilot project in West Bengal. This state offers the advantage of existing partners for the distribution and marketing of sustainable lighting solutions.

## 1.5 The Competitive Advantage

The proposed LED /solar lighting solution has the following advantages over existing lighting products:

- **Health and Safety.** The LED light replaces kerosene-fuelled lamps, which contribute to lung disease and respiratory problems through smoke inhalation. Death and injury from accidental fires are also common with kerosene-based lamps.
- **Durability and Reliability.** Past efforts to introduce solar lanterns using compact fluorescent lighting (CFL) have failed due to fragility of bulbs and poor management of batteries.
- **Energy Efficiency.** LEDs use 5% of the energy of a traditional incandescent bulb and have a lifetime of 10x a normal bulb.
- **Convenience and Flexibility.** The LED lighting solution combines the utility of both a fixed task lamp and a flashlight. The solution needs limited maintenance with rechargeable batteries requiring replacement approximately every 1.5 years.
- **Cost.** The LED light solution costs 1/3 of the price of comparable CFL solar lanterns and is comparable in price to existing kerosene lamps. In comparison with a kerosene lamp, payback on the LED light can be achieved in about one year for most consumers.

## 1.6 The Economic Model

LUTW-India will be a for-profit organization. The sale of each LED light will yield a commission to LUTW-India that will contribute to the overheads incurred by the organization.

The LED light will be sold through existing commercial distributors and retailers. These parties will each mark-up the product and take a commission on the sale. In this way, a sustainable market will be established for the product.

## 1.7 Roll Out Strategy

The roll out strategy for the first four years is outlined below. This roll out begins with a detailed pilot study to validate both the business model and the physical product design. The three years following the pilot would see the initial launch and growth of the market in the four target states.



	Further Validation	Pilot (9 months)	Launch Yr 1	Launch Yr 2	Launch Yr 3
<b>Description</b>	Further development of business plan	Full scale pilot Establish LUTW org.	Launch in one state	Roll out to second state	Roll out to second state
<b>No of units in use</b>	<100	1000	3000	12,000	30,000
<b>Marketing Or.</b>					
<b>Offices</b>	N/a	1	1	2	5
<b>Mktg. Officers</b>	N/a	4	4	8	30

The next steps in evaluating the Indian opportunity should be a three month validation study, followed by a structured, funded pilot project. The aims of these projects will be to test key assumptions of the product design and business model and as well as to begin to develop the distribution and marketing channels within the target regions. The pilot project must also begin to establish an organization within India that is capable of managing activities on the ground and developing key relationships. This pilot period of 9 months will be sufficient to launch and refine the LUTW organization and to develop the product.

Key assumptions to be tested during the Pilot Phase:

- The target market for the lighting solution is the rural poor family who currently rely on kerosene as the major form of lighting in the home
- The needs of the target market are met by the current design and value proposition and these provide a compelling alternative to existing light solutions
- Distribution through existing retail channels and local entrepreneurs is viable and margins applied within these channels are such that the end price is within the acceptable range for the user.

Key Activities during the Pilot

The activities of the pilot proposal are described in further detail in Section 10

The major activities during the phase will be:

- Establish a skeleton organization within India and recruiting key personnel to manage operations within India in the initial pilot region
- Distribute products and marketing materials to government run 'Aditya' solar stores throughout India and monitor response to product in these stores
- Establish relationships with distributors (and / or manufacturers)
- Establish and structure relationships with key NGO and Government organizations to coordinate supply chain and to create initial community groups to support the entrepreneur model
- Further refine single product design and manufacture 500 – 1000 units for field testing
- Field testing prototype units and provide feedback of findings to product designers
- Development of marketing plan, organization and/or partnerships to support full launch of product

## 2 The Business and its Products

### 2.1 *The industry – existing alternatives and competition*

Artificial light is an important service for homes and small businesses in India, even for the poorest of people. For the typical home, artificial lighting is needed in the early morning for chores such as making food and tending to farm animals. At night, artificial light is important for the continuation of farm work, craftwork, visiting and socializing with neighbors, using outhouse facilities, and for reading/studying. Despite low income levels, many families are willing to spend a significant portion of their income on lighting services.

One way of dividing users of artificial lighting services is to consider two categories: those with, and those without, access to grid electricity. Let's first examine options for those without grid-connected electricity.

While the Indian government is working to increase access to electricity, the Indian population is growing faster than the rate of electrification<sup>1</sup>. It is extremely expensive, and sometimes technically infeasible to provide electrification to many rural areas. Furthermore, even when electricity does reach a village, potential customers may be asked to pay steep hook up fees (and possibly bribes) in order to establish service. Field surveys have confirmed that in parts of rural Gujarat, each household is required to pay Rs.90 per month just to be connected to the electrical grid. For many households this makes grid connection an impossible dream. For these reasons, it seems likely that the majority of people living in rural areas will not gain access to reliable grid electricity in the near future, if ever.

Wick kerosene lanterns. These simple lanterns are extremely common throughout India. 85% of people using kerosene lanterns use wick lanterns. These lanterns are very inexpensive (as little as Rs. 100), are easily to find and purchase, and simple to operate. Kerosene is available for sale in almost all areas. However, the lanterns only produce a small amount of yellowish light (about 25 lumens), kerosene is rationed and inconvenient to purchase (may require walking long distances), and the lanterns produce unpleasant and unhealthy smoke. Worst of all, the lighting service provided is very expensive in comparison to prices paid by those in the developed world (as much as 1600 times as expensive<sup>2</sup>), because this type of lantern is very inefficient. Per capita spending on kerosene is about Rs. 20 per month for wick lanterns. Surveys suggest that a more realistic figure for kerosene expenditure is about Rs. 60 per month (4 liters of kerosene per month, Rs.13- 15 per liter).

Hurricane kerosene lanterns. These lanterns are more efficient than the wick type, providing more light, but consume more kerosene. Only about 15% of users have a hurricane lantern, because kerosene is rationed, expensive in the view of many users, and inconvenient to purchase.

Incandescent Torches. Inexpensive torches (flashlights) using disposable batteries are available in many places throughout rural India. These torches cost around Rs. 50-100, and replacement batteries are about Rs. 15 each (most torches use two batteries), lasting 5 – 10 hours when used continuously. The high cost of batteries (relative to their life) means that torches are used sparingly. These flashlights are useful for illuminating task work when the user does not require both hands to be free. Torches are not good for ambient lighting. Incandescent lights are the least efficient of all electric lights, converting as much as 95% of supplied energy into waste heat.

Home solar systems. Systems including photovoltaic electricity generation, wiring, and (usually compact florescent) lamps are available for purchase from private companies such as Selco. Featuring as much as 75 Watts of generating power, these systems can power 4-5 lights in a home, lighting up whole rooms, plus power other appliances. However, with a Rs. 20,000(\$400 approx) purchase price, these systems are out of the reach of many poorer consumers.

<sup>1</sup> Mills, Evan, *The \$230-Billion Global Lighting Energy Bill*, Lawrence Berkeley Laboratory, June 2002.

<sup>2</sup> Ibid.

CFL Solar lanterns. There are a variety of products currently offered for retail sale in the category of solar powered lanterns featuring compact florescent bulbs. Manufacturers such as BP Solar and Phillips have been selling such products for years, in the price range of Rs. 5,000. Recently, prices have declined to as little as Rs. 2,500 with the recent removal of government subsidies. These lanterns provide a lot of light (80 lumens per Watt), spread out in an even ambient pattern. Many of the lanterns are considered to be unreliable by users, as they were never designed for use in the difficult conditions faced. These lanterns typically provide power for about 3-4 hours. Also, these lanterns cannot be dimmed, which can save money or fuel. CFL is considered to be a mature technology, and therefore there is no expectation that efficiencies will continue to grow.

Now let's shift the discussion to electrified areas. While most 70 – 80% of villages in rural India are officially considered to be electrified, the vast majority of homes in these villages are in fact not grid connected. As discussed above, it may be expensive to establish a connection to the grid. Furthermore, electricity service is notoriously erratic, featuring wide variations in voltage (which may damage equipment), and frequent black outs (electricity might only be available for 4 hours per day in some regions). High connection fees of Rs. 90 per month (flat rate) make the service too expensive for many.

Fixed incandescent lights. Some wealthier consumers, especially those living in more urban areas, may have incandescent light fixtures in their homes. A bare 60-Watt light bulb might be used to provide illumination to a room. This would typically provide much more light than fuel-based sources. Electricity service can be used for other things such as powering TV's and other appliances. Replacement bulbs might cost as little as Rs. 10 (\$0.20). However, the unreliability of grid power means that this form of lighting cannot be counted upon. At Rs. 90 (\$1.90) per month for connectivity, grid electricity may be too expensive for many consumers to ever seriously consider.

## **2.2 The Product**

LUTW-India's initial product will be a low cost, solar-powered lantern that provides higher quality, longer lasting illumination than is currently possible with a kerosene lamp or lantern.

The product will consist of a 1.2 Watt photovoltaic power cell (off the shelf), a new design of light, which will feature a 1 Watt Luxeon White LED light source), and a battery pack consisting of two AA Nickel-Metal Hydride (NIMH) rechargeable batteries in a plastic housing. An optional on-grid charge unit and additional battery packs will also be made available for purchase.

The lantern will provide approximately 25 - 50 lumens for about four hours starting with a full battery charge state. This is sufficient light by which to read and cook within a typical small Indian home. The battery pack will require approximately 7 hours (long time to charge) of charge time in sunlight to reach full charge. The lamp will provide task lighting and will have a dual functionality as a flashlight for use when outside the home in darkness. Locally available disposable batteries may substitute for the rechargeable NIMH batteries included. The unit will have a manufactured cost of approximately Rs. 6000 (US\$12), and will retail for about Rs. 1000 (US\$20). Our hope is that this cost can be reduced further through future iterations of the product design and as the LED technology matures.

## **2.3 The Organization and the Concept**

In the short term, LUTW-India will outsource product development, procurement, manufacturing, and shipping to contract manufacturers preferably in India. Over time, LUTW-India will transfer all responsibility for manufacturing to existing Indian manufacturers of electrical products such as flashlights. It is anticipated that for some period, LUTW-India will have to be active in managing manufacture in order to prove the concept before existing manufacturers will pick up the product and run with it themselves.

Contract manufacturers deliver the lowest possible cost solution for the short term, but do not bring distribution and sales channels relationships that will be key in building a market for the product. As the

market develops its own momentum, retailers will place orders on their own for the product, pulling demand through distributors, who will in turn place orders directly with manufacturers. Competing manufacturers will emerge, and LUTW-India's contractors will begin working directly with distributors. At this point, LUTW can move on to another geographic region.

Based on discussion to date, a partnership with IDE India would offer an outstanding opportunity to distribute and market the LUTW-India light. IDE India has already established an appropriate distribution channel for lamps, and also has a strong existing marketing organization. IDE India has a proven capability of conducting market development activities such as promotions, advertising, and demonstrations. IDE India's network of marketing offices and established connections to distributors and retailers is well-suited to the challenges of bringing the LUTW light to market- therefore, it makes little sense for LUTW-India to duplicate IDE India's existing structure. IDE India is looking for new products to move through its established channels, assisting the company by providing sales volume over which to spread relatively high fixed costs.

## **2.4 Entry Growth and Strategy for India**

The immediate next step will be a continuation of the work on this business plan and on product development. The engineering and business graduate students who have participated to date in the project will support these phases. The estimated cost of this short phase (to include in-field research and test) is \$50,000.

This test phase will be followed by a Pilot Phase. This Pilot Phase will serve to test product, distribution and marketing concepts in addition to building out the LUTW-India team, and beginning to build the distribution, manufacturing, and supply networks. This phase is budgeted at \$340,000, and will involve manufacture of 1,000 prototype lights. During this phase, LUTW-India will sell the lamp at cost or even distribute it free of charge if required, and aggressively track customer reactions and lamp performance. Modifications to the business plan or product design can then be made as needed. During the pilot phase we hope to distribute 1000+units through a variety of channels. These channels would include IDE, major NGOs and existing solar projects including government run 'Aditya' Solar shops. These shops have been set up by IREDA (Indian Renewable Energy Development Agency Ltd.) and already sell a variety of solar lighting products. In addition, IREDA has a number of Business Development Associates that work to develop business and promote products endorsed by IREDA. The project team has already had positive discussion with the Director of IREDA, Dr.V.Bakthavatsalam.

The entry strategy for LUTW-India is a pragmatic strategy that will test the product and business model within a single region in West Bengal. From here, the business will be rolled out within the state and onto the three other target states: Orissa, Rajasthan and Uttar Pradesh.

It is recommended that LUTW-India develop strong ties with organizations, commercial operations and NGO's operating on the ground in India during the "year zero" ramp up, in order to help find the right staff to hire correctly choose pilot locations and initial target market, select appropriate contract manufacturers, and ensure marketing promotional materials and educational materials are on-target. Organizations such as IDE will be very important in getting LUTW established with the right people and partners involved, ensuring rapid and trouble-free ramp up and flawless execution.

LUTW-India will contract with small to midsize Indian-owned manufacturers, with production facilities in India, for production and shipment of lanterns. LUTW-India will use seed capital of \$200,000 to fund the initial manufacturing of the final product. As the market develops, LUTW-India will gradually withdraw from purchasing the lamps, encouraging distributors to directly purchase lamps from manufacturers at a lower cost. LUTW-India will also use the seed capital during this period to provide payment guarantees to manufacturers, in order to reduce the manufacturer's risk (thereby encouraging continued participation).

LUTW-India (ideally in partnership with IDE-India) marketing staff will develop educational and marketing plans for the pilot regions, and begin a widespread campaign to stimulate demand in the initially chosen region. For the first year of sales operations, LUTW/IDE India will have one marketing office with four marketing officers.

Each marketing officer will work with 25 retailers, one per village. The target will be 30 - 50 lamps sold per village, suggesting about 10% market penetration. In the second year, a second marketing office will be opened, again with four officers.

Each Marketing Officer will be expected to reach 50 retailers by the second full year, again one per village. Sales should reach about 12,000 units by the end of the second year.

In the third year, LUTW-India will expand to five marketing offices in the target region, keeping other factors the same. Sales should reach about 30K units for year three.

Widespread acceptance of the product is anticipated via word of mouth, due to success in education and marketing, appropriate price/features trade-off decisions, high product reliability, and timely, free after-purchase service. This will in turn lead to high penetration rates (we assume it will build to about 60% in a specific village by the end of year five). Based on this assumption, sales should be in the vicinity of 45,000 units per year in years four and five. This is the point where LUTW-India will shift resources to a new region and begin anew.

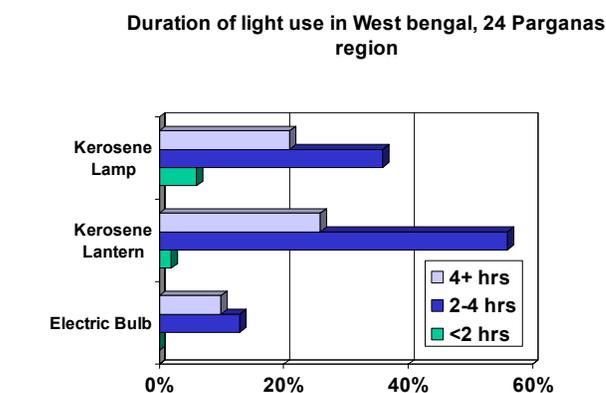
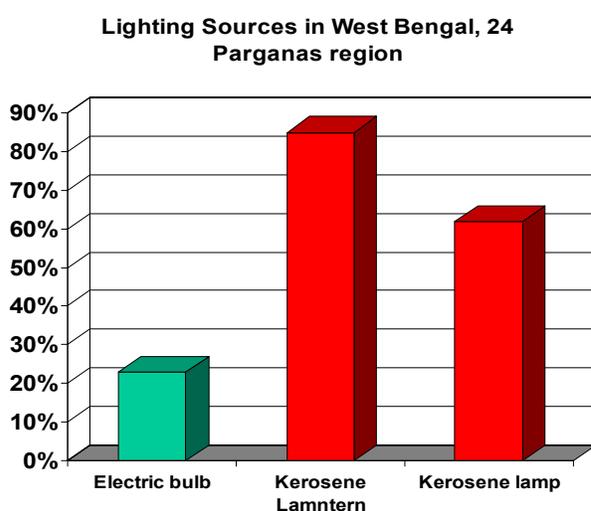
### 3 The Customer

#### 3.1 Customers

The target customers are rural villagers currently using kerosene-based lighting for at least 2-4 hours per day. Over 60% of India's population live in rural locations; of these, between 150million and 300million are without access to electricity and rely almost entirely on Kerosene. Our primary target segment is the **'Kerosene Replacer'** – a poor household with no alternative to Kerosene lighting. However, even those homes with a connection to the electrical grid suffer from an unreliable supply, with frequent power outages in evenings and at night. These households, which often have a higher disposable income, are a secondary target; we name them **'Light Upgrader.'**

In order to further segment the target user group, a geographic segmentation has been made and four target regions identified: West Bengal, Orissa, Rajasthan and Uttar Pradesh. These regions have lowest reported levels of electrification in rural homes.

The graphs below (from IDE Field Research in the 24 Paraganas region of West Bengal, 1999) validate that over 80% of households in survey regions rely on kerosene for light, with the majority using a kerosene lantern for between 2-4hrs per day.



A number of in-field surveys have been conducted during the course of the project to date (see survey responses in Appendix 11.4). These surveys and previous surveys carried out by IDE India identified the following consumer needs:

Need	Addressing this need
Brighter light, with wider diffusion than kerosene	Enable household to read, cook and work (e.g. sewing) using the light
Longer duration of usage (at least 2-4 hours/day)	The cost of kerosene (Rs. 9 – Rs. 20 per liter) means that households limit usage of lamps. Ideally they need 2 – 4 hours of light per day
Lower daily expenditure	Kerosene is an ongoing expenditure that makes saving any money difficult
Portability	Use of the light when walking or cycling in the dark
Low hassle / limited maintenance	Kerosene and solar lanterns require daily maintenance

Wind proofing	Major frustration for kerosene lamp users
Sufficient light to carry out multiple tasks	Enable multiple household members to share the light

### 3.2 User experience summary

#### The 'Kerosene Replacer' Segment

The Kerosene Replacer segment represents the poorer Indian household, with no existing electricity supply and an annual income of typically Rs.15,000 – Rs. 30,000 per year (\$300 - \$600). The family is likely to live in a mud hut or concrete home with one single, central room in which the family, cooks, eats, works and sleeps.

##### 'Kerosene Replacer' profile

*Head of Family: Kutarbhai Nayak (farm worker)*

- 7 family members in home (aged 7 – 75)
- Agricultural worker (head of family)
- "Yellow light of kerosene is inconvenient"
- Require light 0.5 hours in morning and 2-3 hours at night
- Purchases kerosene and lamps from a village vendor
- Use 4 liters of kerosene at 13 Rs./Liter each month
- Owns a single flashlight which is used sparingly when outdoors at night
- Buy two cells for battery per month (Rs. 9 – Rs. 11 per cell)

The Kerosene Replacer is most likely to purchase a light unit that provides light that is superior to the existing kerosene lamp that is used in the main room of the home. The light should offer comparable economics to the current kerosene consumption of the family.

#### The 'Light Upgrader' Segment

The Light Upgrader segment represents the poorer Indian household, with no existing electricity supply and an annual income of typically Rs.15,000 – Rs. 30,000 per year (\$300 - \$600). The family is likely to live in a mud hut or concrete home with one single, central room in which the family, cooks, eats, works and sleeps.

##### 'Light Upgrader' profile

*Head of Family: Bharatsinh Patel*

- 11 family members in household (ages 3 – 62)
- Uses electrical light for cooking, milking in morning, traveling between villages, studying
- Uses kerosene lamp during power outages (virtually every day)
- Everybody in the household is educated and likes to read
- Connected to electrical grid but supply is unreliable – typically available for 6-7 hours per day
- Pay Rs. 90 per month for connection to electrical grid
- Use kerosene as back up - 5 liters per month (at Rs.15Rs per liter)
- Use flashlights outside the home (3 x 1.5 watt cells per month, 8Rs per cell)

The Light Upgrader is likely to purchase the LED light as a 'back-up' solution for use during power outages or for use as a flashlight when outside the home. The product might also be charged from the grid supply when it is available. The images below provide a view into the target user and their use of the LED light solution. Surveyed households in rural Gujarat and Uttar Pradesh provided the pictures.

*The typical rural household*



*Typical household working conditions*



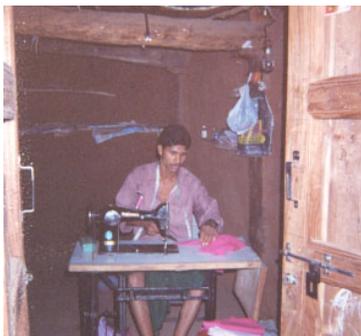
*Women at the BARLI college in Gujarat reading by the light of a Stanford LED prototype*



*A typical 'Kerosene Replacer' family with a Stanford LED prototype light*



*Working later into the night using a Stanford LED prototype light*



### **3.2 Pricing / Customer Ability to Pay**

The benchmark for the customer's ability to pay is the current expenditure of the household on kerosene lighting. This amount varies between homes and regions (where different subsidies apply to kerosene). The willingness of target customers to pay was validated in the 1999 IDE survey "Need Analysis for Solar Lantern & Lighting Systems in Rural Area," in which 80 percent of customers in West Bengal and over 90 percent in Assam wanted improved lighting systems.

Desire to adopt an improved lighting system varies widely from district to district but increases with the economic prosperity of the target segment. The typical 'Kerosene Replacer' rural household off-grid spends Rs. 35-60 on kerosene per month (RM), while a more affluent 'Light Upgrader' household would spend between Rs. 60 – Rs. 200 per month surprisingly, IDE research indicates that willingness to purchase improved lighting does not vary with electrification status of villages.

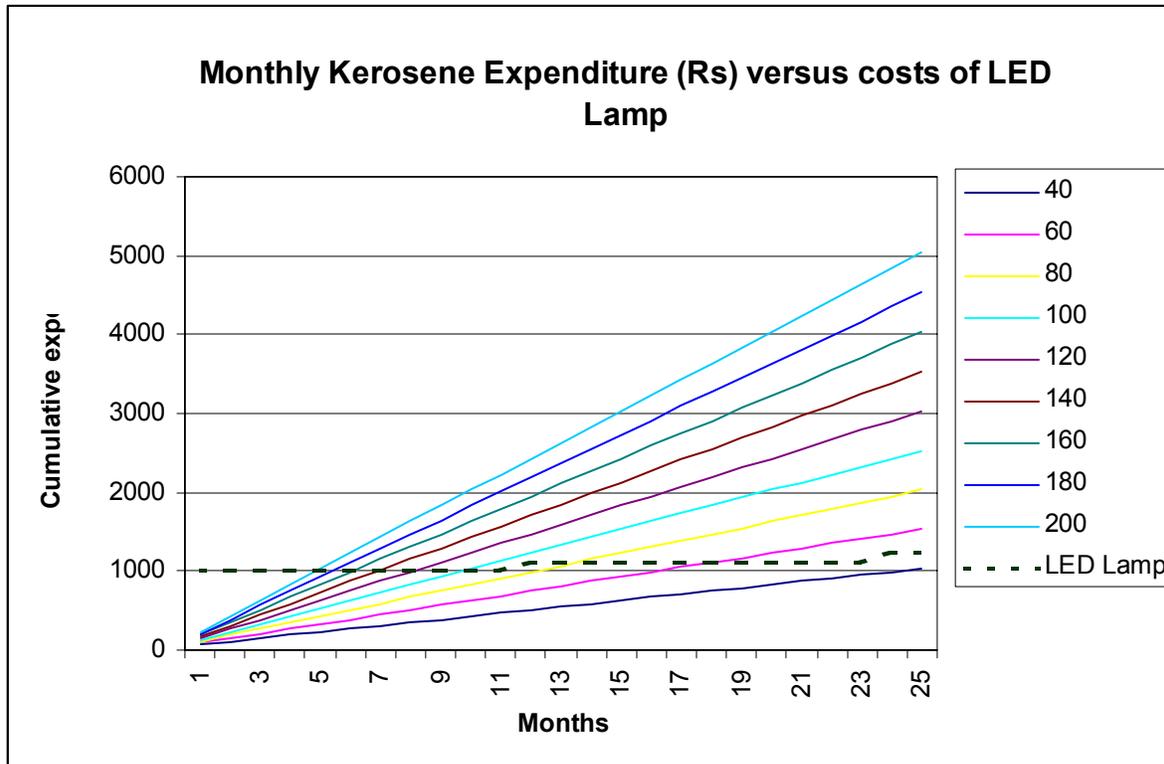
Radios, perhaps a comparable consumption good, typically cost Rs100 – Rs. 250 (\$2.00-\$5.00) and use Rs.25 (\$0.50) alkaline disposable batteries. A minority of households (roughly 20-25 percent in West Bengal) may also own a television set. Some (33 to 50 percent in W. Bengal) own two or more milch animals, and nearly every household owns a bicycle.

An analysis of a typical weekly budget for the 'Kerosene Replacer' segment indicates that this group spends the majority of the household income on simply feeding the family. Clothing, furniture and other consumer goods do not even feature in the budget. However, Kerosene accounts for as much as 10% of overall spending.

<b>Monthly Budget</b>	<b>Rupees</b>	<b>% of budget</b>
Savings	10	2%
Rice and vegetables	250	42%
Milk	100	17%
Meat	100	17%
Other food	75	13%
<u>Kerosene</u>	<u>60</u>	<u>10%</u>
<b>Total</b>	<b>595</b>	
<b>Typical Annual Income</b>	<b>30,000</b>	
<b>Typical Weekly Income</b>	<b>577</b>	

The consumer economics for the LED lamp must be favorable or in parity with kerosene lighting. A comparison of the lifetime costs shows that the LED lamp breaks-even against kerosene in exactly a year when monthly kerosene expenditure is Rs. 92.5.

The graph below indicates the timing at which the LED Lamp economics become favorable relative to kerosene at different monthly expenditures on kerosene.



left title unreadable; had to study graph in order to figure it out- more info needed on it; point out on graph projected breakeven points; 1000 Rs is projected price;

### 3.3 Preferred Payment Method:

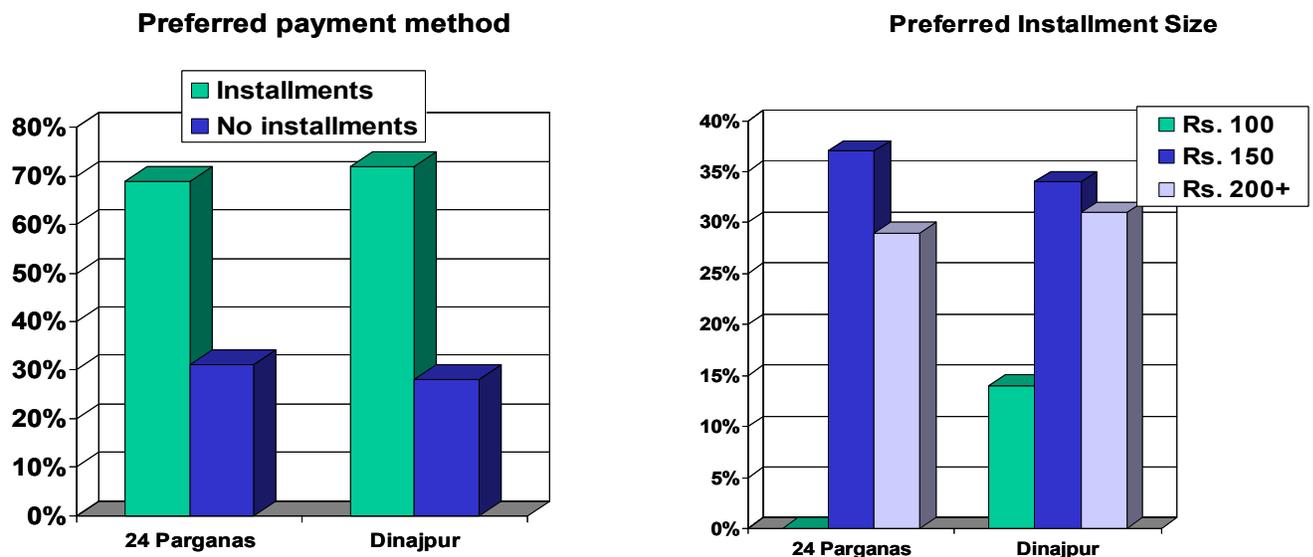
The majority of target (kerosene replacers) customers who have shown intentions of buying the product are not willing to pay 100% cash down at their desired price. However, the 1999 IDE study recommends targeting a few early adopters who would be able to buy the product at cash down basis.

Purchase of the lighting system against 100% cash payment is likely to be low, but varies by region. In two areas of West Bengal (W. Dinajpur and 24 Parganas), 40-46% of potential customers are willing to pay 100 percent cash. In a comparison of 8 regions across Assam, Orissa, Bihar, and W. Bengal, 24 Parganas in W. Bengal emerged as the greatest potential market for 100 percent cash payment because of high income and high expenditure on kerosene.

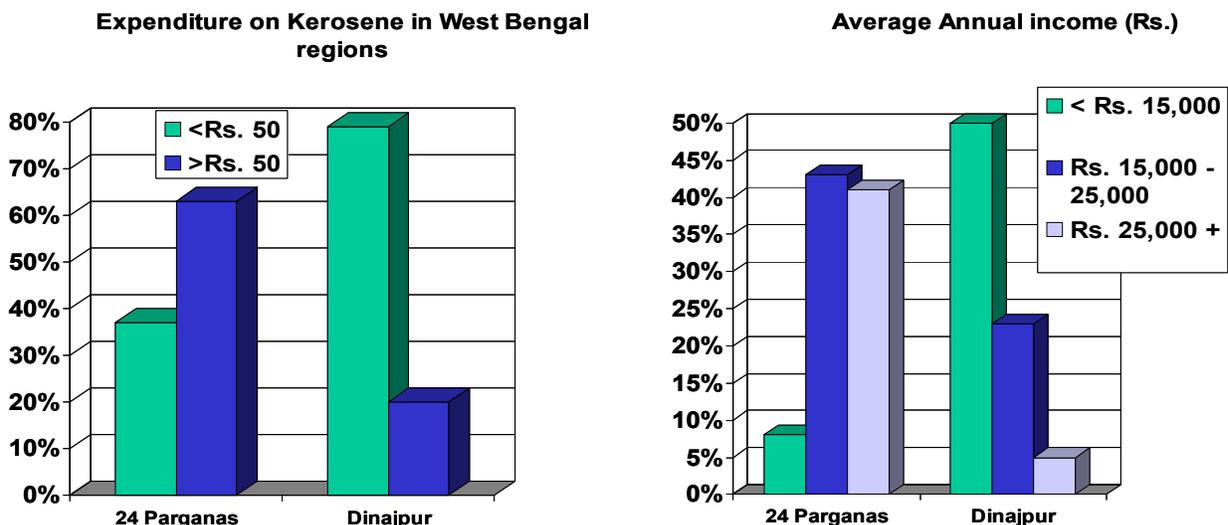
Installment Size	% surveyed expressing preference
Rs. 100 or less	29 – 31%
Rs. 150	14-22%
Rs. 200	34-37%

Payment plans in installments may also help to alleviate customer apprehension about the quality of product performance and after-sales service. During the Pilot Phase we will first test the market response with 100 percent cash down payment, which will likely be most successful in those districts with more early adopters and higher incomes. If some markets do not respond to the 100 percent cash down payment offer (probably poorer districts), payment by installments can be introduced through a

partnership with an existing micro-finance organization as described below. The data represented below is provided from IDE's 1999 survey of West Bengal.



give me numbers for graphs above and below; why don't numbers on installment size= 100%



### 3.4 Description of microfinance options

At a price of Rs.1000 (\$20) the LED light solution may lie just out of reach for the 'Kerosene Replacer' segment. With an annual income of Rs. 30,000 this represents 3% of annual income and is a significant purchase. However, families are used to finding creative ways to pay for essential products and this should be no exception. At Rs. 1000, the purchase price lies below the typical minimum loan amount that most micro finance organizations would entertain. However, a number of options exist for families to make payment for the light in installments. A few of these options are listed below:

### Retailer Financing

One advantage of selling in rural communities is that strength of the community in providing for each other and policing each other. Under these conditions, local vendors may be willing to accept payment for the LED lamp in the form of installments. This might take the form of twelve equal installments over the course of the year. However, for this to work, the customer must be convinced of the reliability of the light.

### Village Co-operative

Once convinced of the benefits of the LED light, existing village co-operatives (such as agricultural co-operatives) may be willing to extend loans to the co-operative members in order to finance the purchase of the light. These co-operatives already have a mechanism for policing themselves and for collection of money. They also exist in nearly every village.

### Savings Group

Many villagers (often the women in the family) contribute to savings groups. These often work by collecting a small weekly sum from all members and awarding the total collected to one member of the group (randomly selected) each month. The process continues until all members have received the monthly payout once. If 20 members each contribute Rs.15 per week, one member of the group would be able to buy an LED lamp each month.

Microfinancing and micro-lending are well established concepts in India. Organizations providing this service might also provide excellent marketing and promotion channels for LUTW-India. The following are organizations already implementing micro-finance and might be approached as partners:

- Grameen Bank, Malaprabha Grameen (Karnataka)
- Selco
- Swayam Krishi Sangam (Andhra Pradesh)
- SHARE (Andhra Pradesh)
- ASA (Tamil Nadu)
- CFTS (Uttar Pradesh)
- SNEHA (Andhra Pradesh)
- Nationalized bank (Syndicate bank)
- State Bank of India

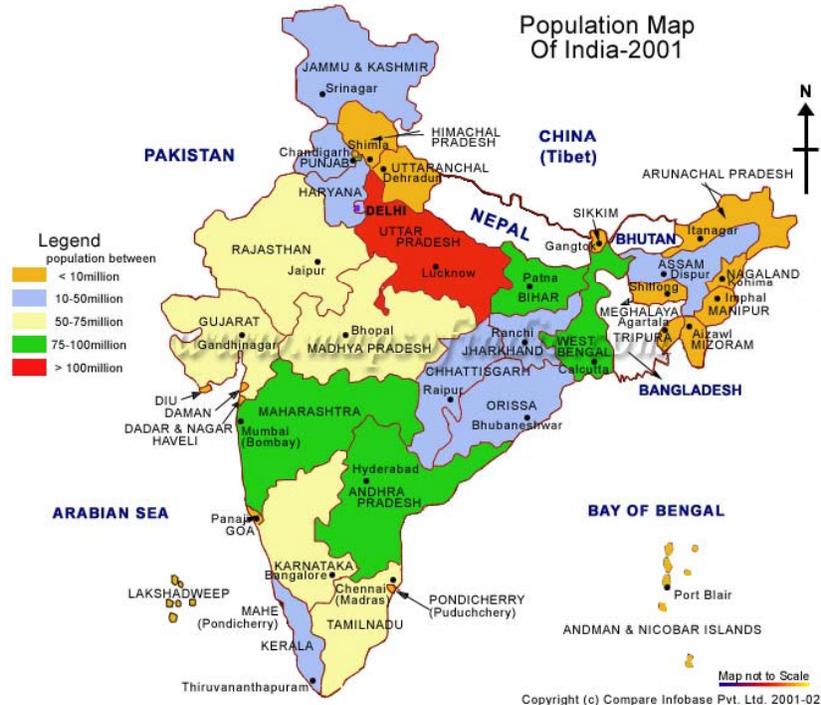
## 3.5 Market Size and Trends

Rural Indians who currently do not use any form of lighting may simply not feel the need for our product since they are accustomed to daily life without it. On the other hand, some people who have electricity may be willing to pay for a light that is more reliable than the government grid. In sum, we are targeting those who would replace kerosene-based lighting with our safer and more energy-efficient alternative. (other 2 statements have nothing to do with in sum statement)

We have identified four focus regions based on their un-electrified status: (chart pop is for total region pop... logic from left to right not consistent; ie not from biggest to smallest; do we have number of villages or pop electrified in regions)

Region	% Villages electrified	% homes in villages electrified	Total Population
West Bengal	78%	26%	80,221,171
Uttar Pradesh	79%	27%	166,052,859
Orissa	73%	25%	36,706,920
Rajasthan	92%	52%	56,473,122

Bihar has been excluded due to the high level of corruption and instability within the state. The electrification status of Bihar is comparable to Orissa, and it should become an active target market if the region becomes more stable in future.



Several other on-grid regions with unreliable electricity may be attractive, based on marketing surveys and feedback from the field:

- Karnataka Pop: 52,733,958
- Tamil Nadu Pop: 62,110,839
- Andhra Pradesh Pop: 75,727,541
- Assam Pop: 26,638,407

Electrification rates (the rates at which the grid is extended to more homes) are such that a significant number of Indian villages will continue to be without electricity for the foreseeable future. Moreover, electrification of villages does not translate to electrification of homes within villages.

## 4 The Economics of the Business

### 4.1 Business Model

The goal of LUTW-India is to create the conditions that will make a self-sustaining market in such lamps possible. It is expected that LUTW-India will operate at breakeven or a modest profit throughout its lifetime. Any profits will be invested into product R&D, and to fund expansion into new geographical regions within India. In the short term (beyond the first three years of operation), LUTW-India will require a modest level of financing to cover losses incurred as the business grows. Base case projections put this figure at \$27,000 for the first three years, in which 45,000 units will be distributed. A self-sustaining market means that there is ongoing consumer demand for the lamp, manufacturers willing to produce it, and distributors and retailers willing to participate in its distribution. Achieving ongoing consumer demand means that an expanding base of people acquire enough knowledge of the product such that they choose to purchase it. Participation by manufacturers, distributors, and retailers is expected to occur based on each entity having profitability with reasonable effort.

LUTW will engage in educational and marketing activities to stimulate end-purchaser demand for the product. LUTW will also identify and recruit suitable retailers and distributors to participate in distribution of the lamp. LUTW-India will provide product and engineering specifications for the lamp to contract manufacturers in India, who will initially produce the lamp directly for LUTW-India (with appropriate markup). LUTW-India will take an additional markup, and sell the lamp to Distributors, who will in turn sell the lamp, at a profit, to retailers. Once the market for lamps becomes self-sustaining, LUTW-India will withdraw from direct involvement in this geographical region, as distributors begin to order directly from manufacturers. We anticipate that this will require approximately five years to occur. At that time, LUTW-India will shift its focus to another, to be determined region within India.)

#### Value Proposition Development

For consumers, the lamp is attractive for a variety of reasons. We anticipate that users will choose to replace their kerosene lamps with the LUTW-India solar lamp, for the great majority of day-to-day use. Research has shown that consumers want more light than kerosene currently offers, a wider spread of light, and portability. Consumers also want low daily expenditure for lighting services. The LUTW-India lamp provides all of these things, while being less expensive than other comparable electric lights (such as other solar lanterns).

Market research has shown that even low-income consumers in many areas are willing to pay as much as Rs. 1500 for a solar light with no operating costs. With many consumers paying about Rs. 50 (lets stay consistent with a kerosene figure) for kerosene each month, the LUTW-India lamp will achieve breakeven in slightly more than one year. Given the estimated life of five years, the customer will enjoy four years of free lighting service (no need to change rechargeable battery during that time?), saving approximately Rs. 600 each year.

Higher-income consumers also are likely to be interested in the LUTW lamp. IDE's research in West Bengal found that consumers earning approximately Rs. 20,000 and above per year expressed interest in a solar lantern costing up to Rs. 2500.

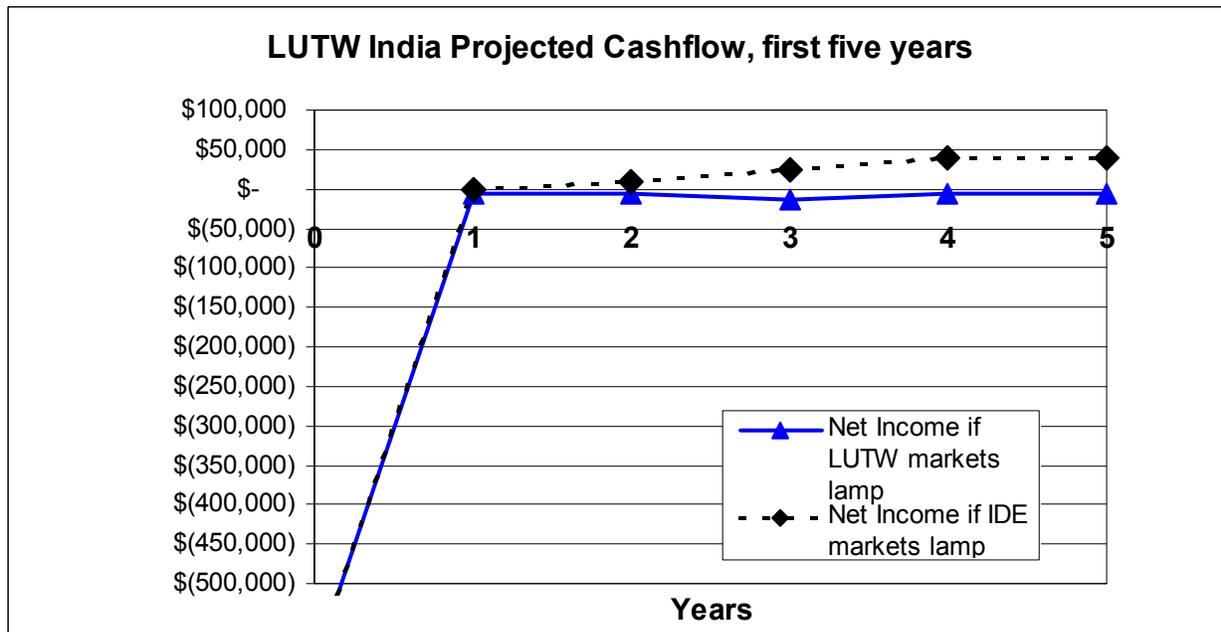
### 4.2 Profit Potential and Durability

Given the goals of LUTW-India, only small amounts of profit are expected or required. Given that the proposed corporate structure is adopted, LUTW-India is projected to operate with an annual loss of \$10,000 to \$30,000 per year during the five year planning cycle, after the initial startup losses of approximately \$500,000 are borne. Assuming projected sales volumes can be achieved (3,000 units the

first year, growing to 30,000 by year 3), the net investment per lamp delivered is about \$1.15. This compares favorably with industry benchmarks (IDE reports about \$4 invested per pump purchased).

However, distributing the lamp using the already established IDE India channels could turn these losses into slight profits. Without bearing the direct marketing costs, LUTW-India might see profits of \$10K to \$75K (spell out 000) over the five year planning horizon.

The graph below shows how cash flow might look for LUTW-India for each of the two cases proposed above.



As stated above, it is anticipated that distributors will gradually begin providing orders directly to manufacturers, effectively cutting LUTW-India out of the loop (are we talking about reducing or eliminating LUTW-India's take- need to take cut at some level in order to control prices, costs, and mission) (an intended and desired consequence). As this happens, LUTW-India profits will invariably decline. It is difficult to determine the impact of this effect over time, given the many unknown factors.

### 4.3 Business Unit of Analysis Summary

(should we have all the numbers below in Rs as well)

The base case business model presents an analysis of the economics at each level in the business.

These are summarized below:

#### Launch Year: Distributor Economics

Units per vendor /year	30
No of vendors served	20
Annual revenue (\$)	9,284
Annual expense (\$)	8,073
Net income (\$)	1,211

**Launch Year: Marketing Officer Economics**

Units per vendor /year	30
No of vendors served	25
Annual revenue (\$)	917
Annual expense (\$)	432
Net income (\$)	486

**Launch Year: Local Office Economics**

Units/ Marketing Officer / year	750
No Of Officers per office	4
Annual revenue (\$)	3,670
Annual expense (\$)	5,451
Net income (\$)	(1,781)

**Years 1 - 3: LUTW-India Economics**

	Year 1	Year 2	Year 3
Units/ Local Office / year	3,000	12,000	30,000
No of local Offices	1	2	5
Annual revenue (\$)	40,367	161,469	403,673
Annual expense (\$)	46,643	168,370	417,275
Net income (\$)	-\$6,276	-\$6,901	-13602.98

**4.4 Fixed, Variable and semi-variable costs**

The main anticipated expense for the individual retailer is the purchase cost of the light, but the retailer will also bear the cost of having space to store, display, and repair the lamps. With an anticipated sales volume of 30 lamps per retailer per year for year three, the retailer will see about Rs. 4000 (\$800) (don't we mean \$80 or \$2.50 per lamp) in profit for the year.

The main anticipated expense for distributors is the purchase cost of the lamp from LUTW-India initially, and then later directly from a manufacturer. With a planned markup of 15% to the retailer, the distributor will earn about Rs. 100 (\$2) per lamp. Hitting the year three projection of 600 lamps sold per distributor results in an operating margin in excess of Rs. 50,000 (\$1000), enough to cover overhead and still provide a profit. A detailed plan of this model is provided in Appendix 11.2.

For LUTW-India, the vast majority of costs are variable. The largest single category is lamp production costs, reaching about 75% of total costs. Other variable costs such as transportation and marketing expenses contribute another 15% of total operating costs. The remaining 10% of costs are fixed- most of this will go towards salaries of marketing and administrative (support and managerial) personnel. For LUTW-India in year three, a net loss of about \$50,000 is expected.

**4.5 Funding Requirements****Test Phase**

In the test phase, the goals are to continue development of the business plan, begin to verify assumptions, continue product development, and begin to establish closer ties with Indian organizations. Detailed planning for this phase is already underway. A number of in-field activities are planned for late July 2003 during which time a project team from Stanford will work in West Bengal to test the

assumptions of this business plan. The projected budget requirement is \$50 - \$75,000 for this phase, and this would be required immediately.

#### **Pilot Phase** (See Section 10 – Pilot Phase)

During the pilot phase, the full time staff will be hired, and 1,000 units will be produced, distributed, and evaluated. The pilot phase has a projected funding requirement of \$340,000, required within the next 4-5 months. (what does the next 4-5 months mean- within 4-5 months of completing the Test Phase or is there a concrete date)

#### **Launch Year**

Although LUTW-India should operate as a self-sustaining business (with the aim of achieving break-even), the initial launch years will require an injection of cash. This funding will allow an initial inventory of products to be manufactured – these products will have to be owned by LUTW-India since in the early stages, it is unlikely that any manufacturer or distributor will be willing to take on the inventory risk involved in a new and untested product. Sum up that you will need \$200,000 in this phase as described in chart below

<b>Item</b>	<b>Description</b>	<b>Funding Required</b>	<b>Timing</b>
Initial production run of 3,000 units	Inventory owned by LUTW-India but held by distributors	\$30,000 (including storage and distribution costs) (this say \$10 a unit, in section 2.2 we say we expect manufacturing costs to be \$12)	Next 12 months
Set-Up costs for Launch	Include initial marketing and promotional budget and salary costs prior to launch	\$50,000 (these costs are for 12 months of operations then or 18 months)	Within 6 Months of Launch
Forecast deficit for year	Forecast deficit in operations for the year	\$10,000 + \$10,000 contingency	Prior to beginning of Launch Year
Budget for assistance in stimulating Indian manufacturers to begin production	Assistance to overcome capital costs of tooling, initial inventory and training and education in manufacturer's supply chain	\$100,000 (estimated) (isn't everything estimates)	Prior to beginning of Launch Year

In total, LUTW-India will require approximately \$600,000 (break out the money to show how it equals 600) over the test and pilot phases, and one year of start-up operations (year zero), in order to put itself in position for the first year of full-scale operation.

Assuming the proposed corporate structure is adopted, LUTW-India will require about \$200,000 in additional funding over the first year of operations. If IDE distributes the lamp, it is likely that no additional funding would be required.

#### **4.6 Progress to Reach Positive Cash flow**

Given the proposed structure, positive cash flow is not achieved under current assumptions before Year 4 of operation. Key driving assumptions are the number of retailers each marketing officer can serve (50), the achievable market penetration rate (an incremental 10% per village in each of first three years, 15% a year subsequently), required marketing materials expenditures (currently budgeted for \$2,500 per year per office, plus \$20K in per state costs), and margin taken by LUTW-India (assumed to be 8-10%).

The volume projection provided here for the Launch year and subsequent two years are conservative, based on a pragmatic roll out of LUTW-India and the LED/Solar product. This approach is modeled on the experience of IDE, Selco, Grameen and others who have been successful in growing a market for a new product or service. Each of these organizations discovered that initial proliferation would be slow, requiring much on the ground marketing and promotion within a focused target area. The plan presented here incorporates these learnings to give a realistic, if not conservative, growth plan for LUTW-India

Year	Target units (base case)	Local Offices	Marketing Officers	Retailers/Vendors
Launch Year	3,000	1	4	100
Year 2	12,000	2	8	400
Year 3	30,000	5	30	1200

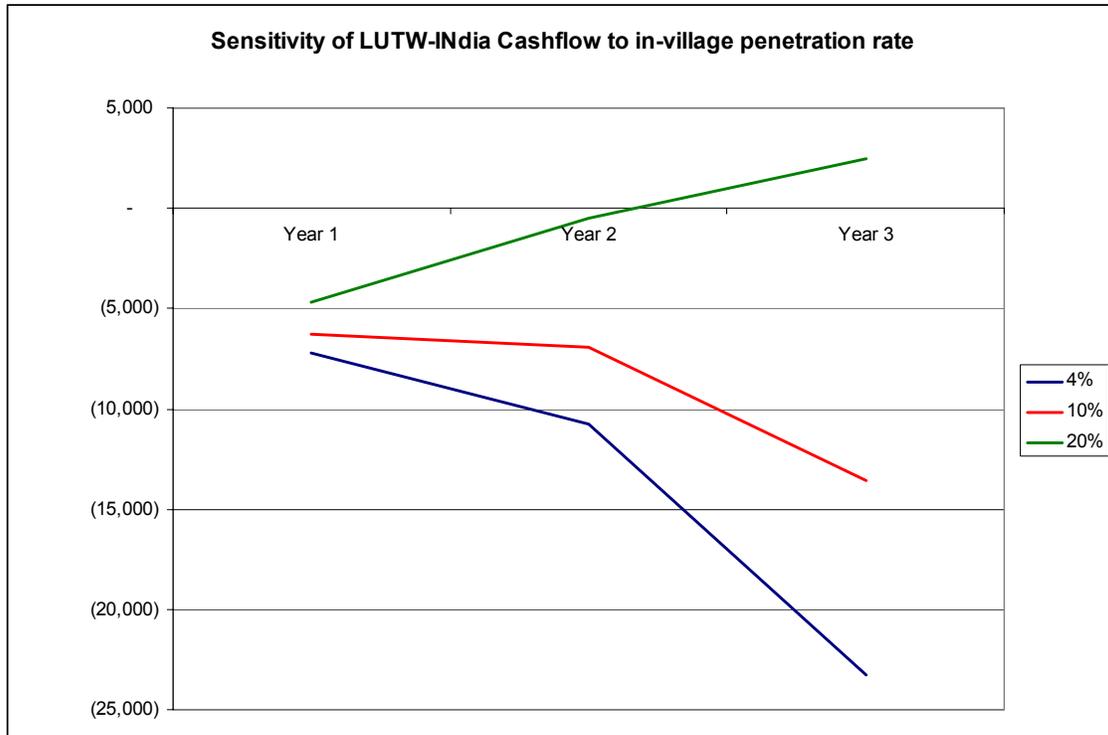
If it is desired to break even or reach positive cash flow with this organizational structure, some leverage points are the margin taken by LUTW-India and the number of retailers served per marketing officer (also need for new offices/ employees). With IDE distributing the lamp, the business is projected to be cash flow positive in year 2. Assumptions are similar to the above.

#### **4.7 Sensitivity of Business Model**

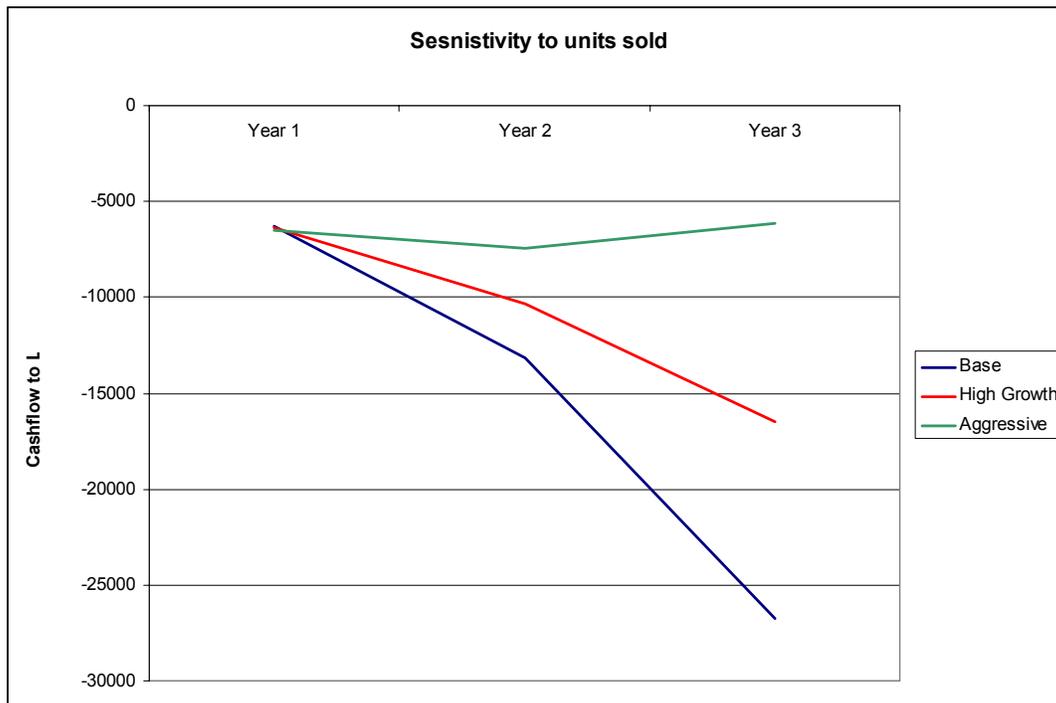
A sensitivity analysis on the projected volumes indicates that the financing requirements are relatively insensitive to reductions or increases in volume over the first three years. In Year 1, the base case model assumes a 10% penetration within each target village. An increase in penetration to 20% in each village would increase the net income to LUTW-India by \$15,100. Although this represents a dramatic increase in penetration, the effects on the funding requirements for the businesses are relatively small.

All sensitivities presented below are based upon sale of the standard '\$20 Might Light'

A sensitivity analysis of sales penetration rates within the individual village indicates that breakeven is achieved in the middle of Year 2 if penetration of 20% is achieved. The base case model assumes a penetration rate of 10% in Years 1, 2 and 3. (what about sensitivity to declining light costs)



A further sensitivity analysis of income to the number of units sold within Years 1 – 3. The analysis indicates that the funding requirements under this conservative growth pattern the base case of 45,000 units by the end of Year 3 leads to an overall cash position of -\$26,780. If 135,00 units are sold by the end of year 3, LUTW-India’s cash position is only marginally negative at -\$6,153.



<b>Units</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>
Base	3000	15000	45000
High Growth	6000	30000	90000
Aggressive	9000	45000	135000

## 5 Product and Technical Details

### 5.1 Description of product solution

#### Overview

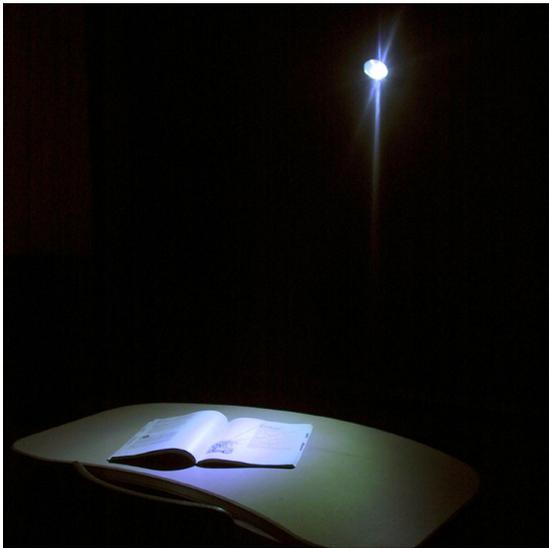
The main product offering that has been developed for the Indian market is a self contained, solar powered LED lamp, with an intended retail price of \$20 / Rs.1000. Two prototype designs have been prepared to meet this specification, the details of which are given in this section below.

A further product concept that has been evaluated in depth and which remains a secondary option is for a lower cost unit, employing lesser LED technology, but at a retail price of \$5 - \$10. Such a product could have appeal to the poorest households in the 'Kerosene Replacer' target segment and would serve as an entry-level product

### 5.2 Design Summary – The \$20 'Mighty Light'

This light has been designed for use in the home for reading, working and socializing and for use as a portable flashlight. It provides the choice of either ambient lighting or a focused task light from a single one Watt white LED. Integrated into the light is a 1.2-Watt photovoltaic (PV) panel and two size-AA batteries that can be replaced.





The light has the following design features:

- Robust and durable design can handle continual, repeated use both indoors and outdoors
- 4.2 hours of light on fully charged batteries
- PV panel can recharge 80% discharged batteries in 7.2 hours of direct sunlight
- NiMH batteries will last for 500-1000 cycles (1.3 – 2.6 years of daily use)
- Dual-use rotor lens allows for focused beam or ambient lighting
- Light easily hung on wall or from ceiling
- Geometry of light housing allows for multiple, stable resting positions on the floor, table or bed
- Resting position for solar recharging allows for easy adjustment for optimal charging as Sun passes overhead during the day
- Handle allows for securing light to a fixture, thus preventing potential theft of light
- Light can be powered utilizing power from wall-outlet (grid power). An AC-DC converter must be purchased to make this possible
- Robust switch guaranteed for two years
- Built-in solar panel prevents corrosion of electrical connections

### Component Summary

With the exception of the WLED, all components and light subsystems can be manufactured and assembled in China or India. Here we provide a summary of target prices for key components, in high volumes (100,000s).

Component	Description	Price
LED Source	1-watt Luxeon LED	\$2.50 - \$2.75
PIC + Circuit	PIC controller and circuit to regulate current to LED and optimize light output while minimizing power consumption	\$0.80 - \$1.00
PV Panel	1.2watt panel Silicon cell module with conformal coating Requires 7.2 hours of light to charge 2x AA batteries	\$3.00
Batteries	2 x AA NIMH rechargeable batteries	\$1.20 (\$0.60 per battery)
Casing	Injection molded polycarbonate, 2 piece casing, with snap fixing and securing screws	\$1.75 - \$2.00
Lens / optics	Plastic rotate-able disk with collimator, reflector	\$0.05 - \$0.20
Switch	Robust, weatherproof on/off switch	\$0.15 - \$0.20
Grid power jack	Allows use of AC-DC converter	\$0.10 - \$0.15

Assembly	Factory and assembly line to be determined	\$0.70 - \$1.00
Packaging	Thin, triangular cardboard box with graphics	\$0.10 - \$0.15
Total		\$10.35 - \$11.65

### 5.3 Design Summary - \$5 - \$10 light , 'Lighty Light'

This light has been designed to provide useful light at the lowest possible cost. It makes use of readily available low cost WLEDs such as those used in the original LUTW LED lights. These LEDs run at close to 0.1Watt each and can be used in combination to provide a usable light source. The light is powered by a single AA battery and is recharged via a small embedded solar panel.

The light has the following design features:

- Gives user access to complete light system at very low cost
- Charges, powers, and lights all in one rugged housing
- User save on cost by spending less money on batteries
- Lifetime of LED light source is 100,000+ hours
- Utilizes most popular and widespread form of WLED: Proven solid-state lighting
- Robust weatherproof and durable design can handle continual, repeated use both indoors and outdoors
- 2.4 hours of light on fully charged batteries
- PV panel can recharge 80% discharged batteries in 4.1 hours of direct sunlight
- NiMH batteries will last for 500-1000 cycles (1.3 – 2.6 years of daily use)
- Reflector and lens optimize usable light from three LEDs
- Easily hung on wall or from ceiling
- Robust switch guaranteed for two years
- Built-in solar panel prevents corrosion of electrical connections

#### Component Summary

All of the components for the Lighty Light can be manufactured in China or India and assembled locally. Below is a list of key components, volume pricing for each component, and estimates of assembly. The critical motivating design constraint in this light is cost. Pricing on several of the items listed here is conservative (e.g. 0.1 W LEDs have been found for as low as \$0.16 each). Our intention is to offset any unforeseen expenses in the manufacturing and construction of the light or in component durability.

Component	Description	Price
LED Source	3x 0.1 Watt WLEDs	\$0.60 (3 @ \$0.20)
PIC + Circuit	PIC controller and circuit to regulate current to LED and optimize power consumption	\$0.80 - \$1.00
PV Panel	0.6 Watt panel Silicon cell module with conformal coating Requires 7 hours of light to charge 2x AA batteries	\$1.50
Battery	One AA, 1800 mAh NiMH rechargeable batteries	\$0.60
Casing	Injection molded polycarbonate, 2 piece casing, with snap fixing and securing screws	\$1.00 - \$1.40
Lens / optics	Simple clear plastic disk and reflector	\$0.10 - \$0.20
Switch	Robust, weatherproof on/off switch	\$0.15 - \$0.20
Assembly	Factory and assembly line to be determined	\$0.40 - \$0.75
Packaging	None	
Total		\$5.15 - \$6.25

## **5.4 Development Status and Tasks**

The designs provided above require further development and testing before they can be finalized. This process will continue during Pre-pilot (Test) and Pilot phases as outlined in Section 10. Based on these designs, prototype units will be made and tested during the pre-pilot phase. The findings from these tests will refine the designs in order to prepare for production of 1000 units for use in the Pilot Phase.

A key area for further development is the optics of the light unit. The beam of light emitted by the LED can be further focused using a combination of reflector and collimator. To date, development in this area has been limited, the team hopes to find an expert in this field who can provide further advice. The further development of designs described above will take the form of:

- Further testing with functional prototypes
- Refinement and optimization of circuitry and code for charging batteries and powering light
- Deploying functional form prototypes into the field and collecting feedback. These prototypes will not have the circuitry and PV – they will simply be used to test the form and function of the design
- Further refinement of knowledge pertaining to actual manufacturing and development costs

## **5.5 Key Component Costs**

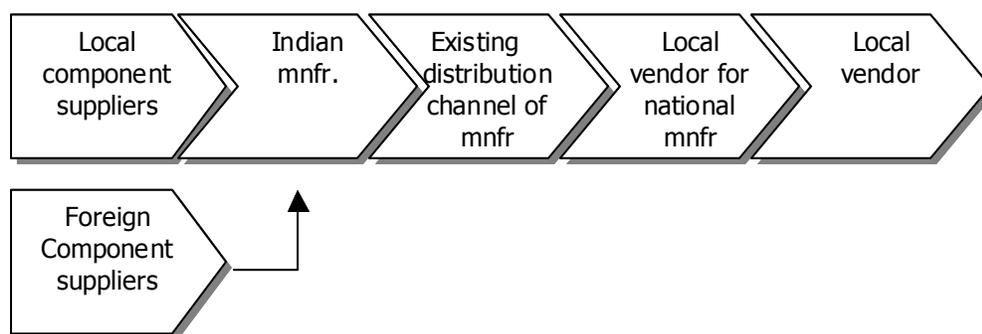
White LEDs are a new and rapidly improving technology. In our work with both industry and non-industry experts we have heard projections for increased light output that range from a factor of four to ten over the next two years. Additionally, growing demand for these LEDs is likely to drive production up and thus reduce unit costs for products like ours. As a result, we anticipate that over the course of the next 2-3 years we will not only be able to reduce the price per Luxeon, but we will also be able to increase the total light output from each Luxeon in our devices. Lumileds are close to launching a 2-Watt Luxeon design. Our expectation that this would be available commercially for use by early 2004. The current pricing for 1 watt LEDs is in the range of \$2.50 - \$4.50.

## 6 Distribution Plan

### 6.1 The Supply Chain

The supply chain to deliver the LED lamp must deliver the light solution to the end user with a minimum number of handovers. The supply chain for the LED lamp must use existing channels and markets where possible. This approach will minimize the costs of distribution and take the lamp to the widest audience. However, certain areas of the supply chain will require or benefit from some additional stimulation and support provided by LUTW-India.

This supply chain model leverages existing distribution channels and manufacturer relationships. Moreover the ownership for inventory and materials is always with the manufacturer. A critical role for LUTW-India would be the sourcing purchasing and organization of key components including LEDs and photovoltaics. LUTW-India acts as a purchasing and manufacturing organization, but with zero inventory risk in the longer term. In the short term, LUTW-India may have to underwrite a certain level of production in order to encourage manufacturers to initiate production of the LED solution. This favored model duplicates the successful manufacturing and distribution strategy adopted by IDE.



### 6.2 Supply Chain Partners

The distribution and supply model consists of the following elements / parties:

Party	Description	Location	Nature of relationship with LUTW-India	Key Risks
<b>Manufacturers</b>	Electrical products manufacturer / flashlight manufacturer in India	National manufacturer in India	Partnership relationship LUTW provides design and R&D support	Manufacturers must make capital investment in new tooling and technology
<b>LUTW-India</b>	Marketing and logistics organization that develops new retail channels and assists manufacturers in marketing	HQ in India supports manufacturers	N/A	LUTW should limit it's own inventory risk and must leverage existing sales channels
<b>Distributor</b>	Existing partner of manufacturer	National or state level	Relationship primarily with	Distributors must promote the LED

	distributes a number of electrical goods to resellers and retailers		manufacturer. Limited contact with LUTW-India	product to resellers
<b>Retailers/resellers</b>	Existing storekeepers, market traders and traveling vendors in villages	Villages, village market and nearest rural town	LUTW provides on the ground marketing support through marketing officers who coordinate promotional activities	Resellers/vendors must promote the products in favor of existing flashlights and kerosene products
<b>NGOs/Secondary Resellers</b>	NGOs, village groups and community groups that promote and distribute the LED product	Village or state level organizations	LUTW marketing officers recruit community groups as promoters and resellers of the LED lighting product	Community groups must support maintenance and servicing of the light unit
<b>Partner Organizations (e.g. IDE, Grammeen, Barefoot College)</b>	Large-scale organizations whose aims are closely aligned with LUTW and that already have a distribution network in India	Throughout India	Distribution partners with LUTW. Use existing distribution network and on the ground resources to market, promote and deliver the product	Aims of organizations are not aligned

### 6.3 Manufacturing Model

The preferred manufacturing model is to leverage existing manufacturers in India. Under this model, the local manufacturer would essentially be manufacturing and distributing the product through existing sales channels. LUTW-India would then help to promote and market the product through these existing channels. These partner manufacturers would receive the product design from LUTW's global organization. In return for marketing and promotional support, LUTW-India will collect a percent commission on each sale.

This model is unlikely to have traction in the short term as manufacturers will be unwilling to bear the risk of capital investment necessary to begin production of the LED Lamp. In order to overcome this, LUTW will use a contract manufacturer such as Solectron to make the initial products for the launch year. Once demand is apparent, Indian manufacturers will be much more likely to make the investment to take on production of the product for themselves.

### 6.4 Selection of manufacturing partner

A number of partner manufacturers of lighting or flashlights are able to play this role. The manufacturing capabilities of the partner must include the following:

1. Circuit board assembly
2. PIC Microprocessor programming
3. Plastic housing manufacture (injection molding and extrusion technology)
4. Component and housing assembly (automated or manual)
5. Packaging and distribution

These capabilities are consistent with those of most flashlight manufacturers, with the exception of PIC programming. This programming of these controller microchips is a straightforward operation that requires a limited investment in PC-based hardware.

Selection of the manufacturing partner should combine an active search by LUTW and a structured RFP (request for proposal) process in which manufacturers are invited to provide a detailed proposal for how

they would manufacture and distribute the product. The recommended approach would be to find a single partner manufacturer with strong distribution networks within the target region for LUTW's launch in India. After proving that the economic model is viable and attractive to one manufacturer, LUTW-India can seek further manufacturing or distribution partners throughout India.

LUTW must provide the partner manufacturer with the following:

1. Initial product design and manufacturing specifications (material requirements, tolerances, molding patterns, etc.)
2. Key component sourcing (for LEDs and possibly solar panels)
3. Guaranteed minimum volume and underwrite initial tooling costs
4. Maintenance and repair requirements
5. Testing and validation processes

The following manufacturers have been identified as potential partners:

#### **Bajaj Electricals Limited**

India's oldest and largest manufacturer of domestic appliances

Contact: Mr. Shekhar Bajaj (Chairman of Bajaj Electricals and Black and Decker India - is interested in pursuing the project further)

<http://www.bajajelectricals.com>

#### **Jabil Circuit Ltd**

\$3.55bn Indian EMS/Contract Manufacturer

Contact: Arvind Saraf

<http://www.jabil.com/>

#### **Eveready Industries India (Flashlight Cases Division)**

The company sold 10.7mn cases of flashlights during the year 2002

<http://www.lavabattery.com/flash/body.html>

#### **Tata BP Solar**

Joint venture of BP and Tata industries. Currently produces solar lanterns and home solar systems

Contact: G M Vijaya Kumar, Sr. Manager - Sales & Marketing

<http://www.tatbp.com>

## **6.5 Component supply**

The majority of components used in the LED light are available from a large number of local Indian suppliers at commodity prices. LEDs and Solar Panels remain as components that will be sourced from exclusive suppliers. LUTW will establish relationships with these suppliers and secure high volume, low cost components. These will then be shipped directly to the manufacturers.

#### **WLEDs**

1-Watt and 2-Watt LEDs will be sourced from Lumileds, based in California. 0.1Watt LEDs are available from any number of Asian suppliers such as Nichia, with whom LUTW already has a strong relationship.

#### **Solar Panels**

The preferred solar panel solution uses an array of series wired silicon solar cells, encased in conformal epoxy resin and mounted on a rigid substrate. LUTW can generally obtain better prices from companies already set up to produce low-power solar panels, such as those used in garden lights. A company with the capability to produce these panels is Jia Wei Solar, based in Hong Kong.

Jia Wei Solar China Ltd.  
Unit 531m 5/F Star House No. 3 Salisbury Road  
Tsimshatsui, Kowloon  
Hong Kong  
Phone: 852-2730-2718  
Fax: 852-2730-2719  
jiawei@netvigator.com  
Contact: Nancy Chou  
www.solarchina.com

## **6.6 Distribution Strategy**

Partner manufacturers will use their existing supply networks to take the LED lighting product to market. These networks are likely to include indirect retail and wholesale channels that put the products in the hands of local vendors and merchants.

Where a manufacturer has a large network of sales channels, LUTW should work with them to identify those that are best suited to the LED lighting solution. These channels are likely to be those that serve the rural consumer market. We anticipate that these will be local vendors and shopkeepers. The sales channel relationships will already exist between vendors, distributors and the partner manufacturers. However, LUTW must also develop relationships with vendors and distributors as a marketing partner. This will be essential in ensuring that these sales channels promote the lighting solution effectively. The manufacturer must remain the ultimate owner of the channel relationships.

LUTW-India marketing officers will be active in coordinating and recruiting further resellers and vendors. These vendors may be existing storekeepers and market traders or they may be NGO and local organizations that recognize and wish to promote the LED light. Examples of such organizations are village and agricultural cooperatives, microfinance groups, schools and women's groups. By acting as agents for the LUTW light, these organizations can offer the light to their members without adding the margin that a commercial vendor would apply (typically around 20%). These groups will also be active in the promotion and validation of the product and providing ongoing support and maintenance.

## **6.7 Communication in the Supply Chain**

Communication throughout the supply chain will be critical to ensure successful promotion and supply of the product to the consumers. Vendors and retailers will receive regular product updates and information from both the distributor and the LUTW marketing officers. The LUTW marketing officers will have direct contact with each of the vendors and will serve as the main point of contact for product information, training and promotional activities such as demonstrations. Marketing officers will communicate with vendors through regular mailshots, email (where possible) and visits. A standard product and sales training program will be provided for marketing officers to use with new vendors.

The key to successful relationships with retailers, who will in turn promote the LED products, will be to establish frequent contact with marketing officers and to provide compelling marketing materials and promotional opportunities.

## **6.8 Key Distribution Steps and Margins**

At each step of the supply chain, a fair margin must be achieved. These margins are likely to mirror those already offered by the partner manufacturer on existing lighting products. Typically, following margins will be added at each stage in the supply chain:

Supply chain stage	Example Cost (\$)	Margin (%)	Margin per unit (\$)	End price (\$)
Manufacturer	11.65	5%	0.58	12.23
LUTW-India	12.23	10%	1.22	13.46
Distributor	13.46	15%	2.02	15.47
Retailers/vendors	15.47	20%	3.09	18.57
Consumer	18.57			
Consumer w/ community channel	15.47	Avoids reseller margin by distributing through non-profit community group		

### 6.9 Maintenance and repair

The LED light solution is designed to last at least 5 years without need for maintenance other than the changing of rechargeable Nickel Metal Hydride batteries. Under the current design, these batteries are likely to last between 1 and 1.5 years at which time they must be replaced. These batteries will be sold through the same sales and distribution channels as the light. The cost of replacement will be approximately \$1.66 for two batteries (including retailer and distributor margins).

In the case of breakdown, the LED light and solar system will carry a 1-year warranty. Experience of existing solar lantern suppliers such as SELCO and Grameen Shakti suggests that the warranty is an extremely important element of the proposition. Since poor families are wary of any new product, their tendency may be to assume that the product will not last. This can only be countered by demonstrating that the product will be fully supported and warranties will be honored. The best way that LUTW can achieve this is to honor all product returns (regardless of age) and to offer a replacement unit in return for the faulty or broken unit. This can only be supported if the vendors and resellers take responsibility for the replacement and return of units. The LUTW marketing officers will manage this process and collect all returned products regularly from the vendors. At the time of collection, the marketing officer will reimburse the vendor for the cost of the replacement light unit.

### 6.10 Subsidies and assistance through the supply chain

In general, our research suggests that government subsidies at the point of sale are likely to stifle the proliferation of LED lighting solutions. Interviews conducted with existing organizations in India suggest that prices are likely to be held artificially high by subsidies, resulting in reduced demand. We therefore advise against the use of blanket or government subsidies. However, efforts to stimulate sales through price promotions and voucher schemes should not be discouraged.

Government assistance can be most powerful establishing the supply chain. Notably, favorable loans and grants to new resellers and entrepreneurs will play an extremely important role in establishing the market. We favor the use of low interests loans and assisted credit terms in this area.

### 6.11 The Role of the Government

We are currently in contact with the Indian Renewable Energy Development Agency (IREDA), and specifically with the West Bengal Renewable Energy Development Agency. Although no plans have been made to work with the government or enlist government support, we believe that maintaining a cordial and open relationship with the Indian government is key to the project's success. On Friday, May 23, the India Team hosted a delegation from IREDA at Stanford.

Unlike Ramakrishna Mission and other NGOs that have experimented with solar energy distribution, however, we will attempt to avoid product-specific government subsidies to consumers. Based on the recommendations of IDE-India, Selco, and NREL, we believe that distribution through un-regulated government panels will be most appropriate for our product, allowing the business to adjust to rapid market changes with new forms of technology.

The potential role of the government is summarized in the exhibit below. These proposals were presented to a delegation including the Ministers for the Ministry for Non-Conventional Energy Sources and IREDA who reacted positively to requests for duty free dispensation on imported components and to requests for assistance in stimulating the supply chain.

## Government role in building the market

Area	Recommended role of government	Rationale
<b>Manufacturers</b>	<ul style="list-style-type: none"> <li>Duty Free Dispensation</li> <li>Assist in set-up costs</li> </ul>	<ul style="list-style-type: none"> <li>Fixed costs will provide greatest barrier to entry for manufacturer</li> <li>Prevent delay and inaction amongst manufacturers</li> </ul>
<b>Distributors</b>	<ul style="list-style-type: none"> <li>Do not limit distribution channels</li> <li>Avoid exclusivity in distribution</li> </ul>	<ul style="list-style-type: none"> <li>Limiting channels would artificially inflate prices</li> <li>Encourage multiple channels</li> </ul>
<b>Vendors and Entrepreneurs</b>	<ul style="list-style-type: none"> <li>Assist with fixed costs</li> <li>Preferred rate loans or micro-finance options</li> </ul>	<ul style="list-style-type: none"> <li>Many entrepreneurs will be unable to borrow from existing lenders</li> <li>Overcome 'chicken and egg' problem</li> </ul>
<b>End User</b>	<ul style="list-style-type: none"> <li>Avoid subsidy to end users</li> <li>Provide funds for marketing and promotion activities</li> </ul>	<ul style="list-style-type: none"> <li>Subsidy artificially inflates prices and restricts vendors and resellers</li> </ul>



## 7 Marketing Plan

In the short-term, our marketing plan will streamline the process of penetrating new markets, emphasizing the incentives for rural users to adopt our new technology over that of available competitors. After-sales customer service will provide mechanical assistance to ensure the reliability of the product, focusing on establishing a good reputation with rural customers and communities.

Over the long-term, LUTW will consistently aim to treat the users as customers rather than charity recipients. Nevertheless, our main goal will be to retain the marketing focus on the poorest customer segments that can benefit from our light.

### 7.1 Overall Marketing Strategy

#### Key Objectives:

- Build excitement and stimulate demand for kerosene-replacing technology in the form of the LED lamp
- Build positive brand recognition, overcome past failure of CFL-solar panel systems
- Emphasize product quality, rather than cheapness, to avoid “poor man’s good” stereotype
- Focus on one-on-one service, relationship between marketing officer and vendors / distributors at the village level

Marketing efforts will target the village and will aim to build trust and recognition for the product throughout each village. The close-knit nature of the village community calls for marketing efforts that identify the decision makers and influencers in each village. At the heart of each village community is the Panchayat or executive committee. It is essential that Marketing Officers develop relationships and win the support of these Panchayats in order to gain credibility and trust for the LED lamp in the village. Although LUTW-India headquarters will determine the overall marketing strategy, specific tactics will be determined on a village level by state marketing officers and will inform the overall strategy. The country-level LUTW office will be responsible only for allocating marketing budgets to the various state offices. As LUTW-India will function primarily as a research, development, and marketing organization, the country level office will be responsible for coordinating marketing and distribution with sourcing from contract manufacturers.

Because rural marketing lacks conventional channels of TV advertisements or billboards, LUTW’s primary focus will be contact with the end user. Therefore, a high level of autonomy will be given to marketing officers in the state office to select culturally and linguistically appropriate marketing strategies and to make their own materials in the local language.

#### Value Proposition

At the heart of the LUTW-India proposition is the promise of a clean, healthy replacement to the kerosene lamp that provides more light, at a lower long term cost than is currently possible with kerosene. The economic and functional benefits must be reinforced consistently in all marketing messages.

#### Product Differentiation

The LED lamp must be differentiated from both the kerosene lamp and existing solar and incandescent lanterns. LUTW-India will differentiate the LED lamp on the reliability and limited service requirement (compared with both kerosene and CFL). Feedback from Selco and Bunker Roy of Barefoot College confirms that existing solar solutions that employ CFL have only been successful when local, trained engineers address reliability concerns. The LED product has the opportunity to offer a much more reliable and robust product.

## **Brand Management**

The LUTW or 'Mighty Light' brand must be a core part of the marketing strategy. The proposed manufacturing model will allow for manufacturers to attach their own brand to the product. As long as manufacturing partners are chosen carefully, this should have a positive branding impact. The LUTW/Mighty Light brand should be a sub-brand that will become a mark of quality and reliability regardless of the primary manufacturer. The brand should be developed in such a way that it reinforces the attributes of: technology, trust, health, education and reliability.

## **7.2 Marketing Units of Analysis**

### # Lights per Household

Other models such as Selco and Ramakrishna Mission (a solar lighting distributor in West Bengal) have successfully installed multiple-light systems into multi-room households. However, based on the current LUTW model and our target of the poorest users, we expect customers will initially buy one light per household.

### # Retailers per Village

The average village population is 1000-1500 people, or approximately 150-250 households. Based on the IDE model, we predict that one village dealer (NGO, shopkeeper, or women's co-operative) will be able to serve the entire village.

### # Villages per Marketing Officer

Based on the IDE model, each marketing officer will serve 50 villages.

### # Officers per Office

Again based on the IDE model, each marketing office will employ 4 officers. These officers will be native to the state and specifically familiar with rural marketing. They will have a great degree of autonomy in designing the most appropriate marketing plans for the local culture, language, and market size.

### # Offices in India

After 5 years, LUTW-India will aim to have marketing offices in 5 states. Each office will be established during successful pilot phase in the state. In addition, there will be a LUTW country headquarters office (currently in Calcutta, West Bengal) that will coordinate countrywide operations. While the LUTW headquarters will determine the budget for each state office, marketing strategies will be determined almost entirely at the state level.

## **7.3 Pricing**

These prices incorporate a 10% margin to LUTW-India, a 15% margin to the Distributor and a 20% margin to the vendor/retailer.

The pricing of the product is critical in generating initial interest in a store/shop setting. During the Pilot Phase a number of price-sensitivity trials will be made to develop a model of the consumer's buying habits and response to price variations. The immediate pricing strategy will be to require 100 percent cost down payment from users. Recognizing that different user income brackets have different abilities to pay, we use a price differentiation strategy by offering two products. See Section 3.4 for further details or financing schemes.

## **7.4 Sales Tactics**

## Sales Channels

During the initial launch phase, LUTW-India will establish distribution and sales channels in target villages, with local marketing officers playing a key role in recruiting vendors to stock and support the LED lamp. However, the intention is that the product should be transferred as early as possible to existing manufacturers. In turn, these manufacturers will distribute the product and sell the product through existing sales channels. These sales channels are local vendors of flashlights and household goods based in villages, weekly bazaars and in the nearest town. The majority of villagers visit a weekly market or bazaar to buy produce and household products. These vendors of these markets rely on kerosene lamps for light and may, themselves, be an early-adopter customer group for the LED light.

The role of the LUTW-India Marketing Officer will be to support and build close relationships with BOTH village communities and the vendors that serve these communities. The Marketing officer should be seen as a resource for both, and a champion for the LED lamp. This will be achieved through the following tactics:

- **Regular village and vendor visits.** The Marketing Officer should visit the village and the vendor at least twice per month. During these visits the Marketing Officer may work with the vendor to develop a local marketing plan, or may carry out a product demonstration to the village. This is also an opportunity for existing customers to raise any concerns with the Marketing Officer.
- **Frequent, publicized schedule of marketing officer visits to each village.** It is important that the visits are planned and publicized to demonstrate to the community that the Marketing Officer / LUTW is a frequent visitor and is accessible to them.
- **Product demonstrations.** The Product demonstrations within the villages will be the core of the marketing efforts. These demonstrations are extremely important in educating the villagers and proving to them the utility and reliability of the light. The Marketing Officer should select a few 'demonstration' users who can be given free lights. These users should be highly visible to the rest of the village – for example a school, village hall or in a busy store.
- **Marketing supports for community organizations that will sell the product.** Village level groups such as women's groups, farming co-operatives or microcredit organizations can provide an extremely reliable and trusted route to the consumer. These groups will purchase the lamp from distributors (the Marketing Officer can coordinate this) and sell the lamps in turn to their members. These groups would also provide maintenance and service support to the user. In order to do this, the Marketing Officer will train one group member in the use of the lamp, the process for ordering lamps and the process for returning faulty lamps.
- **Creative marketing with media .** The Marketing team for LUTW-India must generate the most creative and effective marketing tools for use in villages and by vendors. Specifically, these might include:
  - **Hindi Movies:** Capitalizing on the huge demand for Indian films, LUTW-India can commission movies, featuring known actors that feature the LED lamp within their plot. Similar movies have been employed very successfully by IDE in Bangladesh and India. The showing of these movies within a village will be major event, bringing together many potential customers at one time.
  - **Radio commercials:** Many villages have a shared or common radio. Radio adverts are low cost and can reach an audience with a compelling message.
  - **Printed Materials:** Leaflets and highly visual promotional postcards distributed through high profile locations such as schools and community buildings and vendors.
  - **Celebrity Demonstrations and testimonies:** Movie stars, singers and TV celebrities provide LED lamp demonstrations or testimonies.
  - **Singers and Storytellers:** Employing local singers and storytellers to develop material relating to the LED lamp and its benefits. These can accompany product demonstrations.
- **Starting with early adopter segments.** As mentioned above, the Marketing Officer should identify the users in a village who will influence others and act as a catalyst by publicizing the product. Typical examples would be market vendors, shopkeepers, schools, and village leaders. is a village ever self-sustaining and with little need for visits from marketing officer and if so when is this

### **7.5 A typical day in the life of a LUTW-India Marketing Officer:**

7 – 9am	Prepare marketing plan for the next month: prepare budget for submission to LUTW Regional Office
9 – 10am	Travel to village, met there by local vendor
10 – 11am	Spend 1 hour reviewing sales and marketing plan with vendor, receiving returned / faulty lamp and updating vendor on new product information
11 – 12pm	Visit local women's group to give product demonstration. Train two members in use of the product and how to sell it to other members. Leave group with information pack and details of how to contact distributor to order units
12-2pm	Product demonstration at village market attended by 200 people
2pm – 3pm	Travel to next village where light is only being introduced for first time
4pm – 6pm	Find potential vendors within the village and spend 20 minutes with each. Leave the vendors with info on the LED lamp and a sample, telling them of the marketing officer's planned follow up visit in 2 weeks.
6pm – 7pm	Hire a local singer to write a song about the light in future demonstrations
7pm – 9pm	Show villagers a special Hindi movie that includes the LED lamp and explains the benefits of the movie. The movie is shown at a community hall using a VCR and TV.
9pm -	Return to the LUTW office and then home

### **7.6 Service and Warranty Policies**

After-sales service and warranty policies will be very important to distinguish our product from current competitors and past failures. Although we expect that the LED technology and our low-maintenance product design will require very few repairs, taking responsibility for any product problems and providing personalized service will be a key marketing tactic.

LUTW-India will provide a 1-year warranty, as explained in Section 6. Within 1 year of purchase, any customer who is not satisfied with the product can return it at no cost with no questions asked, exchanging it for a new unit if desired. Any returns or exchanges will happen immediately at the village dealer, who will be served by the visiting marketing officer.

When first distributing a village, marketing officers will give "training" to village dealers in how to facilitate after-sales service to customers. Depending on the needs of users and dealers, training may range from a few minutes of explanation with a printed brochure, to a 1-2 day training session in how to use the solar panel and how to market the light.

Vendors/retailers will return lights to the Marketing Officer who will refund the retailer for the replacement cost. The collected lamps will be gathered at the regional Office where they will be collected once monthly. It is hoped that a market can be established for refurbished lamps. This is an opportunity for an entrepreneur who would salvage the good components and assemble refurbished lamps. These can then be sold through the existing channels at a reduced price.

## **8 Organization**

### **8.1 Organization Structure**

LUTW-India will be incorporated as a for-profit company in India. As a freestanding organization, its main roles will be to manage the manufacture of LED /Solar lights and to drive the marketing and promotion of

the product through a third party supply network. In creating a sustainable company and developing the market for the LED light product, the company must:

- Understand the target customer, their needs and buying behavior
- Develop marketing and promotions to reach these target users and educate them of the benefits of the product
- Establish or employ brands that the target user recognizes and trusts
- Ensure that the product is made available through the right sales channels to reach the poor rural customer
- Initiate and develop relationships with key 'partner manufacturers'
- Support the 'partner manufacturing' model by providing product designs, technical specifications, test and calibration requirements and process specifications for assembly
- Develop strong on the ground relationships with vendors/retailers and build momentum amongst this group to promote the LED product

This proposal has benchmarked the organizations of IDE and Selco<sup>3</sup> to understand the typical requirements to support these activities. LUTW will not establish any manufacturing or wholesale activity of its own. A central office will form the hub for the organization and will be the main point of contact for international LUTW HQ. This central office will consist of the following key staff:

- Country Director with experience of building a national marketing and distribution business
- Manufacturing Partner Coordinator with contacts and experience in Indian electrical products manufacturing
- National Marketing Officer with significant experience in consumer product marketing to poor households

The LUTW HQ will coordinate national and regional marketing activity by providing marketing resources to the regional and local sales offices. The HQ will also carry responsibility for the relationship, accounting and technical support for partner manufacturers. LUTW and the manufacturer will jointly develop product designs, so LUTW must provide sufficient technical support to manufacturers.

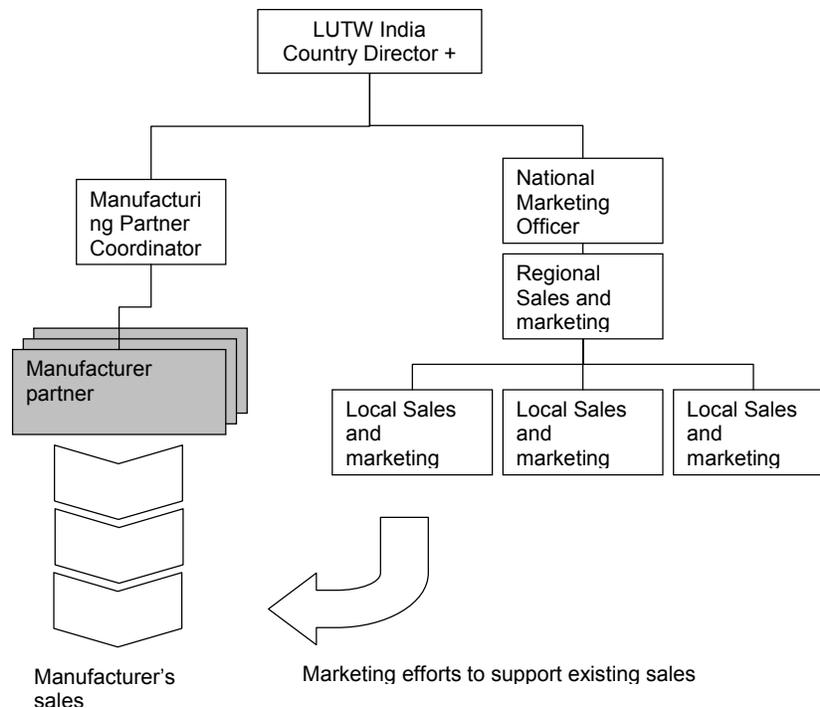
Regional marketing offices will deploy marketing officers in field offices which will be responsible for tactical promotion and training and for working with the sales channel activities in their region. Above all, LUTW must be a world-class marketing organization that is able to stimulate a market amongst end users and work with the sales channels to develop vendors and resellers.

Local offices will house the LUTW Marketing Officers (4-5 officers per local Office). These local offices will be based in the target states, close to the rural villages that they serve. In the short term, these local offices will communicate directly with the HQ. As more local offices are added, Regional offices will be created which will form an additional layer in the hierarchy. A Regional Office is likely to grow from an existing Local Office. The Regional Office will coordinate marketing efforts within each state (across the Local Offices).

This structure is reflected in the following diagram:

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<sup>3</sup> The Solar Electric Light Company



## 8.2 Organizational Development Strategy

### Employee Recruitment

The senior team for LUTW-India must be experienced individuals with significant backgrounds in marketing to poor communities and in managing manufacturer relationships. The key initial hire will be the Country Director who must be hired as soon as the organization is incorporated. This individual must be comfortable with the process of starting from scratch to build a team and an organization.

As the organization grows, the Marketing Officer role will be critical to the success of the venture. This role requires outgoing, energetic individuals who can be proactive in solving problems and identifying new promotions and sales opportunities. This job would be ideally suited to young village residents who are eager to find a professional role and may already be affiliated or associated with community groups in the villages. Recruitment of these individuals will be the role of the Marketing Director and Country Director.

### Employee Training

Training of all employees will be key in establishing a culture for LUTW-India and in engendering a proactive and opportunistic approach for the business. Most important for all employees will be product training and practical training on how to plan and execute marketing and promotional activities. As a small company, LUTW must establish standard training programs and processes early to ensure consistency and to help employees become comfortable and effective quickly.

### Knowledge Transfer

The initial phases of development of LUTW-India (Pilot, Launch and Yrs 1 – 3) will present many opportunities to refine and improve the operations and structure of the organization. The central HQ must make this possible through consistent and open communication channels throughout the organization, and coordination. For example, an annual meeting of all Marketing Officers, and regular Regional meetings will be instrumental in building a sense of community and a sharing of ideas.

### **8.3 Units and Functions within the Business**

#### **LUTW Global HQ**

LUTW-India will have close affiliation to the LUTW Global organization. LUTW's global HQ will provide R&D and technical expertise to the Indian operation. LUTW Global will also provide strategic guidance and planning and will support LUTW-India in building key manufacturer and government or NGO relationships. LUTW Global will have responsibility for initial fundraising to support the pilot and launch phases for the Indian operations.

#### **LUTW-India HQ / Central Office**

The central office, situated in Delhi, Calcutta or Mumbai will co-ordinate partner manufacturers and also manage all national and regional marketing budgets and planning. The staff at the central office will be kept to a minimum but will include a National Director, a Manufacturing Partner Coordinator, a National Marketing officer and a support staff. The HQ will also manage contact with government and national NGOs. This role will be critical in winning support and appropriate funding. The office may also foster relationships with key academic institutions and industry bodies in India.

#### **Regional Sales and Marketing Office**

The Regional Sales and Marketing Offices will be added as the organization grows beyond a single region and as coordination become more complex. The regional Office will be a small unit to coordinate Local Offices within a single state. The Regional Office is likely to grow from a Local Office in a particular state.

#### **Local Sales and Marketing Office**

Each office will serve around 4-5 marketing officers within a specific region. The local office will coordinate regional marketing activities and provide planning and promotions support (based on a regional budget) to the field officers. The Local office will house 2 administrative staff in addition to the field officers.

Typical monthly marketing budget for local office: Rs. 120,000 (\$2,400)

Typical monthly operating costs for office: Rs. 10,000 (\$200)

#### **Local Marketing Officer**

The Marketing Officer has the role of stimulating demand within his or her region by working to promote the LED/Solar lighting solution to consumers through the existing sales channel partners. The officer has responsibility for training the vendors and entrepreneurs who will sell the lighting solution as well as planning and executing local promotional and advertising activities. In the first year, each Marketing Officer will serve 25 vendors/retailers, growing to 50 vendors/retailers by the second full year.

Typical monthly salary for the Marketing Officer: 1500Rs (\$30)

### **8.4 Key Roles within the Business**

#### **Country Director**

The Country Director is the ambassador for LUTW-India. He/She must be combination of marketer, deal broker, cheerleader, entrepreneur, diplomat and politician. Although this is a tall order, this individual will be critical to the overall success of the organization. The Country Director must have experience in developing business relationships with manufacturers and with both the government and NGOs. Moreover, the Country Director must have the skills necessary to build a national marketing organization. The Director will also have responsibility for hiring the rest of the senior team and executing the roll out of local and state offices.

#### **Manufacturing Partner Coordinator**

The Manufacturing Coordinator is a critical role for LUTW-India. The nature of the relationships with manufacturers will be such that they must believe in the potential for the product and the manufacturability of the product. The Coordinator must therefore combine the skills of a salesman with

strong technical and manufacturing experience. This individual should have prior experience in the electrical products industry. His or her first task will be the identification of possible manufacturing partners and the drafting, issuance and consideration of an RFP. This hire must be made immediately on the initiation of the pilot phase.

**National Marketing Coordinator**

LUTW-India will live or die by its marketing horsepower. The National Marketing Coordinator must drive a marketing effort, through his/her marketing organization that appeals to the needs of the poor Indian household and delivers a compelling proposition. An experienced individual who is able to inspire a force of Marketing Officers and who can plan and execute creative strategies should fill the role. This role must be filled early in the pilot project to ensure that marketing activities and concepts are initiated early.

## 9 Critical Risks and Assumptions

### 9.1 Key Assumptions

- *The lantern, with features as described above, will be attractive to consumers if priced at around Rs. 1000 retail.* Changes might be needed in the price offered to consumers, or the payment plans, in order to get initial purchasers to make the decision to buy. These first buyers will be crucial in getting the word out that the light is a good value. If this price point turns out to be too high, LUTW-India has plans for a lower cost version of the lantern system that could be developed.
- *The lantern will last five years.* Many sources confirm that widespread market acceptance is dependent upon high reliability of the product. Word of mouth will quickly spread as to whether the product operates reliably or not. Occasional repairs, as necessary, will be conducted by local contracted repair persons at no charge to end-users. Great care must be taken in the product design phase to ensure maximum reliability. Data from the initial pilot sales of the first 1,000 units must be used to test reliability.
- *The lantern will produce four hours of lighting service on five to seven hours of charge time, during the entire life of the product.* A key product feature is the long length of light provision. If the lantern does not provide significantly more length of operating time than competing products, the product will be seen as much less desirable. The efficiency of PV panels tends to degrade over time, making this a challenging assumption to meet.
- *The average village will support a 10% market penetration rate.* It is difficult to win acceptance of a new technology, particularly with highly risk-averse rural villagers. It will take considerable marketing efforts to educate consumers as to why the LUTW-India solar lantern is superior to what they are now using. A slow acceptance rate could jeopardize the relationship with IDE India, cause a higher than expected investment per light distributed, or cause financial losses that might threaten the entire project.
- *The average retailer will accept a 20% markup; the average distributor will accept a 15% markup; the contract manufacturer will accept a 5% markup, and a 10% markup to Distributors by LUTW-India will financially support LUTW-India operations.* The retailer and distributor margins are based on figures from IDE India. If any entities demand higher margins, it could drive the retail price out of the range in which consumers find it attractive.
- *Manufacturing/Procurement costs will be in the range of \$12 per unit.* If costs are higher, it could create financial losses that might threaten the project.
- *In steady state, one marketing officer can support 50 retailers.* If it is not possible to achieve this goal, than costs may be significantly higher to distribute the same number of lights (or alternatively, fewer lights may be distributed).
- *Transportation costs will be in the range of \$1.27 per unit, from the manufacturing plant to the distributor.* Higher costs could create financial losses for the project.
- *IDE India will be a good and stable partner.* Assuming IDE India is chosen to help create the market, this creates additional risks. IDE India plays a crucial role in the project- the company brings expertise in market development, marketing and channel development, plus an extensive network of distributors, retailers, and marketing personnel. If IDE India were to pull out of the project, it would create a significant challenge to LUTW-India. It would certainly slow down the process of bringing the lantern to market, and add significantly to the development cost.

### 9.2 Critical Risk Areas

- *Personnel selection for LUTW-India national Headquarters.* As with any organization, hiring the right people is especially critical at the beginning. The initial staff will determine the organizational culture and reputation, and immediately start making decisions on partners, other staff hires, etc., which will

determine the success or failure of the venture. For example, local marketing personnel must be properly trained to be effective.

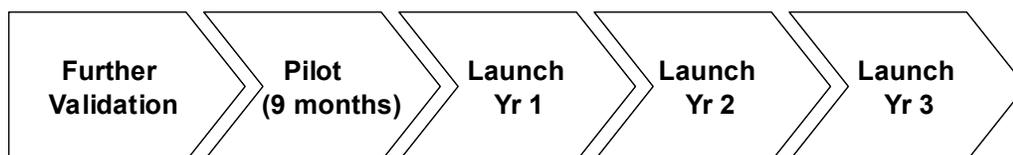
- *Initial product quality.* Given the poor reputation of solar in India, unfamiliarity with technology products in the target market, and typical means of information transmittal in this market (word of mouth), initial quality must be high, or the venture will fail. People will quickly stop buying the product.
- *Initial product service, repairs, and returns.* Similarly, service and returns will profoundly impact consumer perception of the value of the lamp.
- *Government role in price subsidies.* As stated above, direct government price subsidies to consumers will artificially raise the price of the product. This is likely to greatly slow the proliferation of the technology by restricting sales volume, which in turn might actually drive up the effective retail price, and also prevents application of economies of scale (which would lower prices).
- *Identification of the right manufacturing and distribution partners.* This is obviously critical for execution of the business plan. Manufacturer practices will influence product quality greatly.

## 10 Pilot Project / Startup Implementation

### 10.1 Pilot project Description

The immediate next step for LUTW-India is to validate further the assumptions and recommendations presented here. This requires further research and field visits. A fully funded Pilot Phase should follow this short phase. The Pilot has the goal of establishing a national HQ and defining the model for the Local Office and the role of the LUTW Marketing Officer. The three years following the Pilot would see the initial launch and growth of the market in the four target states. The Pilot Study will involve the creation of a LUTW-India HQ and a single Local Office. The Pilot will involve the distribution of 1000 prototype units which will be custom manufactured for the purpose of the pilot.

In order to test the consumer response to the light, a number of units (100 –500) might be distributed to IREDA's 'Aditya' solar stores and IREDA Business Development Associates throughout India. It will be extremely important to ensure that the shops are prepared to receive and to actively sell and promote the lamps. This will require on the ground coordination by LUTW-India.



<b>Description</b>	Further development of business plan	Full scale pilot Establish LUTW org.	Launch in one state	Roll out to second state	Roll out to second state
<b>No of units in use</b>	<100	1000	3000	12,000	30,000
<b>Marketing Or.</b>					
<b>Offices</b>	N/a	1	1	2	5
<b>Mktg. Officers</b>	N/a	4	4	8	30

### 10.2 Key assumptions to be tested during pilot project

The following areas will be thoroughly tested through the pilot phase:

#### Market Opportunity

Understand whether an opportunity exists to replace kerosene in the target households and who the target households should be (based on initial hypothesis). Quantify the expected sales volumes for each year following launch.

#### Consumer Needs

Confirm the needs of the rural family for light, the situations in which they require light and how they use it. Discover where is light most valuable to the family and how can the family member's lives be further enhanced by the use of an LED light. Test multiple product designs that trade off light output against price to understand price sensitivity and the expected positioning of an LED light product.

**Pricing**

Validate the price points at which the LED solution is attractive to the target user group and test the sensitivity to this price relative to competitive products (e.g. kerosene, flashlight, incandescent light). Understand the user's ability to pay for the product and the preferred location of purchase and method for payment.

**Product Design**

Understand in detail the design functionality and features required to meet the needs of the users. Identify the necessary attributes of the product to make it successful and the thresholds for light output, battery light, reliability relative to cost of the lighting solution.

**Organizational Structure and Roles**

Verify the right organizational structure to coordinate LUTW in India give the need to work with national manufacturers and to coordinate an 'on the ground' marketing organization. Define the role of the marketing officer that best serves the rural market and the existing reseller and vendor network. Understand the realistic productivity of these officers.

**10.3 Activities during 9 month Pilot Phase**

The activities of the 9-month Pilot will be as follows:

**Establish the LUTW-India Organization**

- Recruit Country Director to lead pilot phase and initiate recruitment of further senior officers
- Incorporate LUTW-India in India
- Promote the LUTW-India organization to key organizations and industry groups to build awareness for the company and its goal. Use media and PR opportunities to build awareness amongst consumers and retailers

**Initiate Local Office and Test Distribution Model**

- Establish an initial marketing office in West Bengal and recruit 4 'trial' Marketing Officers to serve 'pilot community'
- Recruit network of 'trial vendors' to act as resellers for prototype products
- Evaluate distribution through vendors and storekeepers to understand which approaches are most effective and which resellers are most successful
- Define and test marketing concepts for trial in pilot community (including promotional tactics, demonstrations etc.)
- Test marketing methods and concepts on sample set of users

**Distribute and Test Prototype Designs**

- Distribute up to 500 lamps to IREDA 'Aditya' solar stores
- Engage IREDA Business Development Associates in key regions to identify potential distribution channels
- Recruit test consumers in sample region to buy and use prototype products
- Use surveys to gather structured feedback on the prototype designs from different user groups and usage scenarios
- Survey 500+ end users on usage of the lighting solution, ability to pay and willingness to pay – use data to identify key usage scenarios, response to design and observations on product enhancements
- Test sensitivity of consumers to price and quantity of light, battery life
- Gather data on reliability, failure modes and process for repair or replacement and use this to refine the design, servicing and maintenance model

**Finalize designs and marketing approach for launch**

- Refine product design based on feedback and consumer responses to usage, failure scenarios and price / light trade off
- Define marketing strategy based on feedback to marketing concepts and success of promotional trials. Set marketing budgets for Officers and Local offices and finalize staffing requirements to achieve target sales
- Marry finalized design with finalized marketing approach and distribution strategy
- Develop recruitment plan for Marketing Officers to meet year-on-year growth targets

**Initiate Manufacturing Partnerships and Plan Supply Chain Logistics**

- Invite responses to manufacturing RFP and develop relationships with manufacturing partners
- Assess RFP response and select initial manufacturing partner for production of lighting solution in Year 1
- Identify lowest cost source of LED and solar components and negotiate 3 year contract to meet target demand
- Build demand model for Launch year and subsequent two years based on pricing feedback and response to prototypes within the target group
- Model inventory requirements for each step in the supply chain to ensure available supply but also minimize inventory at each stage
- Establish processes for communicating orders and available supply up and down the chain

**Establish Working Relationships with key government and non-government organizations**

- Lobby key government organizations to achieve Duty Free Dispensation on imported components and to initiate, where possible, financial assistance through out the supply chain
- Develop relationships with key ministries to influence national strategy and to encourage promotion of LED based solutions
- Identify and form partnerships with key NGOs that can provide supplementary distribution channels (e.g. IDE, Barefoot College)

**10.4 Budget for Pilot Project**

Full details of Pilot Budget can also be found in Appendix 11.3.

**Staffing requirements**

The Pilot phase will involve the recruitment of key staff members and further staff to support the project (these may be employed as contractors). These requirements are summarized in the table below:

<b>Staff type</b>	<b>Location</b>	<b>Qty</b>	<b>Salary per Year (\$)</b>	<b>Salary for 9 month Pilot (\$)</b>	<b>Total Salary (\$)</b>
<b>Director</b>	India	1	40,000	30,000	30,000
<b>Marketing Officers</b>	India	2	2,500	1,875	3,750
<b>Field test Support</b>	India	2	1,800	1,350	2,700
<b>Admin</b>	India	1	1,800	1,125	1,125
<b>Marketing Coordinator</b>	India	1	30,000	22,500	22,500
<b>Manufacturing Coordinator</b>	India	1	30,000	22,500	22,500
<b>Engineer / Coordinator</b>	USA	1	70,000	52,500	52,500
<b>TOTAL</b>					135,075

**Travel Costs**

The Pilot Phase will involve both local and national travel at all levels in the organization. Travel costs are estimated at 50% of annual salary:

Estimated Travel Costs during 9 month Pilot: \$67,538

**Test Marketing Costs**

The Pilot Phase will involve intensive test marketing of both the physical prototypes and marketing concepts. These tests will incur an administrative cost to plan them, execute them and to gather survey/response data that must then be analyzed. In addition, marketing materials will be prepared and distributed to test the response to different marketing and promotion approaches.

Test Type	No of Tests	Admin cost per test (\$)	Total costs (\$)
Product Test	1000 (prototype units)	10	10,000
Marketing Concept Test	25	400	10,000
Marketing materials			6,000
<b>TOTAL</b>			<b>26,000</b>

**Overheads**

Overheads include establishing an LUTW Office in India and in the US and purchase of equipment and communications services to support the test.

Total Overhead is estimated at: \$62,000

**Manufacture of Prototypes**

The Pilot Test Plan is based upon testing two product designs:

1. A complete 1-Watt solar lighting solution retailing for close to \$20
2. A 0.1– 0.3 -Watt, low cost solar lighting solution retailing for \$5 - \$8

500 prototypes of each type will be made and tested during the pilot. These must be high quality prototypes that accurately reflect the intended final design. It is expected that these designs would be manufactured in the US. The low volumes involved incur a higher production cost than would be anticipated during full-scale manufacture in India.

Prototype type	No of prototypes	Manufacturing cost per prototype (\$)	Total costs (\$)
'\$20/ 1watt' unit	500	70	35,000
'\$5 / 0.3watt' unit	500	30	15,000
<b>TOTAL</b>			<b>50,000</b>

**Overall Budget**

Based on the cost estimates above, the overall pilot phase budget is: **\$340,613**

**10.5 Schedule and key milestones for pilot**

June-September 2003—pre-pilot research of necessary logistics and field contacts, refining the business plan, preparation of a pilot project funding proposal from LUTW

January 2004-December 2004—pilot project commences in one of the target regions

- Jan-Mar—Market research and technology scan
- April-July—Field Tests
- August-December—Test Marketing, Pilot sales
- Jan-Feb 2005—evaluation of the pilot project, consideration by LUTW to open an office in the region

## 11 Appendices

### 11.1 Key Contacts

#### Contacts in West Bengal

LUTW office—Calcutta

IDE, Paul Polak, Founder

IDE-India office— Suresh Subramanian , Calcutta

West Bengal Renewable Energy Development Agency

Baikunthapur Tarun Sangha (BTS), 6-village Asha Project, S. 24 Paraganas

Swanirvar office (host of Stanford Dosti volunteers), Calcutta

Ashish Chadha, Calcutta

Ayee Goundan (Establishing rural education p[rograms), Karnataka

#### NGOs

Gujarat Agricultural Innovation Network (GIAN), Mahesh Patel

BARLI (Gujarat), Jimmy McGligan

The Asia Foundation, Chris Plant, Franck Wiebe

Rural Innovation Network (Chennai), Paul Basil

Gravis/IBEX, Balu Iyer

Winrock, Jami Hossain

#### Solar related Organizations

Ramakrishna Mission, Sunderbans

Selco (Ben Cook – Selco President & CEO, San Francisco)

Grameen Shakti, Dipal Barua

Noble Energy Solar Technologies, DT Barki

Barefoot College, Bunker Roy (Founder and Director)

Tata BP Solar, G M Vijaya Kumar

#### Manufacturing

Bajaj Electricals, Shekhar Bajaj, Chairman

Jabil (Contract manufacturer), Arvind Saraf

#### Government

IREDA , Dr.V.Bakthavatsalam (Executive Director)

MNES, Shri M. Kannappan (Minister of State)

## **11.2 Financial Model for LUTW-India**

The financial model for each unit analysis is given below:

The model is presented in the form of a model for the first three years following launch of the product (Following the Pilot Phase).

- 
- The units of analysis used in each model are:
  - Customer Household
  - Retailer / Village vendor
  - Distributor
  - Local Marketing Officer
  - Local office
  - LUTW-India
- A single spreadsheet is provided for each year from 'launch year' to 'year 3'
- Each of the Models is based on the '\$20 Mighty Light'
- The first three models presented outline LUTW as an entirely independent organization. The latter three models assume that LUTW-India works in partnership with IDE India and enjoys the synergies of IDE's existing marketing and distribution organization



## LUTW-India, Year 2

**Notes: Year 2** - 50 retailers per marketing officer, 2 marketing offices  
 Mid-market lamp system- 1 luxeon lamp, 2 AA NIMH batteries, 1.2 Watt PV charger.  
 IDE-style model- distribution by private, for-profit distributors and retailers, marketing by LUTW India.

Assumptions					Financials			
Primary	Secondary		Rupee	Dollar/N/%		Year 1	Years 2-5	
<b>Unit of Analysis = Customer Household</b>					<b>Financials</b>			
A1		Lamp system purchases per Household		1.00	Revenue			
A2		Lamp price to Customer Household	877.55	\$18.57	Lamp system	\$18.57		\$0.00
	B1	Hours of light per charge		6.00				
	B2	Years of life for light		5.00				
	B3	Price for repair of light		\$0.00	Comparison Cost		\$15.24	\$15.24
	B4	Monthly Expenditure for Lighting Now	60.00	\$1.27	Annual Saving		-\$3.33	\$15.24
	B5	Exchange Rate: Ind. Rupee vs Dollar	1.00	0.02116				
<b>Unit of Analysis = Retailer</b>					<b>Financials</b>			
A29		1st year Market Penetration Rate		10%	Revenue			
A30		Subsequent year purchase rate		15%	Lamp systems	\$557.07		\$835.60
		Households per Village		300.00	Total Revenue	\$557.07		\$ 835.60
		1st year Hhlds purchasing lamp systems		30.00	Expense			
		1st year Retailer lamp sales		30.00	Lamp systems	\$464.22		\$696.34
		subsequent year Hhlds purchasing systems		45.00	Space	\$6.35		\$6.35
		Subsequent year Retailer lamp sales		45.00	Repair	\$10.58		\$10.58
		Cost Per Lamp to Retailer		\$15.47	Total Expense	\$481.15		\$713.26
		Markup to Consumer		20%	Net Income		\$75.92	\$122.34
		Overhead			NPV			
	B10	Int. Rate on Financed Amount (ann)		10.00%	Discount Rate	10.00%		
	B11	Retail Space (annual)	300.00	\$6.35	Year 1	1.00	\$75.92	
	B13	Repair Costs (annual)	500.00	\$10.58	Years 2-5	3.17	\$387.80	
					NPV at Year 1		\$463.71	
<b>Unit of Analysis = Distributor</b>					<b>Financials</b>			
A31		Number of Retailers Served		20.00	Revenue			
		Cost Per Lamp to Distributor		\$13.46	Lamp system sales	\$9,284.47		\$13,926.70
A32		Markup to Retailer		15%	Total Revenue	\$9,284.47		\$13,926.70
	Derived	Implied Households Served per Distributor		600.00	Expense			
					Lamp system purchas	\$8,073.45		\$12,110.18
					Total Expense	\$8,073.45		\$12,110.18
					Net Income		\$1,211.02	\$1,816.53
<b>Unit of Analysis = Local Marketing Officer</b>					<b>Financials</b>			
A33		Number of Retailers Served		50.00	Revenue			
A13		Monthly Salary	1500.00	31.74	Equivalent		\$1,834.88	\$2,752.31
A14		Monthly Travel & Communication	200.00	4.23	Expense			
					Salary	\$380.88		\$380.88
					Travel & Comm	\$50.78		\$50.78
	Derived	Implied Households Served		1500.00	Total Expense	\$431.66		\$431.66
					Net Income		\$1,403.21	\$2,320.65
<b>Unit of Analysis = Local Office</b>					<b>Financials</b>			
A15		Number of Marketing Officers		4.00	Revenue			
A16		Annual Advertising Costs	120000	\$2,539.20	Equivalent		\$7,339.50	\$11,009.25
		Overhead			Expense			
	B14	Administrators		2.00	Marketing Staff	\$1,726.66		\$1,726.66
	B15	Monthly Salary	2000.00	\$42.32	Advertising	\$2,539.20		\$2,539.20
	B16	Space (annual)	5000.00	\$105.80	Administration	\$1,015.68		\$1,015.68
	B17	Communications (annual)	3000.00	\$63.48	Space	\$105.80		\$105.80
					Communication	\$63.48		\$63.48
	Derived	Implied Retailers Served		200	Total Expense	\$5,450.82		\$5,450.82
	Derived	Implied Households Served		6000	Net Income		\$1,888.68	\$5,558.43
		*Note: Local Office is solely marketing. Local Office does not handle goods						

LUTW-India, Year 3

**Notes: Year 3** - 50 retailers per marketing officer, 5 marketing offices  
 Mid-market lamp system- 1 luxeon lamp, 2 AA NIMH batteries, 1.2 Watt PV charger.  
 IDE-style model- distribution by private, for-profit distributors and retailers, marketing by LUTW India.

Assumptions				Financials			
Primary	Secondary			Year 1		Years 2-5	
Unit of Analysis = Customer Household		Rupee	Dollar/N%				
A1	Lamp system purchases per Household		1.00	Revenue			
A2	Lamp price to Customer Household	877.55	\$18.57	Lamp system	\$18.57		\$0.00
	B1 Hours of light per charge		6.00				
	B2 Years of life for light		5.00				
	B3 Price for repair of light		\$0.00				
	B4 Monthly Expenditure for Lighting Now	60.00	\$1.27	Comparison Cost		\$15.24	\$15.24
	B5 Exchange Rate: Ind. Rupee vs Dollar	1.00	0.02116	Annual Saving	-\$3.33		\$15.24
Unit of Analysis = Retailer		Rupee	Dollar/N%				
A29	1st year Market Penetration Rate		10%	Revenue			
A30	Subsequent year purchase rate		15%	Lamp systems	\$557.07	\$557.07	\$835.60
	Households per Village	300.00		Total Revenue			\$ 835.60
	1st year Hhlds purchasing lamp systems	30.00		Expense			
	1st year Retailer lamp sales	30.00		Lamp systems	\$464.22		\$696.34
	subsequent year Hhlds purchasing systems	45.00		Space	\$6.35		\$6.35
	Subsequent year Retailer lamp sales	45.00		Repair	\$10.58		\$10.58
	Cost Per Lamp to Retailer	\$15.47		Total Expense	\$481.15		\$713.26
	Markup to Consumer		20%	Net Income	\$75.92		\$122.34
	B10 Overhead			NPV			
	B11 Int. Rate on Financed Amount (ann)		10.00%	Discount Rate	10.00%		
	B12 Retail Space (annual)	300.00	\$6.35	Year 1	1.00	\$75.92	
	B13 Repair Costs (annual)	500.00	\$10.58	Years 2-5	3.17	\$387.80	
				NPV at Year 1		\$463.71	
Unit of Analysis = Distributor		Rupee	Dollar/N%				
A31	Number of Retailers Served		20.00	Revenue			
	Cost Per Lamp to Distributor		\$13.46	Lamp system sales	\$9,284.47		\$13,926.70
A32	Markup to Retailer		15%	Total Revenue	\$9,284.47		\$13,926.70
	Derived Implied Households Served per Distributor		600.00	Expense			
				Lamp system purcha	\$8,073.45		\$12,110.18
				Total Expense	\$8,073.45		\$12,110.18
				Net Income	\$1,211.02		\$1,816.53
Unit of Analysis = Local Marketing Officer		Rupee	Dollar/N%				
A33	Number of Retailers Served		50.00	Revenue			
A13	Monthly Salary	1500.00	31.74	Equivalent		\$1,834.88	\$2,752.31
A14	Monthly Travel & Communication	200.00	4.23	Expense			
	Derived Implied Households Served		1500.00	Salary	\$380.88		\$380.88
				Travel & Comm	\$50.78		\$50.78
				Total Expense	\$431.66		\$431.66
				Net Income	\$1,403.21		\$2,320.65
Unit of Analysis = Local Office		Rupee	Dollar/N%				
A15	Number of Marketing Officers		4.00	Revenue			
A16	Annual Advertising Costs	120000	\$2,539.20	Equivalent		\$7,339.50	\$11,009.25
	Overhead			Expense			
	B14 Administrators		2.00	Marketing Staff	\$1,726.66		\$1,726.66
	B15 Monthly Salary	2000.00	\$42.32	Advertising	\$2,539.20		\$2,539.20
	B16 Space (annual)	5000.00	\$105.80	Administration	\$1,015.68		\$1,015.68
	B17 Communications (annual)	3000.00	\$63.48	Space	\$105.80		\$105.80
	Derived Implied Retailers Served		200	Communication	\$63.48		\$63.48
	Derived Implied Households Served		6000	Total Expense	\$5,450.82		\$5,450.82
	*Note: Local Office is solely marketing. Local Office does not handle goods			Net Income	\$1,888.68		\$5,558.43



LUTW-India in partnership with IDE, Year 2

**Notes: Year 2** - 2 marketing offices, 50 retailers per marketing officer  
 Mid-market lamp system- 1 luxeon lamp, 2 AA NIMH batteries, 1.2 Watt PV charger.  
 Distribution by private, for-profit distributors and retailers, market & channel development, and marketing by IDE.

Assumptions					Financials			
Primary	Secondary		Rupee	Dollar/N/%		Year 1	Years 2-5	
<b>Unit of Analysis = Customer Household</b>					<b>Financials</b>			
A1		Lamp system purchases per Household		1.00	Revenue			
A2		Lamp price to Customer Household		\$30.00	Lamp system	\$30.00		\$0.00
	B1	Hours of light per charge		6.00				
	B2	Years of life for light		5.00				
	B3	Price for repair of light		\$0.00	Comparison Cost		\$15.24	\$15.24
	B4	Monthly Expenditure for Lighting Now	60.00	\$1.27	Annual Saving		-\$14.76	-\$14.76
	B5	Exchange Rate: Ind. Rupee vs Dollar	1.00	0.02116				
<b>Unit of Analysis = Retailer</b>					<b>Financials</b>			
A29		1st year Market Penetration Rate		10%	Revenue			
A30		Subsequent year purchase rate		15%	Lamp systems	\$900.00	\$900.00	\$1,350.00
		Households per Village	300.00		Total Revenue			\$ 1,350.00
		1st year Hhlds purchasing lamp systems	30.00		Expense			
		1st year Retailer lamp sales	30.00		Lamp systems	\$750.00		\$1,125.00
		subsequent year Hhlds purchasing systems	45.00		Space	\$6.35		\$6.35
		Subsequent year Retailer lamp sales	45.00		Repair	\$10.58		\$10.58
		Cost Per Lamp to Retailer	\$25.00		Total Expense		\$766.93	\$1,141.93
		Markup to Consumer		20%	Net Income		\$133.07	\$208.07
	B10	Overhead			NPV			
	B11	Int. Rate on Financed Amount (ann)		10.00%	Discount Rate	10.00%		
	B13	Retail Space (annual)	300.00	\$6.35	Year 1	1.00	\$133.07	
		Repair Costs (annual)	500.00	\$10.58	Years 2-5	3.17	\$659.56	
					NPV at Year 1		\$792.63	
<b>Unit of Analysis = Distributor</b>					<b>Financials</b>			
A31		Number of Retailers Served		20.00	Revenue			
		Cost Per Lamp to Distributor		\$21.74	Lamp system sales	\$15,000.00	\$15,000.00	\$22,500.00
A32		Markup to Retailer		15%	Total Revenue			\$22,500.00
	Derived	Implied Households Served per Distributor		600.00	Expense			
					Lamp system purcha	\$13,043.48	\$13,043.48	\$19,565.22
					Total Expense			\$19,565.22
					Net Income		\$1,956.52	\$2,934.78
<b>Unit of Analysis = LUTW India</b>					<b>Financials</b>			
A17	Derived	Number of Local Offices		2.00	Revenue			
	Derived	Implied Retailers Served		400	Lamp systems	\$260,869.57	\$260,869.57	\$391,304.35
	Derived	Implied Households Served Year 2		12,000	Total Revenue			\$391,304.35
A34	Derived	Implied Lamp Systems Year 2		12,000	Expense			
		Implied Lamp Systems Years 3-5		18,000	Mfg/Procure			
		Markup to Distributors		6%	Lamps	\$ 72,000.00	\$ 108,000.00	
A18		Manufacturing/Procurement Costs			Batteries	\$ 21,600.00	\$ 32,400.00	
A19		Mfg Cost Per Lamp		\$ 6.00	Chargers	\$141,000.00	\$ 211,500.00	
A20		Mfg Cost Per Battery pack		\$ 1.80	Total Mfg/Procure		\$234,600.00	\$351,900.00
		Mfg Cost Per Charger		\$ 11.75	Transportation			
A33		Cost of Lamp System		\$19.55	Lamp systems	\$15,235.20	\$15,235.20	\$22,852.80
		Manufacturer markup		5%	Total Transport			\$22,852.80
A21		Mfg/Purchase cost for Lamp System		\$ 20.53	Overhead			
		Transportation Costs Origin-Distributor			Administration	\$1,904.40	1904.4	
		Transport Cost Per Lamp System	60.00	\$1.27	Space	\$317.40	\$317.40	
A25		Overhead			Communication	\$211.60	\$211.60	
A26		Administrators		3.00	LUTW India Ohd		\$2,433.40	\$2,433.40
A27		Monthly Salary	2500.00	\$52.90	Total Expenses		\$252,268.60	\$377,186.20
A28		Space (annual)	15000.00	\$317.40	Net Income		\$8,600.97	\$14,118.15
		Communications (annual)	10000.00	\$211.60	\$ Invested per light		\$0.72	

LUTW-India in partnership with IDE, Year 3

**Notes: Year 3** - 50 retailers per marketing officer, 5 marketing offices, 50 retailers per marketing officer  
 Mid-market lamp system- 1 luxeon lamp, 2 AA NIMH batteries, 1.2 Watt PV charger.  
 Distribution by private, for-profit distributors and retailers, market & channel development, and marketing by IDE.

Assumptions		Unit of Analysis = Customer Household	Rupee	Dollar/N/%	Financials			
Primary	Secondary				Year 1	Years 2-5		
A1		Lamp system purchases per Household		1.00	Revenue			
A2		Lamp price to Customer Household		\$30.00	Lamp system	\$30.00		\$0.00
	B1	Hours of light per charge		6.00				
	B2	Years of life for light		5.00				
	B3	Price for repair of light		\$0.00				
	B4	Monthly Expenditure for Lighting Now	60.00	\$1.27	Comparison Cost		\$15.24	\$15.24
	B5	Exchange Rate: Ind. Rupee vs Dollar	1.00	0.02116	Annual Saving		-\$14.76	\$15.24
Unit of Analysis = Retailer					Financials			
A29		1st year Market Penetration Rate		10%	Revenue			
A30		Subsequent year purchase rate		15%	Lamp systems	\$900.00	\$1,350.00	\$1,350.00
		Households per Village	300.00		Total Revenue	\$900.00		\$1,350.00
		1st year Hhlds purchasing lamp systems	30.00		Expense			
		1st year Retailer lamp sales	30.00		Lamp systems	\$750.00	\$1,125.00	
		subsequent year Hhlds purchasing systems	45.00		Space	\$6.35	\$6.35	
		Subsequent year Retailer lamp sales	45.00		Repair	\$10.58	\$10.58	
		Cost Per Lamp to Retailer	\$25.00		Total Expense	\$766.93		\$1,141.93
		Markup to Consumer		20%	Net Income		\$133.07	\$208.07
		Overhead			NPV			
	B10	Int. Rate on Financed Amount (ann)		10.00%	Discount Rate	10.00%		
	B11	Retail Space (annual)	300.00	\$6.35	Year 1	1.00	\$133.07	
	B13	Repair Costs (annual)	500.00	\$10.58	Years 2-5	3.17	\$659.56	
					NPV at Year 1		\$792.63	
Unit of Analysis = Distributor					Financials			
A31		Number of Retailers Served		20.00	Revenue			
		Cost Per Lamp to Distributor		\$21.74	Lamp system sales	\$15,000.00	\$22,500.00	\$22,500.00
A32		Markup to Retailer		15%	Total Revenue	\$15,000.00		\$22,500.00
	Derived	Implied Households Served per Distributor		600.00	Expense			
					Lamp system purcha	\$13,043.48	\$19,565.22	\$19,565.22
					Total Expense	\$13,043.48		\$19,565.22
					Net Income		\$1,956.52	\$2,934.78
Unit of Analysis = LUTW India					Financials			
A17		Number of Local Offices		5.00	Revenue			
	Derived	Implied Retailers Served		1,000	Lamp systems	\$652,173.91	\$978,260.87	\$978,260.87
	Derived	Implied Households Served Year 3		30,000	Total Revenue	\$652,173.91		\$978,260.87
	Derived	Implied Lamp Systems Year 3		30,000	Expense			
A34		Implied Lamp Systems Years 4-5		45,000	Mfg/Procure			
		Markup to Distributors		6%	Lamps	\$180,000.00	\$270,000.00	
A18		Manufacturing/Procurement Costs			Batteries	\$54,000.00	\$81,000.00	
A19		Mfg Cost Per Lamp		\$6.00	Chargers	\$352,500.00	\$528,750.00	
A20		Mfg Cost Per Battery pack		\$1.80	Total Mfg/Procure	\$586,500.00		\$879,750.00
		Mfg Cost Per Charger		\$11.75	Transportation			
		Cost of Lamp System		\$19.55	Lamp systems	\$38,088.00	\$57,132.00	\$57,132.00
A33		Manufacturer markup		5%	Total Transport	\$38,088.00		\$57,132.00
		Mfg/Purchase cost for Lamp System		\$20.53	Overhead			
A21		Transportation Costs Origin-Distributor			Administration	\$1,904.40	1904.4	
		Transport Cost Per Lamp System	60.00	\$1.27	Space	\$317.40	\$317.40	
A25		Overhead			Communication	\$211.60	\$211.60	
A26		Administrators		3.00	LUTW India Ohd			\$2,433.40
A27		Monthly Salary	2500.00	\$52.90	Total Expenses	\$627,021.40		\$939,315.40
A28		Space (annual)	15000.00	\$317.40	Net Income	\$25,152.51		\$38,945.47
		Communications (annual)	10000.00	\$211.60	\$ Invested per light	\$0.84		\$0.87

### 11.3 Budget for Pilot Phase

#### Pilot Project Budget

##### No of staff

India	Qty	Salary (\$)	Total Salary
Director	1	40000	40000
Marketing Officers	2	2500	5000
Field test support	2	1800	3600
Admin	1	1500	1500
Marketing Coordinator	1	30000	30000
Manufacturing Coordinator	1	30000	30000
	<b>8</b>		<b>110100</b>

##### US based (employed as contractors)

Designer / Engineer / Contractor	1	70000	70000
Total Salary Cost (12 months)		180100	
Total Pilot Salary Costs (9 months)			<b>135,075</b>

##### Travel costs

Travel budget as % of salary	50%		
Total pilot budget travel costs			<b>67,538</b>

##### Test Marketing Costs

No of market tests	Product Test Activities	1000	
	Concept Tests	25	
Admin cost per test	Product Tests	10	
	Concept Tests	400	
Total Test Marketing Costs	Product Tests	10000	
	Concept Tests	10000	
			<b>20000</b>

##### Marketing Materials

Marketing materials	5000	
Distribution of materials	1000	
		<b>6000</b>

##### Total Marketing Costs

**26,000**

##### Overheads

Office (india)	2000	
Office (USA)	10000	
Communications and Equipment	40000	
Other	10000	
		<b>62,000</b>

##### Manufacturing or Prototypes

No of \$20 units	500	
No of \$10 units	500	
Manufacturing cost per \$20 prototype (\$)	70	
Manufacturing cost per \$10 prototype (\$)	30	
Total prototype costs		<b>50,000</b>

<b>Total Pilot Budget Expenditure</b>	<b>228,613</b>
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##### Estimated revenues during pilot

No of \$20 units	500	
No of \$10 units	500	
Revenue per \$20 unit	12	
Revenue per \$5 unit	3	
Total prototype costs		<b>7,500</b>

<b>Overall Budget</b>	<b>221112.5</b>
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## 11.4 Surveys from NGO GIAN in Gujarat, prepared by Mahesh Patel

### Finding of the Survey – Brief Report

#### Methodology:

1. Survey population consisted of three villages in Panchamal District. The details of these are as follows;

Name	Type	No. of house	Govt. Electricity	Region
Sarjumi Village	End-Users	350	Yes	Dahod district
Divya Village	End-Users	40	No	Dahod district
Ankali Village	End-Users	850	Yes	Panch mahals districts
GEDA <sup>4</sup> (Gujarat Energy Development Agency)	Energy Development Agency	A body working under the state government		Baroda City Gujarat State
NID (National Institute of Design)	Product development	A premier institute of the country , working under Government of India		AhmedabadCity Gujarat State

2. Our survey team consisted of two members namely Mr. Mahesh Patel and Mr. Purshotam Patel. Team spent two days each in villages for conducting the survey.
3. Questionnaires were administered as per the guidelines provided by Mark Patel.

#### Findings:

For the convenience of the users of the study, finding of the report has been divided in following categories:

- Need
- Current lighting systems
- Comparison of LED with existing lighting system
- Technology
- Marketing

#### Need:

- ✓ The need for an efficient, compact, handy and affordable lighting system was clearly evident from all the responses.

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<sup>4</sup> Looking at the urgency for the findings and unavailability of officials of GEDA & NID, inputs from these institutions could not be gathered. Hence they will be sent afterwards in second installment.

**Current lighting systems:**

- ✓ The problems related to current lighting systems, prevailing in these villages are as follows:
  - Electricity if available, not-dependable due to irregular supply
  - And Electricity if available, harmful for lights and appliances due voltage fluctuations
  - And Electricity if available, high operating cost.
  - And if fuel based specially the kerosene; supply is irregular and price inconsistency.
  - There is variety of kerosene available with different price ranges.
  - Batteries are costlier than any other option.
  - Also batteries have limitations such as small illumination, time-restricted use.

**Comparison of LED with existing lighting system**

- ✓ Survey participants found that:
  - LED is an efficient lighting system as it has focused light area for the place of application, which saves energy. This makes it suitable for ignorant activities such as children's education etc.
  - LED is very compact, handy and easy to use.
  - White illumination is an attractive feature for them due to its suitability to human eyes.
  - Focus control in lamp 2 is widely acknowledged as an attractive feature, as it offers multiple usages of the same lamp.

**Technology:**

- ✓ Participants were inquisitive about the technology but couldn't understand anything of it once explanation offered.
- ✓ They had questions on the life of the bulb (LED) used in our systems.
- ✓ They also had questions on the battery, its lifetime, cost and reparability.

**Market:**

- ✓ Participant felt that LED could be a solution for their domestic as well as some outside lighting needs if the price is affordable.
- ✓ They wanted to know about operating cost and initial equipment cost.
- ✓ Other critical parameters were life of batteries, availability of batteries, maintenance and post-sales service.

**STANFORD LED LIGHT PROJECT SURVEY**

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**Instructions**

Please fill out Part I yourself

Please fill out Part II by talking to rural families

Please fill out Part III after demonstrating the sample lamps to a rural family / typical end user

Please use Part IV to guide you in taking photographs of people using lights

**PART 1: QUESTIONS FOR GIAN STAFF****General Background on the village:**

Name and Location of End user / Village:

Location: Patel Faliu, Village: Sarjumi, Taluka: Limkheda, District: Dahod, Gujarat state

Number of households in the village (approx.): About 1000 population (350 house holds)

Does the village have access to the government electricity? - Yes

Does the government provide a kerosene subsidy in your area? - Yes

Give the names of any other government or NGO programs working on renewable energy in this village.

-There is no such program running in the village by NGO or by the government.

**PART II: QUESTIONS TO BE ASKED TO RURAL FAMILIES:****General Questions:**

How many people live in the home? 8 (Eight person)

For each person, give the age and gender and family position/relationship.

Name	Age	M / F	Relationship (e.g. daughter)
1. Rupabhai Hirabhai Hathila	96	M	Father
2. Gajabhai Rupabhai Hathila	45	M	<i>Family Head</i> (reference point)
3. Sakodi Gajabhai Hathila	42	F	Wife
4. Mahendra Gajabhai Hathila	25	M	Son (Elder)
5. Ramila Mahendra Hathila	23	F	Daughter-in-Law
6 Sanjay Mahendrabhai Hathila	3	M	Grand son
7. Manahar Gajabhai Hathila	17	M	Son (Younger)
8. Rekhaben Gajabhai Hathila	14	F	Daughter

Which person is the household head?

- Gajabhai Rupabhai Hathila

Which person is the respondent?

- Gajabhai Rupabhai Hathila

What is the occupation of the household head?

- Primary : Agriculture (1 acre cultivated land)
- Secondary : Income from forest produce

How many others in the household work? What are their jobs?

Three persons are involved in agriculture and the elder son is running a small tailor's shop in nearby bigger village.

Does anyone in your family like to read?

Manhar (17) who is studying in 10<sup>th</sup> class is reading regularly. Also Shri Gajabhai (45) and Mahendra (25) are reading occasionally.

**Current lighting in the home:**

Do you currently have light(s)?

Yes, we have lights. We are using two lamps (100 watts and 50 watts) in our house. Also, we are using kerosene lamps for household purpose. For agriculture and other outside home activities, we are using flashlights

If so, what fuel do you use?

For bulbs, we are using conventional electricity supplied by the government authorities and for kerosene lamps; we are using kerosene sold thorough Ration Shops.

What do you use this lighting for?

For Cooking and dining at night, for milking in the early morning and for usual movements outside home in dark (walking) etc.

At what time of the day do you use this lighting and for how long?

- About half-hour in the early morning and two hours in night.

What do you like most about your current light?

- It is just better than kerosene-lit lamp.

What do you not like about your current light?

- Irregular supply,
- Unavailability when you need it most,
- Disastrous fluctuations in Voltage
- Irregular Kerosene supply and price in consistency

How often do you have to purchase kerosene/a new bulb for the current light?

- We are buying the kerosene monthly i.e. three liters in a month. The variety of Kerosene is available with different price.
- In case of electric bulb, we are buying 8 to 9 times in a year.

How much do you pay for kerosene, new bulbs or other materials for the current light?

For Kerosene, we are paying Rs.9 for one liter and for 100 watt electric bulb, we are paying Rs.15.

If you use flashlights, how often do you buy new batteries?

We are buying batteries at least once in a month – 3 no. (1.5 Watt) Battery

Do you take any of your lamps away from home? If so, where and how are they used?

We take the flashlights away from home. We are using it during irrigating the field in night and also for collecting the forest produce in night. Occasionally, we are using the flashlights while moving in and around village.

Were your lamps bought by the men or the women in the family?

- Both by men and women, whoever goes to market.

Is the fuel bought by the men or the women?

- Both by men and women, whoever goes to market.

Who do you go to if your lamp breaks?

- There is a mechanic's shop in a nearby village who repairs this.

What times of day do you use light?

- In the early morning and evenings.

Who else in your family uses the light?

- Everybody

Where do you buy household appliances?

- Nearest town/village place ( i.e Dahod & Godhra )

### **Alternative Lighting Systems**

How much would you pay for a lamp that has no cost for fuel?

- Can't say at this moment. But it depends on initial price we pay.

Would you use the lamp differently if you had a brighter or longer lasting light? If so, how?

No, we would rather use brighter and longer lasting lights.

Have you seen an alternative to your existing light that you would prefer to use?

Yes, We have seen 20-watt rechargeable lantern, which is very cost effective.

What are the three most important things you use lighting for?

Cooking, Irrigating the field in night, collecting the forest produce.

**PART III: QUESTIONS TO BE ASKED TO RURAL FAMILIES WHO USE THE SAMPLE LAMPS****Initial response to LED prototype/samples**

[Show them the LED prototype or incandescent sample.]

What do you think about this light? What do you like/dislike about it? Why?

[Brightness, size, weight, etc.]

Very good, seen the prototype with eagerness. All are portable, lightweight and handy. Especially the Dorcy light prototype is more comfortable due to its stand which helps in placing it on any flat surface, better grip in hands and focus control facility.

How much would you pay for it?

For      Lamp 1 – Rs.250  
            Lamp 2 – Rs.150  
            Lamp 3 – Rs.60

Would you use this light instead of your current light?

Yes

**Response to sample after period of use**

[Leave the light with them for 2 days and return.]

What did you use it for?

Cooking, Reading, Irrigating the field in night, collecting the forest produce at nights

Did you use it instead of or at the same time as your current light/lamp?

Yes

How many hours did you use it?

Two and half hours in night for two days

Who used the lamp?

Women used it while cooking, younger son used it for reading and other used it for irrigating the field in night and also for collecting the forest produce in night in forest.

What did you like/dislike about it?

(Would you recommend it to a friend?)

- We like the white light from LED lights and focus control facility of Dorcy light.

What do you prefer about your fuel-based lamp over our prototype?

- We are used to fuel-based lamp since many years and therefore we are habitual of it. We would like to know the actual price and life of batteries.

What do you prefer about our prototype compared to your fuel-based lamp?

Incase of fuel-based lamp, we do not get sufficient lighting. Secondly it is expensive in terms of operating cost. Incase of electric lamp, we have to compulsorily pay Rs.90 per month, irrespective of amount of usage. Also irregular supply hampers the work and as a result of this we cannot plan our long-term work in night due to lack of surety of constant power supply. Also the bulb failures frequently.

In case of prototype shown to us, we may not face all above problems. We can control the focus, charge the cell, easy to use and maintain.

Are there tasks you can do with our prototype that you can't do with your fuel lamp?

Yes, we can do post- harvest activities like thrashing, meshing etc. At home, reading in night etc that we can't do otherwise.

**PART IV: INSTRUCTIONS FOR PHOTOGRAPHS OF END USERS**

Please take pictures of as many of the following items as possible:

- The family
- Each existing lamp in its place in the home
- People in the household using the lamps
- The most durable/reliable object in the home
- The most valuable item in the home
- The outside of the house
- The inside of the house
- The communal space in the home
- Family members at work
- Family at dinner
- Family after dinner
- Family in the morning in the home
- The person or place from which existing lamps and/or kerosene are bought

**STANFORD LED LIGHT PROJECT SURVEY**

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**Instructions**

Please fill out Part I yourself

Please fill out Part II by talking to rural families

Please fill out Part III after demonstrating the sample lamps to a rural family / typical end user

Please use Part IV to guide you in taking photographs of people using lights

**PART 1: QUESTIONS FOR GIAN STAFF****General Background on the village:**

Name and Location of End user / Village:

Village: Divya, Post: Fangia , Taluka:Devgadh Baria, there is no fix cost. Pin;389380 Gujarat State

Number of households in the village (approx.): Total population 290 (40 house holds)

Does the village have access to the government electricity? - No

Does the government provide a kerosene subsidy in your area? - Yes

Give the names of any other government or NGO programs working on renewable energy in this village.

Presently there is no any program running in the village by NGO or by the government but twelve years ago, rural development authorities had put solar streetlights, which had worked for about two years before it stopped working.

Local NGO is running self-help groups for savings money and other rural awareness programs but nothing related to energy sector.

No any agency is working for renewable energy in this area.

**PART II: QUESTIONS TO BE ASKED TO RURAL FAMILIES:****General Questions:**

How many people live in the home? 7 (Sevenperson)

For each person, give the age and gender and family position/relationship.

Name	Age	M / F	Relationship (e.g. daughter)
1. Kutarbhai Dalabhai Nayak	75	M	Father (reference point)
2. Daharbhai Kutarbhai Nayak	32	M	Son
3. Kaliben Daharbhai Nayak	30	F	Daughter in Law
4. Milanben Daharbhai Nayak	11	F	Grand Daughter
5. Hetalben Daharbhai Nayak	9	F	Grand Daughter
6. Arunaben Daharbhai Nayak	7	F	Grand Daughter
7. Bhavesh Daharbhai Nayak	14	F	Grand Son

Which person is the household head?

- Kutarbhai Dalabhai Nayak

Which person is the respondent?

- Daharbhai Kutarbhai Nayak

What is the occupation of the household head?

- Agriculture, Animal Husbandry & Collection of forest produce.

How many others in the household work? What are their jobs?

- Three persons are involved in agriculture. Many a times Children are required to go to the forest to collect forest produce along with parents

Does anyone in your family like to read?

- Yes, I myself (Daharbhai) and children do like to read.

**Current lighting in the home:**

Do you currently have light(s)?

No, We have no electric supply in our area. We are using kerosene lamp and flash lights (battery driven) and fire the woods for lights (torches).

If so, what fuel do you use?

We are using kerosene for lamps.

What do you use this lighting for?

- For Cooking and dinner, for milking in early morning and local movements within and around village.

At what time of the day do you use this lighting and for how long?

- About half-hour in the early morning for milking and 2 to 3 hours in night for dinner etc

What do you like most about your current light?

- Nothing, yellow light is not a preferred one but there is no choice.

What do you not like about your current light?

- Low illumination, Smell of kerosene, costly, yellow light is inconvenient. Because of low illumination , our children are not studying the at night.

How often do you have to purchase kerosene/a new bulb for the current light?

We are buying the kerosene monthly i.e four litre per month.

How much do you pay for kerosene, new bulbs or other materials for the current light?

- For Kerosene, we are paying Rs.13 per litre.

If you use flashlights, how often do you buy new batteries?

We are buying monthly two battery cell (1.5 watt each) and we are paying Rs. 18 to 22 for two battery cells depending upon the quality.

Do you take any of your lamps away from home? If so, where and how are they used?

We are using flashlights ( battery driven) outside the home whenever required.

Were your lamps bought by the men or the women in the family?

We do not have lights and therefore we are not buying the lamps but we are buying the Battery cells. Both men and women do it as per situation.

Is the fuel bought by the men or the women?

- Both by men and women.

Who do you go to if your lamp breaks?

- NA

What times of day do you use light?

- In the early morning and evening only

Who else in your family uses the light?

- Everybody

Where do you buy household appliances?

- Nearest town place (i.e Devagadh Baria , Chhota Udepur and nearest village Zoz )

**Alternative Lighting Systems**

How much would you pay for a lamp that has no cost for fuel?

-Not able to answer. Argue that without seeing the product and its recurring cost, how we can say the price?

Would you use the lamp differently if you had a brighter or longer lasting light? If so, how?

Yes, we can use it for different post harvest operation in farm, reading in nights etc. Also we stop all our activities after some hour in night or continue them in dark, if possible. In case of new brighter and long lasting and cheap lights , we can continue the light even after our usual activities.

Have you seen an alternative to your existing light that you would prefer to use?

Yes, we had seen the solar operated streetlight. We like it.

What are the three most important things you use lighting for?

Cooking, Milking , and other household use.

**PART III: QUESTIONS TO BE ASKED TO RURAL FAMILIES WHO USE THE SAMPLE LAMPS****Initial response to LED prototype/samples**

[Show them the LED prototype or incandescent sample.]

What do you think about this light? What do you like/dislike about it? Why?  
[brightness, size, weight, etc.]

We like these lights. It is light in weight. We can use also use while riding the bicycle.

How much would you pay for it?

For     Lamp 1 – Rs.100 - 150  
          Lamp 2 – Rs.150 - 200  
          Lamp 3 – Rs. 60 - 75

Would you use this light instead of your current light?

Yes, because we do not have electricity and therefore we are using the conventional flashlights and we are using it because there is no any alternative for us. We would like to use these lights if available to us at reasonable cost.

**Response to sample after period of use**

[Leave the light with them for 2 days and return.]

What did you use it for?

We used it for while cooking. We also used it while flooring the grains in manually operated floor mills. We also used it for farm security purpose / animals

Did you use it instead of or at the same time as your current light/lamp?

Yes, We used it instead of our conventional flashlights

How many hours did you use it?

Two hours in night

Who used the lamp?

Women used lamp 1 and lamp 3 for while cooking by women and reading by children. The men used lamp 2 while farm visits in nights.

What did you like/dislike about it?  
(Would you recommend it to a friend?)

- We like the portability, lightweight and focus control facility in lamp 2. It is convenient to us in all aspects. We recommend it to all in our friend and family members.

What do you prefer about your fuel-based lamp over our prototype?

We are used to fuel-based lamp. But we really don't know if anything good about it. We see new light systems in towns but we have one limitation; no electricity, which hinders usage of any new lamps. Battery lit lamps is a costly option.

What do you prefer about our prototype compared to your fuel-based lamp?

Incase of fuel-based lamp, we do not get sufficient lighting. Secondly it is expensive. Incase of electric lamp, we have to pay Rs.90 per month compulsory, irrespective of use. Also irregular supply would disturb the work.

We like the prototype shown to us because it seems useful to us in many aspects in terms of its illumination, convenience etc. Our children would like to read more with these lights.

Are there tasks you can do with our prototype that you can't do with your fuel lamp?

Yes, we can do more domestic work, agriculture related operations at home such as preparation for farm operation be executed on the next day, some post harvest operation in farm during harvesting season etc. that we would not have been possible with fuel based lamp

**STANFORD LED LIGHT PROJECT SURVEY**

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**Instructions**

Please fill out Part I yourself

Please fill out Part II by talking to rural families

Please fill out Part III after demonstrating the sample lamps to a rural family / typical end user

Please use Part IV to guide you in taking photographs of people using lights

**PART 1: QUESTIONS FOR GIAN STAFF****General Background on the village:**

Name and Location of End user / Village:

Location: Dalva Faliu, Village: Ankali, Post: Dudhia ( Bamroli) , Taluka:Devgadh Baria, District: Panch Mahals ,  
Pin:389380 ,Gujarat State

Number of households in the village (approx.): 850 house holds

Does the village have access to the government electricity? - Yes

Does the government provide a kerosene subsidy in your area? - Yes

Give the names of any other government or NGO programs working on renewable energy in this village.

No any agency is working for renewable energy in this area.

**PART II: QUESTIONS TO BE ASKED TO RURAL FAMILIES:****General Questions:**

How many people live in the home? 11 (Eleven person)

For each person, give the age and gender and family position/relationship.

Name	Age	M / F	Relationship (e.g. daughter)
1. Bharatsinh Nathubhai Patel	62	M	Father (reference point)
2. Pursottam Nathusinh Patel	32	M	Son
3. Surekhaben Pursottambhai Patel 28		F	Daughter- in-law
4. RanjitSinh Bharatsinh Patel	23	M	Son
5. Sumitraben Ranjitsinh Patel	21	F	Daughter
6. Narvirsinh Pursottambhai Patel 14		M	Third Son
7. Rajesh Pursottambhai Patel	2	M	Grand Daughter
8. Chandrikaben Pursottambhai Patel	7	F	Grand Daughter
9. Purviben Pursottambhai Patel 4		F	Grand son
10. Ramiben Ranjitsinh Patel	5	F	Grand daughter
11. Tinabhai Ranjitsinh Patel	3	M	Grand son

Which person is the household head?

- Bharatsinh Nathubhai Patel

Which person is the respondent?

- Bharatsinh Nathubhai Patel

What is the occupation of the household head?

- Agriculture and Animal Husbandry

How many others in the household work? What are their jobs?

- Three persons are involved in agriculture. At the time of season young members goes to collect the forest produce.

Does anyone in your family like to read?

- Yes, All the members in my family are educated and everybody likes to read. I ( Bharatbhai) used to read religious books , magazines however others read educational / study related books.

**Current lighting in the home:**

Do you currently have light(s)?

Yes, we have lights in our village.

If so, what fuel do you use?

We normally use conventional electricity. Occasionally we use kerosene lamp incase of electricity failure.

What do you use this lighting for?

In morning we use lights for 3 hrs for milking the animals and also for tea breakfast etc. In night we are using it for 3 to 4 hrs for cooking, dinner and other household activities.

At what time of the day do you use this lighting and for how long?

During the day we use the three phase lights for irrigating the farm for 3 hours. In early morning we use it for 2-3 hours for milking the animals.

What do you like most about your current light?

We like the better illumination of conventional electricity bulbs as compared to our old system of kerosene lit lamps.

What do you not like about your current light?

- Irregular power supply, failure of bulbs due to load fluctuations.

How often do you have to purchase kerosene/a new bulb for the current light?

We are buying the kerosene monthly i.e 5 litre per month. We buy ten bulbs annually.

How much do you pay for kerosene, new bulbs or other materials for the current light?

-For Kerosene, we are paying Rs.15 per litre.

If you use flashlights, how often do you buy new batteries?

12 We are buying monthly three cells (1.5 watt each) and we are paying Rs. 16 for two cell

Do you take any of your lamps away from home? If so, where and how are they used?

13 We are using flashlights outside the home whenever required.

Were your lamps bought by the men or the women in the family?

- Both by men and women.

Is the fuel bought by the men or the women?

- Both by men and women.

Who do you go to if your lamp breaks?

- NA

What times of day do you use light?

- In the early morning and evening till late nights till kids needs subjected to availability of electricity.

Who else in your family uses the light?

- Everybody

Where do you buy household appliances?

- Nearest town place (i.e Devagadh Baria & Godhra)

### Alternative Lighting Systems

How much would you pay for a lamp that has no cost for fuel?

-Not able to answer. For any cheaper option, we can pay little more.

Would you use the lamp differently if you had a brighter or longer lasting light? If so, how?

Yes, We can use it for different post harvest operation in farm, reading in nights etc

Have you seen an alternative to your existing light that you would prefer to use?

Yes, we had seen the solar lantern available in market and we are thinking to buy the same..

What are the three most important things you use lighting for?

- 1) Cooking in night
- 2) Milking in early morning
- 3) Going one village to another village
- 4) Studying

## PART III: QUESTIONS TO BE ASKED TO RURAL FAMILIES WHO USE THE SAMPLE LAMPS

### Initial response to LED prototype/samples

[Show them the LED prototype or incandescent sample.]

What do you think about this light? What do you like/dislike about it? Why?

[brightness, size, weight, etc.]

It is very good. We have not seen such kind of lights .It is very small, light weight, it's focus goes to long distance and its focus control.

How much would you pay for it?

For     Lamp 1 – Rs.150  
           Lamp 2 – Rs.200  
           Lamp 3 – Rs.65

Would you use this light instead of your current light?

Yes, because its focus is very good and it has many advantage compare to our lights.

**Response to sample after period of use**

[Leave the light with them for 2 days and return.]

What did you use it for?

We used lamp 2 while irrigating the farm in night. The lamp 1 is used for home use like cooking, milking, cleaning, drawing waters from the well, feeding the animals in night etc.

Did you use it instead of or at the same time as your current light/lamp?

Yes, We used it instead of our flashlights

How many hours did you use it?

About two hours in morning and two to four hours in night

Who used the lamp?

Children used the lamp 1 for reading. Women used the lamp 2 and 3 for home while men used the lamp 2 for farm visit at night.

What did you like/dislike about it?

(Would you recommend it to a friend?)

This lights especially lamp 2 is much more convenient due to facility of stand to put it upright etc. The lamp 1 is also good. We recommend it to all in our friend and family members. We would like to know the recurring / operating cost of these lights.

What do you prefer about your fuel-based lamp over our prototype?

There is nothing better in our kerosene lit lamps. In our electricity lamps/bulbs which are brighter and cheap. It makes them a preferable option in our situation. But irregular electricity supply is an issue.

What do you prefer about our prototype compared to your fuel-based lamp?

We like this because it illuminates limited area and thereby we can save the energy. Secondly in our light we have to pay fix amount of electricity bill irrespective of its usage, which make it an expensive alternative. In the light shown to us, we can save the cost because there is no fix cost of establishment.

Are there tasks you can do with our prototype that you can't do with your fuel lamp?

We cannot use our torchlights continuously because it consumes more batteries. In these lights we can do more work domestic household work related with agriculture like preparation for farm operation to be implement on next day, post harvest operation in farm during harvesting season etc that we can not do with fuel based lamp