

## **NEST: ELIMINATING LIGHT POVERTY**

It's 8:30 in the morning. Abdur Rehman arrives in Achampet, a small village in Mehboobnagar district of Andhra Pradesh. As he pulls into the hamlet, he sees a large gathering of locals, waiting to get a demonstration of a unique product. He walks towards the crowd, and out of his sales kit, pulls out a lantern - a portable lighting device – a product which has existed in its erstwhile avatar for several centuries in the country. So what is it that really makes this product unique? At the press of a button, the lantern is switched on, but there is no sign of a wick or kerosene. “Where is this light coming from?” asks a villager. Abdur, with a smile on his face replies, “This is Aishwarya – a product from a company called NEST (Noble Energy Solar Technologies Ltd). This lantern does not require any kerosene or oil. It runs on solar power, in simple words, on the energy from the sun.”

Aishwarya - named after a popular bollywood actress - was the brainchild of Mr. DT Barki, an entrepreneur who launched this product, not out of a sheer commercial intent, but with the noble objective of providing affordable, safe and renewable energy based lighting solutions to the masses in every nook and corner of the country. Little did Barki know that this business venture of his will not only be one of the most successful and talked about launches in the global renewable energy circles, but it will earn him the respect of all the energy specialists around the world, who often referred to him as the ‘Edison of India’.

### **The Problem of Light Poverty and the Need for Safe and Renewable Energy**

In 2005, it was estimated that there are close to 2 billion people in the world who have no access to electricity. Furthermore in South Asia itself close to 700 million people lack access to electricity, and about 90 percent of them live in rural areas. (Source: World Bank)

“Traditionally, Kerosene based lanterns have been the source of lighting world-over. 77 billion litres of fuel are burned in kerosene lamps every year. That amounts to 1.3 million barrels of oil per day. The oil consumption of these traditional lamps represents about one third of worldwide primary energy demand for domestic lighting and is responsible for emissions of 190 million tonnes of CO<sub>2</sub> greenhouse gas per year.” (Source: German Technical Cooperation (GTZ) and Federal Ministry for Economic Cooperation and Development, Germany)

Global energy demand is expected to double by 2030. Considering the scarcity of natural resources, and with global warming and carbon dioxide emissions becoming a serious issue, it has become imperative for all the countries around the world to look at alternative, renewable and cheaper means of providing electricity. (Source: Energy Information Association, USA)

### **Indian Context**

In India, both commercial and non-commercial energy resources are used. However, over 600 million people have no access to modern cooking fuels and close to 300 million do not have access to electricity (as per Census 2001). Moreover, about 100 million families in the country, mostly in the rural areas, use kerosene as a fuel to light up their lamps. Kerosene,

being combustible in nature, is not a safe option, and it also is an additional strain on an already tight budget of an average Indian villager.

In villages they say, life only begins after dark. Children, who are playing outside their homes through the day or are busy attending schools, sit down to study at night. Family and social life truly takes over as the housewife, who spends time in the kitchen cooking food for the family, then gets down to doing other household work like washing clothes or dishes, or sewing among others. Each of these tasks has to be performed under light. Typically, some of the elitist and the richest of the village locals own a power generator, whereas most others spend their evenings under the light from kerosene lanterns.

## **Barki: Life and Times**

### **Early Years**

Dharmappa Tammappa Barki was born in the village of Malgund in the Hangal district of Karnataka in the year 1958. The village of Malgund is part of Dharwad –the cultural capital of Karnataka. Folklore goes that a stone hurled at Dharwad from any direction will inevitably hit a poet or a painter. This artistic tradition left indelible hues on Barki's character. As a child he dabbled with poetry, theatre and pencil sketching. What's remarkable though is the fact that he took all his creative endeavors to fruition. He has to his credit four Poetry compilations in Kannada, about four scripts that were enacted as Plays and several impressive pencil sketches of eminent personalities.

Barki was born to a joint family that spanned three generations and was eighty five member strong. *"Our dining Hall looked more like a hostel mess!"* says Barki. Being one of the twenty children in the family made Barki an accommodating, cheerful lad who, in his own words, was *"an expert in mediating and pacifying quarreling parties!"* Inside the family, Barki looked up to his grandmother with a lot of admiration and reverence. *"Dr. Gangubai Hangal, through her accomplishments was the guiding light for all in the family"*, he remarks. Dr. Hangal, a classical vocalist of the Karnatic style was later felicitated with the Padma Bhushan. She also held a record of sorts. She was awarded seven doctorates over her lifespan from various universities.

Amidst all his happy memories of childhood one terrible accident stands out. *"I was 9 years of age when there was this fearful accident in our family. One of my aunts sleeping with her newborn woke up in the middle of night and stumbled thereby toppling the kerosene lamp over. This led to a raging fire that resulted in the mother and the baby sustaining severe burns. The mother barely survived while the baby died within a few days"*, mentions Barki. Years later this accident was to serve as a subconscious motivator for his path breaking venture.

The year 1977 saw Barki entering the portals of KREC or Karnataka Regional Engineering College (*now known as NIT, Karnataka*). The first two years were joyous extensions of student life where Barki produced and directed plays and published another book on poetry. It was the second half of the program that in some ways was Barki's tryst with the harsh realities of the world. Around this time his family expressed their inability to support him financially. *"I did not know what to do. For lack of a better alternative I wrote to the President of India- Shri Neelam Sanjeeva Reddy! I explained to him my plight and that of others like me who were being denied education for financial reasons."* Quite surprisingly a

reply found its way from the President's desk to the Vice Chancellor's office. Barki was summoned and reassured that the university will take care of the finances and that he should continue with his studies. *"This was my first experience in entrepreneurship. It left me with the understanding that, with sincerity and able expression, you can even make the President of India work for you! Isn't that what entrepreneurship is all about-getting things done through people!"*

### **Foray into solar space**

Barki graduated from KREC in 1982 and joined *BHEL (Bharat Heavy Electricals Ltd.)* as a Quality Assurance Engineer in the Solar Cell Process Module. In this role he witnessed how production inefficiencies led to meager yields of 60% to 80%. *"I tried suggesting ways to improve the efficiencies but Production just wouldn't listen! They were hell bent on making me feel like an intruder"*, noted Barki.

But Barki didn't stop at that. After months of witnessing the inefficiencies he decided to stay back one night at the plant and carry out an experiment. The experiment showed huge promise. *"I carried the results of the experiment to the Plant General Manager the next day. He was really impressed."* That day on Barki had a different stature in the plant. For one, he was shifted to Production and most people now knew him as the '*GM's Man*'.

After a successful twelve year stint in BHEL, Barki felt a need for a larger platform to give shape to his entrepreneurial ambitions. *"I was an 'intrapreneur' at BHEL, always doing my own things! But by 1993 I was looking for a lot more independence"*, he mentions.

Subsequently he joined *Renewable Energy Systems Ltd (RESL)* as a General Manager and setup a world class manufacturing facility for them in Hyderabad. Despite a very exciting stint at RESL, Barki moved out in around two years in search of his own venture. A few brief consultancy assignments and some important publications (with IEEE, PVSEC, etc.) later Barki joined a start up venture called Photon Energy Systems Limited (PESL) in the year 1996. He took this company to great heights through various new initiatives. For instance, he developed a laminating machine in-house for producing solar panels that earned his company the prestigious ELCINA award. It was at PESL that he gained extensive experience and knowledge of setting up a manufacturing facility, sourcing material and building a strong business, attributes which came in handy when he started his own venture.

### **Solar Lanterns - the opportunity and the creation of "Aishwarya"**

By the year 1998, Barki had gained tremendous exposure both nationally and internationally in his industry. Furthermore, his stint at PESL had helped him strengthen his network and contacts. By then, the entrepreneur in him was taking shape. While working at PESL, he was also on the sidelines fervently looking out for that one big idea to start his own venture. During this time Barki developed a strong bond with his boss Uttam Kumar Reddy with whom he frequently shared such ideas.

Moreover, with nearly two decades of experience in the space of solar energy, Barki was keen to do something in his field which he had 'virtually mastered'. In fact his mastery of this space is well brought out by the fact that Barki by then had written many research papers on renewable and solar energy, which were presented in various forums internationally. He was also invited in global forums like the World Conference on Photovoltaic Energy Conversion

(WCPEC). In fact, WCPEC, which was held once in four years, saw Barki presenting his papers on three consecutive occasions in 1994 (launch year), 1998 and 2002.

Over the years, Barki had developed a strong affinity with this idea of providing affordable solar energy products to rural India. Also, the whole notion of renewable energy being used as a status symbol and a technology for the elite was something that used to bother him a lot. Barki says, *“In those days, bulk of our customers were rich people who placed orders for solar heaters, street lights and garden lights. Solar energy was becoming a technology for the rich. It was then that I coined this mantra: Affordable, reliable, truly portable and mass marketable... I used to recite it may be a thousand times every day no matter where I was, to the extent that my son and my family still know it by heart. I always wanted to provide world class renewable energy products to people at the bottom of the pyramid in India. That was my vision, my dream.”*

Also, the kerosene accident which took place when he was a child was still fresh in his memory. He explains, *“I started NEST with the intention of eliminating kerosene lanterns from the country. My vision then was to provide a safe substitute for those killer lanterns. It was only later that it was broadened to eliminating light poverty around the world”*. (Exhibit 1)

As a result, Barki began an extensive research on the opportunity of manufacturing solar powered lanterns. He travelled the length and breadth of the country, identifying who were the key players, if any, where were the components being sourced from, what was the price at which these lanterns were being sold, etc. His research began in the year 1998, and it continued till the mid of 2001.

### **Solar Lanterns Market in India**

In those days, solar lanterns were being sold by Government of India with the intention of providing low cost portable renewable lighting to the un-electrified rural India. The lantern came with a solar panel that would charge during the day and provide illumination for around 4 to 5 hours in the night. Other than its obvious uses inside households, the lantern would come handy to the farmer during the harvesting/ irrigation seasons, to fishermen while out at sea in the dark and to women while going out alone at night. Other than lanterns, the Government also introduced solar powered street lights in tribal areas. Private enterprise in the domain was restricted to small players who largely supplied to the government.

Government also provided subsidies for all these products. The logic behind this was the fact that these lanterns were ultimately reducing usage of Kerosene Oil, a highly subsidized product. (A liter of Kerosene Oil costs Rs. 30 to the Government and is made available at Rs. 10 to the masses.) The MNES (Ministry of Non-conventional Energy Sources) started developing solar lanterns.

### **Components of a Solar Lantern**

The Solar Lantern is built out of the following five major components.

1. Solar Panel - The Panel made out of wafer-based crystalline silicon captures light energy from the sun. This comes as an external attachment to the lantern.

2. Rechargeable Storage Batteries - The light energy is subsequently stored as chemical energy in these storage devices.
3. Electronic Circuit- Provides passage for electric current generated through the storage batteries.
4. CFL/ LED tube - Converts the electrical energy produced by the batteries and the circuit into light energy again.
5. Casing/ Housing and Wiring – These peripherals provide protection to the sensitive parts of the lantern.

### “Aishwarya” is born

Barki had, during his stint at Photon, manufactured and supplied these lanterns to the Government. He strongly believed that the product specified by the Government was grossly overdesigned and that a new product could be built that would serve the requirements of the target segment and yet be made at less than half the cost. From 1998 to 2001, Barki worked on this product. He explored various possibilities including importing some components and indigenously manufacturing others. Finally, he decided to manufacture solar panels in India, to procure batteries and electronics from a Singaporean company and collaborating with a local plastics manufacturer to build the housing. He extensively worked with OSRAM India to develop a special 3 Watt CFL that did not exist in the market. The new product thus developed was named “Aishwarya” Solar Lantern. (Exhibit 2)

Table 1 illustrates the new product’s specifications along with those prescribed by the government. It must be noted that only products adhering to the Government specifications were eligible for subsidy.

**Table 1 Government approved specifications for Solar Lanterns vs. Barki’s Product**

	<b>GOVT. SPECS.</b>	<b>BARKI’S SPECS.</b>
Solar Panel	10 Watts	3 Watts
Rechargeable Battery	12 V, 7 Amp-hr	6 V, 4 Amp-hr
Weight	6 kg	2.1 kg
CFL	7 Watts	3 Watts
Illumination	350 lumens	90 lumens
Price	Rs. 5,000 (approx.)	Rs. 1,500
Price post subsidy	Rs. 2,400 (approx.)	No subsidy

### Comparative analysis

Thus, Barki was able to create a product that was light and portable. It was half the size of the regular lanterns and nearly one-third in weight. The illumination of “Aishwarya” solar lanterns was lesser than that produced by the old lanterns but just right for all practical applications. The most significant aspect of the product, however, was the price which came down to less than one-third of the pre-subsidy price and about half of the post-subsidy price of lanterns supplied by the Government. The price-cut made the lanterns very affordable for village folk for whom garnering a sum of Rs. 2,400 was not easy. When the Government

pulled back subsidies on Solar Lanterns in 2003 the attractiveness of the product increased even more.

## **The Launch of “NEST”**

Having developed “Aishwarya”, Barki went on to create a comprehensive business plan based on his extensive research over the last several years. Considering the rapport he had developed with Uttam Reddy, he thought it would be appropriate for him to first discuss his plan with him. The reason for this was the fact that he could leverage the very infrastructure and financial strength of PESL that he and Reddy had created over the years. Barki proposed to launch a new company called NEST (Noble Energy Systems Ltd.) and offered Reddy a 25% stake in return for his financial and infrastructural support.

Contrary to his expectations Reddy turned down the idea and urged Barki to continue as part of the company. *“It was a very tough decision to take. On one hand I had several family obligations with both my children still in school. On the other I had the staunch desire of ensuring that this unique product sees the light of day”*, Barki expressed.

With a heavy heart Barki took the decision of putting in his papers at PESL and registered NEST in the month of May, 2001. *“I did not have enough money to launch NEST. At this time it was my friend Jagan Mohan Rao who came to my rescue. He lent me about one lac rupees as seed capital along with a makeshift office compound from where I could operate.”*

## **2001 – 2003: The First Steps**

NEST started small by servicing an initial order of 100 solar lanterns which was followed many small orders thereafter. Barki focused his attention on cost reduction in procurement of components. Among other things he purchased used solar cells, that were electrically functional though aesthetically unappealing, with the objective of recycling and reusing them. *“I could make upto Rs. 500 per lantern through this approach!”*, exclaims Barki.

### **Manufacturing Facility**

Barki already had a makeshift assembling facility at Hyderabad. He soon followed this up by establishing a solar module manufacturing plant near Bangalore. The plant was setup with a capacity of 20 KWatts/ month which translates to about 6,500 units of 3Watt panels. The plant is capable of running three shift operations employing 12 people in every shift including a manager and a supervisor. (Exhibit 3)

### **Dealer Network**

Barki was aggressively trying to promote his product and appointed several dealers across the country in a very short span of time. He supplied them his product on lucrative terms leaving 25% to 30% dealer margins with a credit period of one month. However his criteria of selecting dealers were not very stringent. Most of his dealers were located in Tier III towns which were largely feeder markets to nearby villages. They were located predominantly in the states of Andhra Pradesh, Karnataka and some regions of Maharashtra. About 50% of his

dealers were exclusively selling his products while the rest were also dealing in other consumer durables. Along with sales the dealers were also responsible for providing after sales support. A dealer typically had a salesman who would cover about a 150 km long itinerary per day on his motorbike passing through all the adjoining villages.

### **Financial Debacle in 2003**

Two years into the venture in 2003 Barki faced one of the toughest challenges in his career. In his urgency to expand Barki was not discrete about the choice of dealers he appointed. As a result he struggled to recover his money from the market having sold his products on credit.

*“We had barely managed to find our feet when we experienced this rude shock. Our money was stuck everywhere. There was a dearth of working capital now. Market owed me 38 lacs in terms of bad debts. We had reached a point where my wife started questioning my decision of starting this venture itself. I remember that night, I was totally restless and struggled to sleep I walked out of my home in the dead of night with the idea of approaching Mr. Reddy and requesting him to take me back into PESL ”*, says Barki.

However, something inside him pulled him back and gave him the courage to go on. He realized that this venture of his was not just about gaining and losing money. It was meant to serve a larger social cause. But for this inspiration it would have been difficult for him to come out of this crisis.

### **2003-2005: The Road to Recovery**

Despite the financial troubles that NEST was going through it still managed to establish in a short span of time a strong brand in “Aishwarya” and gained considerable market visibility.

#### **‘Exide’ to the rescue**

Considering the brand equity that Barki had created, Exide, one of the largest battery manufacturers in India, approached NEST for a technical collaboration. As a part of this partnership NEST was supposed to manufacture and supply Solar Lanterns to Exide who would then sell them under their own brand name. This initiative was part of Exide’s decision to forward integrate into Solar Lanterns and other lighting devices. Through this tie up NEST managed to receive two orders of 10,000 lanterns each which effectively pulled them out of their financial mess.

#### **Microcredit schemes**

In order to take his venture forward Barki realized that he needed a strong market focus. He diligently worked at developing a value proposition for the end consumer. He launched a scheme unheard of in his space in order to make the product easily available to a larger consumer base. He offered a microcredit scheme through his dealers wherein a consumer could buy the solar lantern at an EMI of Rs. 100 per month. The figure of Rs. 100 was arrived at post extensive research undertaken by NEST. They realized that the average consumption (6-7 lts. @ Rs 10 to Rs. 20 per litre) of Kerosene used for lighting purposes in a household comes to roughly the same amount. This, however, is a recurring expense for the family which can be avoided by buying a solar lantern that comes with a minimum warranty of upto ten years for the solar module (more than 50% of the unit cost) and one year for other replaceable parts.

Post the success of this scheme, Barki went on to introduce new product categories like solar powered fans, etc. (Exhibit 4)

## **2005: Winning the Oscar**

The Ashden Awards for Sustainable Energy, famously referred to as the ‘Green Oscar’, were instituted in the year 2001 in London, UK to promote “the greater use of local sustainable energy to address climate change, alleviate poverty and improve quality of life worldwide” (Source: [www.ashdenawards.org](http://www.ashdenawards.org)).

Every year the prestigious honor is bestowed upon four enterprising ventures globally in the sustainable energy space along with a cash prize of £30,000.

While NEST was holding fort in the market, Barki felt that in order to realize his larger vision he would need a bigger platform to promote his cause. He came across the Ashden awards and saw a great opportunity in them. He began the painstaking process of meticulously drafting an application for filing a nomination in 2005. A total of 70 nominations were submitted that year out of which Barki’s venture made it to a shortlist of top 30. Thereafter, Barki was required to send a concept note among other formalities to London.

*“As I was getting closer to my destination the prospect of winning the Green Oscars excited me. While the Oscars would have gotten me a step closer to realizing my dream they would have also brought in a cash prize of about Rs 2.5million, an amount invaluable for the growth of my venture”,* says Barki.

Basis the concept notes received, Ashden awards made a final shortlist of Top 10 contenders and NEST was one among them. Barki now had to undergo a thorough three week scrutiny conducted by Ashden experts who came down to Hyderabad and audited his venture. After this rigorous process Barki was invited for the final ceremony in London where HRH the Prince of Wales presented the award to him in the presence of Global Delegates and International Media.

*“This was the biggest moment of my life! NEST and “Aishwarya” were now globally known and appreciated”,* he expressed.

Soon after, BBC made a documentary on his venture which was broadcast the world over.

## **2005-2009: The Rise and Rise of NEST**

Having won the Green Oscar and the resulting international acclaim, Barki took his venture to new heights. “Aishwarya” solar lanterns were now being exported to over 16 countries around the world. The profitability of the company grew many folds during this phase (Refer Exhibit 5).

### **Backward integration into Silica Mining**

One of the bottlenecks to global capacity of Solar Cells (used to manufacture Solar Modules/ panels) is the supply of Silicon wafers. Barki found out through his path-breaking research in this field that an alternate source for the same is high purity quartz. The earth’s crust is abundant in this source and thus the bottleneck can be eased. Barki went a step ahead to find

quartz reserves in the state of Andhra Pradesh and got into the business of mining and exporting the ore for Silica extraction.

Barki not only benefited from selling the ore, he also managed to obtain discounts from silicon wafer suppliers for raw material needed to fabricate his solar modules. This helped him to further reduce cost and increase profitability.

### **Conclusion**

While the venture suffered a setback in the year 2008-09 on account of Global Economic Slowdown, it is back on track again and continues to grow today, reaching greater heights. NEST has been recently shortlisted among the **Global Top 10 Social Enterprises for Venture Capital** by the reputed agency “**New Ventures India**” in association with CII, US Aid and British High Commission.

In May 2009, **German Technical Cooperation (GTZ) and Federal Ministry for Economic Cooperation and Development, Germany** released a comparative report of the major solar lanterns developed across the world. In this study, “Aishwarya” was declared as the lantern with the best performance to price ratio. (Exhibit 6)

Barki has fresh plans to launch newer and better products in the market. He is currently working on an LED model of “Aishwarya” that he calls “Aishwarya-WOW” (Exhibits 7 and 8). His mining business which was another contributor to loss in revenues in 2008-09 is also picking up this year.

Exhibit 1: Mission Statement of NEST



## MISSION STATEMENT

*NEST's mission is to apply its scientific, technical and management expertise to all aspects of challenge to implement sustainable energy services globally by providing highest quality, most reliable and affordable solar photovoltaic systems for the benefit of people and the planet.*

*While 2 billion people world over have no access to electricity, over 100 million Indian families use smoky and hazardous kerosene for their lighting purpose.*

The question is that why people in the 21<sup>st</sup> century should be deprived of modern lighting? But the fact remains that no one did bother to provide these people the basic and minimum lighting. Many found it impossible; some found it as on worthy of business, and the rest said it is not their cup of tea!

Always there is a brighter side to anything! **Noble Energy Solar Technologies Ltd. (NEST)** shouldered the responsibility of providing clean, reliable and affordable solar lighting to these marginalized people among others on the planet. As we care to the people and their planet, so we do.

We designed and developed the most simple and useful solar products. Most importantly, we made them as the most affordable solar products in the

world! Yes, Here Comes the world's most affordable and reliable solar lamp, **Aishwarya**<sup>®</sup> a fast moving brand to be ever established in the field of solar photovoltaics in India!

The success of **Aishwarya**<sup>®</sup> prompted us that the small solar products are not only beautiful but they are useful and profitable. We, therefore, added many more cute, affordable and most useful solar products to our range of products,

### **The Team, Technology and Commercialization:**

Things do not make people. People make things! People matter, always; the good and right people matter to make good and useful products.

NEST has the most experienced solar and electronics specialists as its Board of Directors. In brief, NEST knows the true art of Science, Technology & Engineering with the necessary commercial expertise to make the sustainable solar energy technology, a sustainable business venture.

**Noble Energy Solar Technologies Ltd.**

Exhibit 2: "Aishwarya" Solar Lantern



NEST's flagship product - "Aishwarya" Solar Lantern seen here both with and without the accompanying solar panel.



Exhibit 3: Indigenously developed machines at the Bangalore Manufacturing Facility

**Unique Manufacturing Facility:**

In NEST, we do things differently. Our solar manufacturing facilities in Hyderabad and Bangalore are the manifestation

of our mission and vision. Our solar module and system assembly facilities are characterized by efficient, effective and most economical infrastructure. This is one of the reason why our solar products are of highest quality with lowest cost.

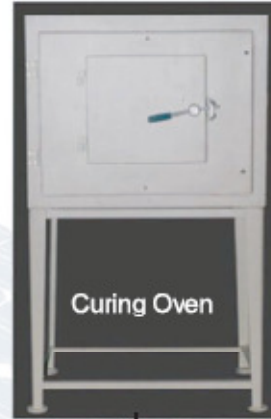


Exhibit 4: Product Catalog of NEST's range of Solar Products



**Range of Solar Products**

**Aishwarya™, Harmony Solar Lamps & Fans**



Model Nos : 6343/6543/6545  
 Hrs/Day : 3/2/3, CFL(W): 3/5/5  
 Battery : SMF 6V4Ah  
 Module(W) : Crystalline/a-Si, 6V3/3/5  
 Module Cable : 5Mtrs



Model Nos: 6543J/6545J  
 12575/12775/127710  
 Hrs/Day: 3/2/3/4, CFL (W): 5/5/7/7  
 Battery: SMF, 6V4Ah/12V7Ah  
 Module: Crystalline/a-Si, 6V3Wp/5W  
 12V5Wp/12V10Wp  
 Module Cable: 5-8Mtrs



Model Nos: 60032F/60432F  
 Hrs/Day: Fan-Cont.opern  
 during day time  
 Battery: SMF: Nil/6V4Ah  
 Module: Crystalline 6V3Wp  
 Module Cable: 5Mtrs



Model Nos: 63432F/65432F/65452F  
 Hrs/Day: 2-3/2-3/3-4, CFL(W): 3/5/5  
 Battery: SMF 6V4Ah  
 Module(W): Crystalline/a-Si 6V3/3/5Wp  
 Module Cable: 5Mtrs



Model Nos: 6543J2F/6545J2F  
 125752F/127752F/1277102F  
 Hrs/Day: 3/2/3/3/4, CFL (W): 5/5/5/7/7  
 Battery: SMF, 6V4Ah/12V7Ah  
 Module(W): Crystalline/a-Si, 6V3/5  
 12V5/12V7/12V10  
 Module Cable: 5-8Mtrs



Model No : 60456F  
 Hrs/Day : Fan-3hrs/day  
 Battery : SMF 6V, 4Ah  
 Module : Crystalline 6V, 3W  
 Module Cable : 5Mtrs

**NOTE:** 1. Features, specifications and shapes of the products are subject to change without prior notice.  
 2. Performance is guaranteed only under proper use of products.

Exhibit 5a: Financial Statements (all figures in USD)\*

	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2008-09</b>
<b>Sales</b>	421,581.00	893,830.00	1,765,727.00	548,332.00	1,724,340.00
<b>COGS</b>	351,222.00	770,464.00	1,502,852.00	354,849.00	1,370,810.00
<b>Gross Profit</b>	70,359.00	123,366.00	262,875.00	193,483.00	353,530.00
<b>Expenses</b>	56,337.00	104,596.00	235,792.00	157,791.00	330,832.00
<b>Net profit</b>	<b>14,022.00</b>	<b>18,770.00</b>	<b>27,083.00</b>	<b>35,692.00</b>	<b>22,698.00</b>

\*NEST's operations post 2006 include results from both the solar equipment and mining businesses.

Exhibit 5b: No of lanterns sold

<b>Year</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>Total</b>
<b>No. of Lanterns Sold</b>	12,101	14,659	14,575	13,121	13,050	6,200	5,100	<b>78,806</b>

Exhibit 5c: Number of Employees

	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2008-09</b>
<b>Employees</b>	22	28	40	25	45

## Exhibit 6: Comparative of the best Solar Lanterns in the world

(Source: German Technical Cooperation (GTZ) and Federal Ministry for Economic Cooperation and Development, Germany)

Solar Lanterns Test (pico-PV systems)							
Product photo							
Product name	Sun x-set mobile	Aishwarya NEST-6543	Solar 2007-1	Solux LED 100	MightyLight 3040	Solux 50	Glowstar 6S7
Manufacturer	Würth Solergy (Germany)	Noble Energy Solar Technologies Ltd. (India)	Solarprojekt Freitassing e.V. (Germany)	Solux e.V. (Germany)	Cosmos Ignite Innovations (India)	Solux e.V. (Germany)	Sollatek Ltd (UK)
Internet address	<a href="http://www.we-online.de">www.we-online.de</a>	<a href="http://www.solarnest.net">www.solarnest.net</a>	<a href="http://www.solarprojekt-freitassing.de">www.solarprojekt-freitassing.de</a>	<a href="http://www.solux.org">www.solux.org</a>	<a href="http://www.cosmosignite.com">www.cosmosignite.com</a>	<a href="http://www.solux.org">www.solux.org</a>	<a href="http://www.sollatek.com">www.sollatek.com</a>
Weight in kg (lamp)	0.7	1.2	0.6	0.5	0.5	0.5	3.2
Light source	CFL	CFL	LED	LED	LED	LED	CFL
Battery	NiMH/Lead	Lead	NiMH	NiMH	NiMH	NiMH	Lead
Module	external	external	external	external	external	external	external
Additional utility	12 V socket, battery charger unit	no <sup>2)</sup>	Radio can be connected	2 brightness levels	3 brightness levels <sup>3)</sup>	no	12 V socket
Preliminary test							
Function	2	3	1	1	1	1	3
Visual examination: lantern	4	3	1	1	1	3	1
Lantern mechanics	2	3	1	1	1	4	3
Electrical components	2	2	1	1	1	2	2
Electronic components	4	2	3	4	3	4	2
Weather protection	4	4	2	1	2	4	4
Visual examination: module	n.s.	2	2	2	2	3	3
Module mechanics	n.s.	2	2	3	2	4	4
User manual	2	2	2	2	3	2	1
Preliminary evaluation	satisfactory	satisfactory	good	good	good	satisfactory	satisfactory
Main test							
Deviation of solar module from specifications	1	1.5	3.5	4	1.5	2	4
Battery capacity deviation (5%)	1	1	1	1	2	2	1
Battery capacity loss in continuous test (5%)	1	-	2	1	5	1	-
Efficiency of charge controller (15%)	1	1	2	1	4.5	1	3
Efficiency of ballast unit (5%)	2	4	1	1	3	1	3
Cycle test/degradation	ok	ok	ok	ok	ok	ok	-1
Breakage test	ok	-0.5	ok	ok	ok	ok	ok
Luminous flux (10%)	1	1	4	2.5	2.5	2	1
Luminous efficacy (5%)	2	2	4	2	2	1.5	3
Solar fraction (20%)	1	3	1	1	1	1	4
Burn time/light duration (20%)	1	2	1.5	1	4	3	3
Main test evaluation	very good	good	good	good	satisfactory	satisfactory <sup>1)</sup>	poor
Costs							
Purchase price CIF, USD (2008)	500 <sup>4)</sup>	52 <sup>5)</sup>	122	117	55 <sup>6)</sup>	36	210 <sup>7)</sup>
Running cost per month, USD	30	1	4	2	3	2	12
Running cost per kilolumen-hour, USD	2.6	0.1	1.0	0.4	0.6	0.2	0.7
Price-to-performance winner:							

The Dot signifies the best Performance to Price Ratio among competing products

Exhibit 7: LED Model “Aishwarya- WOW”

THE NEST-SANKEERNA LED SOLAR LAMP  
**AISHWARYA-WOW™** Solar Lamp

Edison's new edition

AISHWARYA-WOW™ is the brilliant evolution of solar lamp by the visionary association of NEST and Sankeerna Technologies (ST), USA. NEST's flagship product, AISHWARYA® solar lamp, now comes with ST's patented low power LED filament, an invention which will revolutionise the LED lighting technology, which mocks at the high power LED technology for not living up to its expectations. ST's mission of reaching the really needy people, with its invention par excellence, found its meaningful partnership with NEST whose mission is to contribute towards **'Eliminating Light Poverty™'** in the world. NEST and ST believe in widespread utilization and dissemination of their new and innovative solar lighting technologies to all the LED lantern producers in the world. AISHWARYA-WOW™ – the LED avatar of AISHWARYA® - is the hallmark of the marvelous innovation for the benefit of the people in the world



AISHWARYA-WOW™ Solar lamp with LED filament, first of its kind in the world!

AISHWARYA-WOW™

Specifications

- Model No.: AISHWARYA® 6243L\*
- Lamp: LED filament 2W/1W,360° highly uniform spotless light
- Solar module: 6V 3Wp crystalline silicon solar cells
- Battery: 6V 4.5Ah SMF
- Housing: Rugged and cute-looking ABS plastic body in two attractive (red & yellow) colors
- Hours of operation: **6 hours** in "only" High Mode, **8 hours** in Medium Mode and **throughout night** in Bed Lamp Mode.

\*Read 6243 as AISHWARYA®-6243L\*  
 Solar Lamp- 6V system, 2W LED, 4Ah battery and 3Wp SPV module.



A Magic Candle that truly kindles your imagination!

Would you believe if someone told you that this one shown here (see pic.) is a LED filament? The answer is most certainly, a **NO!** From the makers of AISHWARYA® solar lamps, NEST-SANKEERNA brings to you a **NEW** patented LED filament, designed and developed by SANKEERNA TECHNOLOGIES Ltd., U.S. and assembled into the Lantern in India, by NEST.  
*See it to believe it! It will bedazzle you!*

AISHWARYA®: NEST's Flagship solar product

When most solar companies were concentrating on the much lucrative solar cells and modules manufacturing activities, NEST engaged itself in designing, developing and manufacturing solar mini lanterns to replace the unsafe kerosene lamps in the off-grid rural households. AISHWARYA® solar lamp soon became a household brand name in India. AISHWARYA® won the UK's prestigious Ashden Light Award 2005, popularly known as the 'Green Oscar'. AISHWARYA® solar mini lamp has the prime distinction of being voted as the *price-to-performance* winner amongst 12 solar lantern models manufactured across Germany, UK, China, India & South Africa. in a publication brought out by GTZ, a German Technical Cooperation in technical collaboration with the internationally reputed Fraunhofer Institute for Solar Energy (FISE) and on behalf of the Federal Ministry for Economic Cooperation & Development, Germany.



## THE LED FILAMENT

[Patent Ref # 2115/1875836]

Revision 2.21<sup>st</sup>  
July 2009



### About LED Filament

This LED Filament is composed of special LEDs, is designed in the USA by Sankeerna Technologies having world-wide patent. The filament, which is hermetically sealed, contains microprocessor suitable for 6V input. The uniqueness of the filament is that it eliminates the need for the complex design of heat sinks.

### Unique design features of the LED Filament:

- 360° Uniform Light
- Higher lumens output efficacy
- Light-weight, more light
- Most reliable in the world (15 years; the longest serving LED filament!)
- Truly portable.
- Un-interrupted light, year after year.
- Light regulation and dimming feature.
- No Bright Spots.
- Bed-Lamp for use at Night, Energy Saving Mode.

### AISHWARYA-WOW<sup>TM</sup> LED LANTERN (vs) COMPACT FLOURESCENT LANTERN

PARTICULARS	CFL	LED FILAMENT		
SYSTEM VOLTAGE	6V	6V		
WATTAGE	3W/5W	2W		
DIMMING FEATURE	NO	YES		
BRIGHT SPOTS	NO	NO		
LIFE	2000 hrs	20000 hrs.		
SPV MODULE SIZE	6V, 3Wp	6V, 3Wp		
LIGHT DISTRIBUTION	UNIFORM, 360 <sup>0</sup>	UNIFORM, 360 <sup>0</sup>		
OPERATING HOURS (h)	3h	Bright Mode	Medium Mode	Bed Lamp Mode
		6h	8h	Throughout Night
LUMENS (lm)	70 lm	Bright Mode	Medium Mode	Bed Lamp Mode
		125	60	2
ENVIRONMENTAL BENEFITS	HAZARDOUS MERCURY	MERCURY FREE		



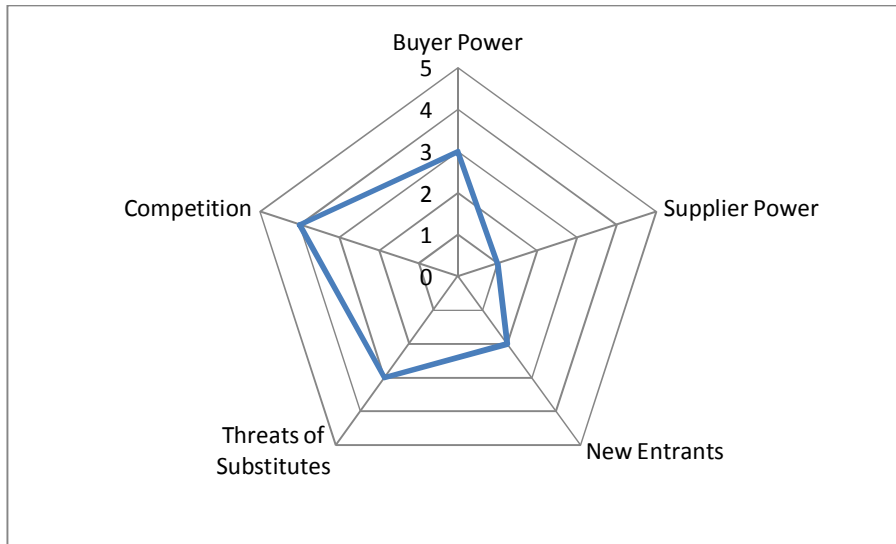
NEST is committed towards *Eliminating Light Poverty*<sup>TM</sup> in the World



## Part II

### Evaluation of the strategies employed and the results obtained

Let's quickly look at a brief analysis of the Solar Lantern Industry using Michael Porter's analysis chart



In the above chart, threat from each of the 5 forces has been ranked from 5 to 1 with 5 being the highest possible threat.

#### **Competition:**

NEST's biggest competition is kerosene lantern, and the threat from competition is high as shown above in the chart. The company will have to take steps to educate the buyers on the reasons why they should move away from kerosene to solar lanterns. It will have to effectively communicate the benefits of using a solar powered lantern, in terms of its cost as well as safety.

#### **Buyer power:**

Considering that the number of potential buyers is many in the case of solar lanterns, they have a strong bargaining power. Therefore, firstly NEST will have to establish a need for their solar lanterns, as buyers are currently happy using kerosene lanterns. And secondly, the company will have to offer a value proposition to the buyers to convert them to solar lanterns.

#### **Supplier power:**

Supplier power is not particularly strong as there are plenty of suppliers available, not only in India but the world over. So NEST has the option of choosing the supplier which offers the best deal.

#### **New entrants:**

Threat from new entrants is not very strong as market is too large and there is enough room for several players, considering the market potential.

### **Threat of substitutes:**

Threat of substitutes is reasonably high considering that there are several Chinese imports that also find their way into the market, and compete with “Aishwarya” on price.

### **Q1. What really made the venture a success?**

Answer: According to us, the following factors were responsible for the success of the venture:

- **The affordability of the product**
  - Barki was able to offer the product to the consumers at a very attractive price point. The cost cutting measures which he undertook (as highlighted in the case) are the reasons why he managed to successfully offer a value proposition to the consumer.
- **The value proposition – Micro credit scheme**
  - Barki not only managed to develop a product which was affordable, he also designed this EMI scheme (of paying only Rs. 100 per month) which made it a very attractive proposition to people in the rural areas. They did not have to worry about paying a lump sum upfront anymore.
- **The timing of the venture**
  - The timing of the venture was also very good. By the time Barki launched his venture, Government of India had decided to withdraw subsidies on the lanterns that they were selling to the consumers, thereby allowing private players like NEST to tap into this market which had great potential.
- **Barki’s experience and technical expertise**
  - Barki had nearly two decades of work experience by the time he started his venture. His understanding of the manufacturing and product development, technologies involved, nature of the industry, consumer’s psyche among other things really helped him to make this venture a successful one.
- **Large untapped market**
  - The market potential for solar lanterns was very vast, considering that potentially 100 million families who were using kerosene lanterns were prospects for this product. Therefore, there was enough room for several players in the market, and all that NEST needed was to take their product to the customer and communicate the value proposition effectively, which NEST managed pretty successfully.
- **Barki’s brand image and Global recognition**
  - Considering that he had written several research papers on renewable energy even before he started his venture, Barki was a known name in the global ‘renewable energy circles’. The awards that he won (including the Green Oscar), the international acclaim that he received, his association with several prominent bodies like WCPEC meant that he had a strong brand equity in his industry. The fact that he managed to use that brand equity and leverage that to his venture was another important factor that was instrumental in the success of the venture.

### **Q2. By what criteria was the venture successful?**

Answer: The venture was successful on the basis of the following criteria:

- **Profitability of the venture**
  - The venture was profitable from year 1 itself. Except for the slowdown that the business experienced, in the year 2008-09, the top and the bottom line continued to grow year on year.
- **Exports**
  - NEST was exporting its products to about 16 countries and they are in talks with customers in another 24 countries, a testimony to the success of the product and the venture.
- **Awards and recognition**
  - The awards and recognition that the venture received both nationally and internationally was good indication of its success.
- **Social impact of the venture**
  - NEST has managed to sell over 100,000 lanterns so far at the grass root level. This is in spite of the fact that the company has not undertaken any aggressive growth strategies. Most importantly, they are selling their quality products in the remotest of villages and through affordable and attractive schemes, which are greatly beneficial to the masses.

### **Q3. Where did it fall short?**

Answer: According to us, the venture fell short on the following counts:

- **Scalability**
  - While, the venture was successful, and there is still a tremendous potential for it to grow, it still did not reach the heights that Barki envisaged. NEST did not even come close to converting the targeted 100 million families who use kerosene lanterns.
- **Limited marketing**
  - NEST never adopted any innovative marketing strategies to market their products aggressively.
- **Investments for growth and expansion**
  - Barki did not explore the option of looking for funds from external sources to grow his business further.

### **Q4. What did you find particularly admirable or insightful about the entrepreneur's actions?**

Answer: What we found particularly admirable about the entrepreneur's actions was the manner in which he managed to marry his entrepreneurial ambitions with the intent of contributing to the society. He took up the challenge of actually taking his product to the remotest of locations in the country, although he did not have the infrastructure or the financial muscle needed for such an approach. He was purely driven by his vision 'to eliminating light poverty', and thereby diligently continued to reach out to the villages 'engulfed by darkness'.

### **Q.5 How could have the venture been improved upon?**

Answer: The venture can be improved upon, by working on the following areas:

- **Funding**
  - The venture could do with some external VC money. That will really help the venture to scale up and expand not just within India but even outside India.
- **Products for urban markets**
  - Barki could also look at developing products for urban markets which he can sell at a reasonable premium. This would help him to mitigate costs of distribution and operation in the rural markets. In essence, he could use this revenue to expand his operations in the rural markets.
- **Business-to-Business Sales**
  - NEST could even look at designing and developing products for industries and companies. That could be developed as an additional revenue stream.
- **Marketing & Customer Orientation**
  - NEST has to become more marketing and customer oriented in that they need to design a robust marketing strategy to effectively promote and market their product across the country. This may include road shows, events, village skits (on dangers of using kerosene as a fuel), etc as part of marketing implementation.
- **Barki –the Edison of India**
  - The company can capitalize on the brand equity of Barki and leverage that to promote the product. For someone who has won several accolades for his work in the renewable energy sector, a product from his stable will definitely find takers.

## Part III

### Our reflections on the story

#### Q1. What general principles or rules of thumb did the story of this venture reinforce in your mind, lead you to modify, or cause you to reject?

Answer: General principles or rules of thumb reinforced in our mind:

- **One does not need a lot of capital to start a venture**
  - The one theory that got reinforced from this story is that it is not necessary to have a lot of capital to start a venture. A good idea will find enough takers to make it into a successful venture.
- **Relevant work experience is often the premise to launch a venture**
  - As in the case of several successful entrepreneurs, Barki's ideation is a product of his extensive work experience in the field of Solar Technologies. In our course, we have also seen a similar example in *Dr V (Aravind Eye Hospitals)*.
- **Think big, but start small**
  - This is another general principle on entrepreneurship that was reinforced through this story. While Barki had a great vision of 'Eliminating light poverty', what was important was that he was willing to take the small steps necessary to get going at the initial stages of the venture, in order to realise his dream eventually.
- **It is important to be patient. Resolve pays off eventually**
  - The story of NEST proves that there will be challenging times during the course of the venture. But it is important to be patient as the resolve pays off in the long run. For example, Barki went through a slump during 2003, he was on the verge of giving up, but for his resolve. His vision kept him going and eventually, he succeeded in creating a robust enterprise.
- **It is never too late to start a venture**
  - Barki started his venture at the age of 43. At that age many people are planning their retirement. In fact even today, the hunger to achieve his vision is clearly visible. He is still as enthusiastic as any young entrepreneur, and raring to go.

General principles or rules of thumb that the story led us to modify or reject:

- **Entrepreneurs take very high and undue risks**
  - Barki did not put a lot at stake when he started his venture. He did not take any exorbitant amount of loan as seed capital. Moreover, he always had the option of going back to his job in case the venture did not succeed.
- **It is difficult to sustain or scale up a venture that is built around selling products only in the hinterland**
  - NEST as a company has been only selling its products in the villages and rural environment. However, they have not only attained sizeable revenues, but they have also managed to remain profitable throughout.
- **'Me against the world' mindset**
  - Some entrepreneurs easily get into this mindset of trying to gain all types of consumers by providing all kinds of services. Barki realized that it is important to stay focused on the vision he had, the specific customers he

wanted to cater to and the specific types of markets he wanted to sell his products in. This strategy paid off very well for him.

- **It is difficult to build a commercial venture with the intention of serving the society**
  - Barki proved that one can build a strong, profitable and commercial organization, which may still have a deep intent of serving the society.

**Q2. What did you learn from this story that will influence your career in the next five years?**

Answers: Our learnings from this venture are as follows:

- **A business opportunity can often stem from a great sense of passion towards a certain issue or a cause**
  - An emotional moment in life (the kerosene incident in case of Barki), can turn into this driving force for your vision. While planning a venture, an entrepreneur often focuses on sectors and industries that will give him high profitability and growth and not necessarily in areas which he is really passionate about or where he really wants to make a difference. One should seek for opportunities which are not only profitable but more so what one feels passionate about, as this passion will continue to drive the individual even in difficult times.
- **It is great to have a unique idea but it is equally important to have an understanding of the domain and a strong network**
  - While, many successful ventures are built around great and unique ideas, it is equally important to have a good understanding of the industry / domain in which one intends to operate. Barki had close to 20 years of experience before he started his venture. His experience, his understanding of solar energy coupled with his contacts and network were some of the key reasons that helped him succeed.
- **Intrapreneurship can be a good starting point to hone entrepreneurial instincts**
  - Barki, even while he was working with a huge organization like BHEL, managed to inculcate his entrepreneurial qualities through internal entrepreneurship. The lesson learnt is that even if a budding entrepreneur has to join a large organization for a while, he should focus on entrepreneurial opportunities available inside his organization.
- **Entrepreneurship, when combined with a social cause can be immensely satisfying**
  - When entrepreneurship is combined with a great social cause like in the case of Barki, it brings about a great sense of satisfaction. Barki believes that every lantern that NEST sells means another home saved from the hazards of kerosene, and that much more reduction in CO<sub>2</sub> emissions.