

# Lighting the Middle of Nowhere

**Professor Toby Cumberbatch**

When there is no sun and no moon and you are in the middle of nowhere, it is pitch black – you are effectively blind, you navigate by touch. The smallest imaginable amount of light connects you to your surroundings; marginally more enables you to be productive. We take light for granted in the industrialised world – we expect light to be available at the touch of a switch. For the extreme poor, especially for the women, the day begins with sunrise and ends at sunset.

It is almost impossible to comprehend that over 20% of the world's population, about 1500 million people, does not have access to a clean, affordable source of light. The extreme poor still use an oil lamp, – a small vessel containing local vegetable oil or animal fat into which a wick is inserted to provide a miserable, smelly light – a 70,000-year-old technology. Kerosene, not a significant improvement, is no longer obtainable. Its price is too high. Good light sources are expensive and thus inaccessible – only low cost products are available. Flimsy flashlights are pulsed on and off to maximise the useful life of the sub-standard batteries. Cheap solar-powered lanterns have disappeared – people have learned not to waste their money.



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This is the story of a project that started in 2006, as a challenge to a freshman engineering class at The Cooper Union in New York City to design a rechargeable lantern for the poorest of the poor. SocialLite set out to truly address the needs of those left out of the lighting equation, those who live in the middle of nowhere far from the end of the dirt road. Most often, well-established engineering from the industrialised world is adapted to satisfy their perceived demand – an approach that accounts for neither the real needs of the user nor the operating environment. These errors are compounded by distributing many of these solutions as “aid”, which rarely incorporates the issues of sustainability and is often devoid of the principles of socially, economically and environmentally responsible entrepreneurship. Ian Smillie, describing the outcome, says “too many failures in the ‘development business’ have been ignored or covered up, condemning poor people to suffer the re-invention of too many wheels that never worked in the first place” (Smillie, 2000).

The middle of nowhere is not a giant laboratory. To design a light source for this environment, you cannot just sit down in New York or London or Singapore. You must first understand the needs and aspirations of the community. Which types of light are useful and what are they used for? How much can one family afford to spend on light and do all family

members have equal access? Asking question after question brings you closer to an understanding of how to design and implement a product alien to those only familiar with combustible light sources.

To be successful, our light source has to work under the most arduous conditions, it has to be robust and simple to operate; it has to be technologically and financially sustainable; it has to incorporate locally sourced materials, be open to local manufacture, distribution and operation. It has to be easily repaired, can withstand being left in the rain, getting dirty and being partially eaten by goats. The solution has to exceed a gold standard for engineering excellence – it has to withstand being used by individuals unacquainted with the baseline technology we take for granted. And, the lantern has to be sufficiently attractive for people to use their meager income to pay for it.

We first had to understand the social meaning of light by working directly with remote, rural communities through a local champion who has empathy with, and is able to understand the nuances of the extreme poor. An individual who speaks their language and commands their respect; who believes that what you are doing is of real benefit. We searched “for approaches which are open to the unexpected, and able to see into, and out from, the predicament of the rural poor themselves” (Chambers, 1983). Who



Community Discussions – Cooper Union student in Nambeg, Upper West Ghana (2007)

bears the brunt of this grinding poverty? The women who form the human supply chains to collect and transport wood, food and water over distances of many kilometres; the same women who have made so little progress during the last 2000 years. As soon as they are able, young girls are conscripted into this supply chain, often missing school to carry the required resources – so propagating the cycle of intergenerational poverty.

How can light impact the lives of these women? They can pursue home businesses such as sewing, typing or manufacturing, increasing their income and extending their children’s schooling; children, especially girls, have extra time at the end of the day to complete their homework and so gain a better education. Robert B. Zoellick sums it up by stating that “(investing) in girls is smart. It is central to

boosting development, breaking the cycle of intergenerational poverty, and allowing girls, and then women – 50% of the world’s population – to lead better, fairer, and more productive lives. Girls who are more educated earn more income, have greater access to family health information and services, are more likely to delay early marriage and childbirth, and to have healthier babies” (Nike Foundation and World Bank, 2011).

Already acquainted with the community of Nambeg in Ghana’s Upper West region, we sought their help with evolution of the lighting system. In June 2007, we stood with them under a mango tree and watched, exalted and humbled, as everyone exuberantly voted to collaborate with us. With the delivery of three very rudimentary LED lanterns supported by an equally rudimentary shared charging

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station, comprised of a solar panel and a car battery, we took our first steps towards a solar-powered community lighting service. Users drop off their lanterns in the morning and pick them up charged in the afternoon.

So started the long journey of what it really means to light up the middle of nowhere – a much more difficult path than we ever envisaged. We asked the Nambeg community to use the lanterns, provide feedback and pass them on to their neighbours. We imagined control of the light intensity would be appreciated – the men liked twiddling the knob, the women said keep it simple – a high and a low setting. We took the women’s advice. Nambeg, a community of potters, built lantern housings from clay, more durable than our *sustainable* bamboo – a valuable lesson in materials usage.

We quickly learned that there is much more to light than a battery and a LED. Completely unexpected and unanticipated were the fistfights that arose when users were reluctant to release their lanterns to the next family – police intervention was required to force the transition. Our design approach had failed to appreciate the enormous social impact of light and the consequential change in social dynamics, and our mentors had missed this as well.

Sharing expensive items, such as imported photovoltaic panels and locally available car batteries, reduces the cost to an individual. For the housing, clay proved too heavy and molded plastic too fragile – once broken, it is irreparable. Containers that no one can afford when full provide a valuable resource when empty and are readily available in the larger markets. Undergraduate students in Ghana and Rwanda placed the battery and the circuit into a robust plastic hair relaxer container. With two bicycle spokes, they connected this to a translucent juice bottle to diffuse the light and used a third spoke for the handle.

Exploring ideas through which these communities can become more self-reliant led to the concept of a Lighting System in a Suitcase. A kit from which to build, install and operate a standalone lighting service that combines imported components – electronic circuits, tools for assembly, a solar panel and a charge controller – with a comprehensive set of instructions, in the form of pictograms and videos in local languages. Everything imported for an eighty-lantern kit fits into a cylinder of diameter and length approximately one third of a metre. To this are added the locally sourced lantern housing materials, a car battery and the 6V lantern batteries. The complete system



Left: Author with lantern user in Baayiri, Upper West Ghana (2013)



Right: New and Used Lanterns

is now ready for delivery to the community – on someone’s head, a bicycle or the back of a donkey – a functional supply chain that requires no infrastructure.

How does the financing work? Someone somewhere needs to purchase the components and the end-user has to pay the real price, with perhaps a subsidised rate of interest. Homer Atkins, in *The Ugly American*, said “whenever you give a man something for nothing the first person he comes to dislike is you” (Lederer and Burdick, 1958). Users pay an initial deposit of approximately US\$4 followed by a monthly charging fee of about US\$2 to clear the capital cost. Without the advantages of bulk purchase, the cost of an installed eighty lantern system is US\$30 per lantern – allowing compensation for those who assemble,

install and operate the system.

In the less-industrialised world, ventures such as Socialite traditionally start in the capital city, home to the NGOs and international agencies, diffusing outwards through a slow and expensive process with uncertain outcomes. Our intention is to reverse the flow – start in the middle of nowhere and propagate to the cities where intermittent electricity supplies create a large demand for rechargeable lanterns. With seven lighting systems in six communities in northern Ghana and Rwanda, we have sat transfixed listening to stories that perfectly illustrate *the social meaning of light*. Stories about finding lost goats, tending sick kids, avoiding snakes and extending the day for kids to read and do homework. We have learned that the acquisition of light is transformational

in ways which those of us with light cannot begin to imagine.

However, we believe that the technological and operational aspects of SocialLite have been proven – an engineering methodology and a *philosophy* for a robust lighting service created to address specifically the needs of the extreme rural poor. A self-sustaining system designed for manufacture close to the point of use, affordable at real cost, and easily operated and maintained. SocialLite systems have been built, installed and operated by people with no prior exposure to this type of technology. Community interaction, including a sense of ownership and shared responsibility, has increased through the delivery and collection of lanterns. Users have paid their monthly fees and the systems have operated for six months without external intervention.

We thought the lessons to be learned would be straightforward and comprehensible, but a successful philosophy is one thing and full cultural adoption another. After seven years, only a handful of the 500 or so lanterns installed are currently operative. We continue to encounter situations that are incomprehensible to us: academic administrators, originating from the very communities in which the lighting systems are installed, thwart delivery of the promised student technical support;

elsewhere, a broken charging station goes unreported for months in the same community that so enthusiastically embraced light a year earlier. Some lanterns await local repair with trivial faults but most are unused due to dysfunctional charging stations – inoperative because of a blown fuse or a loose wire. Our champions who guide and mentor us, are equally perplexed, yet they remain shoulders to cry upon when we sit bewildered at the unexpected outcomes of ideas jointly devised. For it was they who made initial contact with the community; they who worked through the details of system installation and operation with the chief; they who witnessed the same broad smiles when light arrived. We have learnt that making something work in remote, rural communities is very hard and that there is more to learn than we ever imagined.

Bringing light to the poorest of the poor is almost on the global radar. In passing H.R. 2548, the *Electrify Africa Act of 2014*, the US Congress acknowledged that women are disproportionately affected by a lack of access to electricity and that improved lighting options greatly contribute to better educational outcomes. International organisations,

*Images Clockwise from top: Residents of Baayiri (2014); SocialLite Lantern in Baazing (2010); Lantern Charging Station, Baayiri (2014) - all communities in Upper West Ghana*





Left: Prototype Lantern, Baazing, Ghana (2009)



Right: Community instruction, Muganza, Rwanda (2009)

local and state governments are now beginning to accept that access to a clean light source should be a human right in the 21st century. With this acceptance comes an acknowledgement that carefully considered subsidies are needed to provide affordable lighting systems.

In their search for a single object that would “embody the concerns and aspirations of humanity, speak of universal experience and at the same time be of practical, material importance to a great many of us in the world” (MacGregor, 2010), the British Museum selected the solar powered lamp as its 100th object to sum up the world in 2010. This represents two important concerns of the world going forward, namely the ability to generate clean energy from a renewable source and use this energy to provide light and communications. These resources are of benefit to all humankind by allowing

“humanity to share more equally in the opportunities of life... without damaging the planet” (MacGregor, 2010).

The social change that accompanies the acquisition of a good, clean light source is transformational – it enables the poorest of the poor to comprehend that they can be self-deterministic, that their children can be educated and that they have the means to break the intergenerational cycle of poverty. With light, there is less incentive to leave the rural areas, the breadbaskets of the world. The simple impact of light is perhaps best summarised by an old lady in Baayiri, Ghana, who told me that ever since acquiring her lantern she sleeps peacefully at night. When she goes to bed, she puts the lantern on the low setting. If she wakes up she can easily scan the surroundings and, knowing that all is well, go back to sleep.

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