



LITER OF LIGHT:

Lighting homes and lives one bottle at a time





Hundreds of millions of people live in informal settlements worldwide. Many of these dwellings lack windows or adequate lighting and people often resort to kerosene, candles or inventive wiring for light, risking health and safety in the process. While some people have access to electricity, many do not and simply go without. This is a common occurrence in urban informal settlements especially in the Philippines, where 20 million Filipinos – a quarter of the population – live below the poverty line. The Philippines has the highest electricity prices in Asia and suffers constant blackouts due to outdated power plants. The country is also vulnerable to extreme weather events resulting in loss of life and destruction of property and infrastructure. Typhoon Haiyan, which struck in November 2013, one of the strongest tropical cyclones ever recorded, destroyed 14 million houses and pushed millions of people into further poverty.

Filipino social entrepreneur Illac Diaz saw the need for clean, affordable alternatives when he visited rural areas of the Philippines hit by severe storms during his work as a telecommunications manager. He began to think about ways of providing cheap and durable replacement buildings in these storm-damaged areas. He left his job in 2005 to study alternative architecture and urban planning at the Massachusetts Institute of Technology (MIT). It was there that he first came across the bottle-light technology, which had originally been developed by a Brazilian mechanic, Alfredo Moser, in 2002. Diaz hit upon the idea of using the technology to light poor and storm-damaged homes after seeing videos of it being put to similar use in Haiti. He returned to his home country and in 2006 set up a non-profit social enterprise, MyShelter Foundation, offering sustainable building solutions for underprivileged communities and storm-damaged areas.



In 2011, MyShelter Foundation created the Liter of Light programme which aims to provide poor communities in the Philippines and around the world with a cheap source of lighting that can be produced and distributed locally. Recycled plastic bottles filled with water and a bit of bleach are fitted into the roof to provide lighting during the day and can be upgraded with an LED bulb, micro-solar panels and a battery to provide a low cost night lighting system. Liter of Light was conceived as an open-source, DIY programme that could easily be replicated by anyone around the world using readily available materials and basic carpentry/electronics skills. Rather than relying on large-scale, imported or patented technologies, the project sought to create a grassroots green lighting movement starting from the principle that anyone can and should become a solar engineer.

Liter of Light began with one carpenter and one solar bottle bulb installed in a house in San Pedro, Laguna, Philippines in April 2011. The use of social media, such as **Facebook**, for inquiries and communication about the project, **online video tutorials** and easy replication of the technology has enabled the Liter of Light concept to take off across the world. Within 20 months of its inception, Liter of Light had become a global movement benefiting more than 150,000 households in the Philippines, and 350,000 homes in 15 countries.

LIGHT IN A BOTTLE



The Liter of Light is both a day and night solution that provides passive daylight as well as solar nightlights such as lanterns, house lights, and streetlights.

The solar bottle bulb is a simple device consisting of a 1.5–2 litre plastic bottle filled with water plus a little bleach to inhibit algal growth and fitted into a hole in a roof to refract sunlight. The device functions like a deck prism: during daytime the water inside the bottle refracts sunlight, delivering about as much light as a 40–60 watt incandescent bulb to the inside of the house. One solar bottle bulb helps prevent carbon emissions of up to 200 kilos and can keep working for as long as five years.



WATCH VIDEO: 'How to build a solar bottle bulb'

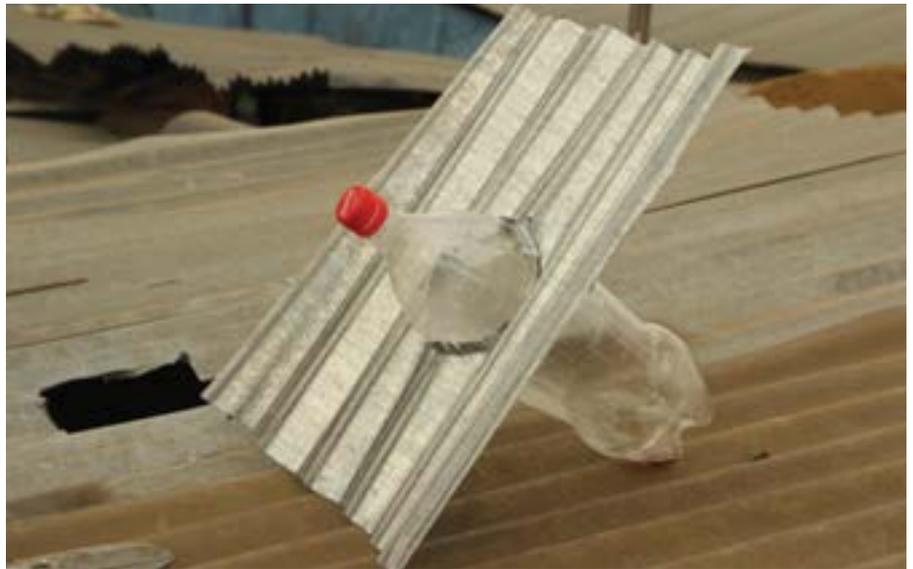
A further development was initiated in order to provide low cost lighting at night by upgrading the device with LED bulbs, solar panels and batteries. In 2012, Liter of Light started offering a package to upgrade to a 1-watt or 2-watt LED light with micro-solar panels and battery to Filipino households with the solar bottle bulbs already installed on their roofs. With a simple circuit panel, drill and soldering, the LED light is put together and inserted into the already installed bulb giving residents another 10 hours of light at night.



WATCH VIDEO: 'How to Build Solar Night Light part 1'



WATCH VIDEO: 'How to Build Solar Night Light part 2'



The premise of Liter of Light is to use materials that are plentiful and only require basic skills to create lighting that can be quickly put to use in the developing world. Instead of importing solar products, Liter of Light works with the local community to make everything locally and gives considerable training and access to green skills, innovation and livelihood to local groups in building the solar lamps, mobile chargers and street lights from scratch with available parts. The project works with women's cooperatives to make solar nightlights from a small number of parts, including both recycled components and a new high-tech chip guaranteed to make the light last 70,000 hours. It has also trained people with disabilities to build the solar lighting products. Involving disabled people, women's groups, and economically marginalised groups has allowed the Liter of Light to build a network of solar engineers with technical skills to solve energy poverty in their community. These groups are the main sources of feedback for Liter of Light for figuring out ways to make the lights more functional, practical and useable. They know what their communities need and because they understand how the technology works, they are empowered to offer innovative ideas for making the product better.

On the installation side, the volunteers who work with Liter of Light are community-based groups or young people that identify priority neighbourhoods or communities for installation; survey the area to assess the feasibility of installation; and monitor the use of solar night lights and street lamps after installation. By involving local groups in the installation process, they maintain ownership over the way that the Liter of Light can benefit their community and that the project's expansion continues to be community-driven.



Replication is done by equipping local partners or grassroots entrepreneurs with basic tools to build and install solar bottle bulbs and teaching them to build solar nightlight upgrades by purchasing kits from MyShelter Foundation or by sourcing other parts locally. Step-by-step guides on materials and installation are available online through **video tutorials** and social media in order to facilitate the use and replication of the technology.

Liter of Light has moved beyond the original solar bottle bulbs and has launched programmes that include solar-powered street lights that brighten public spaces not only in cities but also in off-grid areas. Its expansion is less about the technology and more about training people who can further facilitate and train even more people on how to build and assemble these lights.

Liter of Light is working in partnership with global and local private enterprises to run the programme. Current supplier partners include Pepsi, Sika and Philips among others and their support enables the project to keep product costs low. Pepsi has been supporting the Liter of Light programme in the Philippines since 2011 and is helping its transfer to other countries. Pepsi also contributed in other ways e.g. by providing bottles, staff and grants as part of their corporate social responsibility (CSR). Sika is an essential partner for research and development and provides Liter of Light with glue for the solar bottle on a global scale. Philips has been instrumental in innovating the nightlight solution for the Liter of Light by creating a customised solar LED card that works in synergy with other components such as batteries, solar panels and wiring. Most of the Liter of Light funding comes from private sector CSR initiatives and private donations.



WATCH VIDEO: 'Solving Energy Poverty, a liter at a time – Illac Diaz'

SUCCESS FACTORS:



- ✓ Having a simple but effective idea with a clear and tangible impact;
- ✓ Low cost and open source technology which enables the solution to be easily replicated and transferred to other areas;
- ✓ Applicability of the solution to contexts where energy access is an issue;
- ✓ Strong social media campaign and branding which attracted a number of young volunteers;
- ✓ Pairing up the project with corporate social responsibility initiatives that garnered support from the private sector;
- ✓ Low environmental impact as the use of recycled materials and LED bulbs contribute to reduction of local and global carbon emissions;
- ✓ Importantly, the project is not only about the technology, but how it works with communities in empowering them to produce the lighting systems and helping them be responsible for their own income and development.



Since 2011, Liter of Light has completed more than 150,000 installations in 100 cities in the Philippines. The project aims to install 1 million bottle lamps across the country by 2017. Liter of Light is improving the quality of life of thousands of impoverished families in the Philippines who live in the cramped conditions of slums where most homes are windowless making the interiors dark as night. With the solar bottle bulbs, residents do their chores and activities efficiently inside a brighter home. Residents are also able to save an average of \$10 in electricity bills a month by installing the daylight solar bottle bulb alone. Considering that one in four Filipinos live on US\$1 a day, this significant saving allows them to have more disposable income to pay for essentials such as education, nutrition and other basic needs.



WATCH VIDEO: 'Liter of Light @ night'

The simple lighting technology creates local jobs, teaches green skills and empowers local communities. Even with no knowledge of electronics, residents can assemble the lights after just one hour of training. MyShelter Foundation offers technical training to the recipients of the bottle lamps in cooperation with the Philippines' national training centre (TESDA), local government units, non-governmental organisations and a growing network of volunteers. Designated residents in the community are trained in the repair and maintenance of the lights and are in charge of helping other families repair theirs in case there are any issues. By making the assembly and installation of solar lighting affordable with solar bottle bulbs and easily built micro-solar lights, this has allowed a wide range of people to get involved including women's cooperatives, people with disabilities, community organisers and young volunteers to take part in reducing the country's energy poverty.



 **WATCH VIDEO: 'Liter of Light in Tacloban after Typhoon Haiyan'**

Liter of Light also illuminates homes and villages in remote disaster areas that were completely devastated during Typhoon Haiyan, the deadliest hurricane ever recorded in the country's history. In the aftermath of the typhoon, Liter of Light worked with the United Nations Development Program (UNDP), Pepsi and All Hands volunteers in installing solar lights in temporary shelters, rebuilt houses and streets in the affected areas of Leyte, Cebu and Iloilo. This provides the affected families with up to ten hours of light at night which has a big impact on their safety and in quickly rebuilding their lives. The project empowers residents of the affected areas with the necessary skills to adapt to dire circumstances, thereby minimising their dependence on humanitarian aid.

AROUND THE WORLD



With an open source technology for solar lighting, Liter of Light has inspired viral replication around the world rapidly expanding to over 15 countries within the first 20 months of its inception. It has also worked with the UN High Commission on Refugees (UNHCR) in Ethiopia to test and build community streetlights and tent lights for a camp of more than 200,000 families. As of May 2016, there are more than 21 branches of the project worldwide.



Fig. 1 A map of Liter of Light initiatives around the world. Countries shaded in blue are where there are 'chapters' or local Liter of Light programmes.



Each country 'chapter' (i.e. Liter of Light initiative or programme led by a local organisation) is self-sufficient to build and install solar bottle lights. They work with local communities in the assembly and installation of lights and use local materials for repairs and maintenance. Each chapter has also developed its operations and programming at a local level, but shares technical knowledge, conducts troubleshooting and crowd-sources innovations to the technology through regular coordination calls and emails with other Liter of Light initiatives around the world. Prototypes and models are constantly being innovated, for example, to provide wireless internet connection as well as lighting as in the case of the Liter of Light programme in Colombia.

In decentralising the technology and the means of implementing it around the world, Liter of Light was able to exponentially grow its operations and impact. In fact, the Liter of Light Switzerland, which was the first to be established in Europe, was initiated to support other Liter of Light projects in developing countries with fundraising, developing strategies and plans and national expansions. The concept of Liter of Light Switzerland focuses on cooperating with existing local solar bottle projects or supporting the initiative in new countries. It also aims to facilitate the set-up of a global network to build a basis for international cooperation in order to increase awareness of the Liter of Light movement, simplify fundraising and improve cost-efficient sourcing of materials.



A spotlight on Un Litro de Luz Colombia (Liter of Light Colombia)

In Colombia, access to electricity is not stable as about 10% of the country's population (approximately 5 million people) still do not have access to electricity. Colombians living in the rural areas suffer the most in terms of access to energy and other services. In order to address this issue, social entrepreneur Camilo Herrera (with the help of MyShelter Foundation) initiated Un Litro de Luz Colombia in June 2011, the first Liter of Light programme implemented in Latin America. To start with, he installed a solar bottle bulb in one house in Duitama town in the Boyaca district, approximately 200 kilometres from the capital, Bogota. Later, in collaboration with Liter of Light Switzerland a pilot was launched in Bogota in February 2012 installing solar bottle bulbs in the areas of Divino Niño and La Colina of Ciudad Bolíva. That same year, the project installed solar bottle bulbs for 800 families in the city of Cali. Working together with the community, the government and thousands of volunteers mostly from the private sector, Un Litro de Luz Colombia has now lit up more than 4,000 homes in 14 cities in the country.



WATCH VIDEO: 'The work of Un Litro de Luz Colombia (Cali)'



Un Litro de Luz Colombia has mainly been installing the daylighting solution to vulnerable households in the country. It also focuses on installing solar streetlights in off-grid areas and neighbourhoods that lack public lighting. In 2014 they developed their own streetlighting technology using a 3-watt LED lamp connected to a controller and a battery pack, which is powered by a small solar panel and encased in an old plastic soda bottle. With higher capacity batteries, powerful panel and LED bulbs, it is an improvement from the solar lighting technology that was initiated in the Philippines. Each streetlight costs \$300 and can illuminate a space of up to 60 metre radius, has a guaranteed lifespan of 70,000 hours which equates to about 16 years and can shine for three consecutive nights without recharging.

The streetlighting solution has provided communities with lighting at night increasing visibility of the walkways and public spaces. By installing streetlights across a wider area, this has helped in reducing fear among residents, particularly among girls and women, for their personal security and safety and in preventing crime in the neighbourhoods. The streetlights also helped the residents to be able to use and socialise at public spaces in the evenings which could have an impact on community cohesion and development. More than 750 streetlights have been installed in Colombia's off-grid, conflict-torn areas and Farc rebel group zones.



In 2016 Un Litro de Luz Colombia went a step further with the innovation of their street lighting system by making it 'intelligent' – allowing the possibility of installing a Wi-Fi antenna which provides internet service for the community. By integrating a Wi-Fi modem and router to the bottle, the street light poles can be used as Wi-Fi stations for people to connect to the internet. The installation does not cost the community anything as this is funded by private enterprises. Residents pay less than \$0.10 per hour to use the internet which they can pay through prepaid services from stores such as Chance lottery shops and internet cafés. The intelligent streetlights are currently installed in a school in La Guajira district providing free internet to indigenous Wayuu children, and in Ciudad Boliva, one of the poorest neighbourhoods in Bogota. Each 'intelligent' streetlight costs \$500 and can connect 300 users at the same time in a range of one kilometre. With this innovation, Un Litro de Luz Colombia aims to deliver public services through free lighting and low-cost internet service to rural areas in the country.

Un Litro de Luz Colombia has already exported its solutions to the Liter of Light programmes in the Philippines, USA and Pakistan. It also works closely with MyShelter Foundation and is funded by Pepsi, and other private companies through sponsorship and CSR initiatives in alliance with the government and PepsiCo's local bottler.

THE BASICS OF STARTING A LITER OF LIGHT PROJECT



IF THE LITER OF LIGHT HAS SPARKED YOUR DESIRE TO MAKE A DIFFERENCE...

PLANNING



Contact Liter of Light through **Facebook** and explain your idea of what you would like to do to spread the Liter of Light.



PEOPLE

Some things to consider: mobilising a group of motivated volunteers; who your target beneficiaries /group(s) are.



MATERIALS

Assessment of availability of materials in the local area: can solar panels be found locally, where will the bottles come from, LED bulbs and other materials, etc...



FUNDING

Identification of funding streams for your project together with Liter of Light either via fundraising, grant seeking or corporate sponsorship.