

ACCESS TO CLEAN DOMESTIC ENERGY IN AFRICA

Lessons from Solaraid

From the African Community of Practice on Management for Development Results at the African Capacity Building Foundation



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SYNOPSIS

Economic development and access to energy go hand in hand. Improving electricity supply and distribution boosts economic growth, creates jobs, and expands the reach of educational and health services. It can also empower women, providing income-generating opportunities and enabling them to spend their time and money more productively. This case study shares insights from the solar light initiative in Africa of SolarAid and SunnyMoney. It features an innovative approach to address climate change, poverty, and business-development issues while providing a decent life to more than 60 million rural Africans in five countries – Kenya, Malawi, Tanzania, Uganda, and Zambia.

Key findings: Solar energy has the capacity to empower rural communities with off-grid lights. It can bring opportunities for local entrepreneurs, improve health, well-being, and safety; boost the economy; raise education and knowledge attainment; improve equity for women and children; and enhance the livelihoods of many people.

Key lessons: More policies and capacity building are needed to develop solar energy and the best way to ensure universal access is through a unique mix of business and innovation. It is, thus, important to promote and support innovative efforts to supply energy to the populations.

Key recommendations: African governments should encourage the uptake of solar lights and their components by removing taxes and duties on imported technologies and by reducing the number of licenses required for solar-light manufacturers and distributors. Capacity Building and institutions in research and development should be strengthened, and governments should invest in special innovation funds.

Introduction

The importance of good access to clean energy in Africa and globally cannot be overemphasized. In Sub-Saharan Africa, more than 700 million people rely on traditional biomass cooking fuels—wood, charcoal, dung, and agricultural residues. With population growth, that number is expected to rise to 880 million by 2020 (IEA 2014). Dependence on these fuels has many adverse impacts on people's health and on the environment. It holds back development, and collecting and cooking with these

fuels is arduous and time consuming (IEA 2014; Akbar et al. 2011; Cordes 2011). Cleaner, safer alternatives are available, and momentum is growing among African governments, development partners, and the broader international community to scale up their use.

In its flagship report, 'Better Growth, Better Climate' (2014), the Global Commission on the Economy and Climate highlights the potential for low-carbon technologies, including clean cookstoves, to help advance energy policy objectives—energy security,

universal access, affordability, reduced import dependency—and broader economic and social development goals, such as reduced poverty and improved public health. The report also underlines that appropriate technologies and potential benefits vary by local conditions, from the energy supply options available to the strength of institutions.

Other research (such as UNDP 2014; 2015; UNEP 2014; and World Bank 2015) shows that good access to energy and economic development go hand in hand. Improved electricity supply and distribution boosts economic growth, creates jobs, and expands the reach of educational and health services. It can also empower women, providing income-generating opportunities and enabling them to spend their time and finances more productively.

More than 589 million people in Sub-Saharan Africa in 2012 lived without access to electricity. Only 35 percent of the population have access, compared with 96 and 78 percent in East Asia and the Pacific and South Asia, respectively (World Bank 2015). For most Africans, electric power is inaccessible, unaffordable, or unreliable. The lack of quality energy services and access to modern sources of fuel such as natural gas, liquefied petroleum gas, diesel, and biofuels traps many families in the region in extreme poverty (World Bank 2015).

Lack of access to modern energy in Sub-Saharan Africa touches all sections of society—health clinics cannot refrigerate vaccines, students find it difficult to read after dark, and businesses have shorter operating hours (World Bank 2015). The same challenges are experienced by Africans with modern energy, as they face high-priced unreliable and unpredictable supplies.

The region's energy sector meets neither the needs nor the aspirations of its citizens (World Bank 2015), and Africa's development challenges will become even more daunting as population growth outpaces electrification. On current trends, electrification will grow from 35 to 51 percent, but the absolute number of people without electricity will also grow, from its 2012 level of 589 million to more than 645

million by 2030. Action is therefore needed to accelerate electrification beyond the business-as-usual pace (World Bank 2015).

The comforting news is that reports such as World Bank (2015) show that Africa is well endowed with energy resources. Ensuring that they are available at the exact time, place, and form in which they are needed remains a major challenge, and will be for years to come. Helping countries chart low-carbon growth paths will reduce future dependence on fossil fuels. Most recent research reports, such as World Bank (2015), strongly advise that off-grid renewable technologies, such as small hydro, solar, or sustainable biomass, represent the least-cost power supply for site-specific needs. New technology, ranging from low-cost electrification techniques to improved cookstoves and solar photovoltaic technologies, can provide solutions for clean and efficient delivery of traditional and modern fuels.

This case study draws heavily on these recommendations. It aims to showcase the approach and impacts of initiatives by SolarAid—a United Kingdom-based international charity combating poverty and addressing climate change, set up in 2006—and by SunnyMoney—a social enterprise owned by SolarAid and also launched in 2006—in Kenya, Malawi, Tanzania, Uganda, and Zambia. The case study also seeks to present to other African countries' policy makers and development partners a glimpse into the importance and possible returns on solar energy to Africans' lives, especially in rural communities. The case study is largely based on SolarAid's periodical progress and performance reports, especially its annual reports.

Edging Africa to cleaner fuel use

Sub-Saharan Africa is vastly rich in energy resources but very poor in energy supply. Making reliable and affordable energy widely available is critical to developing a region that accounts for 13 percent of the world's population but still only 4 percent of its energy demand, even if since 2000 it has seen rapid economic growth and energy use has risen by 45

percent. Many governments are now reinvigorating their efforts to tackle the numerous regulatory and political barriers holding back investment in domestic energy supply. (IEA 2014).

The majority of households in Sub-Saharan Africa—some 700 million people—rely on traditional biomass for cooking, and more worrying, while in other regions biomass use is decreasing, in Africa it continues to rise (WHO 2014; World Bank 2015). If current trends continue, almost 900 million people in Sub-Saharan Africa are expected to be cooking with traditional biomass in 2020.¹ Efforts to bring modern energy access to all—electricity and clean fuels—are outpaced by population growth.

There is a growing body of experience on how best to achieve a shift to cleaner and safer cooking fuels and stoves. Although numerous cookstove interventions across the region are beginning to reach scale, there is an urgent need to ramp up these initiatives, tailoring them to each country's conditions. Not only would such a shift generate huge improvements in health, it would also create many business opportunities and jobs. But most cookstove markets in Sub-Saharan Africa are still quite far from that goal. This means that transforming markets is likely to require several intermediate steps, starting with stoves that burn the fuels currently used by households—such as wood and charcoal—but more cleanly and efficiently. Given how rapidly the region is urbanizing, and how widely charcoal is used in urban households, it is also crucial to regulate charcoal production and ensure it is as sustainable as possible. While these measures cannot solve all the problems associated with traditional biomass use, they can nudge markets in a more beneficial direction.

Harmful impacts

Traditional biomass use has multiple negative impacts, most notably on health: 600,000 lives are

lost each year in the region due to exposure to biomass smoke (WHO 2010; 2012). The economic costs of high reliance on biomass for cooking are also substantial, at about \$36.9 billion per year, or 2.8 percent of GDP, including \$29.6 billion from productive time lost in gathering fuel and in cooking (World Bank 2015). The impacts are particularly severe for women and girls, who are typically responsible for these chores.

These impacts stem from the fact that the only choice for lighting for the roughly 600 million people in Africa without electricity is to rely on toxic kerosene, paraffin, or candles. The billions of dollars spent on extending electricity grids don't make any difference to 91 percent of Africa's rural population (SolarAid 2016). Household air pollution causes lung cancer, chronic lung disease, and cataracts. Excessive smoke exposure is the leading risk factor for these diseases—and blindness from cataracts—among nonsmoking women in developing countries. More than 50 percent of premature deaths due to pneumonia among children under 5 are caused by the particulate matter (soot) inhaled from household air pollution; 3.8 million premature deaths annually from noncommunicable diseases including stroke, ischemic heart disease, chronic obstructive pulmonary disease (COPD), and lung cancer are attributed to exposure to household air pollution (WHO 2016). The United Nations Children's Fund's recent predictions for 2030 show indoor air pollution will cause more premature deaths than HIV and malaria combined. Without a sweeping change in policy, the number of people relying on solid fuels will remain largely unchanged by 2030 (World Bank 2010). The use of polluting fuels also deposits a heavy burden on sustainable development.

Inhaling smoke and black carbon is detrimental to human health (Rode et al. 2011), and when people cook on rudimentary cookstoves and open fires, they are often inhaling carbon monoxide and other pollutants at levels up to 100 times higher than the

¹ <http://2015.newclimateeconomy.report/wp-content/uploads/2015/10/NCE-SEI-2015-Transforming-household-energy-sub-Saharan-Africa.pdf>.

recommended limits set by the World Health Organization. Traditional cooking methods also increase the risk of house fires: South Africa alone has an estimated 45,000 house fires and 3,000 deaths annually due to paraffin use as a fuel source. Table 1 summarizes the problems of kerosene and the way, according to SolarAid, solar power addresses them.

Table 1. Kerosene problems and solar solutions

<i>Kerosene—problems</i>	<i>Solar solutions—free sunshine</i>
Costly—About 15% of a family's income is spent on lighting, whether kerosene, candles, or batteries for flashlights.	Saves: money—Families save \$70 a year, on average, after they buy a solar light, or around 10% of household income. The money saved can be spent on food, schooling, business development, or farming inputs.
Toxic—Using a kerosene lamp for a year is estimated to be similar to inhaling the black carbon from smoking 298 cigarettes. One lamp is estimated to emit a tonne of carbon over five years.	Improves: health—Solar lighting reduces the risk of fire, lung damage, and eye strain and eliminates poisonous kerosene from the home.
Dim—Candles, kerosene, and paraffin don't emit enough light to study, read, or work without straining the eyes.	More study time—SolarAid research shows that students study an hour more per night on average, and are more motivated to study without eye strain or smoke.
Prevents study—The smoke, smell, cost, and dangers of fire make kerosene a problem for students who need to study at night.	Cleaner air—Cutting the use of kerosene lamps reduces pollution in the home and saves up to an estimated 200kg of carbon dioxide a year.

Source: SolarAid 2016.

SolarAid's aims, solutions, and model

SolarAid provides access to solar lights in some of the most remote regions of Africa, including the five countries, and is building a movement to eradicate the kerosene lamp from Africa by 2020. SunnyMoney is an innovative charitable model based on trade not aid. SolarAid is also a founding partner of "Power for All"—a global education and advocacy campaign outlining a path to universal energy access. Power for All believes that consumer choice and private enterprise can deliver universal energy access in half the time and a fraction of the cost of current predictions (SolarAid 2016).

SolarAid provides a unique solution—solar lamps that are safe, clean, and affordable. They give off hours of light in the evening so families can earn, learn, and feel safe after dark. They are not the answer to all life's energy problems, but they are available right now, and will ensure that the very poor can begin to develop and prosper without having to wait for a grid system that may never come or take too long to come to their communities.

Selling, rather than giving away, lights

SolarAid is pioneering a sustainable model via SunnyMoney, which sells lights via school networks and local enterprises. This approach allows money to be reinvested back into its work, encourages job creation, and ensures that money stays in the local economy. With increasing demand for solar power, other players begin to enter the market, creating more access than ever. And so SolarAid is establishing a market that will reach far beyond the lights that SunnyMoney sells: a market that will "eventually light up an entire continent and leave a lasting energy legacy" (SolarAid 2016).

A charity instead of a business approach

SolarAid believes that universal access to renewable energy is the best way to alleviate poverty, and that the best way to ensure universal access is through a unique mix of business and innovation (SolarAid 2016), for which it set up SunnyMoney, the leading seller of solar lights in Africa. SolarAid's volunteers

travel to remote rural communities, educate people in the benefits of solar power, instill trust, and build demand. They help inculcate trust and create demand in a new and unfamiliar technology—which helps build the foundations for a sustainable solar market and a lasting energy legacy. All this costs time and money, but helps in getting lights to the people who need them most; and if they cannot afford them, the initiative thinks of new ways to help them get on the energy ladder, such as “pay as you go solar.” This approach has helped people to gain access to safer light, but it costs the charity: On March 5, 2016, it reported a loss of around £3 (roughly \$4) on each solar light sold—one reason so few private companies are involved (SolarAid 2016).

Community distribution, local support, and marketing

SunnyMoney’s unique community distribution model uses teachers to raise trust and build awareness of solar energy. Each light shining in the night attracts neighbors, and as word spreads the demand for solar lights grows (figure 1).

Through this approach, SunnyMoney sparks the market conditions required for local shops and independent agents to sell a range of solar lights profitably within their community so that solar lights become available for people to buy year-round. SunnyMoney supports these local entrepreneurs by providing marketing campaigns, training, and products.

SunnyMoney continues to find ways to drive demand by creating brand awareness, community engagement, and media attention. It runs promotions and finds ways to market new products cost effectively to make solar technology more affordable and meet customers’ increasing demand for bigger and better products—so the market continues to thrive (SolarAid 2014; 2015).



Figure 1. The SunnyMoney model

Source: SolarAid 2016.

The impact of the solar light initiative by SolarAid/SunnyMoney

According to SolarAid’s 2015 Impact Report, the charity had achieved several milestones. First, it reached 10 million people with solar light. Second, through its market-building approach, solar markets in Tanzania and Kenya took off. In 2009, the charity sold just 5,000 solar lights in Tanzania; by 2015, it sold nearly a million (see just below). For each of these lights, another four were sold by other enterprises. This cost-effective, rapid, and extensive impact gives the charity more confidence than ever that it has seen the beginning of the end of the kerosene lamp. Third, it established SolarAid as a world-class resource for research and policy, providing advice to governments, companies, international institutions, and nongovernmental organizations alike.

In short, during 2015, SolarAid and SunnyMoney sold over 1.7 million solar lights, which meant that:

- 10 million people had better access to clean, safe light (9 million of them living below the poverty line).
- \$345 million was saved by 1.5 million households.
- Children had 2 billion extra study hours.
- 5.8 million people experienced improved health.
- 880,000 tonnes of carbon dioxide was eliminated.

SolarAid was also recognized for its work, becoming a finalist in the Zayed Future Energy Prize; it was highly commended in the Unilever Global Development Award; and it received a platinum rating from GIIRS.

Country impacts in 2015

The SolarAid 2015 annual report cites the following main county achievements during 2015:

Kenya

- 494,802 solar lights sold.
- 3 million people with better access to clean, safe solar light.
- \$160 million saved for the households reached.

Malawi

- 142,917 solar lights sold.
- 720,000 people with better access to clean, safe light.
- 115,000 households reached.

Tanzania

- 904,528 solar lights sold.
- 1 million people with better access to clean, safe light.
- 50,000 tonnes of carbon dioxide emissions averted.
- 375,000 people experiencing better health.

Uganda

- 42,894 solar lights sold.
- 320,000 people with better access to clean, safe light.
- 50,000 tonnes of carbon dioxide emissions averted.

Zambia

- 168,011 solar lights sold.
- 1 million people with better access to clean, safe light.
- 375,000 people experiencing better health.
- 320,000 people with better access to clean, safe light.

Sectoral impacts

By sector and Sustainable Development Goal (SDG) of the United Nations, the following impacts are seen.

Economic [SDG 1, 2, 4, and 8]

SunnyMoney now supports over 600 solar agents across East Africa whose income has risen by 30 percent on average.

Education [SDG 1, 2, 3, 4, and 8]

Head teachers at the schools that SunnyMoney works with report improvements in pupils' performance, attendance, and motivation. In addition, 28 percent of solar light customers interviewed use savings (from no longer needing to buy kerosene) on school fees and education. In rural areas of Kenya, 75 percent of head teachers reported that recruiting and retaining teachers was a problem—but 60 percent said better lighting would encourage teachers to work in remote regions. Over a third of teachers said that they used a solar light for marking, lesson planning, and extra classes (SolarAid 2014; 2015).

Health [SDG 1, 2, 3, 4, and 8]

According to SolarAid's Impact research reports (2014; 2015), 60 percent of customers who used kerosene lamps before a switch to solar associated an improvement in their health with reduced use of kerosene, including a reduction in coughing, flu-like symptoms, eye irritation, and respiratory illness.

Well-being and safety [SDG 1, 2, 3, and 4]

The SolarAid impact survey reports (2014; 2015) show that, with safer and brighter homes, children are studying better at school and, with more income available, many families say that solar lights have brought a better quality of life. Solar lights reduce the risk of fire and accidents and improve safety and security.

Environment and climate [SDGS 1, 2, and 13]

Enabling families to access solar technologies, training communities on solar energy, and establishing distribution networks also builds low-carbon development pathways. Reducing kerosene use will help minimize government expenditure on expensive kerosene subsidies.

Equality, Women, and Children [SDG 5 and 10]

The SolarAid impact reports indicate that solar lights may have significant impacts on inequality and gender. A SolarAid study in Kenya found that half of head teachers interviewed felt that school attendance of girls with access to solar lights was better, and that girls' motivation and performance had improved. Anecdotal evidence also shows that solar lights can improve the safety of women and children outside the home at night and that this factor can help improve they can be important in conditions for childbirth. A Lighting Global pilot in Nigeria confirmed that solar lights and phone charging helped midwives care for their patients.

Others impacts and global appreciation

- The SunnyMoney approach has been cited as best practice by the United Nations Environment Programme,² United Nations Development Programme, and United Nations Children's Fund.
- Since 2012, the Research and Impact team at SolarAid has undertaken more than 30,000 research interactions—surveys, observations, and interviews—developing the world's most comprehensive data on the impact of rural energy access and gaining international recognition. Taking into account the engagement of solar-light users, school head teachers, solar agents, the public, and traders across rural Africa,

the data have helped establish a picture of solar light impact on income, education, health, and the environment, which is crucial for informing poverty reduction strategies and government policy as well as providing the foundations for sector knowledge. The SolarAid research is communicated to leading institutions around the world and provides insights for organizations such as the World Bank, United Kingdom Department of International Development (DFID), and Global Off-Grid Lighting Association

- GOGLA (SolarAid 2015).
- Through its Research & Impact Unit, SolarAid has played an integral role in developing the GOGLA harmonized reporting framework for the off-grid energy sector. As chair of the GOGLA Social Impact Working Group, advisors from the World Bank and GIZ aim to create a priority set of metrics to calculate sector data in a consistent way, enable the industrywide aggregation of results, and equip stakeholders to communicate impact. This is critical for understanding and communicating social outcomes, attracting investment, and evaluating regulatory support. A pilot of the GOGLA Framework was launched in June 2015. The working groups have started developing a reporting protocol and have refined research activities and processes (SolarAid 2015).
- SolarAid is undertaking research with leading academics at the University of California, Berkeley to determine the contribution of kerosene lamps to indoor air pollution and health outcomes.

² <http://www.unep.org/south-south-cooperation/solutions/casefiles.aspx?csno=136&ni=solution> (accessed March 2016).

Cumulative impact

The cumulative impact of SolarAid is summarized in table 2.




Table 2. SolarAid impact by end-2015



<i>SolarAid impact</i>	
More than 10 million solar lights sold	More than 60 million people benefiting from clean safe lights
35.5 million people experiencing better health	More than 2 billion dollars saved
5.3 million tonnes of carbon dioxide averted	12.5 billion extra study hours

Note: Figures are estimates, based on SolarAid research on solar light users in its current countries of operation.

SolarAid lights come in various forms (table 3).

Table 3. SolarAid Lights—selected few

	The S2 has an integrated solar panel and uses highly efficient light-emitting diodes. It provides a focused light that can be oriented in any direction, making it ideal for studying or working
	The D20 is an ideal home and small business solar solution that can easily be upgraded from its standard two hanging lamps to four
	The Sun King Pro 2 is ideal for day and night phone charging. It is fitted with convenient dual USB ports, and can charge a phone while powering an additional appliance such as a small radio or second phone. Besides its multi-use stand, the Sun King Pro

	2 has charging-power and battery-status displays
	The Sun King Pico is ideal for studying and working, and is available in all five countries. It has a two-year warranty, offers 25 lumens, three brightness settings, an integrated solar panel, an adjustable/removable stand, and up to 72 hours after one day's charge.
	SolarAid—range of study and work lights.

Source: SolarAid 2016.

Future plans

The charity's future plans include entering new countries and regions, building sustainable social enterprises, developing cooperation partnerships, creating new business models to fit changing business dynamics, and proceeding with new funding mechanisms to drive growth (SolarAid 2015).

Challenges to SunnyMoney and the solar industry

- **Funding:** The SunnyMoney model is working, and is ensuring that millions of people can access clean light for the first time. However, it requires donations and grants to sustain its efforts.
- **Quality:** Poor consumers mulling a \$100 investment need to be sure that their purchase will be robust. The International Finance Corporation (the World Bank's private-sector investment arm) and other aid bodies are running a program to verify manufacturers' claims.

- **Inapplicability:** Most electronics goods are not made to work well on low-voltage direct current produced by renewable energy sources and batteries, and makers of mass-market appliances that use mains power have been slow to re-jig their products to run on it.
- **Inadequate working capital:** It takes five months from paying the manufacturer to getting paid by the customer. Some companies are coming up with ingenious hire-purchase schemes for bigger systems to spread the cost. Others offer “solar as a service,” where the customer pays monthly for the power, with maintenance thrown in.
- **Counterfeit lights:** New market entrants have put their operations under pressure and, in Tanzania especially, low-quality counterfeit lights are damaging consumer confidence. Despite that, SolarAid is determined to adjust its model while maintaining its affordable, quality products backed up by solid customer service.

Conclusions

SolarAid and SunnyMoney are leading the way in eradicating kerosene lamps from Africa by 2020. Aiming to sell more than 10 million solar lights in 14 countries to benefit more than 60 million people, SolarAid is having a real impact on African communities. Some experts see solar energy as a second-best solution—arguing that it can improve lives but not power an economy—yet this case study demonstrates that access to energy and economic development go hand in hand. The findings show that tough choices need to be made by African governments especially in policies for energy climate change. The governments and their development partners are therefore urged to work together to promote and support innovative efforts to supply energy to their populations.

Policy recommendations

The following recommendations are made based on the findings in this case study:

- 1) Solar energy and light is of significant value to African states, and is the single cleanest and most easily available energy source for most households. There is an urgent need for governments in the region to support social entrepreneurship in solar energy and light to improve lives, especially in rural areas.
- 2) African leaders should show greater leadership in mobilizing domestic resources to finance access to clean energy, prioritizing light to rural communities. They should also craft short- and long-term strategies to implement the globally agreed targets on universal access to energy by 2030. National agricultural, climate change, and energy transformations should be aligned for coherence and coordination.
- 3) Governments in the region should encourage the uptake of solar lights and their components by removing taxes and duties on imported technologies and by reducing the number of licenses required by solar-light manufacturers and distributors. A specialized agency should be established to plan and promote clean solar light, coordinate technology standards and testing, and manage national and subnational data on the supply and demand of solar energy and light.
- 4) There is a need to tap into and promote local and regional innovations. Research and development in the local solar sector should be promoted to match the financial and policy support that larger, international solar partners can access. Institutions in research and development should be strengthened, and governments should invest in special innovation funds.
- 5) African countries and their partners should adopt, promote, and learn from innovations such as SolarAid and SunnyMoney by seizing the opportunity, as the ground is already set.

- 6) The impact research initiative should be taken up by African regional bodies such as the African Union, African Capacity Building Foundation, and United Nations Economic Commission for Africa; and they should aim to support countries in this area. They should also help African states by means of capacity building to combat counterfeit lights flooding markets, especially the national bureau of standards, food, and safety institutions.
- 7) Private investors and multinational companies should adopt and promote the SolarAid model and support scale-up efforts.

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