POLICY BRIEF 2

Building a market for off-grid solar lighting

July, 2016

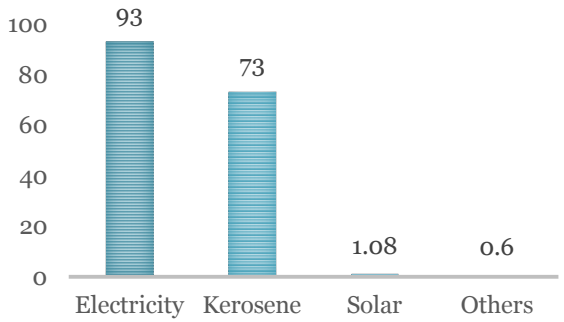
This Policy Brief looks at the current market situation for off-grid solar technologies in India, and the current impediments to an enabling business environment for solar.

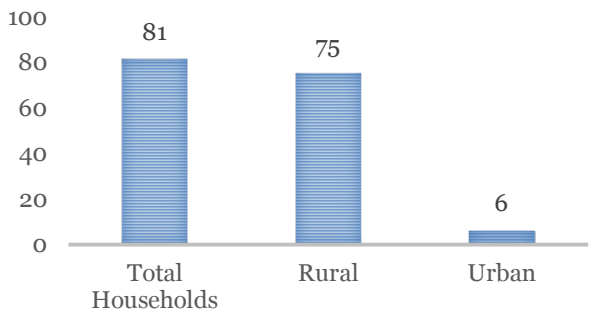
INTRODUCTION

Today, 300 million people in India still have no access to electricity, while a great majority of those that do experience highly intermittent and unreliable electricity supply (see Figure 2 below). The Government of India (GoI) has made efforts to enhance access to the electricity grid through schemes including 24x7 Power for All and Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY). Yet there still remains much to do, when the number of underserved households is expected to decline by only 5 per cent over the next 10 years (TCG 2015).

Off-grid solar lighting applications have the potential to play a key role in the provision of clean lighting to rural households. Solar lighting technologies are increasingly cost effective, have virtually no ongoing cost for fuel, and provide a clean substitute for kerosene. At the same time, each consumer that switches from the use of kerosene to solar saves the GoI around INR 600 (not including leakage costs) per year; a significant figure given the millions of households currently using kerosene (CEEW, 2016).

Figures 1 & 2: Rural households' primary lighting fuel (millions); Households not connected to electricity grid (millions)





The market for solar applications has expanded strongly in recent years. In India, more than 2.92 million solar off-grid lighting products (solar lantern and solar home systems (SHS)) were sold on a commercial basis in the last 1.5 years, providing clean energy access to an

estimated 12.7 million people, and replacing more than2.8 million kerosene lights to date (GOGLA 2015). Nevertheless, penetration of off-grid solar technologies among rural consumers in India – the world's largest single market for such technologies – remains low (see Figure 1 above).

Key Observations:

- The government is making ambitious efforts to increase electrification, through Power for All and Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY). Yet the business as usual scenario with electrification will still leave many households without access to electricity
- In spite of ambitious electrification, 73 million rural households depend on kerosene for lighting in India.
- The solar market in India is growing by using innovative business models such as 'pay as you go'. But the penetration of off-grid solar technologies remains low in rural Indian consumers

THE KEY BENEFITS OF OFF-GRID SOLAR TECHNOLOGIES

There is increasing evidence that solar off grid systems play a considerable direct role in poverty reduction, better education outcomes and improved health. Key benefits include the following aspects:

Potential financial savings: In India, typical expenditure on subsidized kerosene for lighting is approximately INR 576 per year (see Policy Brief 1). Conservatively assuming a 1.5 year life span for a basic solar lantern that retails at INR 500, household with access to subsidized kerosene stand to save around INR 76 per annum from switching to solar. If kerosene was not subsidized, and for those households that do not have access to subsidized kerosene, the saving increases to INR 760. Policy Brief 1 provides a more detailed analysis of the economics of kerosene versus solar use.

Health: Kerosene lamps contribute to indoor air pollution that leads to nearly 500,000 premature deaths in India annually (WHO 2014). In a study conducted, 21 per cent of families in India using kerosene reported suffering from eye problems as a result.

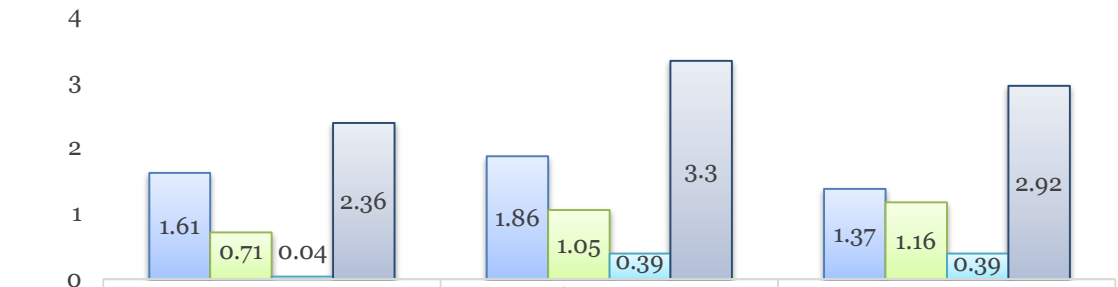
Education and economic development: Poor quality light or no light in households has a clear impact on education outcomes. In India, clean lighting solutions have provided around 1 billion hours of night study time for 2.5 million children (TCG 2015). Furthermore, at least 20,000 people are directly employed by the off-grid lighting sector in India (CLEAN 2015).

The environment: Kerosene use produces carbon dioxide (CO_2) and black carbon, with each kerosene lamp emitting on average 200kg of CO_2 and black carbon combined per year. UNEP estimates that the substitution of solar lighting for all traditional lighting in India would save about 34 million tons CO_2annually (2010).

CURRENT OFF-GRID SOLAR MARKET BARRIERS

Despite the transformative potential of off-grid solar lighting applications to concretely enhance developmental outcomes for millions of households in rural India, use of these applications, as discussed, remains relatively limited given the size of the unelectrified population and in international comparison (see Figure 3 below).

Figure 3: Sales of off-grid solar products by market, 2014-2015 (millions)



	Jan - Jun 2014	Jul - Dec 2014	Jan - Jun 2015
Africa	1.61	1.86	1.37
India	0.71	1.05	1.16
ROW	0.04	0.39	0.39
Total	2.36	3.3	2.92

This can be explained with reference to several key barriers that currently exist to the creation of a flourishing off-grid solar market in India. Four key barriers can be identified:

1. An uneven playing field amongst competing lighting options;
2. Solar promotion policy that impedes market development;
3. Bottlenecks and restrictions for solar financing;
4. Lacking trust and inadequate quality assurance.

To create a business environment in which off-grid solar markets can thrive and consumers can have access to affordable clean lighting solutions, government policy (at state and national levels) needs to directly tackle these barriers. Such policy solutions are the subject of Policy Brief 3.

An uneven playing field for solar expansion

The continued existence of large per-unit kerosene subsidies in India significantly compromises the value proposition of solar lighting alternatives for household. While in countries such as Kenya or Tanzania the payback period for an entry-level solar lantern, retailing at about USD 13, can be as little as three months given the cost of other lighting alternatives, it is approximately eleven months in India (BNEF 2016). Because of the *availability of cheap kerosene*, the costs of financing solar technologies (or the amortised upfront cost of such technologies over a certain time period) is most often higher than the cost of kerosene in the same period, especially for higher-grade lanterns and SHS (see Policy Brief 1). This is borne out in sales in India: in Kenya, where 32 million people do not have access to the grid, 947,000 solar lighting products were sold in the year to June 2015. In

India, which has an off-grid population ten times the size of Kenya, only about twice as many products were sold (BNEF 2016).

In addition, complex and *slow import regulations* in India unnecessarily lengthen the supply chain for solar technologies and components, increasing unit costs for suppliers and consumers. High import tariffs and VAT on solar products further drive up end-user costs. For example, while is no import duty on solar PV cells, modules, LEDs and charge controllers, there is a ten per cent duty on batteries used in solar applications. Solar products are exempted from these various duties in only in few states such as Andhra Pradesh, Maharashtra, Uttarakhand and Uttar Pradesh.

A lack of market-based solar promotion policy

In an effort to rapidly enhance access to off-grid solar technologies in rural households, state and central governments in India have experimented with a variety of solar promotion schemes, including effectively giving away lantern units to poor communities for free or at highly subsidized rates. Recently, in Chhattisgarh, solar lamps were distributed free of cost to 1.3 million households in 95 rural areas. This year around 43,000 more will be distributed in Kerala. In 2013, the Rural Electrification Corporation Ltd (RECL) and the Solar Energy Corporation of India (SECI) agreed to distribute 150,000 solar lanterns in poorly electrified areas across India (REC 2013).

In general, the mass distribution of low-cost products can necessarily only be a temporary measure to enhance clean lighting access. Efforts to promote the off-grid solar applications through the *distribution of free or very low cost units, however, can destabilize budding solar markets and significantly impair enterprises*, while at the same time indefinitely jeopardising the public perception of off-grid solar products. Negative unforeseen consequences are manifested in several ways, including by:

- **Killing competition** – subsidized systems monopolize markets on a large scale and prevent any other technologies and suppliers from competing;
- **Creating dependence** – if government programmes come to dominate the market, once the programme ends or the subsidy is suspended the market may disappear completely;
- **Focusing on distribution not service provision** – the mass procurement and distribution of near-zero cost solar products most often leads to an under-provision of aftersales service, leaving many units unrepaired and customers with potentially jaded views on the reliability of solar units;
- **Undermining buy-in** – evidence shows that households tend to place greater value in goods and services which they have chosen to use scarce resources to buy and in which they are invested. Distribution of near-zero cost systems can lead to under-utilisation and misuse, which can again affect consumer perceptions of the products in question;

The financing bottleneck

Unlike kerosene use, for example, the use of solar applications has a large upfront cost for poor households in the absence of financing mechanisms that can be provided, in theory, by financial institutions (e.g., rural development banks, MFIs etc.), solar distributors or other

third parties. In India, however, non-bank entities are not authorised to provide in-house financing of small solar projects for consumers, significantly constricting the ease of financing options. At the same time, the financing of small solar projects by banks and MFIs have not become more than niche products, due to poor after-sales records and high transaction costs. For these reasons, innovative payment mechanisms such mobile money have seen relatively slow take-up in India, although financial inclusion has increased rapidly in recent times (see Policy Brief 3 for more detail on these issues).

Reflecting the existence of an enabling environment for corporate and customer financing in countries in the region, four companies operating in Kenya and Tanzania have attracted fifty per cent of total global investment in the off-grid lighting industry (ODI & GOGLA 2016). Unsurprisingly, these two countries having the world's strongest sales growth rates for off-grid solar units, with strong access to corporate finance allowing these companies to be able to extend credit to customers on a large scale (ODI, 2016). In India, even for those firms that are authorized to extend credit to end-users, raising debt financing to fund these allocations of credit remains difficult.

Quality assurance and consumer protection

The availability of low quality off-grid solar products in relatively new markets such as India has the potential to significantly damage the reputation of the sector as a whole in these markets, to negative influence consumer attitudes over several years, and to thereby markedly impede the use of solar applications in rural communities over time. Anecdotal evidence abounds of cases in which consumers have been provided faulty low quality equipment with little after-sales recourse. As such, a lack of trust remains one key barrier to greater solar penetration India.

Quality assurance standards can help to ensure that solar units meet common minimum standards for product performance. In India, however, quality assurance frameworks (and enforcement of these) remain underdeveloped, partly due to the small relative size of the off-grid solar market in the country. A key building block of solar promotion policy should therefore be the relatively simple establishment of internationally harmonized quality assurance standards, warranties, grievance mechanisms and enforced after-sales obligations for consumers.

CONCLUSIONS

Policy designed to promote greater penetration of off-grid solar applications in India – and therefore to unlock the great potential of solar lighting to enhance developmental outcomes in poor communities – should clearly be aimed at tackling the barriers to a flourishing solar market that are described in this policy brief. The key areas and broad outlines of simple solar promotion policy are clear. Key policy reform initiatives should include:

- An embrace of market-based solutions to solar sector promotion, including limitation of the use of the mass distribution of near-zero cost and highly subsidized solar lanterns;

- The improvement, harmonization and enforcement of quality assurance frameworks and after-sales obligations for solar products and providers to build trust in the sector;

- The relaxation of restrictions on the provision of in-house financing for select, authorised off-grid solar providers so that credit for solar applications becomes more widely available;

- Measures to promote solar providers' access to capital (e.g., through rural development banks) and to enhance financial inclusion and payment services options in India (e.g., through on-going and highly successful financial inclusion and electronic money initiatives being undertaken by the GoI);

- Consideration of simple fiscal mechanisms to reduce the costs of solar units, such as VAT and tariff exemptions; For example Solar products are exempted from these various duties in only in few states such as Andhra Pradesh, Maharashtra, Uttarakhand and Uttar Pradesh

- Leveraging of the sophisticated Direct Benefits Transfer (DBT) subsidy payment infrastructure to give households a choice to use subsidy payments for either solar or kerosene. This notion is discussed in detail in Policy Brief 3.

REFERENCES

Arora, PR, 2013, World's Highest Off-grid Solar PV Potential in India - Search and Penetrate, International Journal of Scientific and Research Publications, Vol. 3, Issue 8. Available from http://www.ijsrp.org/research-paper-0813/ijsrp-p20132.pdf

Clarke, K, 2014, Kerosene Subsidies in India, IISD. Available from https://www.iisd.org/GSI/sites/default/files/ffs_india_kerosene.pdf

CLEAN, 2015, Skill Solution for Off-Grid Clean Energy, AnthroPower. Available from http://thecleannetwork.org/downloads/skill-solution.pdf

Dalberg, 2012, Lighting Africa Market Trends Report, IFC. Available from http://www.dalberg.com/documents/Lighting_Africa_Market_Trends_Report_2012.pdf

GOGLA, 2014, Investment and Finance Study for Off-Grid Lighting, ATKearney. Available from http://global-off-grid-lighting-association.org/wp-content/uploads/2013/09/A-T-Kearney-GOGLA.pdf

GOGLA, 2015, Standardised impact metrics for the off-grid energy sector. Available from http://www.enlighten-initiative.org/portals/0/documents/Resources/publications/OFG-publication-may-BDef.pdf

GOGLA, 2015, Delivering Universal Energy Access. Available from http://goo.gl/SoQJ5I

IFC, 2010, Solar Lighting for the Base of the Pyramid - Overview of an Emerging Market. Available from http://goo.gl/TNz4XO

IFC, 2012, Lighting Asia Market Trends Report. Available from http://www.dalberg.com/documents/Lighting_Africa_Market_Trends_Report_2012.pdf

Lighting Global, 2014, Energy and Carbon Benefits of Pico-powered Lighting, Issue 4. Available from https://www.lightingglobal.org/wp-content/uploads/2013/12/Issue-4_EnergyandCarbonBenefits_Final.pdf

Mills, E, 2014, Lifting the Darkness on the Price of Light, UNEP. Available from http://evanmills.lbl.gov/pubs/pdf/lifting-the-darkness-on-the-price-of-light-2014.pdf

Mills, E, 2014, Light and LiveLihood, UNEP. Available from http://goo.gl/A0UAtG

Mills, E, 2014, Light for Life, UNEP. Available from http://goo.gl/7Gg4OH

ODI, 2016, Accelerating Access to Electricity in Africa with Off-Grid Solar. Available from: http://www.odi.org/publications/10200-accelerating-access-electricity-africa-off-grid-solar

Shanoy, BV, 2010, Lessons Learned from Attempts to Reform India's Kerosene Subsidy, IISD.

Singh, K. 2015, Business Innovation and Diffusion of Off-Grid Solar Technologies in India, Energy for Sustainable Development, vol. 30, pp. 1-13. Available from http://goo.gl/aQMOEdSolarAid, 2015, Impact Report. Available from http://www.solar-aid.org/assets/Uploads/Impact-week-2015/SolarAid-IMPACT-REPORT-2015.pdf

TCG, 2015, The Business Case for Off-Grid Energy in India. Available from http://www.theclimategroup.org/_assets/files/The-business-case-for-offgrid-energy-in-India.pdf

UNEP, 2010, Off-Grid Lighting Assessment – India. Available from http://app.olela.net/infomap/files/classOffGrid/OGL_IND.pdf

UNEP, 2015, Developing effective off-grid lighting policy. Available from http://www.enlighten-initiative.org/portals/0/documents/Resources/publications/OFG-publication-may-BDef.pdf

WHO, 2014, The World Health Organisation's Guidelines for Indoor Air Quality.

World Economic Forum, 2013, Lessons Drawn from Reforms of Energy Subsidies.

IISD
International Institute for Sustainable Development

Climate Parliament
Legislators working worldwide to combat climate change