GOGLA

The Voice of the Off-Grid Solar Energy Industry

Providing Energy Access through Off-Grid Solar: **Guidance for Governments**

GROUPE DE LA BANQUE AFRICAINE DE DÉVELOPPEMENT

LIGHTING GLOBAL

WORLD BANK GROUP

SUSTAINABLE ENERGY FOR ALL

POWER AFRICA

About This Guide

This guide was developed by **GOGLA, the global association for the off-grid solar energy industry**, with the support of the joint **World Bank/International Finance Corporation, Lighting Global Program**, the U.S. Government-led **Power Africa** initiative, **Sustainable Energy for All**, and the **African Development Bank** (AfDB). This document reflects our shared views with regards to key policy and regulatory issues in the standalone, off-grid solar sector. We believe the information contained in this publication is derived from carefully selected sources. Thanks go to the **World Bank Energy Sector Management Assistance Program (ESMAP)** and the **UK Department for International Development** (DFID) for providing technical advice.

With over a billion people not yet served by modern electricity and just 12 years to go until the 2030 target, achieving universal energy access will be challenging. According to the Sustainable Energy for All (SEforALL) initiative, governments are rising to the challenge, but faster progress is needed[1]. We are committed to supporting governments in their efforts to design pro-investment, standalone, off-grid solar policies and regulations. To that end, this guide provides a holistic overview of issues for consideration in the design of policies and programmes intended to deliver on energy access goals.

In developing this guide, we have consulted widely with companies, development partners, civil society and other stakeholders in Africa, South Asia, and around the world. Recommendations are based on unique insight, and presented in a practical way for decision-makers with responsibility for achieving Sustainable Development Goal #7 **(SDG 7) - access to affordable, reliable, sustainable and modern energy for all by 2030.** We hope to accelerate the creation of a policy and regulatory environment that enables standalone, off-grid solar to fulfil its potential, and play a vital role in the achievement of universal energy access as well as other SDGs, such as those related to health, environment and quality of life.

Inclusion of grid, mini-grid and off-grid solutions in electrification strategies, as part of an integrated approach, is the key to developing effective electricity access solutions. Every national context is unique. The exact policy actions required to support the off-grid sector vary depending on: the stage of off-grid market development; the pace and future potential for grid and mini-grid electrification; availability of funding; broader macroeconomic conditions; and government priorities. In addition to pursuing policy and regulatory reform at the national level, in close collaboration with the private sector, we encourage governments to work towards regional harmonization of policy and regulatory frameworks. This makes it easier for companies to navigate the policy environment, and to establish operations in multiple neighboring countries, thereby improving the range of products available to the customer.

Section 1 outlines the role of standalone, off-grid solar in achieving universal energy access, while Section 2 provides a summary of the latest trends in the sector. Section 3 is a set of guidance notes on key policy topics, which have also been published as individual factsheets to inform discussions around specific issues.

The guidance notes will be kept up-to-date by GOGLA and its development partners, and made available online at www.gogla.org. We encourage readers to get in touch with GOGLA if they have any questions or would like more information, at info@gogla.org.

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About Us

GOGLA

GOGLA is the global association for the off-grid solar energy industry. Established in 2012, GOGLA now represents over 135 members as a neutral, independent, not-for-profit industry association. Its mission is to help its members build sustainable markets, delivering quality, affordable products and services to as many households, businesses and communities as possible across the developing world. The products and solutions that GOGLA members sell transform lives. They improve health and education, create jobs and income opportunities and help consumers save money. To find out more, go to www.gogla.org.

African Development Bank

The African Development Bank (AfDB) Group is the premier development finance institution in Africa, with a mandate to spur sustainable economic development and social progress on the continent, thereby contributing to poverty reduction. The Bank Group achieves this objective by mobilizing and allocating resources for investment, as well as by providing policy advice and technical assistance. In 2016 the AfDB launched the New Deal on Energy for Africa, a transformative partnership-driven effort with an aspirational goal of achieving universal access to energy in Africa, and a specific target of achieving 75 million new off-grid connections by 2025. Working with governments to provide energy access through promoting standalone, off-grid solar solutions is a central component of the AfDB's strategy to achieve this target.

Power Africa

Launched in 2013, Power Africa is a U.S. government-led partnership, coordinated by USAID, that leverages the resources of 12 U.S. government agencies and over 150 private and public sector partners, to achieve two ambitious targets to expand access to power across sub-Saharan Africa by 2030: to increase installed generation capacity by 30,000 MW, and to create 60 million new connections. The Power Africa model focuses on practical solutions, and is uniquely positioned to drive results, because the partnerships Power Africa has forged combine three important elements: deep knowledge of the power sector, a private sector-led engagement approach, and experience working with governments and civil society to improve policies and sector governance.

The World Bank Group's Lighting Global Program

Lighting Global is the World Bank Group's platform to support sustainable growth of the international off-grid solar market as a means of rapidly increasing energy access to the 1.2 billion people without grid electricity. Through Lighting Global, the International Finance Corporation (IFC) and the World Bank work with the Global Off-Grid Lighting Association (GOGLA), manufacturers, distributors, and other development partners to develop the modern off-grid energy market. The Lighting Global program supports market development by working with private companies to lower first-mover risk and mobilize private sector investment through market intelligence, quality assurance, business support services and consumer education.

Sustainable Energy for All

Sustainable Energy for All (SEforALL) is an international organization working with leaders in government, the private sector and civil society to drive further, faster action toward achievement of Sustainable Development Goal 7, which calls for universal access to sustainable energy by 2030, and the Paris Climate Agreement, which calls for reducing greenhouse gas emissions to limit climate warming to below 2 degrees Celsius. For more information visit www.seforall.org or follow us at @SEforALLorg.

World Bank Energy Sector Management Assistance Program

ESMAP is a global knowledge and technical assistance program administered by the World Bank. It assists low and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is funded by Australia, Austria, Denmark, the European Commission, Finland, France, Germany, Iceland, Japan, Lithuania, Luxembourg, the Netherlands, Norway, the Rockefeller Foundation, Sweden, Switzerland, the United Kingdom, and the World Bank.

[1] Beyond Connections: Energy Access Redefined, SEforAll and World Bank ESMAP, 2015

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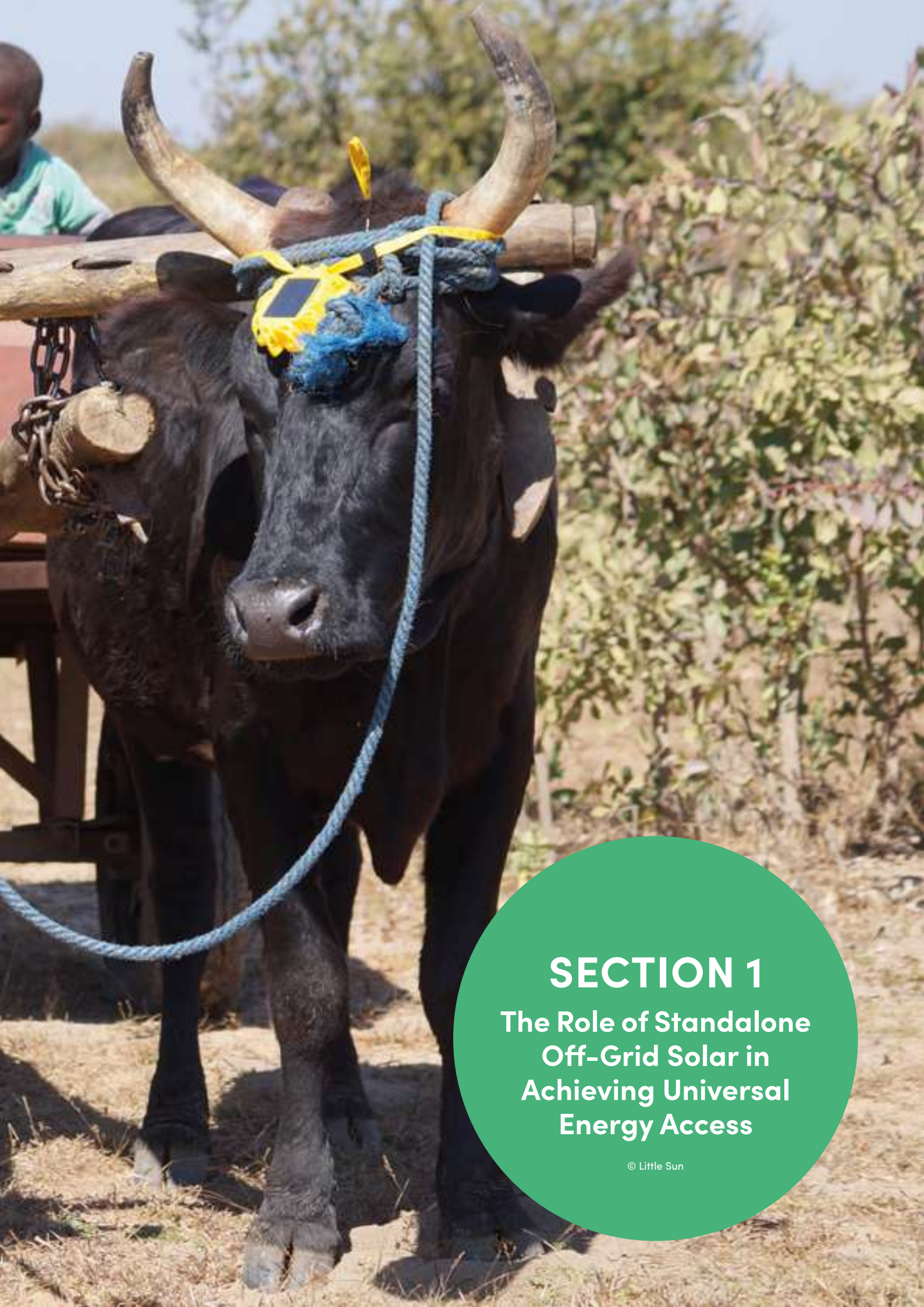


SECTION 1

The Role of Standalone Off-Grid Solar in Achieving Universal Energy Access

1.1 Faster Progress is Needed to Achieve Universal Energy Access by 2030

Over the last decade, the scale and importance of the energy access challenge has been fully recognized for the first time. SEforALL paved the way for the establishment of SDG 7 in 2015, with the target of ensuring 'universal access to affordable, reliable, sustainable and modern energy for all by 2030'. It is increasingly recognized that energy has a vital role to play in contributing to other SDGs, with former UN Secretary General Ban Ki-Moon describing energy as the 'golden thread that connects economic growth, social equity and environmental sustainability'[2].

The world is not currently on-track to achieve universal energy access by 2030, with remote and rural areas lagging behind and progressing slowly. From 2014 to 2016, household electricity access rose 0.83% per year, below the 0.9% needed to achieve universal energy access by 2030[3]. According to the International Energy Agency (IEA), if access deficit countries do not accelerate progress, 674 million will still be without access to electricity by 2030 (Figure 1)[4].

In Sub-Saharan Africa, electrification rates are now starting to keep pace with population growth. From 2014 to 2016, the population grew by 26 million, and energy access grew by 37 million, resulting in a net gain in electricity access for 11 million people[5]. However, a further 43% of the population or 566.8 million people are still without access to electricity in the region. In Central Asia and Southern Asia, 57 million people gained electricity access from 2014 to 2016, outpacing population growth of 24 million over the same period and leading to a net gain of 33 million[6].

In line with GOGLA's mandate as the voice of the off-grid solar energy sector, this guide focuses on the role of off-grid solar products and services in helping to deliver universal energy access, and the steps governments can take to promote these solutions. As such, it does not cover other important energy access issues such as access to clean cooking, electrification through grid extension or mini-grids, which fall outside of GOGLA's scope.

Figure 1: Energy access growth rate (per year) and rate needed to meet 2030 target – Source: Tracking SDG7: the Energy Progress Report, 2018

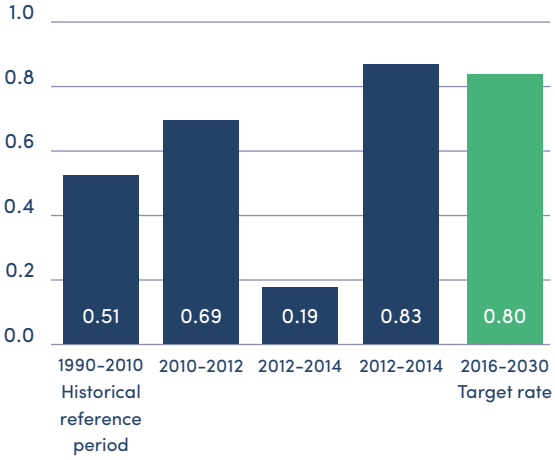
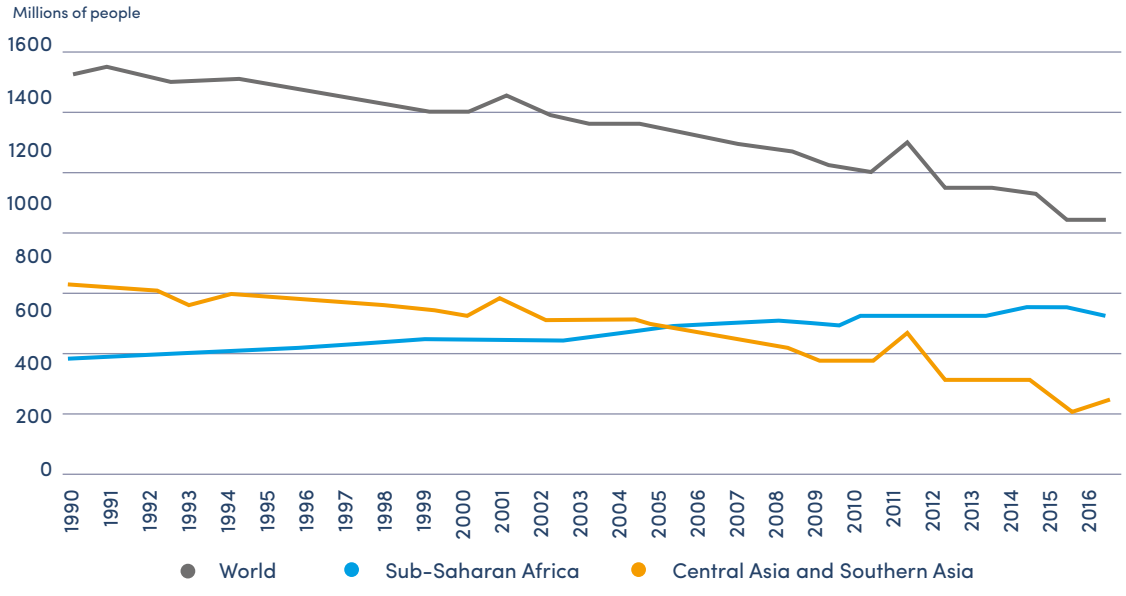


Figure 2: Evolution of the access-deficit, 1990-2016 – Source: Tracking SDG7: the Energy Progress Report, 2018



[2] https://www.un.org/press/en/2012/sgsm14242.doc.htm
[3] Tracking SDG7: the Energy Progress Report, 2018
[4] International Energy Agency, 2017
[5] Global Tracking Framework, World Bank and International Bank for Reconstruction and Development 2018
[6] Tracking SDG7: the Energy Progress Report, 2018

1.2 Off-Grid Solar is the most Cost-Effective Solution for a Significant Proportion of People lacking Electricity Access

The most cost-effective way to expand household electricity access varies widely, within and between countries. At a global level, whilst 30% of new household electricity access is expected to come from grid extension, the IEA concludes that for the large rural population distant from power grids, 'decentralised systems are the most cost-effective solutions for over 70% of those who gain access'[7]. It goes on to anticipate that 315 million people in rural areas will gain access to electricity by 2040, and suggests that **25% of household electricity access needs to come from off-grid solar systems** (Figure 3). This share may need to be even larger if grid and mini-grid solutions do not develop at the pace required to fulfil their anticipated contribution to the electricity access goal by 2030.

The further a community is from the main grid, the more expensive the cost of grid extension becomes, compared to off-grid solutions. For example, the 2015 Global Tracking Framework finds that, for 100,000 people with no electricity at all, basic solar lighting could be delivered for around $3 million* whilst full grid connection with 23 hours supply would cost around $150 million[8]. When the cost of grid extension becomes prohibitive, mini-grids or standalone, off-grid solar systems become a more cost-effective solution. Mini-grids are more likely to be viable in areas of high population density or energy-intensive economic activity, while standalone solutions are more cost-effective in more sparsely populated, or poorer areas. Figure 4 illustrates how a range of factors influences the most cost-efficient way to connect communities. These include: the size of the community; population density; distance to national grid; terrain; and level of economic activity.

* All references to currency, monetary values and dollars in this report are United States dollars (USD)

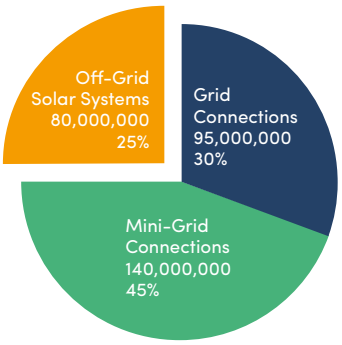
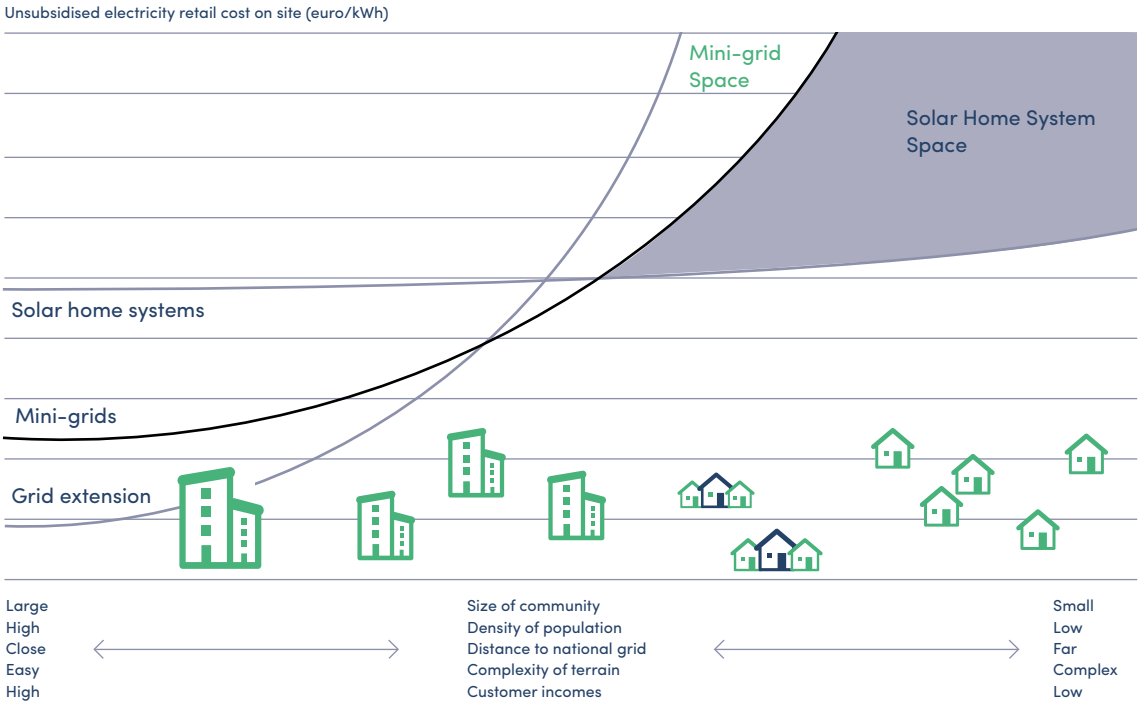


Figure 3: Most cost-effective mix of technologies needed to deliver universal household electricity access in rural areas - Source: World Energy Outlook, IEA, 2014

Figure 4: A growing role for off-grid solar solutions - Source: Adapted from Mini-Grid Policy Toolkit, EU Energy Initiative Partnership Dialogue Facility (EUEI-PDF) and REN 21, 2014



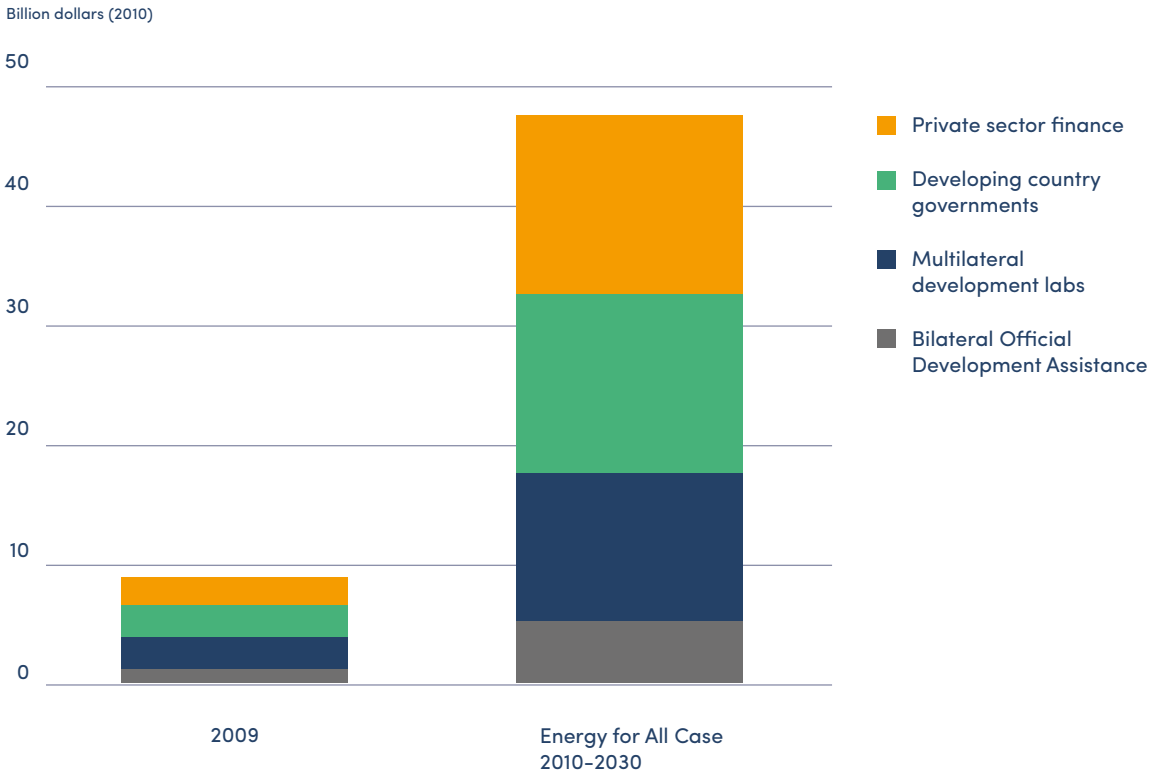
[7] International Energy Agency, 2017
[8] Global Tracking Framework, SEforAll 2015

1.3 The Private Sector has a Vital Role to Play in Scaling Off-Grid Solar Solutions

According to the IEA, to achieve universal access by 2030, levels of investment need to increase about five-fold from 2009 levels[9]. Figure 5 shows the increase in average annual investment needed, with suggested sources of financing. Both public and private investment need to increase dramatically. To reach the required investment level, **a significant proportion of public funding must be deployed in ways that help to attract private investment.**

Where governments lack the resources to deliver universal energy access through subsidized grid extension, the private sector can play a vital role in filling the gap. This is especially true for achieving household electricity access through off-grid solar solutions. Off-grid solar can deliver basic electricity access more quickly than on-grid solutions. Since 2010, GOGLA members and Lighting Global affiliates have sold 38.1 million products worldwide. Since the beginning of 2016 alone, these products have delivered 17 MW in installed capacity[10]. Future growth projections for the entire off-grid sector show 25% growth in sales volumes year on year until 2022[11]. Private investment can act as a vital supplement to public investment, helping to accelerate access. Even in countries where the government's goal is to provide grid-based solutions to the vast majority, off-grid solutions can still accelerate the electrification process. Off-grid solutions can reach more remote households years or even decades earlier than grid extension programmes, thus accelerating economic development in remote areas. **A market-based approach to promoting off-grid solar can achieve household electricity access at scale, at speed, and at low cost to government - making it an attractive option for resource-constrained countries.**

Figure 5: Average annual investment in energy access currently and to achieve universal access by 2030 - Source: World Energy Outlook, IEA, 2016



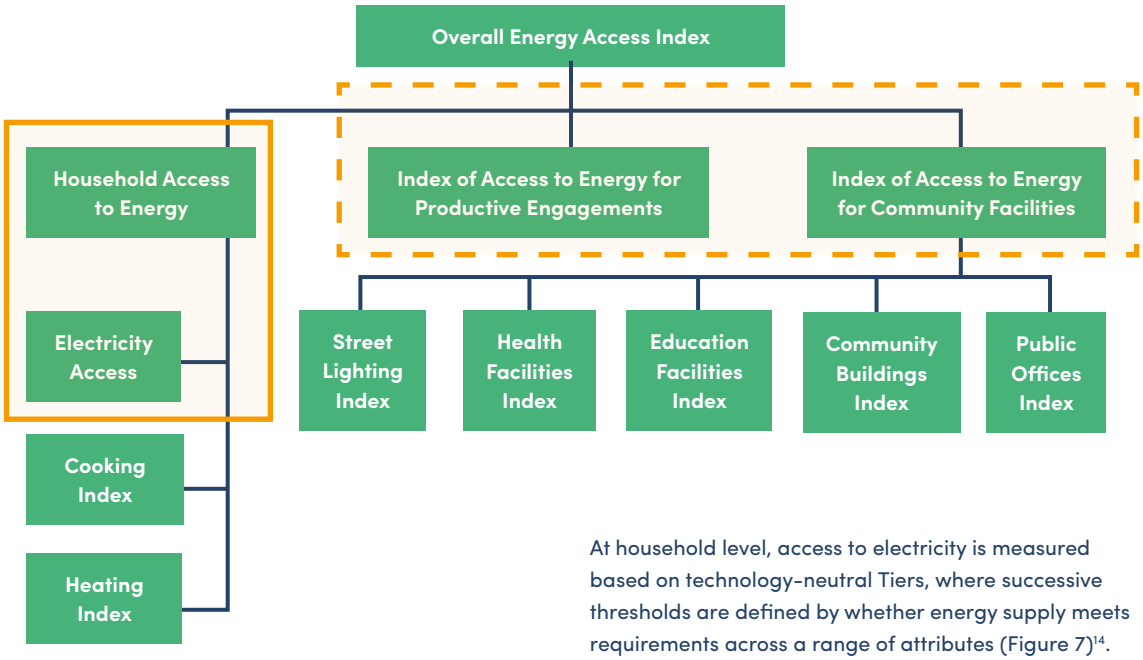
[9] International Energy Agency, 2016
[10] Adapted from GOGLA and Lighting Global Semi-Annual Data Collection, June 2018
[11] Off-Grid Solar Market Trends Report 2018, Dalberg Advisors and Lighting Global, 2018

1.4 Measuring Progress: Capturing the Complexity of Energy Access

SDG 7 recognizes the complexity of energy access. A multi-tier framework for defining and measuring energy access was initially proposed in the first SEforALL Global Tracking Framework report, published in 2013[12]. This framework is broader than previous binary metrics, such as whether a household is connected to the electricity grid. Building on this work in Beyond Connections: Energy Access Redefined, ESMAP — in its role as SEforALL Knowledge Hub — defines 'meaningful' energy supply as having the following attributes. It must be: adequate in quantity; available when needed; of good quality; reliable; convenient; affordable; legal; healthy; and safe[13]. The multi-tier framework has been widely adopted. It recognizes that energy access covers energy for households, productive uses and community facilities, and focuses on both the quantity and quality of energy being accessed.

The multi-tier framework for goal-setting, planning and tracking progress recognizes that there are many ways to expand energy access – from grid extension to mini-grids, off-grid solar home systems and solar lighting, as well as improving cook stoves and clean fuels. Improvements in supply through generation, transmission and distribution, as well as demand management through energy efficiency, also contribute to achieving energy access. A 'hierarchy of indices' is used to show how different kinds of energy access fit under the overall energy access index. Given the nature of standalone, off-grid solar products and services, the sector's main contribution to energy access will be through improving household electricity access, but it is also likely to play a role in improving access to energy for productive uses and community facilities (Figure 6).

Figure 6: Hierarchy of energy access indices - Source: Beyond Connections: Energy Access Redefined, SEforALL and World Bank ESMAP, 2015



At household level, access to electricity is measured based on technology-neutral Tiers, where successive thresholds are defined by whether energy supply meets requirements across a range of attributes (Figure 7)[14]. This is complimented by frameworks for access to electricity services, based on the types of appliances used in the household, and for electricity consumption. multi-tier matrices have also been developed for access to cooking, access to space heating, productive uses of energy, street lighting and access in community institutions[15].

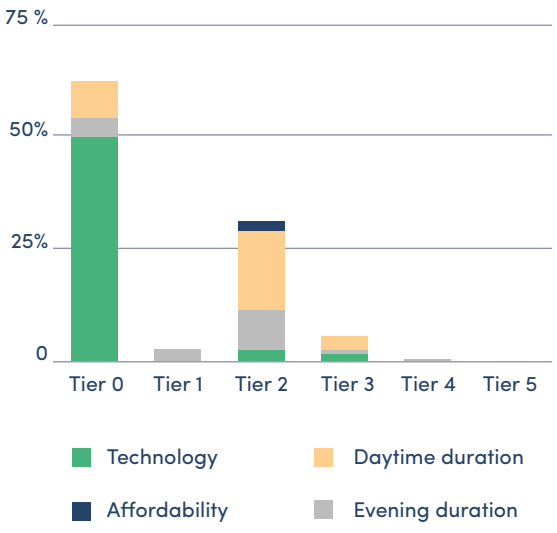
[12] Global Tracking Framework, International Energy Agency and World Bank, 2013
[13] Beyond Connections: Energy Access Redefined, SEforALL and World Bank ESMAP, 2015. http://www.esmap.org/.
[14] Beyond Connections: Energy Access Redefined, SEforALL and World Bank ESMAP, 2015. http://www.esmap.org/. In the multi-tier matrix for access to household electricity supply, 'capacity' for Tier 1 and 2 can be measured either by power/daily capacity or by services provided. This recognizes that advancements in energy efficiency are likely to make it possible to deliver a Tier 1 or 2 level of service with less power/capacity in future. The MTF approach also recognizes the partial improvements provided by off-grid products below the Tier 1 threshold, such as those provided by the most basic solar lights, and has developed a methodology for measuring their contribution to Tier 1.
[15] Beyond Connections: Energy Access Redefined, SEforALL and World Bank ESMAP, 2015. http://www.esmap.org/

Figure 7: Multi-tier matrix for access to household electricity supply – Source: World Bank and IEA

In Euro		Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
1. Capacity	Power		Very Low Power Min 3 W	Low Power, Min 50 W	Medium Power Min 200 W	High Power 800 W	Very High Power Min 2KW
	AND Daily capacity		Min 12 Wh	Min 200 Wh	Min 1.0 kWh	Min 3.4 kWh	Min 8.2 kWh
	OR Services		Lighting of 1.00 lmhrs per day and phone charging	Electrical lighting, air circulation, television and phone charging			
2. Duration	Hours per day		Min 4 hrs	Min 4 hrs	Min 8 hrs	Min 16 hrs	Min 23 hrs
	Hours per evening		Min 1 hr	Min 2 hrs	Min 3 hrs	Min 4 hrs	Min 4hrs
3. Reliability						Max 14 disruptions per week	Max 3 disruptions per week of total duration < 2 hours
4. Quality						Voltage problems do not affect the use of desired appliances	
5. Affordability						Cost of a standard consumption package of 365 kWh per annum is less then 5% of household income	
6. Legality						Bill is paid to the utility, prepaid card seller, or authorized representative	
7. Health and Safety						Absence of past accidents and perception of lower risk in the future	

The multi-tier framework provides a more nuanced picture of the energy access situation, compared to traditional binary definitions of electrification. The World Bank/ ESMAP team is currently carrying out a global baseline survey to collect multi-tier framework data in partnership with the Scaling Renewable Energy Programme (SREP). The survey is carried out through a household questionnaire applied to a nationally representative sample of households. Survey results can be used to analyze what is preventing people from gaining access to higher Tiers of energy access. This kind of 'gap analysis' can be a powerful tool for decision-making regarding policy, regulation and investment. In the theoretical example provided in Figure 8, for example, colours reflect the different factors preventing households from enjoying a higher tier of energy access. It shows that over 50% of households are held back in Tier 0 because of a lack of any source of electricity. Stand-alone solutions are an important strategy to enable more people to move from Tier 0 to Tiers 1, 2 and 3[16].

Figure 8: Example gap analysis using multi-tier framework survey data – Source: World Bank and IEA



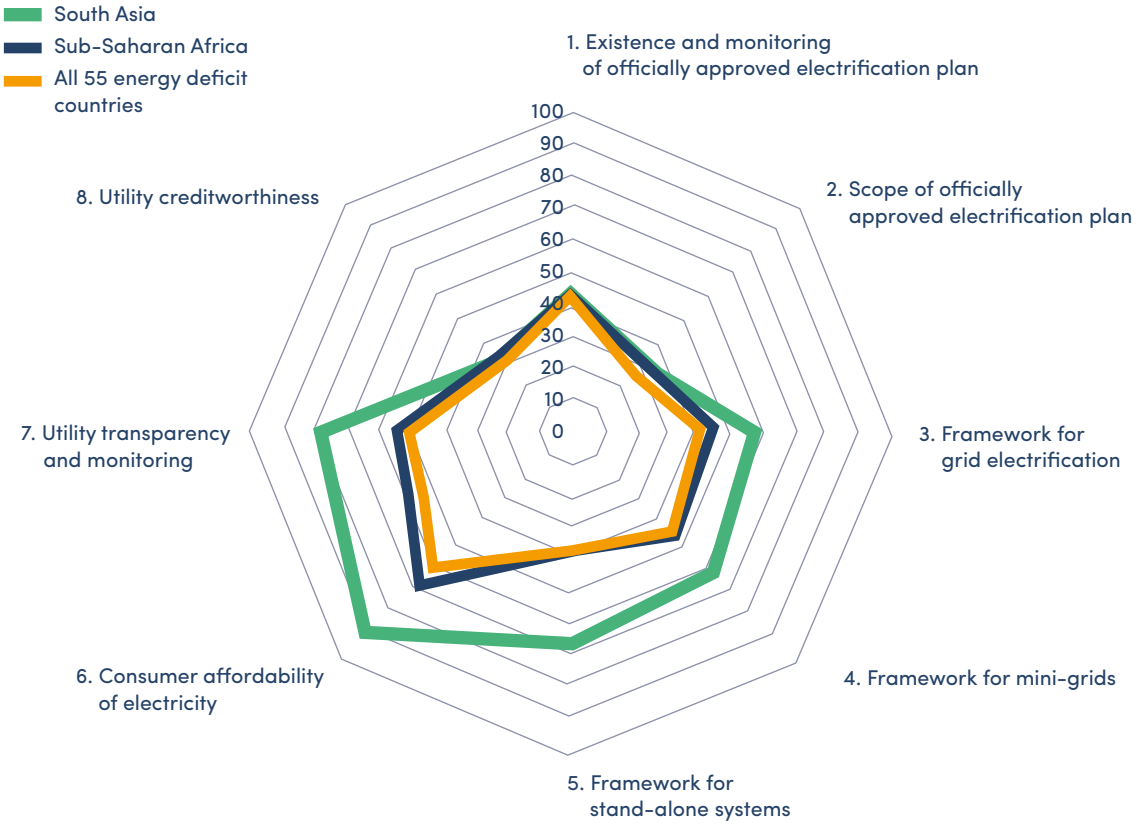
[16] Global Tracking Framework: Progress Towards Sustainable Energy, International Energy Agency and World Bank, 2017

1.5 Policy and Regulatory Reform: The Key to Accelerating Access through Off-Grid Solar Market Growth

The off-grid solar sector has emerged rapidly over the last decade, with companies regularly developing new technologies and business models. Meanwhile, governments, aid agencies, investors and philanthropic foundations are becoming increasingly interested and involved too. This has made the role of policy and regulation even more critical.

In 2016 the World Bank, in collaboration with SEforALL, ESMAP and the Climate Investment Funds, published the most comprehensive survey of policy and regulation for sustainable energy undertaken to date. The Regulatory Indicators for Sustainable Energy Global Scorecard for Policymakers (RISE) ranks 55 countries, where access deficits exist, on eight core indicators for energy access (Figure 9), as well as for renewable energy and energy efficiency (http://rise.esmap.org/)[17]. These countries are almost all low-income countries in Sub-Saharan Africa and South Asia.

Figure 9: Average indicator scores on energy access – Source: RISE Database, World Bank, 2016



The scope of officially approved electrification plans is often limited. Only a few countries worldwide have electrification plans that include off-grid, community and productive load elements, as well as service quality standards. Encouragingly, consumer affordability is found to be less of a constraint than many policy makers have assumed in the past[18].

On almost all policy dimensions, Sub-Saharan Africa shows weaker policy frameworks than other access-deficit regions, particularly South Asia. However, examples of good practice can be found in every region of the world. For energy access, India, the Philippines, Kenya, Uganda, and Tanzania are the top five scorers. In Sub-Saharan Africa, the three East African countries lead, followed by South Africa, Cameroon and Senegal. In South Asia, Bangladesh, India, and Sri Lanka are top scorers. In East Asia and the Pacific, Cambodia and the Philippines are doing well in adopting good practices to scale-up energy access.

[17] Regulatory Indicators for Sustainable Energy: A Global Scorecard for Policy Makers, World Bank, 2016

[18] "Electricity is considered affordable if annual expenditure on a basic allowance of 30 kWh per month for residential users at the prevailing retail price is at most 5% of gross national income (GNI) per household in the bottom 20% of the population. Electricity is considered unaffordable if costs surpass 10%. Despite widespread price concerns, the RISE indicator suggests that unaffordability may be less common than feared, with subsistence consumption costing less than 5% of GNI in 73% of surveyed countries in 2015", Regulatory Indicators for Sustainable Energy, World Bank, 2015

Countries are rated highly for frameworks for stand-alone, off-grid solar systems, if:

a. there is a national program to promote adoption of stand-alone technologies;
b. there are subsidies or duty exemptions in place;
c. there is no legal limit on the price stand-alone home system retailers and service providers can charge;
d. there is formal adoption of international quality standards and test methods (Figure 10).

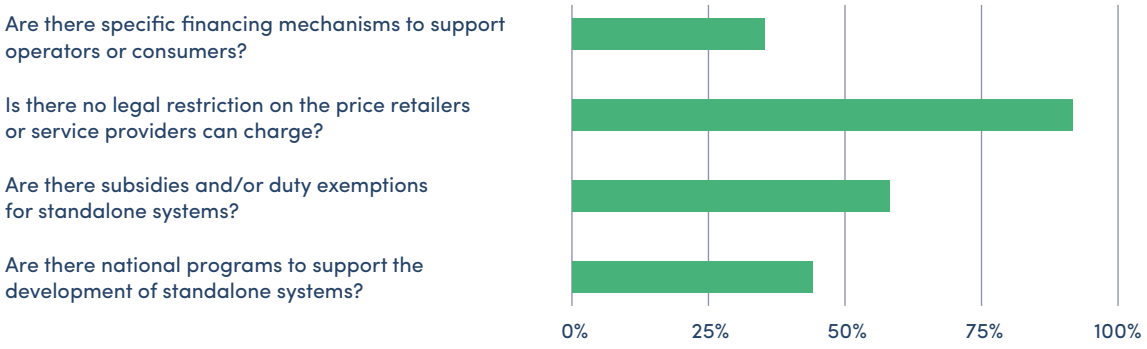
These 'best practice characteristics' are explored in detail in the guidance notes in section three.

Overall, four countries - Cambodia, Ghana, Kenya, and Uganda - stand out for exhibiting almost all the desirable characteristics for promotion of stand-alone systems. Bangladesh, Cameroon, the Democratic Republic of Congo, Ethiopia, India, Malawi, Myanmar, Nepal, Pakistan, South Africa, and Tanzania also score highly. However overall, **just 44% of the 55 countries surveyed have defined and implemented a national program aimed at developing stand-alone systems.**

RISE concludes that 'stand-alone systems... offer an early opportunity for eight countries, because all have yet to establish a framework for off-grid electrification (South Sudan, Chad, Burundi, Central Africa Republic, Burkina Faso, Niger, Nigeria and Sudan). Top RISE scorers do well across three energy supply solutions – grids, mini-grids and standalone systems, suggesting they are not being pursued as substitutes, but rather as complements.

These conclusions align with previous findings from the SEforALL Global Tracking Framework report, that 'many low-access African countries have yet to create a supportive policy environment for energy access, in particular for off-grid solar home systems', and 'where many countries appear to lag is on the regulatory framework to support off-grid access through solar home systems and other distributed resources. Regulations that clarify market entry and exit, define minimum quality standards, and target subsidies and duty exemptions should be considered for supporting off-grid solutions and enabling countries to benefit from the plummeting costs of decentralised solutions based on solar photovoltaics'[19].

Figure 10: 55 energy access countries answering yes to questions about framework for standalone solutions - Source: RISE Database, World Bank, 2016



[19] Global Tracking Framework 2017: Progress Toward Sustainable Energy, Sustainable Energy for All, 2017'

1.6 Beyond Energy Access: Socio-Economic Impact

According to the World Bank's 2017 State of Electricity Access Report 'a review of all SDG targets indicates that energy is interconnected with 125 (74%) out of the 169 targets, making it crucial for all societies to recognize the key interlinkages of energy and the wider development agenda'[20]. **The benefits of supporting the off-grid solar sector go way beyond the achievement of energy access goals.**

Household Savings

When basic solar lights replace kerosene lamps, battery powered torches or candles, they lead to **cost savings of around 4% of total household income.** A recent study in rural Kenya found that, on average, households spend 3% of income on lighting on average, rising to 8% ($1.60 per month) for the poorest quintile[21]. With the acquisition of a solar light, the average number of kerosene lamps in use drops from 2.2 to 1.3, and expenditure on energy drops by 40-60% ($0.96 per month on average). Households with solar lights that charge phones make additional savings on phone-charging[22]. To date, sales of solar lanterns and multi-light kits by GOGLA Members and Lighting Global affiliates will save off-grid households an estimated $8 billion in energy expenditure over the product lifetime[23].

National Savings

As off-grid solar markets grow, for countries that import kerosene, batteries, torches, or candles there will be a **positive impact on the balance of payments and on foreign exchange reserves,** as these imports are replaced by off-grid solar. For example, according to UNEP en.lighten, Kenya imports 853 million litres of kerosene, 464 million candles and 114 million batteries costing around $896 million per year[24]. This is the equivalent to 6.3 million barrels of crude oil energy. A significant portion of this could potentially be saved by adopting off-grid solar as an alternative. For countries that subsidize kerosene for lighting, there are also **significant savings on kerosene subsidies.** For example, since 2009 the government of India has gradually reduced expenditure on kerosene subsidies, saving over half a billion dollars between 2015-16 and 2016-17, when expenditure dropped from $1.8 billion to $1.18bn[25&26].

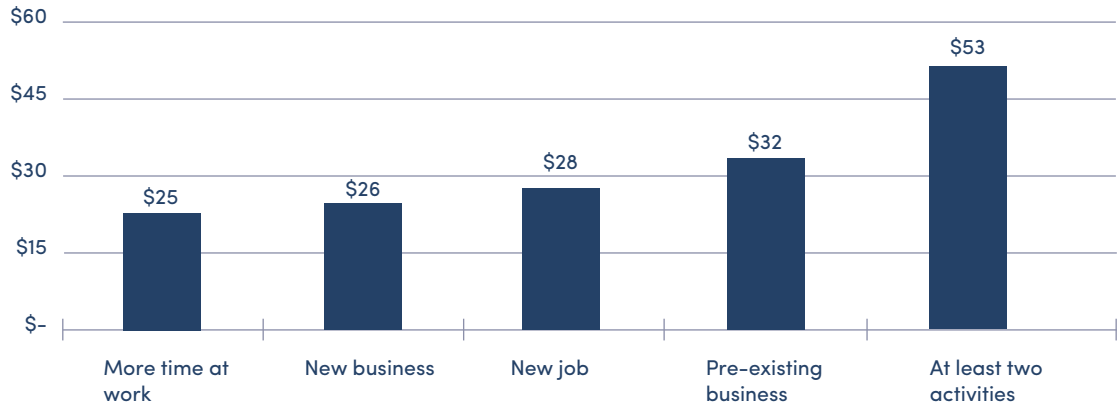
Job Creation and Economic Activity

The off-grid solar sector is creating jobs and opportunities for enterprise. Recent research in East Africa and Mozambique found that **nearly 60% of customers that purchased solar home systems reported increased economic activity** due to a household member being able to spend more time working, getting a new job or using the system to support enterprise, such as phone charging for a fee or keeping shops and restaurants open later at night[27]. The study revealed that, within the first three months of ownership, 36% of customers reported income increases of $35 per month on average; more than 50% of monthly GDP per capita.

The sector is also creating tens of thousands of jobs along the value chain. Globally, the decentralized renewable energy industry, including both mini-grids and standalone solutions, is expected to directly employ 3.5 million people by 2030[28]. Within market countries, the off-grid sector employs both full-time staff and agents in management, logistics, finance, sales, marketing, retail, engineering and software development. Job growth has been driven by market growth in the sector.

Figure 11: Average additional monthly income generated by type of economic activity - Source: Powering Opportunity. The Economic Impact of Off-Grid Solar, GOGLA 2018

N (More time at work) = 359 N (New business) = 220 N (New job) = 99 N (Pre-existing) = 220 N (At least two activities) = 236



[20] State of Electricity Access, World Bank, 2017
[21] The Economic Impact of Solar Lighting: Results from a Randomised Field Experiment in Rural Kenya, ETH Zurich et al, 2017
[22] The Economic Impact of Solar Lighting: Results from a Randomised Field Experiment in Rural Kenya, ETH Zurich et al, 2017
[23] Global Off-Grid Solar Market Report H1 2018, GOGLA & IFC Lighting Global, 2018
[24] http://map.enlighten-initiative.org/
[25] Kerosene Subsidies in India: The status quo, challenges and the emerging path to reform, International Institute for Sustainable Development, 2017
[26] India Energy Subsidy: Briefing Note, International Institute for Sustainable Development, 2017
[27] Powering Opportunity: The Economic Impact of Off-Grid Solar, Altai Consulting, 2018
[28] Renewable Energy and Jobs, IRENA, 2016

Access to Mobile and Financial Services

Pay-as-you-go (PAYG) solar technologies and business models enable customers to access higher levels of energy service by paying over time, typically for between 1-5 years. Mobile technologies underpin the PAYG model in three main ways:

1. By enabling customers or agents to make payments via mobile money.
2. By enabling companies to control assets and services remotely, using machine to machine (M2M) connectivity.
3. By enabling communication between companies, agents and customers through mobile, SMS or apps.

Research by the industry association for mobile network operators, GSMA (the global association for mobile operators), has concluded that PAYG is accelerating adoption of mobile money through helping to scale agent networks in off-grid areas; helping to acquire new customers; facilitating digital financial literacy and generating frequent account activities. It is estimated that globally, **PAYG solar generates close to 1.6 million mobile money transactions per month**[29]. The PAYG model enables companies to collect data on customer power, consumption patterns, and create credit history for the unbanked. PAYG-enabled credit scoring is making it possible for customers with no formal financial history to access loans, savings and credit products. Towards the end of their payment term, customers with positive credit ratings have the opportunity to access products such as fuel-efficient stoves, rainwater harvesting tanks, smartphones, TVs, water pumps, bicycles or school fee loans. **In the case of M-KOPA in Kenya, credit reports have been transferred for more than 160,000 customers, enabling previously unbanked customers to gain access to institutional loans with low interest rates**[30].

Health, Safety and Quality of Life

Moving from traditional energy sources, such as kerosene and candles, to modern solar power transforms quality of life, making homes safer and brighter. For example, FINCA International's recent study in Uganda paints a stark picture of health and safety in energy poor households that use kerosene for lighting, explaining: "Life is… dangerous and unhealthy. In Uganda, single-wick lanterns are responsible for 70% of fire incidents and 80% of burn injuries. Kerosene, a clear fluid in plastic bottles, spoils food and is accidentally ingested by children. Meanwhile, fuel combustion releases hundreds of pollutants into the air, including carbon monoxide, formaldehyde and benzene, along with a myriad of other damaging particles"[31]. Responses from nearly 800 of their Ugandan solar home system and lantern customers go on to describe the array of health improvements they felt after they switched from kerosene to off-grid solar, including fewer burns and eye problems, reduced toxicity and respiratory problems. With a wider dispersion of light, SHS are also appreciated for their deterrence of rats and other pests. 87% of solar lantern and 95% of solar home system customers reported health and safety improvements once they switched to off-grid solar[32].

These additional hours of clean, safe light also bring other benefits to the home, creating more time for children to study and for families to enjoy time together. For example, research in Kenya found that students with solar lamps studied 35 minutes per day more[33] than those without, while data collected from solar home system customers across East Africa found that 93% spent more time with family after purchasing their system and 94% reported improvements in their quality of life[34].

Climate Benefits

The reduction in toxic kerosene also provides a huge environmental impact, with the switch to off-grid solar products sold by GOGLA Members and Lighting Global affiliates alone responsible for avoiding an estimated 50 million tonnes of CO_2e emissions – equivalent to taking 12 coal fire power plants offline in one year[35&36].

[29] Mobile for Development Utilities: Lessons from the use of mobile in utility pay-as-you-go models, GSMA, January 2017
[30] Mobile for Development Utilities: Lessons form the use of mobile in utility pay-as-you-go models, GSMA, January 2017
[31] Perceived Health Benefits of Off-Grid Products: Results of an end user survey in Uganda, FINCA International, 2018
[32] Powering Education 2, Enel Report, Hassan and Lucchino, 2016
[33] Powering Education 2, Enel Report, Hassan and Lucchino, 2016
[34] Powering Opportunity: The Economic Impact of Off-Grid Solar, Altai Consulting, 2018
[35] Global Off-Grid Solar Market Report H1 2018, GOGLA & IFC Lighting Global, 2018
[36] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

1.7 Further Reading

- Beyond Connections: Energy Access Redefined, SEforALL and World Bank ESMAP, 2015
- Mobile for Development Utilities: Lessons from the use of mobile in utility pay-as-you-go models, GSMA, January 2017
- State of Electricity Access Report (SEAR), World Bank, 2017
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- The Economic Impact of Solar Lighting: Results from a Randomised Field Experiment in rural Kenya, ETH Zurich et al, 2017
- Lifting the Darkness on the Price of Light: Assessing the Effect of Fuel Subsidies on the Off-Grid Lighting Market, UNEP, 2014
- Global Kerosene Subsidies: An Obstacle to Energy Efficiency and Development, Lawrence Berkeley National Laboratory, 2017
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- India Energy Subsidy, IISD, 2018
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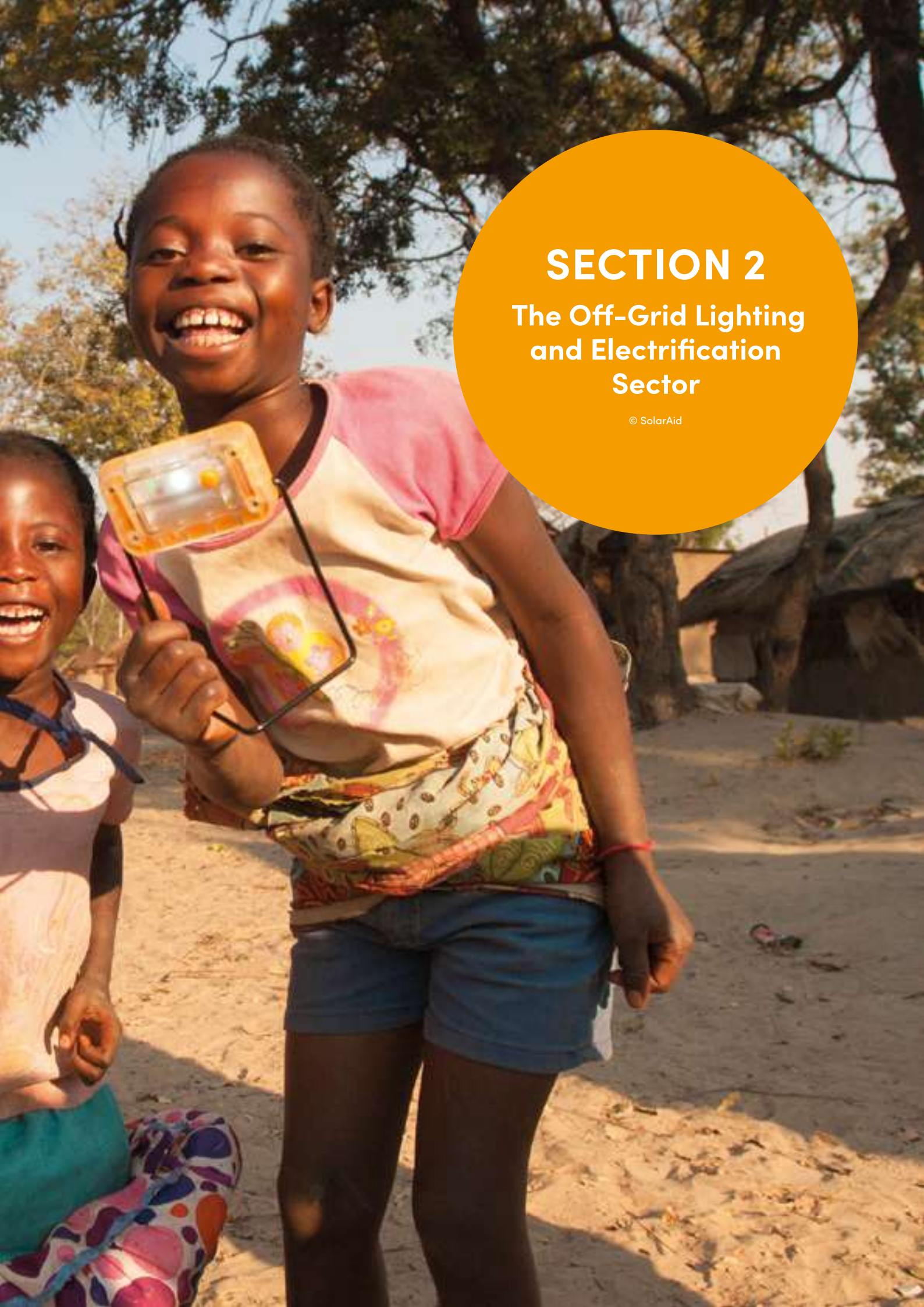


SECTION 2

The Off-Grid Lighting and Electrification Sector

2.1 A Strong Track Record in Delivering Household Electricity Access

The market for off-grid lighting products has grown rapidly, with over 38 million sales from 2010 to the first half of 2018 reported by GOGLA and Lighting Global affiliates (Figure 12). Quality-verified products made up almost 90% of sales in the first half of 2018. The market continues to deliver sales of nearly 8 million products per year, with growth in installed capacity growing 20% from 2016 to 2017[37]. The market grew almost nine-fold in two years from 2011 to 2013, before slowing to 9% average annual growth between 2014 and 2016 (Figure 12). Growth has been driven by advances in technology, which have led to improvements in performance and reductions in price, combined with the emergence of new business models. East Africa and South Asia remain key markets in the off-grid sector, with each region responsible for one-third of global sales in 2017[38].

Figure 12: Sales Volumes, Worldwide, 2014-2016 - Source: GOGLA and Lighting Global Semi-Annual Data Collection

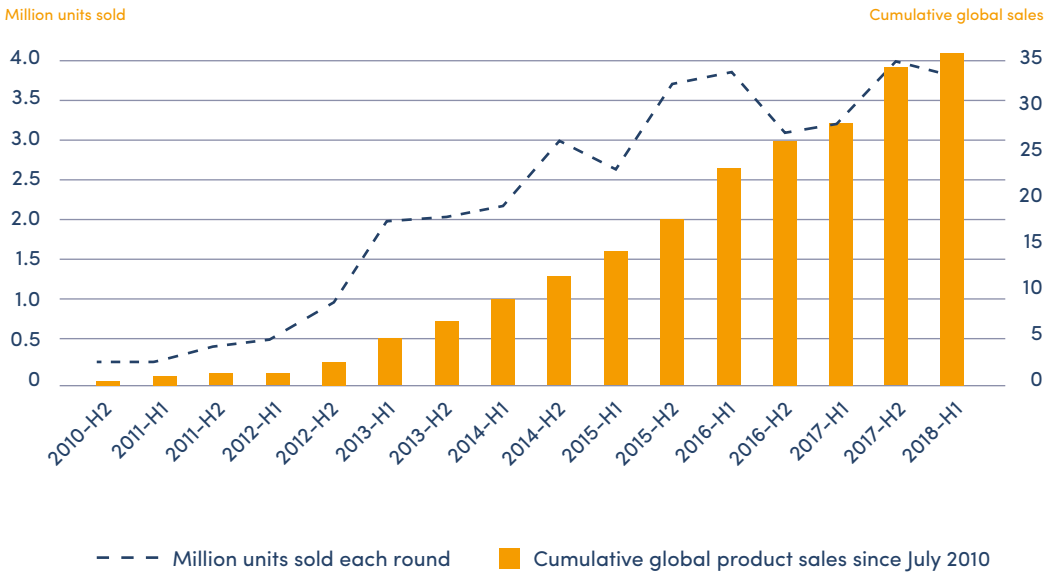
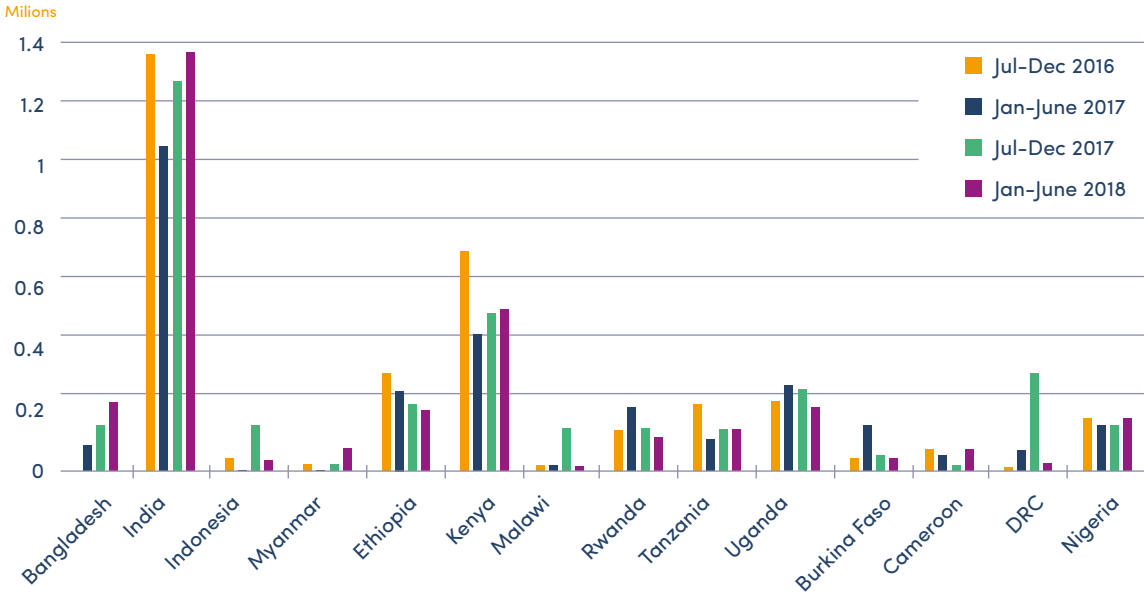


Figure 13 – Volume of Products Sold in Top 10 Countries (Historical)



[37] Adapted from GOGLA and Lighting Global Semi-Annual Data Collection, June 2018
[38] Adapted from GOGLA and Lighting Global Semi-Annual Data Collection, June 2018

There is a connection between off-grid solar market size, and the energy access policy and regulatory environment. Three of the top four markets by sales volume (2016 to 2018) are in the top-performing cluster of 'green zone' countries, scoring 67 or more out of 100, according to the RISE energy access scorecard. The rest are all either green or the mid-performing yellow zone, with only Nigeria and Ethiopia in the poorly-performing red zone[39].

In such a dynamic and fast-moving market, it is helpful to look in detail at factors that have previously led to a dip in overall sales volumes, for example between July and December 2016. This provides a good indication of the kinds of political, economic and environmental factors which influenced market performance in the past and could do so again in the future. These included:

- **Exchange rate fluctuations:** Exchange rate fluctuations make it difficult for companies to price products appropriately. This is particularly challenging for companies that offer consumer financing, as customer payments are in local currency, while costs are largely incurred in hard currency.
- **Extreme weather:** During the second half of 2016, there was a severe drought across East Africa, with devastating consequences for rural populations. With sharp increases in the price of food, coupled with declining agricultural output, the disposable income of many rural customers was severely constrained.
- **Import tariffs:** In the East African Community (EAC), changing fiscal policies led to increased import tariffs on solar products and appliances, presenting companies with a challenge to maintaining product affordability. While overall sales in EAC still grew, the rate of growth was significantly slower than in previous rounds. A decline in the sales of solar home systems was recorded for the first time in East Africa.
- **Demonetization:** In India, demonetization rendered a significant proportion of the nation's cash invalid, having a major impact on the economy. Distributors of solar products had to focus efforts on making sales and collecting payments in an environment where consumers were suddenly cash-strapped, contributing to a decline in sales.

The slower pace of growth since 2014, and the decline in sales in H2 2016, both point to an urgent need for continued policy and regulatory reform, if sustained and rapid growth – and thus achievement of universal energy access – is to be achieved. Improvements in the policy and regulatory environment can boost growth, and make the market more resilient in the face of environmental or macro-economic shocks.

Despite headwinds, over the past eight years the sector has built a strong track record in delivering household electricity access. Off-grid lighting products sold by GOGLA and Lighting Global affiliates are currently delivering improved energy access to nearly 104 million people worldwide. 55.0 million people have now reached Tier 1 energy access and 3.7 million people have reached Tier 2 energy access, according to the latest Global Off-Grid Solar Market report[40].

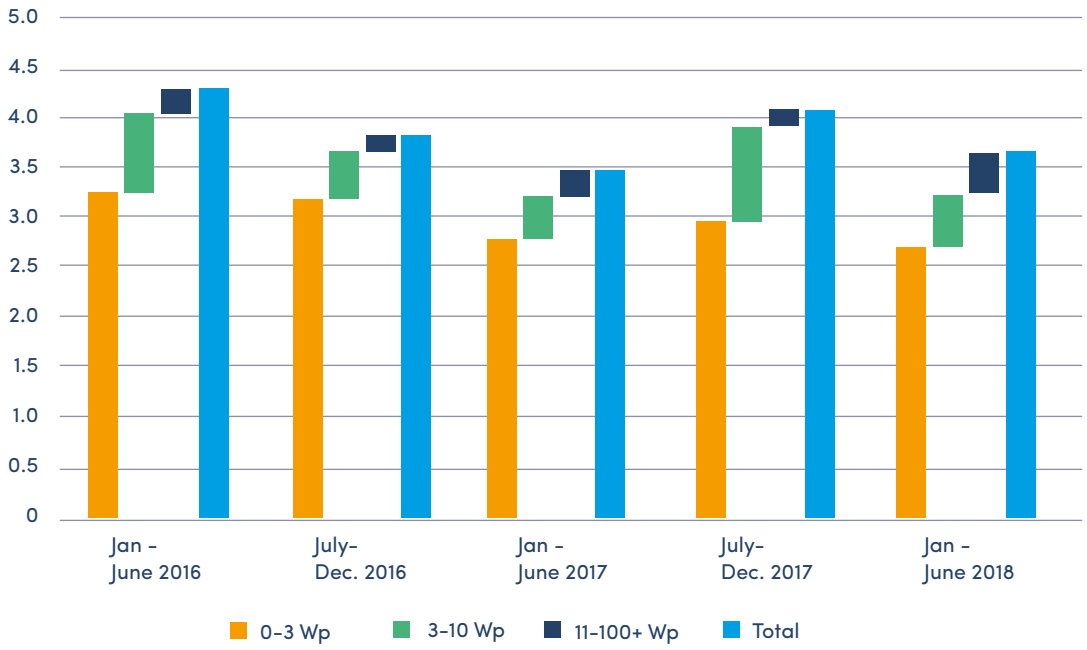
Figure 14: Product categories and levels of energy service - Source: GOGLA Sales and Impact Reports

Overall category	Solar module capacity , Watt Peak (Wp)	Categorization by services provided by product	Corresponding level of multi-tier framework energy access enabled by use of product
Portable Lanterns	0 – 1.499 Wp (indicative)	Single Light only	Enables partial Tier 1 Electricity Access to an individual person
	1.5 – 2.999 Wp (indicative)	Single Light & Mobile Charging	Enables full Tier 1 Electricity Access to at least one person and contributes to a full household
Multi-light Systems	3 – 10.999 Wp (indicative)	Multiple Light & Mobile Charging	Enables full Tier 1 Electricity Access to at least one person up to a full household
Solar Home Systems	11 – 20.999 Wp	SHS, Entry Level (3-4 lights, phone charging, powering radio, fan etc.)	Enables full Tier 1 Electricity Access to a household
	21 – 49.999 Wp	SHS, Basic capacity (as above plus power for TV, additional lights, appliances & extended capacity)	Enables full Tier 2 Electricity Access to a household when coupled with high-efficiency appliances
	50 – 99.999 Wp	SHS, Medium capacity (as above but with extended capacities)	Enables full Tier 2 Electricity Access to a household even using conventional appliances
	100 Wp +	SHS, Higher capacity (as above but with extended capacities)	

[39] United Arab Emirates is in the top ten countries by sales volume, but nearly all products entering the country are subsequently exported for sale elsewhere. As the country does not have an energy access deficit, it is not ranked in the RISE report, and thus not colour-coded.
[40] Adapted from GOGLA and Lighting Global Semi-Annual Data Collection, June 2018

With the emergence of PAYG and other innovative solutions to affordability barriers, **the sector is steadily delivering greater functionality and higher levels of energy access to customers.** As shown in Figure 15, the proportion of sales delivering Tier 1 and Tier 2 access through multi-light systems and solar home systems is 26% from January to June 2018, increasing from 22% in January to June 2016.

Figure 15: Sales by product category, worldwide – Source: GOGLA Sales Reports and RISE Database



A Note on GOGLA Sales and Impact Report Data:

GOGLA data presented in this section is self-reported every six months by GOGLA and Lighting Global affiliates, selling both quality and non-quality verified off-grid solar lighting kits; this means that products that are sold as components (e.g. individual panels or batteries) or as top-up products (e.g. TVs, fans or radios that are sold as single appliances) are not included in the numbers reported here. Quality verified products are those that have met the IFC Lighting Global Quality Standards, which are based on IEC Technical Specification 62257-9-5, during the relevant reporting period; the absence of quality verification does not necessarily imply that products are of lower quality, and there are a variety of legitimate reasons for products not to have quality verification.

Based on previous analysis by Dalberg Advisors for the Off-Grid Solar Market Trends Report 2018, we estimate that the data reported here represents around 30% of the market for systems with less than 11 Wp, and around 60-80% of the market for solar kits with capacity larger than 11 Wp. This proportion varies substantially from country to country.

Data on a specific region, country or product category is only included when it has satisfied the three-data point rule, meaning that at least three separate product manufacturers have reported data for any single data point. When we have fewer than three responses for a region, country or product category, no results are shown to protect the proprietary interests of the companies who have supplied data in support of this industry report.

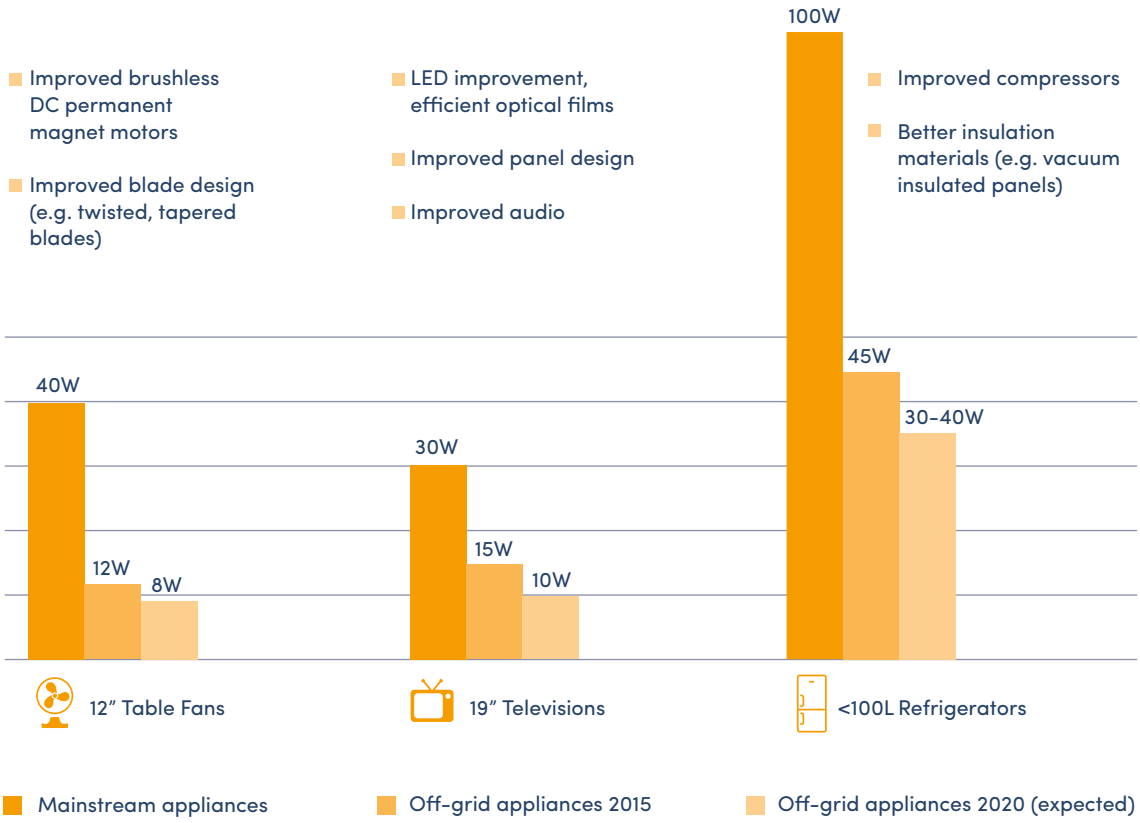
2.2 Technology Trends: Performance Enhancements and Cost Reductions

All product categories have undergone significant cost reductions and performance improvements since 2010. For solar lanterns, which cost $15 to produce in 2012, the cost is expected to decline to $10.90 in 2016, and to $10.10 by 2022, a decrease of nearly one-third[41]. Whilst price reductions are not as dramatic for larger solar lanterns, this category has benefited from increased functionality, with phone charging becoming a standard feature. More efficient LED bulbs have replaced compact fluorescent (CFL) bulbs, whilst lithium-ion has replaced lead acid as the dominant battery technology, improving cycle life and efficiency.

Solar home systems are often sold bundled with efficient appliances (such as fans, radios and TVs) giving customers everything they need to enjoy the benefits of basic energy access. If the goal of energy access is to provide access to the services that energy enables – services which improve access to information, boost productivity, and support other positive social outcomes around health, education and entertainment – then both energy-generating technologies and energy-consuming appliances are needed.

Thankfully, efficient appliances already consume 50-70% less energy than mainstream appliances, and by 2020 these are expected to consume up to 80% less (Figure 16). This will enable more consumers to power appliances using off-grid energy systems. The sale of efficient appliances is an important source of revenue for many companies, helping to attract investment to the industry and drive overall market growth.

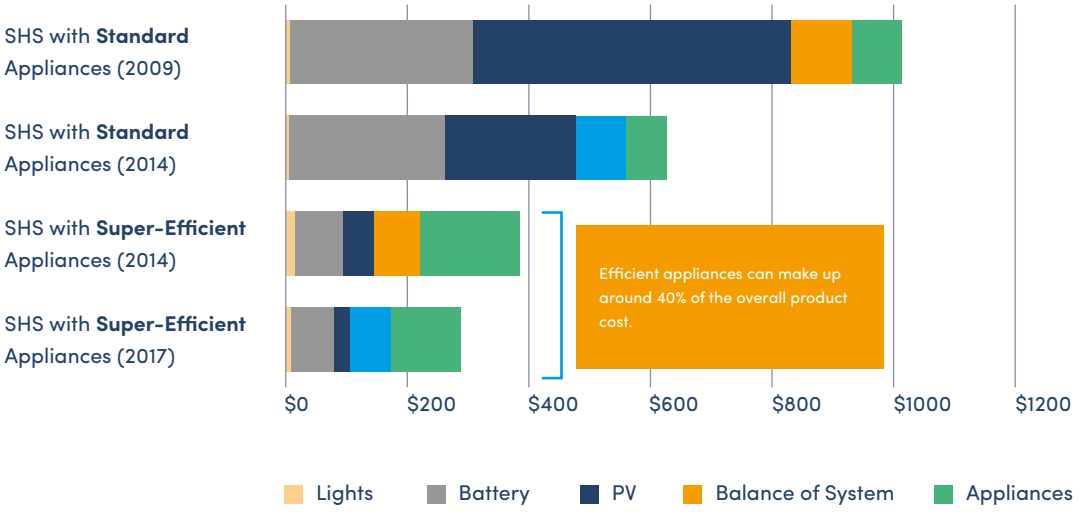
Figure 16: Estimated power rating (W) of off-grid appliances, 2015 - Source: State of the Global Off-Grid Appliance Market, Global LEAP, 2016



[41] Off-Grid Solar Market Trends Report 2018, Dalberg Advisors and Lighting Global, 2018, p. 49. Holding Performance constant for a PV of 3W, light output of 75 lumens and battery size of 14 Wh.

Whilst larger batteries and panels are expected to get slightly cheaper by 2020, savings on bundled solar home systems will mostly come from appliance performance improvements and price reductions, enabling higher levels of service delivery with smaller panels and batteries. In 2014, standard appliances required 121W of PV and 125 Ah of battery capacity, whilst super-efficient appliances delivering the same user experience required just 27W of PV and 27 Ah of battery capacity[42]. **Improving the affordability of appliances is key to scaling up the energy services supplied to the customer**, as efficient appliances can still make up around 40% of the overall product cost (Figure 17).

Figure 17: SHS purchase price based on appliance type – Source: Phadke, et.al., "A Home Energy System in just 25 Watts: Super Efficient Appliances Can Enable Expanded Energy Access Using Off-Grid Solar Power Systems" (1.usa.gov/1K6yfyn)

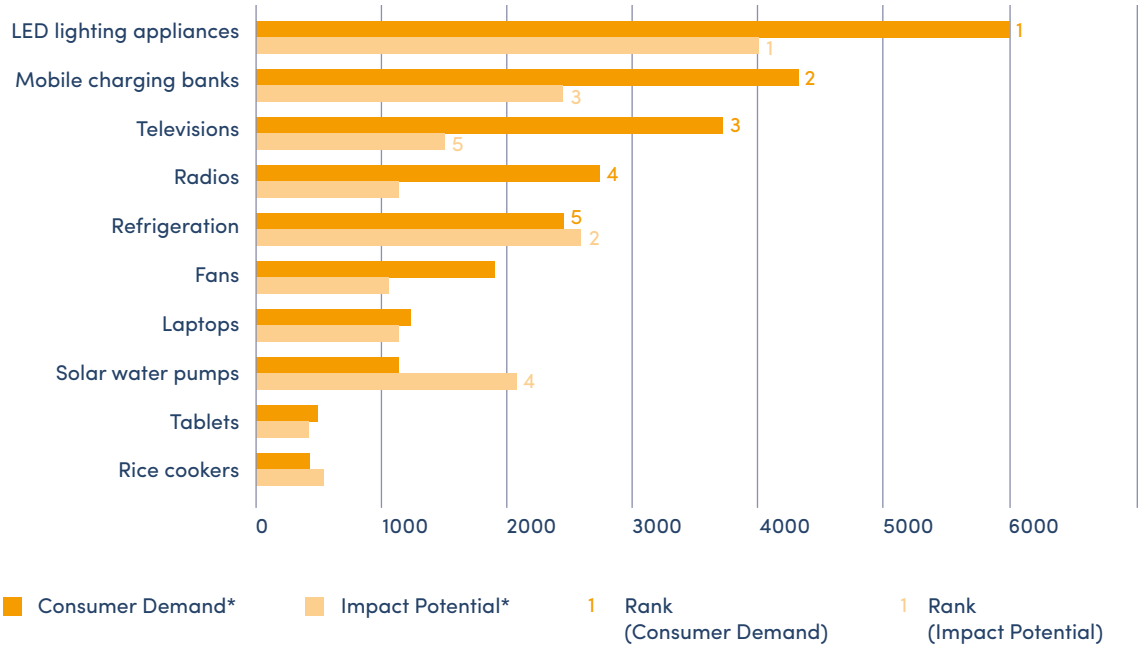


* Systems provide energy for 4 lights, a 19" color TV, a radio, and mobile phone charging
* Appliance use assumption: lights=4hrs/day, TV=3hrs/day, radio=6hrs/day, mobile phone=1 charge per day

[42] Bloomberg New Energy Finance, Off-Grid Solar Market Trends Report, 2016

A survey of 239 energy access professionals from industry, policy and development sectors, undertaken by the Global Lighting and Energy Access Partnership ('Global LEAP' – an initiative managed by the US Department of Energy) found a strong correlation between the level of demand for appliances and their potential development impact (Figure 18)[43]. LED lighting ranks #1 for both consumer demand and potential impact. In terms of anticipated consumer demand, the top five household/SME appliances are: LED room lighting appliances, mobile phone charging, televisions, radios, and refrigeration. In terms of impact potential, the top five are: LED room lighting, refrigeration, mobile phone charging, solar water pumps, and televisions. **As costs come down and efficiency improves, the sector has the potential to sell aspirational and impactful appliances at scale, making a tangible difference to quality of life for millions of customers.**

Figure 18: Household/SME off-grid appliances - anticipated demand and impact ranking – Source: Global LEAP, 2015



2.3 Business Models: A Broad Range to serve Diverse Customer Segments

Alongside technology advancements, efficiency gains and cost reductions, new business models have also been critical drivers of growth. They have made it possible to offer a broader range of products and services, at more affordable prices, in new geographical areas. To serve a diverse set of customers around the world, with different income levels and energy needs, a range of models has emerged. These range from rental or perpetual lease models offering a service, through to direct cash sales offering products (Figure 19).

Figure 19: Main business models, offering products and services

[43] Off-Grid Appliance Survey, Global LEAP, April 2015

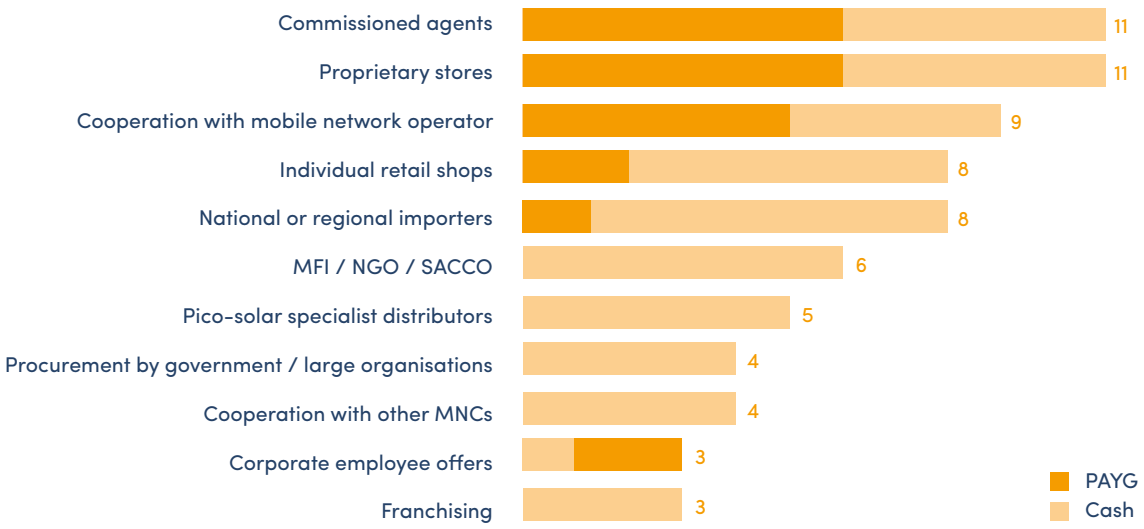
In a rental or perpetual lease model, the company continues to own the solar asset and the customer pays for its usage on a temporary basis. In the lease-to-own model, the most common business model for PAYG companies selling larger systems, customers pay over time for a fixed period before owning the asset. Cheaper, more basic solar products are more likely to be sold for cash, or over time via a financing partner such as a microfinance organization. Customers range from those living below the poverty line in rural areas, to those living in urban and peri-urban areas seeking a back-up system for when grid electricity is not available.

The range of business models in the sector is rapidly evolving and becoming increasingly diverse, with specialized companies emerging to solve specific challenges faced in the market. For example, companies such as Angaza Design work with manufacturers to convert basic solar products into PAYG products, which can be switched off remotely if incremental payments are not made. Mobisol offers a software suite and mobile app to other PAYG companies, to help them manage their customer relationships, payments and salesforce.

Most manufacturers employ multiple distribution strategies to maximize their customer reach. The five distribution models identified by Lighting Africa in 2012 continue to be prevalent today[44]:

- **Proprietary Distribution Channels:** The company maintains a proprietary distribution channel in which its products move from manufacturer to in-house storage facilities to a salaried/contracted salesforce, which exclusively delivers the company's products directly to customers.
- **Distributor-Dealer Channels:** The company sells its products through existing networks of generalist or specialist distributors. This model piggybacks on the traditional private sector supply chain of consumer durables and usually engages a distribution hierarchy of at least two levels (distributor and dealer/retailer).
- **Institutional Partnerships:** The company partners with a relevant institution, for example an NGO, rural financial institution or mobile network operator, to market its products to that institution's customers or members.
- **Franchise Model:** The company offers franchising packages (often including training, marketing support, and financing) to entrepreneurs who wish to become retailers.
- **Rental / Leasing System:** The company recruits entrepreneurs who either rent products out, or sell lights or batteries without a panel, and offer a fixed fee for charging.

Figure 20: Distribution channels used by 30 companies, 2015 – Source: Interviews with 30 companies for the Off-Grid Lighting Market Trends Report, Bloomberg New Energy Finance, 2016



[44] Lighting Africa Market Trends Report 2012, Lighting Africa, April 2013

Lighting Africa and Dalberg Global Development Advisors estimate that companies on average derive 30-50% of their sales from distribution partnerships and 50-70% through standard retail channels[45]. Figure 19 illustrates the different distribution strategies used by leading manufacturers.

The GSMA is supporting PAYG companies through its Mobile for Development Utilities programme, to help drive mobile and mobile money adoption. It finds that, like the market for products sold for cash, the PAYG solar market has grown rapidly, achieving average annual growth rates of 140% from 2012 to 2016, and proving to be by far the most attractive market segment for investors. Over **800,000 units, ranging from 4W to 200W+ have now been sold**, with 5% of PAYG companies responsible for more than 90% of sales. Each month there are an estimated 40,000 sales, with around $10 million in credit extended to customers[46].

Four East African markets — Kenya, Tanzania, Uganda and Rwanda — account for around 730,000 PAYG sales, whilst around 30,000 systems have been deployed in West Africa and 20,000 have been deployed in South Asia[47]. The countries that have benefited most from the emergence of PAYG, apart from Nigeria, are all in the 'top-performing' or 'mid-performing' clusters of countries according the RISE policy scorecard. The size of the addressable market has been a key factor to consider when launching operations[48]. Other factors to consider include ease of doing business, population density, maturity of mobile payment infrastructure and cost of alternative energy supply[49].

Lease-to-own business models, where customers pay for the product over time and eventually become the owner of the system, are more prevalent than 'energy-as-a-service' models where customers pay on an indefinite basis. This leads the GSMA to conclude that customers appear to value asset ownership over long term engagements. Partnerships with mobile operators are becoming increasingly commonplace, with around 9 out of the 30 PAYG companies being supported by the GSMA cooperating with mobile network operators on distribution. The far-reaching distribution and sales networks of mobile operators, combined with their recognizable and trusted brands, gives providers the opportunity to leverage these assets to reach underserved customers[50].

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[45] Lighting Africa Market Trends Report 2012, Lighting Africa and Dalberg Global Development Advisors, 2012
[46] Mobile for Development Utilities: Lessons from the use of mobile in utility pay-as-you-go models, GSMA, January 2017
[47] Mobile for Development Utilities: Lessons from the use of mobile in utility pay-as-you-go models, GSMA, January 2017
[48] This is estimated by the GSMA based on the number of customers covered by mobile networks, but without access to electricity. The ten countries with the largest addressable markets are found to be India, Nigeria, Bangladesh, Indonesia, Kenya, Uganda, Tanzania, Pakistan, Philippines and Democratic Republic of Congo.
[49] Mobile for Development Utilities: Lessons from the use of mobile in utility pay-as-you-go models, GSMA, January 2017
[50] Mobile for Development Utilities: Lessons from the use of mobile in utility pay-as-you-go models, GSMA, January 2017

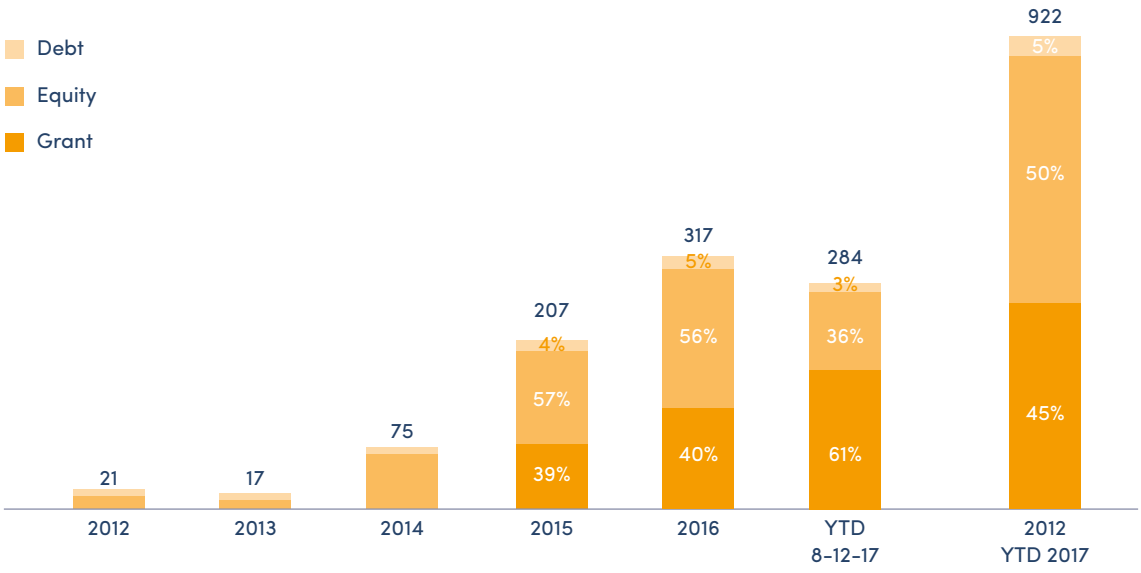
2.4 Investment Trends: Faster Growth is Needed

Despite strong growth in overall investment over the past five years, improving **access to finance continues to be cited as one of the key drivers of continued and accelerated market growth**. In 2017, investments reached $284 million, which while 21 times higher than annual investment in 2012, still falls short of the estimated $5 billion that is needed annually for the off-grid solar sector to reach its potential (as shown in Figures 21 and 22). Moreover, while the number of transactions in the sector has grown, investment remains highly concentrated in a small number of companies and one region - the top 10 firms account for 87% of investments while the East African market absorbed nearly two-thirds of the funds in 2017[51]. Addressing the financing gap is therefore not only a question of volume but also about funding flows. To adequately fund the industry, more funding needs to be channeled towards a higher number of companies and into underserved regions.

PAYG companies, which provide financing for most of their customers, have attracted the bulk of financing due to its higher growth rates and larger funding needs. When PAYG companies began to emerge in early 2013, cash-sales companies has already attracted almost $40 million. By the end of 2015, PAYG companies had raised almost $250 million, four time as much as the cash-sale segment. This figure had risen to more than $360 million by the end of 2016[52]. More specialized investment products continue to evolve and develop as the market grows and the first companies have been able to secure investment from local banks.

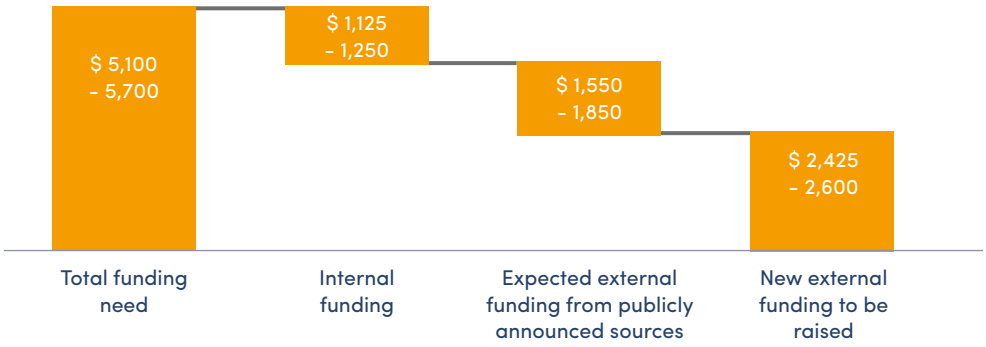
Cultivating local sources of capital will be integral to the market's long-term development, especially for the growing PAYG sector which is exposed to significant foreign currency risk. Nonetheless, current funding from local institutions is insufficient to support industry growth given the size of the sector's needs, and foreign investments continue to be needed to maintain the market's growth.

Figure 21: Annual investment in the off-grid sector over time, by financing instrument - Source: Off-Grid Solar Market Trends Report 2018, Dalberg Advisors and Lighting Global, 2018



[51] Off-Grid Solar Market Trends Report 2018, Dalberg Advisors and Lighting Global, 2018, p.125
[52] Mobile for Development Utilities: Lessons from the use of mobile in utility pay-as-you-go models, GSMA, January 2017

Figure 22: New external funding to be raised: Projected funding sources (millions USD) – Source: Off-Grid Solar Market Trends Report 2018, Dalberg Advisors and Lighting Global, 2018



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- Off-Grid Solar Market Trends Report 2016, Bloomberg Energy Finance, 2017
- Mobile for Development Utilities: Lessons from the use of mobile in utility PAYG models, GSMA, January 2017
- Off-Grid Solar Market Trends Report 2018, Dalberg Advisors and Lighting Global, 2018

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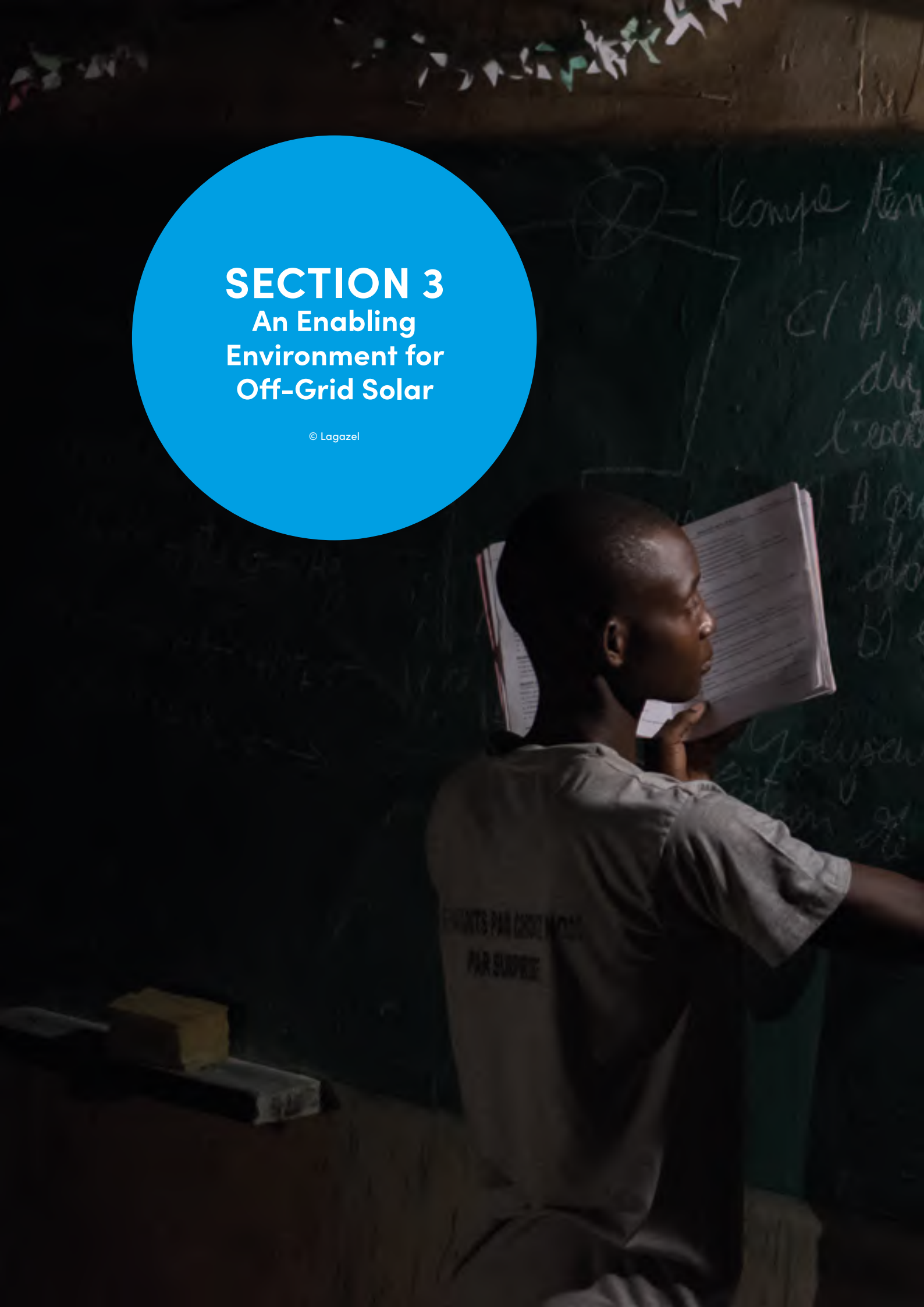
SECTION 3
An Enabling Environment for Off-Grid Solar



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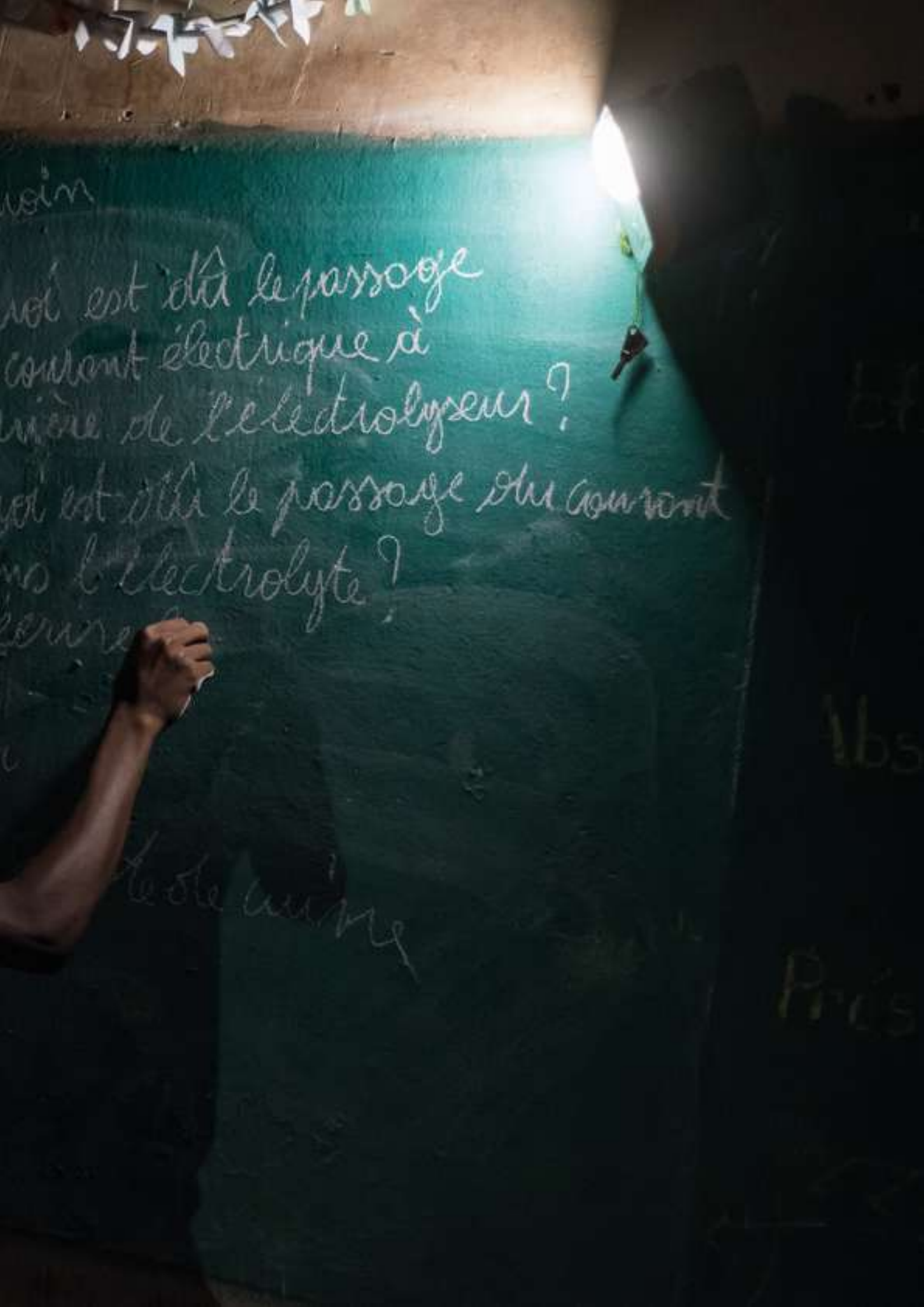
quoi est dû le passage
courant électrique à
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oi est dû le passage du courant
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3.1 Collaboration to Accelerate Off-Grid Energy Access

More research and innovation is needed to identify the most effective ways that government and the private sector can work together to create and maintain an enabling environment for off-grid solar market growth. However, there is emerging consensus that **a robust partnership between government and private sector is needed for stakeholders to work together effectively in pursuit of energy access goals.** Governments need to be able to communicate changes in the policy environment to the private sector, and receive feedback from companies with regards to how policies and programmes are affecting performance. As noted by SEforALL, 'enhanced collaboration between energy ministries and other ministries—such as finance, education, health, rural development and environment [is needed] - to ensure policy coherence across a range of policy areas in the economy'[54]. Companies in turn need a channel through which they can communicate emerging challenges and opportunities in the market. Regular communication can help to build trust and mutual accountability.

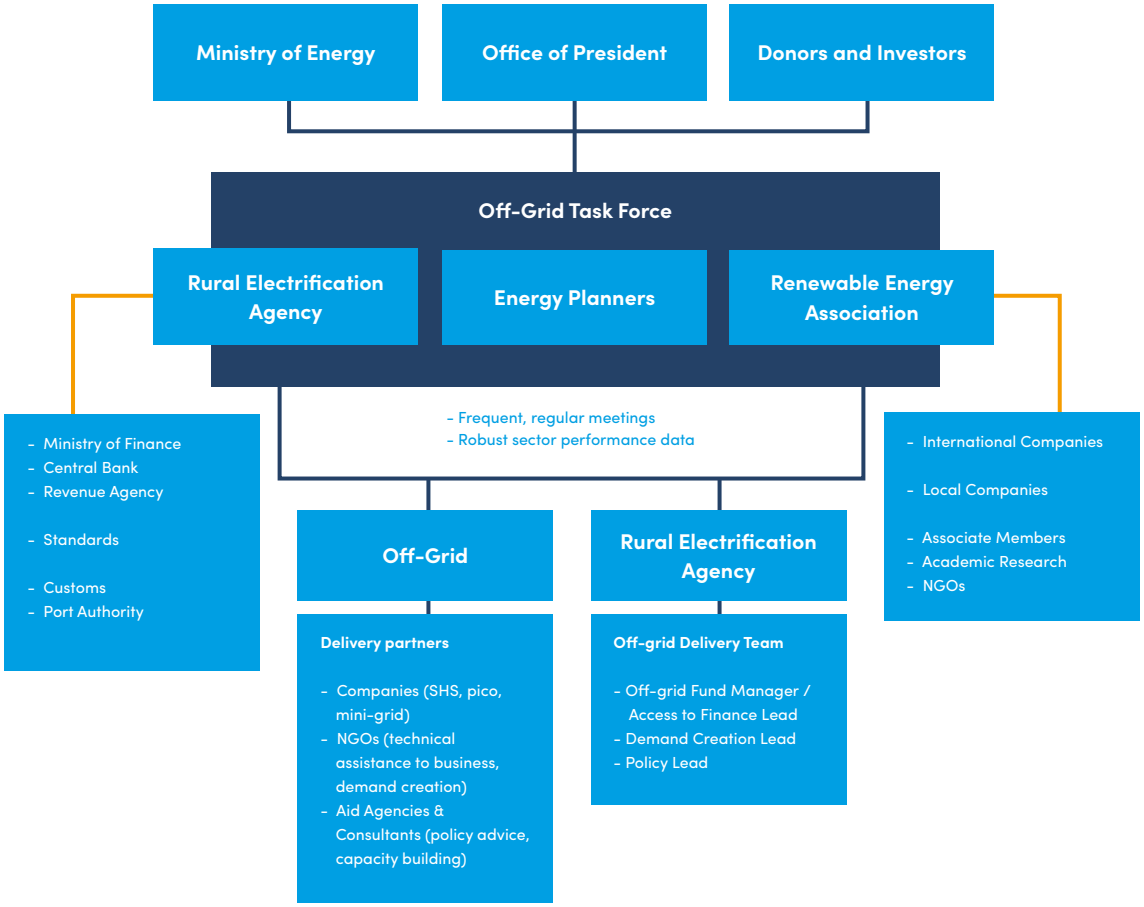
To facilitate collaboration and dialogue, **a lead agency within government is needed, that has been clearly mandated to work with the private sector to achieve universal energy access.** Such an agency could coordinate activity across all Ministries, Departments and Agencies to support off-grid energy access. On the private sector side, companies can form or join national renewable energy industry associations, and develop joint policy recommendations, to speak with one voice on issues of relevance to the market as a whole.

Off-grid energy 'task forces' can be formed to enable government, private sector and other relevant stakeholders to meet regularly, monitor progress and, where relevant, take action in support of off-grid solar market growth (Figure 23). According to the Power for All campaign, based on experience in Sierra Leone: 'once established and empowered by a country's head of state, the energy ministry, and the local donor coordination committee (including aid agencies, development finance institutions, and multilateral development banks), a taskforce can become a powerful collaboration tool to bridge the goals of a Rural Electrification Agency and the interests of the National Renewable Energy Association'[55]. The Energy Revolution Taskforce in Sierra Leone was able to drive through implementation of a VAT/tariff exemption for solar products in 2016 through engaging customs authorities, revenue authorities and the Ministry of Finance. Ideally, taskforce meetings would be informed by the latest data from energy access programmes, as well as market sales and impact data, thus helping to build a shared understanding of market performance, as well as the challenges and opportunities companies are facing.

In addition to facilitating dialogue and collaboration between government and the private sector, task forces can be used to engage other stakeholders with a role to play in delivering energy access. For example, civil society organizations with strong links to communities can be engaged to play a role in public awareness campaigns, provide technical assistance to distributors, or provide policy advisory services to government. Mobile network operators, local financial institutions and cooperatives can be engaged to play a role in last mile distribution, or to help overcome affordability challenges through offering consumer finances. Off-grid energy task forces or similar structures can provide a platform through which to engage other stakeholders and enlist their support in the pursuit of off-grid energy access goals.

[54] Energizing Finance, SEforALL, 2017
[55] Decentralised Renewables: From Promise to Progress, Power for All, March 2017

Figure 23: A multi-stakeholder 'task force' can coordinate and accelerate policy reform and programme design to drive market growth – Source: Power for All, 2017



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3.2 Integrated Electrification Planning: Key to Understanding Challenges and Developing Solutions

The establishment of a robust policy framework for stand-alone solutions helps to create certainty, increase the predictability of the policy environment, and attract investment. Investment risks, or the perception of risks, can be mitigated through consistent policy statements from decision makers in government, the use of clear wording in electrification planning and policy documents, and clarity and transparent communication around the roles and responsibilities of each government agency involved in electrification planning. In some countries, off-grid solar is electrifying more households than the grid, and is doing so in more cost-effective ways for both governments and customers in many locations, so inclusion in national electrification planning is vital to the achievement of electrification goals.

When developing or updating national electrification policies, coordination and collaboration with stakeholders, including industry and development partners, is vital to ensure that electrification policy solutions proposed are able to be met with available technology and are conducive to supporting a sustainable off-grid sector.

Inclusion of grid, mini-grid and off-grid solutions in electrification strategies, as part of an integrated approach, is the key to developing effective electricity access solutions. Geospatial planning techniques can be used to analyse a range of factors which influence the most cost-efficient and technology-neutral way to connect communities – including the size of the community, population density, distance to national grid, terrain and level of economic activity. Based on such analysis, governments can make more informed decisions about the appropriate mix of grid, mini-grid and off-grid solutions to deploy, whilst also factoring in other considerations such as availability of funding, broader macroeconomic conditions and government priorities. A technology-neutral approach to electrification planning can reduce the cost, time needed and complexity of reaching universal access targets, and can focus instead on the energy services required by households, including improving reliability of access. The penetration of mobile money, and the ability and willingness to pay can help determine which solution or solutions are viable in each region. This type of market intelligence is useful both to governments looking for energy solutions, and to the private sector to help guide future market expansion. Co-existence of energy solutions can work – solutions need not be exclusive. Well-designed electrification plans leverage the complementarity of a range of energy solutions.

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Inclusion in national electrification planning also raises the profile of off-grid solar, which helps establish a consistent and coherent framework for decision making in other areas of government where decisions that impact the affordability of solar products are made, avoiding sudden changes in policy, especially those which have a direct impact on the cost of business. Clarity and continuity of government support can improve market and investor confidence in a government's commitment to promoting growth in the sector.

Setting targets, based on the multi-tier framework, can send a powerful signal to companies and investors that a government is committed to creating the conditions for off-grid solar market growth. This is especially the case, if targets are timebound and accompanied by geospatial plans showing where grid, mini-grid and standalone solutions are to be deployed. Whilst targets should take account of government ambitions for energy access, it is also important to consider household electricity needs, as well as ability and willingness to pay. Multi-tier framework surveys, outlined in more detail below, can help to set targets in a way that takes account of all these factors.

Monitoring: The World Bank recommends a four-pronged approach to strengthening data for monitoring energy access, and tracking progress. These approaches could be used not only to track energy access itself, but also to track other key metrics such as the level of public and private investment flowing into the sector[56]:

1. **Establishment of a multi-tier baseline:** A survey is currently being undertaken by the World Bank ESMAP team, covering 15 countries. This could be extended to cover more countries in future.
2. **Integration of basic energy access questions into existing household surveys: These might** include Demographic and Health Surveys and Living Standards Measurement Surveys. A 'minimalistic framework' has been developed by the World Bank ESMAP team specifically for this purpose.
3. **Multi-tier framework surveys:** All energy access survey efforts can be integrated into one standardized household energy survey, customised to meet individual country needs and conducted every 2-3 years. Such a survey could provide comprehensive energy access diagnostic information to inform strategy and planning.
4. **Adoption of the multi-tier measurement approach by programs and projects** would provide up to date data in between detailed country-level surveys, as well as making it easier to synthesize monitoring information to track progress at national and international levels. Supply-side measurement can be based on the performance characteristics of solutions supplied, whilst demand-side measurement can be undertaken through household surveys.

Finally, it is important that electrification planning allows for future flexibility based on new technologies becoming available or economic developments within the country. Plans should be regularly reviewed, and flexibility should be given to allow the market to respond to these types of changes.

Further Reading

- Beyond Connections: Energy Access Redefined, World Bank / ESMAP, 2015
- State of Electricity Access Report (SEAR), World Bank, 2017
- Global Tracking Framework, SEforALL, 2013
- Global Tracking Framework: Progress towards Sustainable Energy, SEforALL, 2017

[56] Beyond Connections: Energy Access Redefined, World Bank / ESMAP, 2015

3.3 Public Funding: How to Support Growth and Minimize the Risk of Distortion

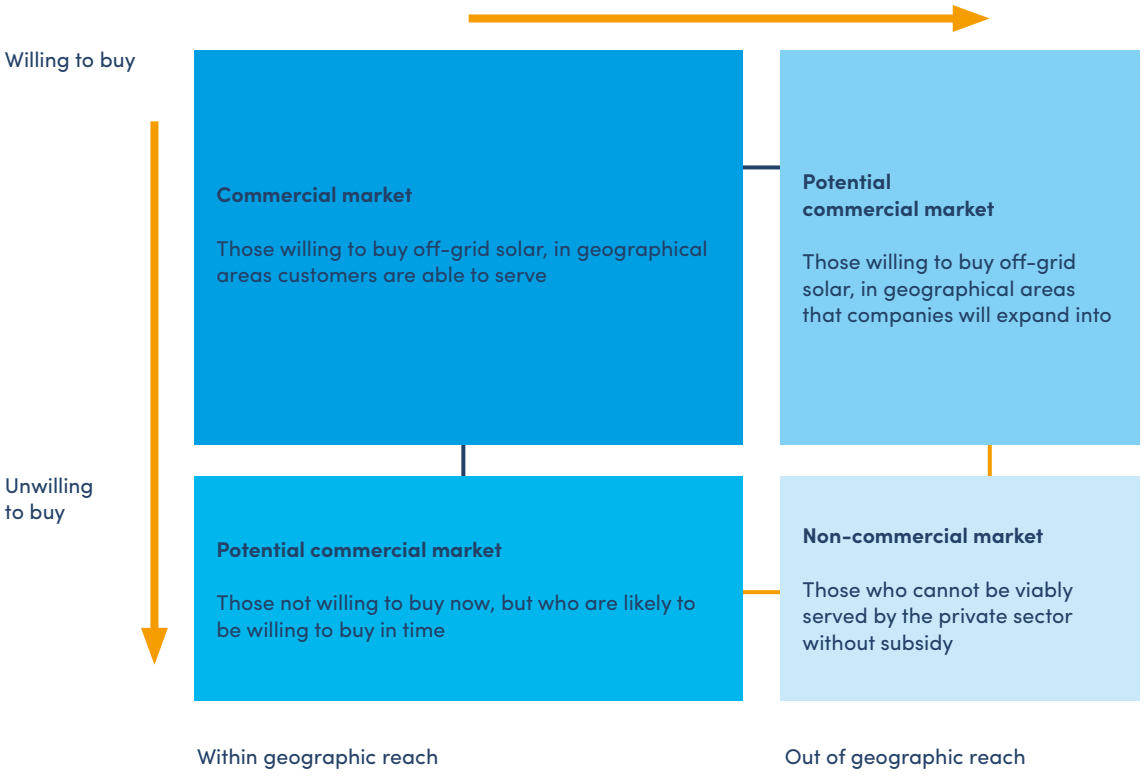
Public funding has a vital role to play in accelerating energy access through accelerating market growth. Publicly funded awareness campaigns, results-based or concessional financing schemes, tax exemptions, or efforts to promote quality in the market, are all widely supported within the sector. These measures require government investment in the short-term, but deliver a significant pay-off in the long term.

However, if governments subsidize end-user prices or distribute products for free in areas where companies are seeking to sell products, this can distort the market, signalling to customers that they do not have to pay full retail price, or pay at all. Customers may hold out for reduced-cost or free goods in future, and are more likely to default on PAYG products that they have already purchased. This undermines the commercial viability of off-grid companies, and discourages future investment. While there may be short-term benefit for selected users, longer-term adoption of stand-alone solar is likely to be reduced, and could be reversed, if market distortion is not carefully minimized.

Free distribution schemes rarely lead to sustainable outcomes, whilst if customers make a financial contribution to system cost, a sense of ownership is created which supports sustainability in the longer term.

It is useful to differentiate between the 'commercial' market and the 'non-commercial' market. The commercial market is made up of those who are currently willing to buy in geographical areas that companies are able to serve. The non-commercial market is made up of those that cannot be served on a commercial basis without subsidy. This is either because they are unable to afford off-grid solar, they live in a geographical area that companies are not able to serve, or both. The commercial market expands over time — as companies enter new geographical areas they will first serve wealthier 'early adopters'. However, as communities become more familiar with standalone solar and as trust in the technology grows, demand and willingness to pay improves amongst lower income groups as well (Figure 24)[57].

Figure 24: The expanding commercial market for off-grid solar - Source: GOGLA



[57] An important factor in determining the size of the commercial market is the size of the solar system – basic solar lighting products are more affordable, and cheaper to distribute and maintain across a sparsely populated area, than larger solar home systems. Forthcoming research from Humboldt State University and the UN Capital Development Fund finds that the income levels of those choosing PAYG SHS and those choosing entry-level products do not vary as much as expected. Availability of larger systems may be more important than income in determining the size of system that customers choose. Flexible financing can enable relatively low-income customers, with annual incomes of between $550 and $1600, to purchase a 10-20W SHS as their first solar product. See: Off-Grid Energy Adoption Dynamics in Uganda: Initial Findings and Observations, Jacobsen & Goyal, Humboldt State University, 2017

Public funding should be used to accelerate expansion of the commercial market, to all geographical areas that companies can viably serve, and to all customers that can afford to buy. Figure 25 shows how public funding can be used to build demand and willingness to pay, support consumer choice, 'crowd in' private investment, and minimize market distortion. These interventions focus on reducing 'upstream' risks and costs for businesses, so that they do not undermine 'downstream' consumer price expectations and willingness to pay. They are explored in more detail in other guidance notes in this series.

Figure 25: Best ways to deploy public funding on commercial, potential commercial and non-commercial markets

Accelerating off-grid market growth should be the starting point for government intervention. In general, interventions which seek to accelerate market growth lead to more competition and lower prices for consumers, expanding the proportion of consumers that can be reached by the commercial market. This minimizes the need for end-user price subsidy, which can then be provided only for supporting those target groups that really need it, at lower cost to government. The need for price subsidies can also be reduced if governments set targets for achieving universal Tier 1 or Tier 2 energy access as a first step, in line with customer needs and willingness to pay, rather than focusing on Tier 5 access immediately.

End-user subsidies are likely to be needed to reach 100% of off-grid customers. However, due to the risk of market distortion, which can slow down overall electrification efforts, they should ideally be introduced only in the final phases of electrification efforts, once market-based approaches have fully realized their potential. If subsidy programs are implemented in parallel with efforts to expand the commercial market, they need to be designed carefully to minimize the risk of market distortion. It is recommended that such programs be designed and monitored in consultation with the private sector, which is well-placed to track the impact such schemes are having on customer behaviour and business performance. For example, the Government of Kenya consulted extensively with the private sector before designing the Kenya Off-Grid Solar Access Project for Underserved Counties (K-OSAP) programme, which provides debt and results-based financing to companies that agree to enter specific, under-served regions of the country[58]. This both accelerates off-grid market growth and enables poorer communities, in more remote areas, to benefit.

In general, good public funding schemes are simple, predictable, reliable and transparent. They are designed in partnership with industry, and based on a solid understanding of market barriers. They focus on replicating and scaling proven solutions, and are delivered at scale over the long term to ensure they have a meaningful and lasting impact. Technology should be used to minimize administration and transaction costs for businesses, and robust data collection systems should be used to track progress and monitor impact. Well-designed schemes phase out over time, leaving a sustainable off-grid solar market.

Further Reading

- Industry Opinion on the Role of Public Funding to Mobilise Investment for Access to Energy, GOGLA, June 2016

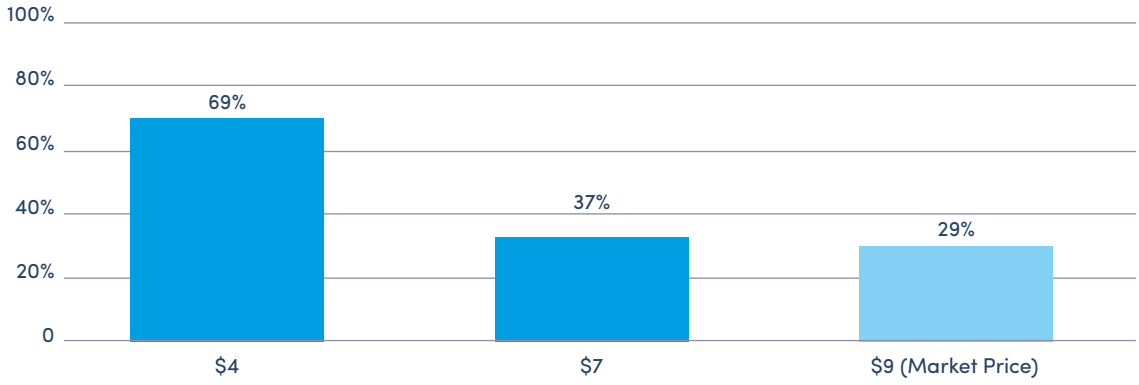
[58] http://documents.worldbank.org/curated/en/212451501293669530/Kenya-Off-grid-Solar-Access-Project-for-Underserved-Counties

3.4 Lower Taxation: One of the Most Effective Ways to Improve Affordability

The business case for customers to switch from kerosene, battery-powered torches or candles to solar lighting is compelling. Basic solar lights can 'pay for themselves' through savings in around 10 weeks when they replace kerosene lamps. While the monthly repayments for basic PAYG solar products are similar to, or only slightly more than, previous spending on inefficient lighting, they offer a far higher level of modern energy service. Data collected by the social enterprise, SolarAid, in Kenya, Malawi, Tanzania, Uganda and Zambia shows that 82% of customers buying $10 solar lights live below the $3.10 poverty line. Looking across five SHS and mini-grid companies, Acumen finds that around 36% of customers live below the poverty line[59]. Despite this, a major barrier to market growth is affordability of standalone solar products, services and related appliances. Buying solar lights remains a challenge for the extreme poor, whilst payment for larger systems and appliances is out of reach for a significant proportion of low income households.

Consumers across all income brackets are price sensitive – with willingness to pay closely linked to price. VAT and import tariffs on solar products can be as high as 40% of the cost of goods, raising prices and putting off-grid products and services out of reach of the poorer customers who need them most. The increase in uptake due to reduced product prices can be significant. A study in Kenya found that reducing the price of a solar lamp from $7 to $4 increased household uptake from 37% to 69% (Figure 26)[60]. Lighting Africa finds that, even after using a product for just one week at home, the price customers said they would be willing to pay tripled[61].

Figure 26: Take-up ratio at different prices – Source: ETH Zuricht et al, 2017



In a competitive, price-sensitive market, achieving significant sales volumes - and the economies of scale that come with high volumes - is vital to business success. Competition forces companies to pass on savings from lower taxation, to consumers in the form of lower prices. The temporary or permanent removal of VAT and tariffs – covering the entire product, including any appliances - is one of the most effective ways for governments to support the growth of the standalone solar market, improving affordability, boosting uptake and accelerating energy access. Price reductions and enhancements in performance are expected across all product categories to 2020, however efficient appliances remain a large proportion of the total cost (Figure 25). Tax exemptions on appliances in particular help to keep prices affordable for consumers.

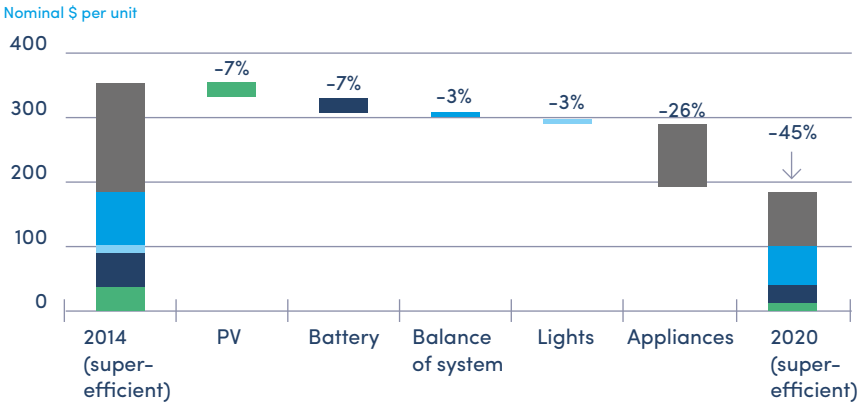
VAT and import tariff exemptions have been a major driver of market growth all over the world. In Africa, Kenya, Tanzania, Uganda and Rwanda have all utilized exemptions to drive growth – these four countries alone account for over 25% of worldwide market share.

GOGLA and its members consider tax exemptions to be preferable to end-user price subsidies, because tax exemptions are less likely to cause market distortion - they benefit all companies equally. They attract more companies into the market, thereby increasing competition, which ultimately benefits consumers.

[59] An Evidence Review: How Affordable is Off-Grid Energy Access in Africa, Acumen, 2017
[60] The Economic Impact of Solar Lighting, ETH Zurich & SolarAid, Feb 2017
[61] The Off-Grid Lighting Market in Sub-Saharan Africa: Market Research Synthesis Report, Lighting Africa, 2011

Figure 27: Product cost developments - Source: Off-Grid Lighting Market Trends Report, Bloomberg New Energy Finance, 2016

Solar home systems with TV, radio, lights



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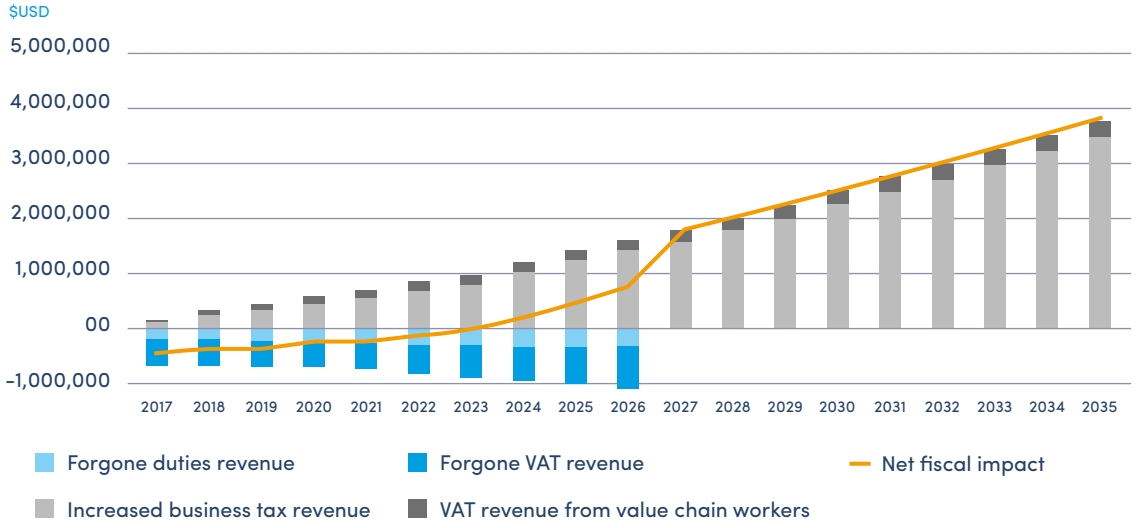
A common concern around VAT and import tariff exemptions is the loss of revenue for cash-strapped governments. However **recent studies suggest that for many countries VAT and import tariff exemptions may deliver a boost to government finances in the long-run, in addition to broader household and macroeconomic benefits.** One model in Mozambique found that standalone solar market growth would increase business taxes through enabling businesses to stay open longer, increasing time spent working through improved health, and job creation in the standalone solar supply chain (Figure 28)[62].

These findings are corroborated by studies showing that off-grid solar unlocks economic opportunities and creates savings which are invested back into local economies. For example, research profiled in the recent report, Powering Opportunity, found that nearly 60% of households with solar home systems in East Africa reported increased economic activity, with 36% creating additional income within the first three months of ownership. Almost a quarter of customers were using their systems to support business and enterprise, such as keeping shops and restaurants open later at night, whilst others were making the most of additional time unlocked by more light hours and less time travelling to buy fuel to take on more work or get a new job. Meanwhile, savings on energy expenditure created by switching from a kerosene lantern to a solar light, are found to be spent on food, education and small business development[63].

Figure 28: Fiscal impact of 10-year vat/tariff exemption in Mozambique – Source: Economic Consulting Associates, 2016



For countries that import kerosene, batteries, torches, or candles there is likely to be a **positive impact on the balance of payments and on foreign exchange reserves,** as these technologies are replaced by off-grid solar. For countries that subsidise kerosene for lighting, there could also be **significant savings on kerosene subsidies** (see Section 1.6).

Further Reading

- An Evidence Review: How Affordable is Off-Grid Energy Access in Africa, Acumen, March 2017
- The Economic Impact of Solar Lighting, ETH Zurich et al, Feb 2017
- Energy Africa Mozambique – Technical Assistance to Model and Analyse Effects of VAT and Tariffs on PicoPV, Solar Home Systems and Improved Cookstoves, Economic Consulting Associates, August 2016
- Lifting the Darkness on the Price of Light: Assessing the Effect of Fuel Subsidies on the Off-Grid Lighting Market, UNEP, 2014
- Powering Opportunity: The Economic Impact of Off-Grid Solar, Altai Consulting and GOGLA, July 2018

[62] Energy Africa Mozambique – Technical Assistance to Model and Analyse Effects of VAT and Tariffs on PicoPV, Solar Home Systems and Improved Cookstoves, Economic Consulting Associates, August 2016
[63] SolarAid Impact Report, 2015

3.5 Supporting Job Creation: How to Support Job Creation without Reducing Affordability

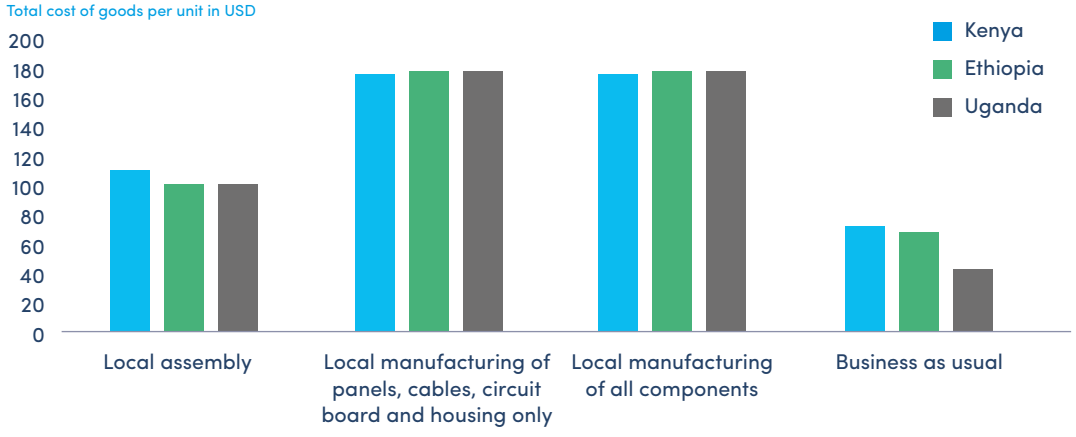
The off-grid solar sector has already created tens of thousands of jobs, and is set to create many more in the coming years. In Bangladesh, the off-grid solar industry already employs an estimated 127,000 people, whilst in India it employs 72,000 people[64]. Globally, the decentralized renewable energy industry, including both mini-grids and standalone solutions, is expected to directly employ 4.5 million people by 2030[65].

The importation and distribution of low-cost, high-quality off-grid solar products is estimated to employ 30 people per 10,000 people living in rural areas, compared to just one person per 10,000 people in the case of kerosene for lighting[66]. In addition, off-grid solar jobs are more likely to be in the formal economy, thus contributing to tax revenues. Full-time employees in the sector work in areas such as management, logistics, finance, sales, marketing, retail, engineering and software development. A similar number of people are employed as agents, deriving part of their income from selling off-grid solar products. Most jobs have been created in South Asia and East Africa where markets are largest, but job creation in other regions is on the rise as markets emerge elsewhere. A forthcoming study from GOGLA will shed more light on skilled job creation within South Asia and East Africa[67].

Job creation has been driven by market growth, which in turn has been made possible by rapid advances in technology, with products and components being offered at ever lower prices (see Section 2.2). Increasing production volumes have also had a significant impact on the cost of production, with the industry achieving tremendous economies of scale as a result of nearly all quality-verified products being manufactured in China.

The desire to create jobs is leading many governments to explore options for promoting assembly or manufacturing in their regions and countries. The focus of GOGLA members is on delivering high-quality products at the lowest possible price to ensure that as many people as possible are reached. Whilst some companies are exploring options for **local assembly or manufacturing, local manufacturing is challenging for companies, and as such, is not expected to make a significant contribution to job creation in the off-grid solar sector.** A recent study funded by the UK Department for International Development, and developed with technical support from GIZ and the World Bank/IFC Lighting Global program, found that local manufacture 'would lead to a significant increase in the cost of goods sold and that locally produced products or components would not compete with imports under current circumstances... imports will out-compete local manufacture/assembly'[68]. Comparative costs for business as usual, compared to local assembly, local manufacturing of some components and local manufacturing of all components, for three African countries are shown in Figure 29. There is also concern around the quality of locally-sourced products and components. Companies manufacturing locally would need to invest heavily in developing the capability to manufacture products that would meet internationally-recognised IEC quality standards.

Figure 29: Cost of goods under different manufacturing/assembly scenarios - Source: Energy Africa – Kenya, Uganda, Ethiopia Analysing the feasibility of local manufacturing and assembly within the off-grid solar lighting and electrification value chain: Final Report, Economic Consulting Associates Limited, July 2018



[64] Renewable Energy and Jobs, IRENA, 2016
[65] Renewable Energy and Jobs, IRENA, 2016
[66] Light and Livelihood: A Bright Outlook for Employment in the Transition from Fuel-Based Lighting to Electrical Alternatives, UNEP, 2014
[67] To be released early 2019
[68] Analysing the feasibility of local manufacturing and assembly within the off-grid solar lighting and electrification value chain: Final Report, Energy Africa, July 2018

The most commonly used mechanism to promote local manufacturing is to place tariffs on comparable imported products, thus making them more expensive so that locally manufactured products can compete on price. In the off-grid solar sector, such an approach would risk: a) pushing up prices for end-users, rendering products unaffordable for many; b) reducing the overall quality of products in the market, if locally manufactured products did not meet international standards; and c) slowing down or possibly even reversing market growth. **Tariffs on imports, designed to help local manufacturers compete on price, are likely to reduce the number of jobs created by the industry and reduce the number of people gaining access to energy through off-grid solar solutions.**

The key to creating jobs in the off-grid solar sector is accelerating market growth. There is a need to create trust in technology and protect consumers through promoting quality-verified products (see Section 3.5) and to take steps to make products as affordable as possible for price-sensitive, low income customers (see Section 3.3). **The current model, achieving tremendous economies of scale in manufacturing and making high-quality products ever more affordable, is best-suited to accelerating market growth and maximising job creation.** The faster the market grows, the more jobs will be created, boosting tax revenues and helping governments achieve universal energy access by 2030.

Governments also play a key role in helping companies overcome barriers in access to skilled labour. Promoting education, youth education and the inclusion of off-grid sector related topics in university curriculum is important to ensure continuing skilled employment within the sector. At present, companies report finding it difficult to recruit skilled labour and often rely on their own academies and training to upskill staff members.

Further Reading

- Analysing the feasibility of local manufacturing and assembly within the off-grid solar lighting and electrification value chain: Final Report, Energy Africa, July 2018
- Renewable Energy and Jobs, IRENA, 2016
- Light and Livelihood: A Bright Outlook for Employment in the Transition from Fuel-Based Lighting to Electrical Alternatives, UNEP, 2014

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3.6 Promoting Investment: How to Use Public Funding to Attract Private Capital

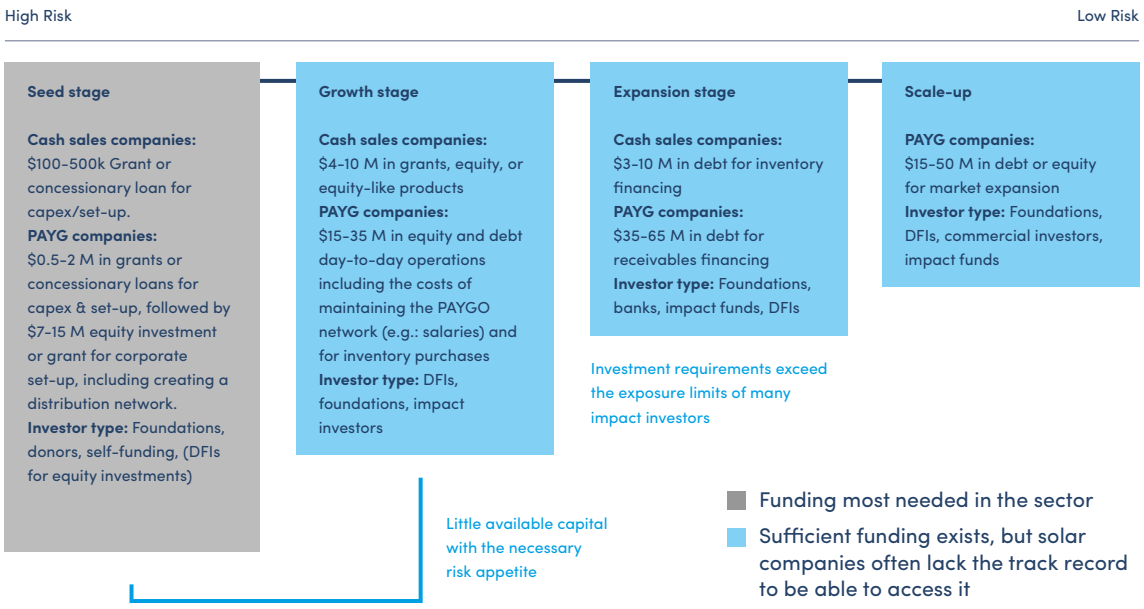
SEforALL estimates that $45 billion a year in new public and private investment is needed to achieve universal energy access by 2030. For 2013-14, financial commitments were $19.4 billion a year – well below the $45 billion target[69]. **Governments should increase the proportion of energy investment spent on energy access initiatives, and on stand-alone solar in particular.** Potential sources of funding to support the off-grid solar sector might include resources currently allocated to grid extension, overseas development assistance, climate finance or fossil fuel subsidies.

Most donors and multilateral development banks (MDBs) spend only a small fraction of energy budgets on energy access or on off-grid solutions, although the situation is steadily improving. The Sierra Club and Oil Change International's analysis of the major development banks' energy lending portfolios in 2014 shows that the Asian Development Bank had 2.2% of its energy access portfolio invested in off-grid solutions and the African Development Bank had 0.7%. The World Bank and the Inter-American Development Bank score better, with 10.7% and 19.7% of energy access lending focused on off-grid solutions respectively. Encouragingly, many bilateral and multilateral donors are ramping up funding and support for off-grid energy, including DFID through the Energy Africa campaign, the US Government through Power Africa, and the World Bank. The AfDB's New Deal on Energy for Africa contains a target of 75 million off-grid connections through AfDB-supported activities by 2025[70]. **Governments can take advantage of the growing interest in off-grid energy, amongst development agencies, by seeking funding and support for their off-grid energy programs.**

Off-grid solar companies require capital for multiple reasons, as illustrated in Figures 30 and 31. At the outset, companies need funding for setting up their businesses and market entry. Afterwards, capital is used to scale up their business and grow into new geographies and product categories. An increasingly important use of funds is for working capital, including providing financing for consumers to pay for products over a period of time.

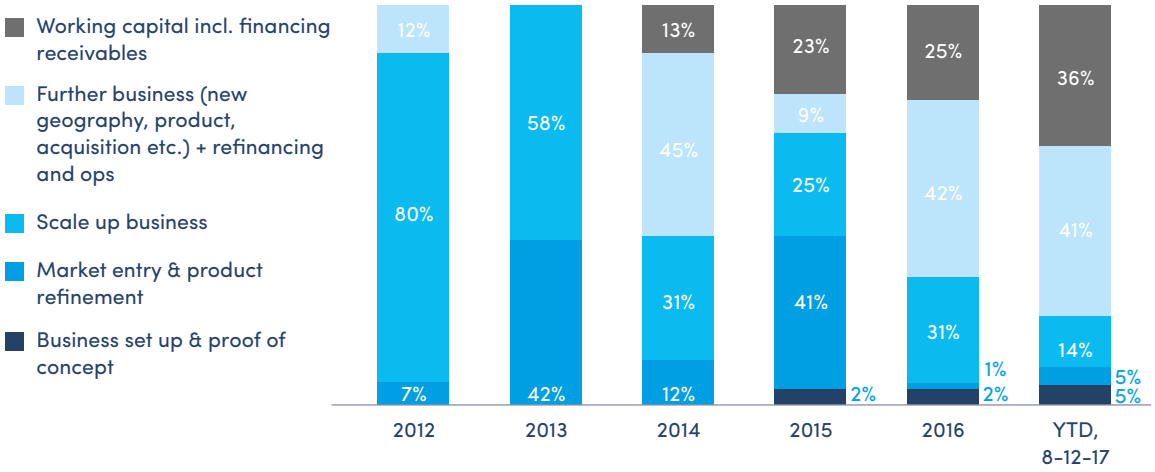
Figure 30 below shows the main financing needs of standalone solar companies at different stages of their growth and development. More capital of all kinds is needed at all stages, especially for smaller, earlier-stage firms[71]. Early-stage equity and grants are particularly critical when firms are at seed stage, whilst at later stages, cash sales companies primarily need working capital financing, whilst PAYG companies need debt to fund on-lending to customers. Companies at all stages need financing in both international and local currencies, to help mitigate foreign exchange risk.

Figure 30: Main financing needs at different stages of growth, adapted from Dalberg Advisors and Lighting Global and Bloomberg New Energy Finance – Source: Off-Grid Solar Market Trends Report, Dalberg Advisors and Lighting Global, 2018 and Off-Grid Solar Market Trends Report, Bloomberg New Energy Finance, 2016



[69] Energizing Finance, SEforALL, 2017
[70] Still Failing to Solve Energy Poverty: International Public Finance for Distributed Clean Energy Access Gets Another 'F', Sierra Club and Oil Change International, April 2016
[71] Off-Grid Solar Market Trends Report 2016, Bloomberg New Energy Finance, 2017

Figure 31: Use of funds, % of total funds raised (2012-17) - Source: Off-Grid Solar Market Trends Report 2018, Dalberg Advisors and Lighting Global, 2018



Governments should use public funding to attract private finance through cost-absorbing or de-risking strategies that encourage investors to enter the market. For example, public funding can be used to cover the cost of undertaking due diligence or preparing for a transaction. De-risking measures could include providing credit guarantees or first-loss facilities, that increase deal flow. Foreign exchange risks can be mitigated if local currency financing facilities are available, and if governments allow companies priority access to international currency when foreign exchange is limited. Companies need to be able to repatriate profits, in order to invest in wider business development, as well as to provide returns to international investors that have taken on risk. Restrictions on profit repatriation dramatically reduce international investment.

National development banks can play a vital role, by developing facilities that either incentivize financial institutions to invest, or that invest directly. For example, in Ethiopia access to foreign exchange was a major bottleneck impeding the import of off-grid lighting products. To address this issue, the Government of Ethiopia established a financing facility in 2013, with support from the World Bank / IFC Lighting Africa program and $20 million in financing. The fund, administered by the Development Bank of Ethiopia (DBE), provides private sector companies with the foreign exchange working capital to import qualifying solar products that meet Lighting Global Quality Standards, while microfinance organisations can access this line of credit for household-level loans. A further $20 million in financing was added to the fund in 2016[72]. A Collateral Support Facility provides up to 50 percent of the required collateral for participating companies.

[72] http://www.worldbank.org/en/news/feature/2016/08/15/off-grid-solar-lighting-up-ethiopia

Figure 32 below shows how government and donor supported funding mechanisms can play an essential bridging role, helping companies reach the scale, maturity and track record needed to access mainstream debt and venture capital[73]. At the same time, these approaches help investors to build the skills and experience needed to analyse risk accurately, and continue investing in the sector once de-risking mechanisms come to an end.

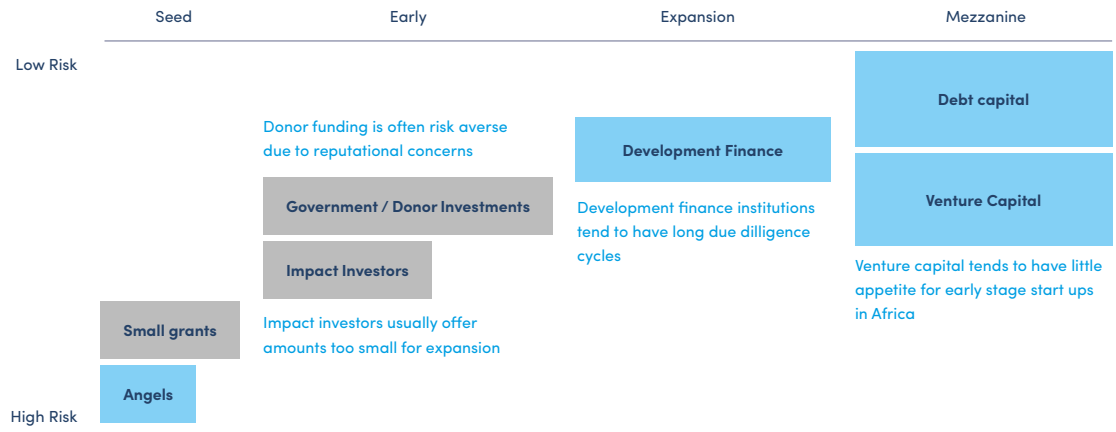
Public funding for energy access, including government funding, development assistance and international climate financing, should be deployed in efficient and effective ways to reduce energy poverty and help meet climate change objectives. It is therefore recommended that governments:

- **Steadily increase the amount of public funding** for energy access, in particular for companies and projects focused on standalone solar solutions, in line with the absorptive capacity of the sector. While more funding is needed, governments should also be mindful of the risk of over-funding the sector, leading to market distortion which can undermine sustainability.
- Use public funding to develop **cost-absorbing or de-risking strategies that attract private investment.** Such solutions need to be carefully designed and targeted to address the main barriers to growth, and achieve a sustainable impact.
- Collaborate with commercial banks and investors to offer financing through **a wide range of financial products,** both for consumers and for companies.
- Collaborate across sectors to help to create an **enabling environment for business** in general.

Further Reading

- Accelerating Energy Access: The Role of Patient Capital, Acumen, 2018
- Energizing Finance: Scaling and Refining Finance in Countries with Large Energy Access Gaps, SEforALL, 2017
- Clean Energy Services for All: Financing Universal Electrification; Craine, Mills & Guay; June 2014
- Kerosene Subsidies in India: The Status Quo, Challenges and the Emerging Path to Reform, IISD & Global Subsidies Initiative, May 2017
- Global Kerosene Subsidies: An Obstacle to Energy Efficiency and Development, Evan Mills, Lawrence Berkeley National Laboratory, World Development Vol 99, 2017
- Off-Grid Solar Market Trends Report 2018, Dalberg Advisors and Lighting Global, 2018
- Scaling Energy Access with Blended Finance: SunFunder and the Role of Catalytic Capital, SunFunder, 2018

Figure 32: Donors and impact investors providing grants and loans – Source: Off-Grid Lighting Market Trends Report, Bloomberg New Energy Finance, 2016



[73] Scaling Energy Access with Blended Finance: SunFunder and the Role of Catalytic Capital, SunFunder, 2018

3.7 Consumer Protection: How to Promote Quality and Ensure Value for Money

Promoting quality in the marketplace helps to build trust in solar technology, and creates demand. This, in turn, accelerates market growth, delivering energy access, household savings and broader social impact. Low quality products – especially counterfeits or those which falsely claim to provide a level of service which they do not deliver – undermine trust, reducing demand and damaging the market. These products imitate the look and feel of respected brands but use inferior technology, often leading to early failure.

In countries where the market has emerged, but is missing adequate regulation to promote quality, an increased number of low-quality products entering the market can be observed. Non-quality verified products and suppliers benefit from the investment in awareness-raising and distribution chain development made by more reputable companies. They take a significant proportion of market share and contribute to market spoilage. Analysis by the Global LEAP program shows that a missing quality assurance framework has a significant negative impact on market growth and therefore uptake of household solar technologies[74]. Strong growth can only be sustained if there is a robust quality assurance framework.

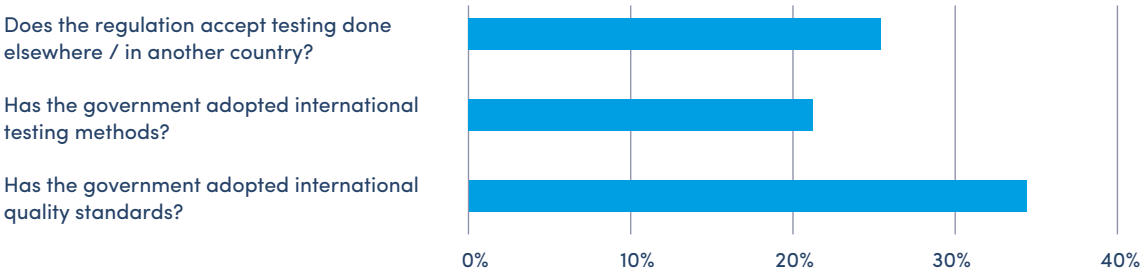
To protect consumers from poor-quality products and to promote consumer confidence, the World Bank / IFC Lighting Global program maintains a series of quality standards and testing methods for solar lanterns and solar home systems up to 350W. Standards cover five key areas:

- **Truth in Advertising:** Advertising and marketing materials accurately reflect tested product performance.
- **Durability:** Product is appropriately protected from water exposure and physical ingress, has durable switches and connectors and, if portable, survives being dropped.
- **System Quality:** Product passes a visual wiring and assembly inspection.
- **Lumen Maintenance:** Product maintains consistent light output after 2,000 hours of operation.
- **Warranty:** A consumer-facing warranty is available; the required warranty duration varies by product type.

The test methods used to assess the Lighting Global Quality Standards have been adopted by the International Electrotechnical Commission as a reference point for quality assurance of off-grid lighting products (IEC Technical Specification 62257-9-5). A range of governments, inter-governmental bodies and aid agencies require that solar lighting meet this specification in order to benefit from support, or participate in procurement schemes. These include the UN Framework Convention on Climate Change (UNFCCC), Clean Development Mechanism for carbon financing, the UN Refugee Agency (UNHCR) and the multi-donor Energising Development programme. IEC standards have also been adopted by Kenya, Tanzania, Ethiopia and Rwanda. Pakistan, Afghanistan, Madagascar, Uganda and ECOWAS are in the process of adopting IEC standards.

Looking at the issue more broadly, according to the RISE report only 33% of 55 energy access countries have adopted some kind of international quality standard, only 20% have adopted international testing methods and only 24% accept testing done in another country (Figure 33).

Figure 33: 55 energy access countries answering yes to questions about quality standards and product testing – Source: RISE Database, World Bank, 2016



[74] Potential Future of the Lighting Global Quality Assurance Program, Navigant, 2015

It is recommended that governments work towards **the adoption of internationally harmonized quality standards, and the test methods outlined in IEC Technical Specification 62257-9-5, as well as accepting test results from accredited test laboratories in other countries.** There are several advantages to adopting internationally harmonized standards and test methods rather than developing a series of regional or national standards. The IEC standards are kept up to date as new technology and new products emerge. It is easier and cheaper for companies and investors to engage with a single standards and testing system for all countries of operation, rather than design products to meet diverse requirements set at regional or national level in different markets. Finally, given the high cost and technical expertise required for thorough product testing, it is cheaper and more efficient to conduct testing through IEC-accredited test laboratories around the world, than to establish new national testing facilities specifically for solar lanterns and home systems.

When markets are nascent, governments need not prioritize adoption of harmonized quality standards right away, since the presence and impact of poor quality products is also likely to be small. As a first step, governments can also **promote quality-verification through sector support programmes.** For example, programmes that create demand or improve access to finance can make support available only to companies that sell quality-verified products. Governments can adopt harmonized quality standards in their own procurement procedures. However, as markets mature the need for harmonized quality standards, and measures to promote quality such as those outlined below, become increasingly important. Once standards are adopted, governments can raise awareness about quality standards among importers and distributors to promote good quality products on the marketplace, as well as with consumers (see Section 3.7).

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Once standards are adopted, governments should implement and enforce them, by developing a mechanism which would only allow those products which comply with standards to enter the market. This would require development of a robust but simple importation procedure, that enables quality to be assessed at the point of entry. Pre-Export Verification of Conformity (PVoC), where governments license companies in exporting countries to very quality prior to importation, is one way that this might be achieved. However, before such measures are introduced, it is vital that governments build the capacity to implement effectively, so as not to cause disruption, delays or increased costs for businesses that could undermine affordability or growth in the market. Pilots could be undertaken to help to build this capacity before quality-linked policies or regulations are introduced.

To address issues around counterfeiting, **governments should provide a legal framework that enables companies or public authorities to prosecute those caught distributing counterfeit or poor-quality products.** Governments should ensure that clear and efficient procedures for patent registration and protection, judicial enforcement and criminal persecution are in place. Fines should reflect the severity of the committed crimes. There is a broader need to improve enforcement efforts by police, border guards and custom authorities.

The off-grid industry is leading the way on consumer protection. GOGLA has established a consumer protection code of conduct with the aim of safeguarding impacts and respecting rights of consumers. The code consists of a set of principles and an assessment framework to enable companies to measure, demonstrate and improve their practices, and provide investors and other stakeholders with a framework to promote good practice. The six principles of the code include: good product quality, transparency, fair and respectful treatment, responsible pricing and sales, good customer service, and personal data privacy.

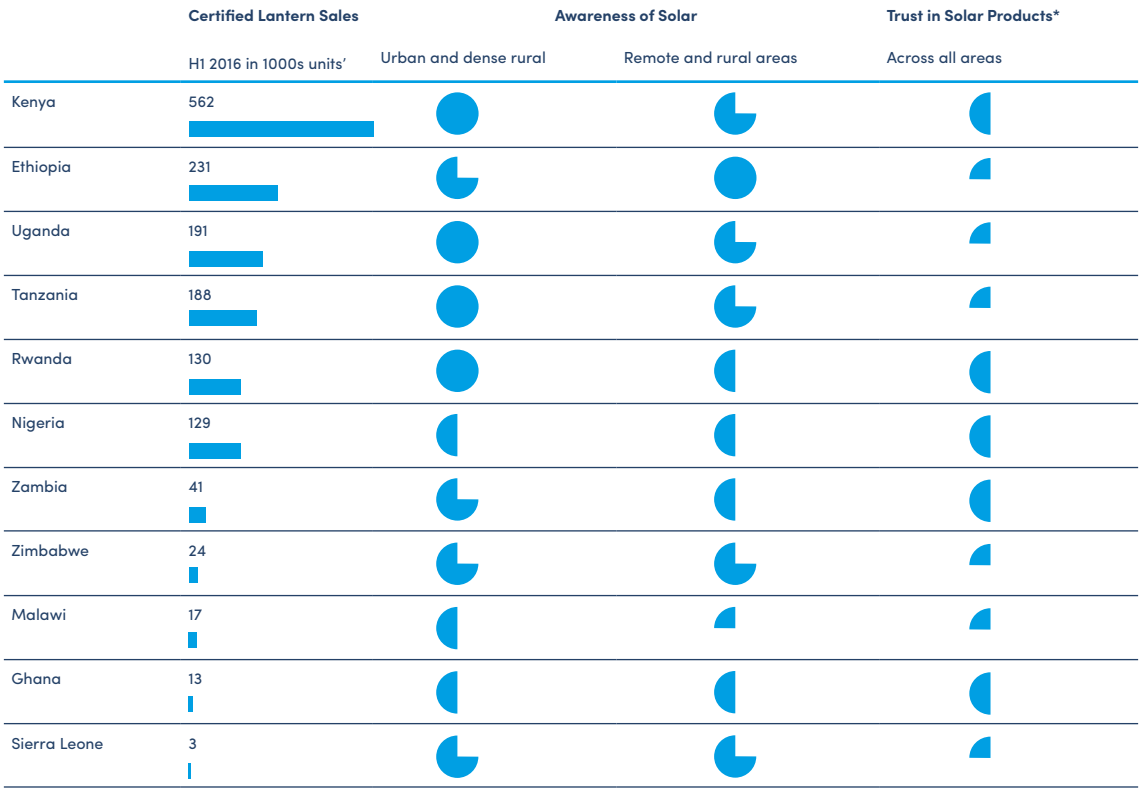
Further Reading

- World Bank / IFC Lighting Global Quality Assurance Program - https://www.lightingglobal.org/quality-assurance-program/
- Regulatory Indicators for Sustainable Energy: A Global Scorecard for Policy Makers, World Bank 2017 - http://rise.worldbank.org/
- Consumer Protection Code, GOGLA 2018, www.gogla.org/gogla-consumer-protection-code'

3.8 Raising Public Awareness to Build Trust and Demand

Consumers and retailers are often not aware of the electricity access solutions now available and the economic benefits they offer. Where a market is in the early stages of development, individual solar product companies rarely have the resources to create this awareness, and those who do attempt to do so risk losing the commercial benefits of this "public good" to other market participants. In more advanced markets, if consumers are not equipped with the knowledge they need to make an informed decision with regard to product quality, they may inadvertently purchase a poor quality or fake product. Whilst data is limited, a report by the consulting firm Hystra in 2017 provided a useful indicative assessment of levels of awareness and trust in leading African markets (Figure 34)[75].

Figure 34: Consumer awareness and trust in solar, selected Sub-Saharan African countries – Source: Hystra Consulting



Government support can ensure consumers are educated about the benefits of solar, how to use it, and where to buy quality products. Similarly, they can reach out to retailers and distributors, educating them about the benefits of working with quality products, instead of sub-par products that might offer higher margins in the short run, but are not serving consumer interest in the long term. To fully leverage synergies, campaigns can be carried out in cooperation with development partners, NGOs, or trade associations.

Especially in the early phases of market development, consumer awareness campaigns have proven to be catalytic by explaining the economic benefits of buying a solar light or home system. They can play a vital role in expanding the geographic scope of commercial markets. The markets with the highest penetration today have benefited from below the line marketing activities that allow consumers to experience products first hand before making a purchasing decision. These campaigns were first implemented in Kenya by Lighting Africa and SunnyMoney. Today, Kenya is the strongest market in Africa for solar products.

'Above the Line' (ATL) marketing activities can include: public announcements via TV, radio, or newspapers. Lighting Africa has increased the general level of awareness and knowledge for solar off-grid household products. As part of a behavioural change campaign in Kenya the topic was also discussed as part of the script in popular soap operas to reach the target audiences[76]. As the proliferation of smart phones and internet access

[75] Reaching Scale in Access to Energy: Lessons from Practitioners, Hystra Consulting, May 2017
[76] https://www.lightingafrica.org/what-we-do/consumer-education/

is moving quickly in many markets, digital content can also be very powerful in reaching influencers and early adopters. Governments can play a vital role in above the line marketing activities, by making airtime available on state-owned radio or TV stations, for example.

'Below the Line' (BTL) marketing activities can include: engaging school children and their parents, product demonstration at local markets, or 'van campaign' with teams going into deep rural areas, complement ATL activities with 'touch and feel' experiences for the end-user. SunnyMoney, a distributor owned by the social enterprise SolarAid, is leveraging education networks to increase awareness: via school campaigns they engage head teachers as early adopters and ambassadors and sales agents for solar lighting products. In Senegal, a "light libraries" project allows children to rent out solar lights at a small cost and to share the experience with their parents back home[77]. By exposing students and parents to solar technologies, awareness for and trust in solar products is increased.

Through "Village Solar Days" the Tanzania Renewable Energy Association (TAREA) is educating rural populations about solar and how to recognize sub-standard products. To attract large audiences, the events are accompanied by a social function, such as a traditional dance or football match[78]. The IFC's Lighting Asia/India program ran a van campaign in 2014 and 2015 which reached more than 200,000 people comprising men, women, children and retailers. It reached rural consumers through a 360-degree, integrated media approach using traditional and non-traditional media. This included outreach through mobile van exhibitions, school contact program, community contact program, women group meetings, wall paintings, radio announcements, an audio-visual film, a call centre and a retail connect program to increase rural access through a wider network of retailers[79].

NGOs or religious organizations, that have an established presence in rural communities and relationships of trust with opinion leaders, can leverage those relationships to help deliver below-the-line marketing activities, and make it easier for companies to enter and serve rural areas for the first time. Governments can also direct their employees, many of whom are themselves local opinion leaders such as headteachers, nurses or civil servants, to support such activities.

Successful consumer campaigns:

- **Focus on increasing category awareness:** instead of promoting individual off-grid solar solutions, ensure activities concentrate on increasing understanding for the technology in general.
- **Promote quality products:** to protect consumers, any awareness campaign should highlight quality products that have undergone testing and meet minimum quality standards (see Section 3.7).
- **Ensure demand is met by supply:** distribution readiness of the private sector is key in ensuring awareness is translated into adoption. The rollout and design of the campaign should therefore be closely coordinated with the private sector to ensure that when demand is created it can be met.
- **Target the supply chain across distributors, retailers, and end-users:** which products are available to end-users in rural areas largely depends on which products are selected by distributors and subsequently stocked by retailers. The promotion of quality products should therefore not only focus on the end-user but also on distributors and retailers.
- **Work closely with trusted organisations and individuals with an established presence in communities,** such as NGOs, cooperatives and women's groups, as well as opinion leaders such as chiefs, teachers or religious leaders.

Further Reading

- Lighting Africa Consumer Education Program – https://www.lightingafrica.org/what-we-do/consumer-education/
- Lighting Asia Consumer Awareness Program – http://lightingasia.org/india/consumer-awareness/
- Light Library Project Report, SolarAid, 2013
- Reaching Scale in Access to Energy: Lessons from Practitioners, Hystra Consulting, May 2017

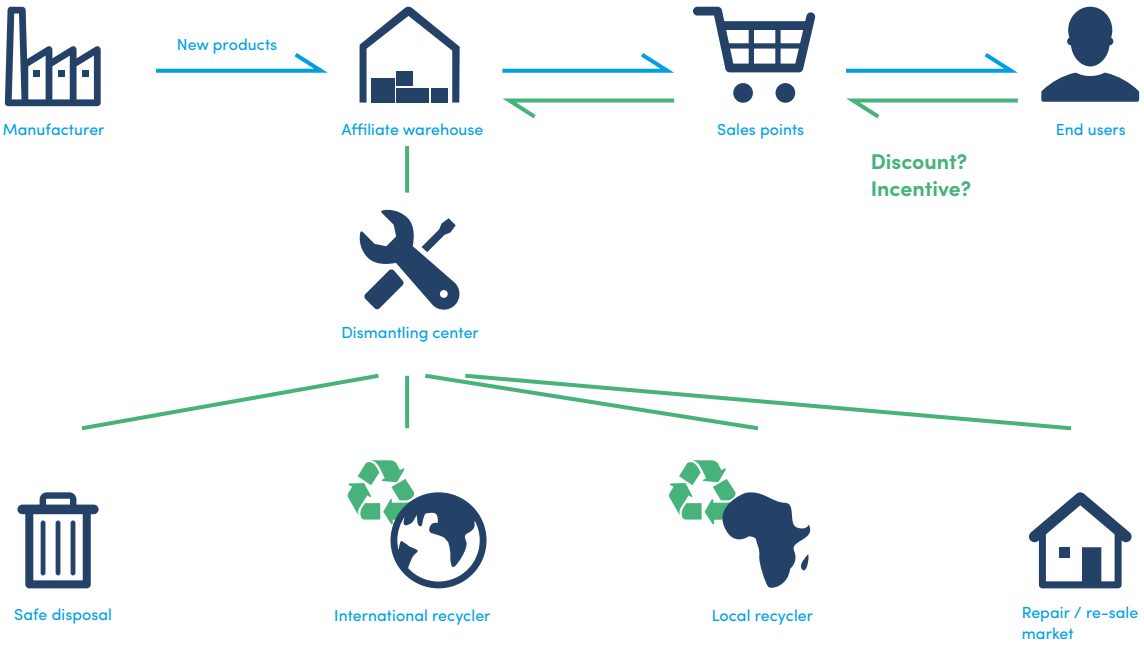
[77] http://www.solar-aid.org/assets/Uploads/Publications/SolarAid-Light-Library-project-report-external-version-KH-18.09.13.pdf
[78] http://www.tarea-tz.org/index.php/blog/80-solar-village-day-at-malinyi
[79] http://lightingasia.org/india/consumer-awareness/

3.9 Promoting Repair and Recycling to Improve Sustainability

Managing discarded electronic appliances, known as 'e-waste' or 'waste electrical and electronic equipment (WEEE)', is a growing challenge for governments and businesses. GOGLA and its member companies are committed, as much as possible, to putting in place robust e-waste management systems. The total volume of discarded solar lights and home systems is still small. **According to a study commissioned by DFID in 2016, standalone solar makes an 'almost negligible' contribution to e-waste as a whole, providing less than 0.5% of total volumes generated[80].**

In a more established e-waste recycling value chain, the revenue generated from the resale of valuable recovered materials partially covers the costs of collection and recycling. However, in the case of standalone solar, both the volume of e-waste and the volume of recoverable materials remain low. Recycling facilities capable of extracting all recyclable materials in standalone solar products may be a long way from the customer, increasing transportation costs. Raising product prices to fully cover the cost of collection, transportation, repair, dismantling and recycling of components would have a negative impact on affordability and sales in a highly price-sensitive market, and thus on energy access outcomes. Financial incentives are needed either at consumer or company level, to ensure products with low intrinsic value such as solar lights or home systems can be viably included in broader e-waste initiatives (Figure 35).

Figure 35: Typical e-waste value chain – Source: Total Presentation, GOGLA AGM, 2017



GOGLA and its members recognize the importance of adherence to environmental standards, especially if the industry is being supported through tax exemptions or subsidies. In line with the principle of Extended Producer Responsibility, whereby governments hold importers responsible for ensuring products are recycled, GOGLA members are committed to taking voluntary action, as far as possible, to:

1. Develop products that can be easily maintained and repaired. Spare parts must be made available.
2. Develop strategies to take back faulty products, and find ways of recycling products in countries of operation.
3. Identify synergies in the use of resources and materials across the industry, to facilitate separation during recycling and reuse.
4. Build partnerships with other electronic and electrical sectors, to share the cost of collection, repair, transportation, dismantling and recycling.
5. Avoid the use of hazardous substances and, where possible, finding alternatives for them. If there are no viable alternatives, members commit to creating incentives for collection of the parts containing these hazardous substances.
6. Join together to approach ministries, NGOs and other key stakeholders to build awareness that, like all new

[80] Electronic waste (e-waste) impacts and mitigation options in the off-grid renewable energy sector, Evidence on Demand, August 2016

electronic products, standalone solar technology should be supported by a sound environment of managing end of life products.

7. Join forces, beyond the industry, to build awareness amongst consumers of the value and benefits of handling electronic waste correctly and appropriately.

Regulation around repair and recycling in the off-grid solar sector needs to be commensurate with the small volumes of e-waste generated by the sector. Companies are not yet able to bear the full cost of establishing e-waste value chains, without passing these costs on to consumers, creating the risk that higher prices might undermine market growth. It is recommended that:

- Governments recognize the difference between the small, emerging standalone solar market, where products of low intrinsic value cannot be viably recycled without financial incentives, and larger, more established electronic industries. They can **exclude standalone solar from broader e-waste initiatives, or develop alternative frameworks specifically for the standalone solar sector.**
- **Ensure policy is clear, and implemented in a coordinated way across multiple government ministries.** For example, Ministries of Energy need to coordinate with Ministries of Environment, that are often responsible for e-waste legislation.
- **Provide financial incentives to customers or companies, so that products with low intrinsic value, such as solar lights and solar home systems, can be collected and recycled** as part of broader e-waste initiatives, without imposing significant additional costs on companies and end-users.
- **Support consumer engagement efforts** to encourage safe disposal and recycling. For example, government agencies and companies in Kenya are responding positively to contractual arrangements for e-waste disposal[81].

Further Reading

- Electronic waste (e-waste) impacts and mitigation options in the off-grid renewable energy sector, Evidence on Demand, August 2016
- Cost-Benefit Analysis and Capacity Assessment for the Management of Electronic Waste in the Off-Grid Renewable Energy Sector in Kenya, F. Magalini, D. Sinha Khetriwal & S. Munyambu, S, 2017

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[81] Electronic waste (e-waste) impacts and mitigation options in the off-grid renewable energy sector, Evidence on Demand, August 2016

GOGLA

The Voice of the Off-Grid
Solar Energy Industry

Arthur van Schendelstraat 500
3511 MH Utrecht
The Netherlands

info@gogla.org
Telephone +31 304 100 914

www.gogla.org
goglassociation