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ISSUE BRIEF

STIMULATING PAY-AS-YOU-GO ENERGY ACCESS IN KENYA AND TANZANIA: THE ROLE OF DEVELOPMENT FINANCE

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EXECUTIVE SUMMARY

Nearly 620 million people in sub-Saharan Africa lack electricity access. Improving access to affordable and reliable energy is critical to reducing poverty and improving quality of life (IEA 2011). To improve energy access, it is important to develop financing and payment schemes that fit consumer energy budgets. “Pay-as-you-go” (PAYG) business models harness technology to provide a “one-stop-shop” solution for consumer finance and energy products. The PAYG model originated in Kenya, and addresses the key challenges of extending end-user finance and collecting payments from remote customers who often have erratic and limited cash flow. PAYG companies, at this point, typically provide basic lighting and mobile phone charging services. The technology can play an important role in expanding access to electricity services to remote and low-income populations.

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This issue brief draws on findings from desk research, workshops, and interviews with PAYG companies, donors, and development finance institutions (DFIs) active in energy access in East Africa to assess how PAYG companies have stepped up to serve the approximately 35 million people in Kenya and 36 million people in Tanzania who lack access to electricity, as well as additional millions who are underserved. Our paper also draws on interviews with stakeholders involved in Bangladesh's IDCOL program to provide insight into how DFIs and donors supported the Bangladesh program, in order to elicit lessons relevant to the Kenyan and Tanzanian contexts. We chose Bangladesh's IDCOL program as a reference point for two reasons: the energy enterprises in Bangladesh perform the same one-stop-shop role as the PAYG companies, and IDCOL provides an example of where DFIs have played a significant role in channeling finance (US\$750 million) to achieve substantial energy access goals (three million solar home systems).

Given the nascent stage of most energy access markets, much of the existing PAYG literature focuses on analyzing the innovative variations of business models as well as factors that could improve the enabling environment. However, market players in both Kenya and Tanzania have evolved beyond an early-stage pilot phase. These pioneering companies have successfully raised grant, equity, and—more recently—debt finance to pilot, develop, and scale their businesses. According to our estimates, they have reached more than half a million households through rapid sales growth. The market overall is also evolving, as suggested by the participation of 52 international private sector investors—ranging from foundations

to large companies—and five debt deals struck in 2015, the largest of which was a US\$45 million raise by one company. Market leaders such as M-KOPA, Mobisol, and Off-Grid Electric have begun expanding into regional markets.

While encouraging progress has been made, the addressable markets in Kenya and Tanzania are much larger than those reached by existing companies so far, and the products they offer need to be larger in capacity if they are to provide more than basic lighting and mobile charging. PAYG companies will require about one billion dollars across these two countries to scale for broader impact. Therefore, this issue brief focuses on how this broader impact can be created. We look at how successful PAYG businesses operating in Kenya and Tanzania have raised finance and the constraints faced by the industry, and we propose recommendations for how donors and DFIs can continue to support the development of these markets.

Currently, the various types of capital (debt, impact equity capital, grant) that PAYG companies need are available almost exclusively from international investors. Local financial institutions in Kenya and Tanzania have been hesitant to provide financing to PAYG customers: they perceive PAYG companies as early-stage, risky businesses and are unfamiliar with the technology as well as the creditworthiness of rural consumers. The absence of local capital sources to some extent explains the fact that almost all the successful PAYG companies are foreign owned and foreign managed. Local companies often lack the initial resources, as well as the networks and skills, to raise both early-stage capital and develop complex financial structures to raise debt

capital from international markets. Local companies are also hesitant to take on foreign currency risk.

Technological barriers to the PAYG business are falling, and the sector is likely to see the entry of a larger number of companies. This is not yet happening, because access to finance remains a key entry barrier, particularly for locally owned and managed companies. Finance is most critically needed to build out marketing, sales, and service infrastructure and to provide customers with financing. The relative lack of access to finance results in fewer companies and less competition in the PAYG sector.

Local currency debt could eliminate currency volatility costs, reduce the transaction complexity associated with raising international debt and reduce entry barriers for local companies. In turn, new entrants and increased competition could lower prices and allow offerings of products and services that offer higher levels of electricity access at affordable prices.

DFIs and donors have a role to play in supporting local financial institutions to extend local currency debt. In Bangladesh, international DFIs and donors channeled funds for energy access through IDCOL, a government-owned financial intermediary. IDCOL also played a strong role in market development. The market support roles played by IDCOL can be adapted to the Kenyan and Tanzanian contexts. The debt-financing role in Kenya and Tanzania can be played by commercial banks from the very beginning. Involving commercial banks would have the advantage of ensuring that funds are available to the sector even after donors withdraw. Results-based

financing involving private donors and civil society organizations could help private sector operators build up their marketing and distribution infrastructure under a limited period of donor assistance. Monitoring and verification functions could be housed within public organizations such as rural electrification agencies, in partnerships with the respective bureau of standards, as per World Bank Group (WBG) Lighting Africa standards.

Drawing on the success of the IDCOL program and the unique needs of PAYG companies, we offer recommendations targeted primarily to DFIs and donors regarding how they can support local financial institutions in their efforts to expand energy access in Kenya and Tanzania.

- International DFIs and donors can leverage their long relationships with local financial institutions in Kenya and Tanzania to stimulate local finance for the PAYG sector. DFIs and donors can provide guarantee schemes and lines of credit to local banks. This support would help banks develop a deeper understanding and familiarity with PAYG business models, and make finance more accessible to local companies. International DFIs and donors can “crowd in” private sector investment in PAYG by channeling their investments through fund of funds run by professional impact investors and incentivize PAYG companies to invest in targeted marketing and distribution infrastructure through results-based financing. DFIs and donors can also provide technical assistance to public organizations to support capacity building in monitoring and verification.
- Local commercial banks can begin to explore the PAYG sector, and understand company cash flow patterns, through the provision of short-term trade finance. They can also explore mechanisms such as a debt service coverage account to partially cover for default risks.
- National governments can provide support through a suite of policy and regulatory measures to unlock domestic commercial financing for distributed renewable energy including, for example, the development of mechanisms to coordinate roles of institutions in this space and encourage private sector activity by setting clear national priorities and releasing grid extension plans to the public.
- Private sector investors can help companies to access different types of capital and partnerships in response to evolving business needs. This may include support for raising capital from local commercial banks. Foundations and family offices can provide loss guarantees to local banks.
- Private sector PAYG businesses can adopt standardized accounting standards to assist in transactions with local banks.

The scope of this issue brief is confined to analysis of financing in support of PAYG solar home system companies. While we recognize that PAYG products providing lower-level energy services are not comprehensive solutions to the energy access challenge, we believe that our recommendations will also support the broader energy access sector, including mini- and micro-grids.

INTRODUCTION

The Imperatives of the Electricity Access Challenge

Nearly 1.3 billion people, or 18 percent of the world's population, still lack access to grid electricity (IEA 2014a). An additional one billion are “under electrified,” a status characterized by unstable grid connection with regular power outages (A.T. Kearney and GOGLA 2014; IEA 2013). Sub-Saharan Africa bears a disproportionate share of this burden. Over 620 million people, nearly two-thirds of the region's population, are without electricity access (IEA 2014b). Increasing access to affordable and reliable energy services is fundamental to reducing poverty and improving other human development indicators (IEA 2011).

Electricity access has long been measured by the physical connection of a household to grid electricity or the presence of a nearby electric pole. This binary definition of electricity access has increasingly come into question in recent years, because it fails to capture the quality of electricity services received by end users. In response, the World Bank's Energy Sector Management Assistance Program (ESMAP) has developed a multi-tier framework for defining and measuring levels of energy access. Under this approach, access to electricity refers to the ability to obtain electricity that is characterized by the following attributes: “adequate, available when needed, reliable, of good quality, affordable, legal, convenient, healthy and safe for all required applications across households, productive enterprises and community institutions” (Angelou and Bhatia 2015).

The framework measures electricity access across five tiers; each tier reflects a specific level of performance of an electricity supply system defined by the attributes. Tier 1 and Tier 2 are the low-power capacity levels (minimum 3W and 50W, respectively). At Tier 1 level, electricity access is defined as providing lighting and mobile charging for a minimum of four hours per day. At Tier 2 level, access additionally includes the ability to power a fan and/or television for four hours (see Annex II).

The PAYG businesses that we study in this issue brief provide electricity access mainly at the Tier 1 and Tier 2 levels through standalone solar home systems (SHSs). The standalone solar system comes with a battery, a charge controller, a solar panel and LED (light emitting diode) bulbs, and a mobile charger. Larger systems (typically 50W and above) can potentially connect direct current (DC) appliances such as a television. Even at lower tiers of electricity access, there are numerous household-level benefits. These benefits stem from the fact that the SHSs replace alternate sources, which are often very expensive.

Previous WRI research conducted in collaboration with the International Institute for Applied Systems Analysis indicates that household kerosene use is significantly lower for households with SHSs, even when compared with grid customers. While 80 percent of households with access to grid electricity continue to use kerosene, only about 25 percent of homes with SHSs use kerosene. The reliability of SHS electricity supply may explain this finding (Rao, Agar-

wal, and Wood 2016). Other research indicates benefits such as prevention of GHG emissions (both carbon dioxide and black soot) (Kaufman et al. 2000; Wang et al. 2011), increased household disposable income because of reduced spending on kerosene and candles (Mills 2005; Tracy and Jacobson 2012), health benefits such as reduced accidents and indoor pollution (Mills 2014; Samad et al. 2013) and social benefits such as increased evening study hours for children (A.T. Kearney and GOGLA 2014; Khan and Azad 2014; Samad et al. 2013).

Measuring energy access across tiers allows one to measure the quality and quantity of energy services that are available to households.

The Importance of “Pay-as-You-Go” (PAYG)

Previous WRI research has underscored the importance of designing financing and payment schemes that fit consumer energy budgets. The research notes that energy enterprises have to design innovative financing and payment schemes to encourage consumers to purchase their products, because customers are accustomed to buying energy in small increments (Ballesteros et al. 2013). Consumer surveys have consistently indicated that the propensity to purchase increases quite dramatically when consumer finance is available, both among rural households and rural small and medium enterprises (SMEs) (GreenMax Capital Advisors 2013; A.T. Kearney and GOGLA 2014). The provision of such finance has been a key challenge for scaling up standalone solutions (IRENA 2015). The same WRI research has indicated that there are several innovative approaches to providing end-user finance. Prominent among these approaches is a partnership between a company providing the renewable energy product and a financial institution providing a loan to a consumer or a dealer. The PAYG model that has emerged in East Africa has several advantages over this partnership approach.

PAYG is a technology-driven method that allows consumers to pay the lease amount for a given energy system or pay a fee for the service of using the system. It uses information technology to enable remote activation with payment receipt (Alstone et al. 2015). PAYG includes a range of business models, which differ as to how payments are accepted and to whom the ownership of the system ultimately devolves.

From the consumer’s point of view, the PAYG model offers a one-stop shop, where the product and the financing are available from the same source. The willingness of companies to finance products gives customers’ confidence in the new technology. Indeed, energy companies have tried to partner with microfinance institutions (MFIs) but often with limited success. The energy service companies have typically been smaller than their counterpart MFIs, and partnerships have been hard to manage given the differing expectations of the two parties. In Kenya, for example, consumers could not access technical maintenance services from the energy companies, which were limited in their geographic outreach. The poor after-sales service left many customers dissatisfied with their products, which in turn led to a refusal to repay loans (Rolffs, Byrne, and Ockwell 2014).

The benefits of the PAYG model in providing a one-stop-shop solution to customers are several. As we have already noted, the offer of finance by the energy company instills trust in consumers regarding the quality of the product. Operational efficiency is improved because there is no need for coordination between finance providers and technology providers. With PAYG, the companies are able to provide longer-term loans than those usually offered by MFIs. PAYG models also allow the provision of relatively large credit amounts (to cover the cost of the renewable energy system) to consumers whose credit worthiness may be unknown. The credit risk is partially mitigated by the incentive system that links payments to service provision. PAYG approaches, which use mobile

communication technologies, also reduce the costs associated with collecting repayments (Rolffs, Byrne, and Ockwell 2014). Finally, PAYG enables significant data collection. This gives enterprises the advantage of understanding product performance and consumer behavior (Alstone et al. 2015).

PAYG allows energy companies to provide consumers credit independently, without relying on partnerships with MFIs or other financial institutions—which are often difficult and ineffective relationships.

Objective and Scope

The objective of this issue brief is to assess how international development finance institutions (DFIs) can support the PAYG energy access sector in Kenya and Tanzania. Our aim is to identify ways in which the international development finance community can help the PAYG sector provide energy services with the attributes of reliability, affordability, and health and safety. These service attributes are based on the multitier framework (MTF) to evaluate and monitor progress toward energy access goals developed by ESMAP and Sustainable Energy for All (SE4ALL) initiative as part of the Global Tracking Framework (see Annex II for details on the multi-tier framework). The issue brief examines this challenge in the country contexts of Kenya and Tanzania. We chose Kenya and Tanzania because Kenya is the country where the PAYG model originated and Tanzania represents another large country where the business model can have a significant impact.

The primary audience for the paper is staff members within the DFI and donor organizations who are involved in supporting energy programs in Kenya and Tanzania, or supporting the development of the private sector in these two countries. We also aim to inform consultancies that provide services such as assessments of project viability or program implementation support to DFI and donor organizations.

Following this introduction, Section I explores the PAYG model in Kenya and Tanzania. Section II examines how local debt could help scale up the PAYG model to improve energy access. We conclude with a set of rec-

BOX 1

ABOUT THE SERIES

This is the third in a series of three briefs. These studies are based on interviews and desk research, as well as workshops held by the World Resources Institute (WRI) and the DOEN Foundation in 2012, 2013, and 2015. By leveraging the experiences of socially oriented energy enterprises, civil society groups, and investors focused on energy access in developing countries, these publications use the collective knowledge of these stakeholders to help accelerate the scale-up of distributed renewable energy services in developing countries. The first brief—“Implementation Strategies for Renewable Energy Services in Low-Income, Rural Areas” (2013)—describes four common core business strategies employed by the enterprises and gives examples of how these strategies were implemented. The second brief—“Clean Energy Access in Developing Countries: Perspectives on Policy and Regulation” (2015)—analyzes the challenges these organizations faced in delivering services, discusses how they have overcome these hurdles, and examines the enabling conditions that support their set-up, start-up, and scale-up. This issue brief focuses on the financing strategies DFIs and donors can use to support the growth of the pay-as-you-go solar home system market.

ommendations on which stakeholders can act to establish the enabling conditions for appropriate support from the international financing community.

Methodology

This issue brief is the product of ongoing WRI initiatives in clean energy policy and financing. It builds on previous publications in the series, which focused on implementation strategies for renewable energy services in low-income, rural areas, and the policy and regulatory challenges facing the sector (see Box 1). This brief focuses on financing strategies to scale PAYG models in Kenya and Tanzania. We began with extensive desk research focusing mainly on end-user finance issues in energy access, Bangladesh’s Infrastructure Development Company Limited (IDCOL) program, and existing literature in the emerging

PAYG area. The list of peer-reviewed literature is provided in the References. To identify the main PAYG players, we conducted an extensive online search of companies providing solar lighting and decentralized renewable energy solutions in Kenya and Tanzania. We screened and identified six PAYG solar home system companies operating in these two countries. The companies were chosen based on the criterion that they should have been able to raise external equity capital (after initial grant and angel investment) or that they have an established PAYG offering (beyond the pilot stage). This allowed us to analyze the challenges in scaling up energy access using proven business models. Between April 2015 and February 2016, we interviewed the senior management of all six identified PAYG solar home system companies by phone or in person at the company headquarters or the country offices in Kenya and

Tanzania, and we validated key data on funds raised and investors in the PAYG companies through online research.

In the next phase, we identified the energy access projects and local financial institutional relationships of the major international DFIs and donors in Kenya and Tanzania. The brief draws on information gathered from local bank, international DFI, and donor websites as well as personal interviews with DFIs and donors in order to assess the relationship between international DFIs and donors and local banks in these two countries.

In order to draw lessons from the IDCOL model in Bangladesh, we supplemented the literature review with field interviews with the key actors involved: IDCOL management, the DFI supporters of IDCOL, and the IDCOL Partner Organizations.

The solar products available in East African countries are mostly imported from China, and we interviewed two

Hong Kong—based suppliers (one of which was World Bank Group Lighting certified) to assess whether there are any bottlenecks in supply and to get an overall assessment of quality and price issues.

Finally, we validated several of the findings and generated additional insights from two workshops involving international DFIs, donors, local financial institutions, and other stakeholders. The workshops were convened by WRI and New Ventures. The workshops in Dar es Salaam in April 2016 and Nairobi in July 2016 focused on stimulating local capital in the PAYG energy access sector in Tanzania and Kenya, respectively.

We recognize that solar home system products that provide Tier 1 and Tier 2 levels of access are not comprehensive solutions to the energy access challenge, and they should be considered alongside other solutions. Mini- and microgrids have an important role to play. However, this issue brief focuses on solar home system providers and does not address the financ-

ing needs of mini- and microgrids. In the workshops, stakeholders noted that the recommendations have general applicability for the mini- and microgrid sector. We recommend additional research on the mini- and microgrid sector to validate and tailor these recommendations to this important emerging sector.

Details on interviewed personnel, workshop attendees, and interview guide questions are provided in Annex I.

SECTION I: EXPLORING THE PAY-AS-YOU-GO MODEL

Key Players in Kenya and Tanzania

In this section, we describe the main PAYG players in each country, their indicative installed base (in terms of number of estimated household installations) and the main product offerings in each country. The market situation is dynamic and this information will change with time. New players are emerging. For instance, in Kenya, Philips has

TABLE 1

PAYG PROVIDERS IN KENYA AND TANZANIA (DECEMBER 2015–FEBRUARY 2016)

Country	Market leaders (as measured by number of installations)	Other SHS PAYG players
Kenya	M-KOPA	Raj Ushanga (local partner of Azuri Technologies)
	BBOX	Sun Transfer
Tanzania	Off-Grid Electric	Tigo Tanzania (local partner of Azuri Technologies)
	Mobisol	M-KOPA

Source: WRI, based on interviews (see Annex I)

recently introduced a solar lamp PAYG product and Greenlight Planet is reportedly planning to introduce a range of SHSs. In Tanzania, there are at least two companies currently piloting their solutions, namely, Simusolar and Sollatek Tanzania. Companies are also seeking to expand into other countries in the East African region. For example, M-KOPA is trying to expand into Tanzania, Mobisol is trying to expand into Kenya, and Off-Grid Electric is trying to expand into Rwanda. Most of the companies that provide PAYG technologies and products are foreign owned and managed. The participation of locally owned and managed companies in the PAYG sector is limited.

In terms of installations, the market leaders in Kenya and Tanzania are M-KOPA and Off-Grid Electric, respectively. The companies treat installation figures as confidential, but our estimates, based on the field interviews, are that M-KOPA now has about 300,000 installations

(225,000 in Kenya), Off-Grid Electric has 100,000 installations (mainly in Tanzania), and Mobisol has 35,000 installations (25,000 in Tanzania).

The companies are growing rapidly in terms of sales. Our interviews, conducted during the period April 2015 to February 2016, indicated that M-KOPA had 100,000 systems at the end of 2014 and added another 200,000 during 2015. Off-Grid Electric monthly sales figures were in the range of 10,000 systems. Mobisol had sold about 10,000 systems by 2014 and added 25,000 systems across Rwanda and Tanzania in the course of 2015.

Tables 2 and 3 summarize the product offerings of the market leaders in the two countries.

Table 3 indicates that all the product offerings (except for Mobisol's largest system, which is typically not targeted at households) offer Tier 1 (very low) and Tier 2 (low) levels of energy access.

Solar home system providers with PAYG functionality are emerging as key providers of off-grid electricity in Kenya and Tanzania. There are at least two large providers in each country and several other competitors. The companies are growing rapidly in terms of sales.

TABLE 2

PRODUCT OFFERINGS OF THE TWO MARKET LEADERS IN KENYA

Company	Product	Payment terms	Total cost
M-KOPA	8W system (4 x 1W LED + torch + radio)	50 KES (US\$0.48) per day for 365 days 3,500 KES (US\$33.5) upfront deposit	21,750 KES (US\$208)
BBOX	15W system (4 x 1W LED + radio)	950 KES per month (US\$9) for 36 months 950 KES (US\$9) upfront deposit	35,150 KES (US\$336)
	50W system (4 x 1W LED + radio + 19" LED TV)	2,150 KES (US\$21) per month for 36 months 2,150 KES (US\$21) upfront deposit	79,550 KES (US\$761)

Source: WRI, based on interviews (see Annex I)

Notes: The US\$ amounts are based on the currency exchange as of Jan 31, 2016, obtained from OANDA. The appliances are typically sold along with the system.

TABLE 3

PRODUCT OFFERINGS OF THE TWO MARKET LEADERS IN TANZANIA

Company	Product	Payment amount/frequency/ terms	Total cost over three years
Off-Grid Electric (fee-for-service or subscription model)	2*1W lights package	<ul style="list-style-type: none"> ■ 15,000 TZS (US\$8.25) per month of subscription ■ 15,000 TZS (US\$8.25) upfront 	555,000 TZS (US\$305.25)
	3*1W lights + radio package	<ul style="list-style-type: none"> ■ 22,000 TZS (US\$12.1) per month of subscription ■ 22,000 TZS (US\$12.1) upfront 	814,000 TZS (US\$447.7)
	3*1W lights + radio + TV package (the TV is not sold with the unit)	<ul style="list-style-type: none"> ■ 30,000 TZS (US\$16.5) per month of subscription ■ 30,000 TZS (US\$16.5) upfront 	1,110,000 TZS (US\$610.5)
Mobisol (rent-to-own model)	80W system (3*2W LED + radio + torch + 19" LED TV)	<ul style="list-style-type: none"> ■ 49,100 TZS (US\$27) per month for 36 months ■ 128,000 TZS (US\$70) upfront 	1,895,600 TZS (US\$1,043)
	120W system (3*2W LED + torch + 24" LED TV)	<ul style="list-style-type: none"> ■ 62,900 TZS (US\$35) per month for 36 months ■ 196,000 TZS (US\$108) upfront 	2,460,400 TZS (US\$1,353)
	200W system (village shop system)	<ul style="list-style-type: none"> ■ 82,900 TZS (US\$46) per month for 36 months ■ 277,000 TZS (US\$152) upfront 	3,261,400 TZS (US\$1,794)

Source: WRI, based on interviews (see Annex I)

Notes: The US\$ amounts are based on the currency exchange as of Jan 31, 2016, obtained from OANDA. The appliances are sold with the system, unless noted otherwise.

While the main product offered by all companies is essentially a SHS, at the time we conducted the interviews there was one key difference between Off-Grid Electric and the others. All the other major companies offer a “rent-to-own” plan, where ownership of the system is transferred to the end customer after complete repayment of the loan. Off-Grid Electric, on the other hand, offers a “fee-for-service” model by providing an energy service against regular payments but never transferring ownership of the system to the end customer. Companies can, however, switch between business models. As

The market leaders—M-KOPA in Kenya and Off-Grid Electric in Tanzania—offer smaller products. The main competitors—BBOXX in Kenya and Mobisol in Tanzania—offer larger systems. However, most offerings are still at the Tier 1 and Tier 2 level of energy access. The customers’ payments are designated in local currency on a daily or a monthly basis.

KEY FUNDS RAISED BY PAYG COMPANIES OPERATING IN KENYA AND TANZANIA (AS OF FEBRUARY 2016)

Company	Details of funds raised
Azuri Technologies	<ul style="list-style-type: none"> ■ US\$1.7 million: Barclays Social Innovation facility (2013)^a ■ US\$0.75 million: AECF REACT Round 2 (2012)^b ■ Amount undisclosed: IP Group Plc, a VC fund (2012)
BBOX Capital	<ul style="list-style-type: none"> ■ US\$15 million: previous backers and ENGIE and CeniARTH, Oikocredit (2015)^c ■ US\$3 million: DOEN and Bamboo Finance (2015)^d ■ US\$1.9 million: Synergy Growth and Khosla Impact (2013)^d ■ US\$0.30 million: AECF REACT Round 2 (2013)^e
MobilSol	<ul style="list-style-type: none"> ■ €10.7 million: DEG (2015)^f ■ £288,000: GSMA grant (2013) ■ US\$1.1 million: AECF REACT Round 2 (2013)^g ■ Amount undisclosed: DEG (2012)^h ■ €200,000: EEP (2012)ⁱ
M-KOPA	<ul style="list-style-type: none"> ■ US\$19 million: led by Generation Investment Management (2015)^j ■ US\$12.45 million: led by LGTVP (2015)^k ■ US\$20 million: syndicated by Commercial Bank of Africa (2014)^d ■ £350,000: GSMA grant (2013) ■ US\$~1.9 million: led by LGTVP (2011)^k
Off-Grid Electric	<ul style="list-style-type: none"> ■ US\$45 million: Packard Foundation, CeniARTH, Calvert Foundation (2015) ■ US\$25 million: led by DBL Partners (2015)^d ■ US\$7 million: IFC, Cordiant Capital (2015)^d ■ US\$16 million: led by SolarCity, Zouk Capital, and Vulcan Capital (2014)^d ■ US\$7 million: Vulcan Capital, SolarCity, Omidyar Network (2014)^d
Devery (a mini grid company in Tanzania)	<ul style="list-style-type: none"> ■ £350,000: GSMA grant (2015) ■ US\$809,000: led by Acumen (2015)^l ■ €115,000: DOEN project subsidy (2012)^m
Powerhive (a mini grid company based in Kenya)	<ul style="list-style-type: none"> ■ US\$20 million: led by Prelude Ventures LLC (2016)^d ■ US\$12 million: Enel Green Power (2015)^d

Source: WRI, based on interviews validated by online research (see Annex I)

Notes:

^a Barclays Bank PLC, "Financing Innovation," n.d. Retrieved on January 3, 2016, from: <https://www.barclayscorporate.com/why-barclays/supporting-uk-business/azuri.html#>.

^b Ashden Award Winner, "Case Study Summary Azuri Technologies, Africa," 2013. Retrieved January 3, 2016, from: <https://www.ashden.org/files/Azurivinner.pdf>.

^c PV Magazine, "BBOX Secures US\$15m Funding for Africa Solar Ventures," 2015. Retrieved January 3, 2016, from: http://www.pv-magazine.com/news/details/beitrag/bbox-secures-15m-funding-for-africa-solar-ventures_100022514/#axz3x1GppyKz.

^d Crunchbase.

^e AECF REACT Round 2, "BBOX Solar Franchising Model in East Africa," 2013. Retrieved on January 3, 2016, from: http://www.aecfafrica.org/sites/default/files/project_files/BBOX%20LTD.pdf.

^f DEG Investment in MobilSol GmbH, 2015: Retrieved on January 3, 2016, from: https://www.deginvest.de/DEG-Documents-in-English/About-DEG/Responsibility/Investment-related-information/201507_MobilSol_EN.pdf.

^g AECF REACT Round 2, "MobilSol—Affordable and Sustainable Solar PV," 2013. Retrieved on January 3, 2016, from: http://www.aecfafrica.org/sites/default/files/project_files/MobilSol-GmbH.pdf

^h Africa-EU Renewable Energy Cooperation Programme (RECP), "DEG-Direct Investments," 2012. Retrieved on January 3, 2016, from http://www.africa-eu-renewables.org/_funds/deg/.

ⁱ MobilSol Presentation, EEP Project of the Year Finalist," 2015 Retrieved on January 3, 2016 from http://eepafrica.org/wp-content/uploads/151202-MobilSol-presentation-EEP-PotY-pitch-v1-0_External.pdf.

^j PV Magazine, "M-KOPA Solar Secures US\$19m Equity Investment," 2011. Retrieved on January 3, 2016, from http://www.pv-magazine.com/news/details/beitrag/m-kopa-solar-secures-19-million-equity-investment_100022256/#axz41e3ShTFS.

^k M-KOPA, "M-KOPA Concludes Series A Investment," 2011. Retrieved on January 3, 2016, from: <http://www.m-kopa.com/updates/m-kopa-concludes-series-a-investment/LGTVP> (US\$500k debt, 37.5k equity), <http://www.lgtvp.com/HOPS/Organisation/M-Kopa.aspx>, Acumen (US\$1.1m) <http://acumen.org/investment/m-kopa/> and d.o.b Foundation (€240k/US\$260k) <http://www.dobequity.nl/east-africa-fund/m-kopa-kenya/>.

^l Africa Capital Digest, "Acumen Leads Group Backing Solar Firm Devery," 2015. Retrieved on January 3, 2016, from: <http://africapitaldigest.com/acumen-leads-group-backing-solar-firm-devery/>, Acumen (US\$700k) <http://acumen.org/investment/devery/>, OPES Impact Fund (€100k/US\$109k) http://www.opesfund.eu/file/investmenti_doc/investmenti_9_2.pdf.

^m Stitching DOEN, 2012: *Annual Report, 2012*. Retrieved on January 3, 2016, from: <http://services.gdl-webservices.nl/DOEN/jaarverslagen/2012UK/magazine.html#/spreadview/26/>.

of September 2016, we understand that Off-Grid Electric had switched to a rent-to-own model while BBOXX was considering a fee-for-service model.

Success to Date in Raising International Capital

PAYG companies have raised significant capital from international investors in the last few years in the form of grants (for developing and testing products and markets) and, more recently, in the form of equity capital (for growth and scaling up). In 2015, on the strength of several previous equity rounds, companies have also been able to raise debt for funding their further scale-up and growth. In Table 4, we summarize the key fund raises of PAYG companies operating in Kenya and Tanzania. In order to demonstrate the strong investor interest in this sector, we have also included the fund raises of two mini grid companies operating in these two countries. There is significant interest among donors in supporting the development of products and market-testing strate-

gies. Based on the initial success of these pilots (largely funded by grants), companies have been able to raise significant equity rounds. Increasing confidence in the model is further evidenced by the fact that debt investments also have been recently forthcoming. The key debt investments are summarized below.

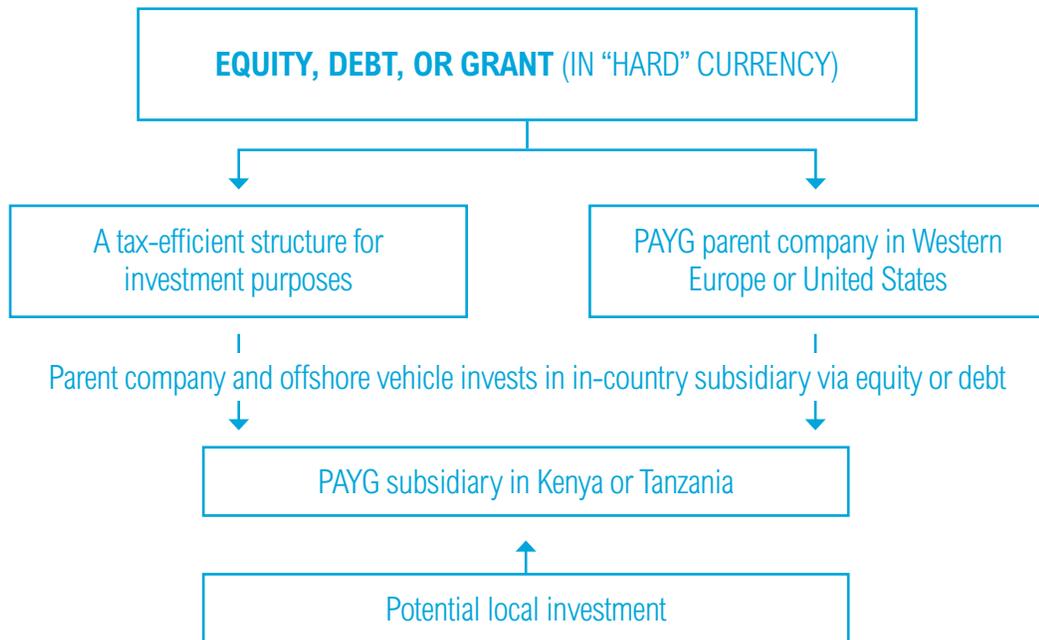
- Barclays facility to Azuri of US\$1.7 million (2013).
- Commercial Bank of Africa's syndicated debt facility to M-KOPA of US\$20 million (2014).
- DEG's loan to Mobisol of undisclosed amount (this debt investment is part of the total €10.7 million in 2015).
- Debt component of US\$6 million in the LGTVP-led round investment to M-KOPA (2015).
- Oikocredit securitization deal of US\$0.5 million with BBOXX (2015).
- IFC (US\$4.5 million), Cordiant Capital (US\$2.5 million) debt to Off-Grid Electric (2015).

- Packard Foundation, Ceniarth, Calvert Foundation debt facility of US\$45 million to Off-Grid Electric. USAID provided a grant of US\$5 million of the US\$45 million (2015).

Of the seven debt deals in the sector, five were struck in 2015. This excludes the Africa Enterprise Challenge Fund (AECF) investments disbursed in the form of repayable grants (which are treated as zero-interest rate loans in the books of the company). Financiers are responding to the need for debt capital for scale-up. However, these international investors generally provide debt capital in "hard" currencies. All the debt deals (except the debt deal syndicated by the Commercial Bank of Africa for M-KOPA) are in foreign currency. The debt deal syndicated by Commercial Bank of Africa was facilitated by a guarantee from the Gates Foundation (Bill and Melinda Gates Foundation 2016). In fact, none of the interviewed companies had secured letters of credit or any other form of short-term trade finance from local banks.

There is now a strong community of international investors in the PAYG sector. In our analysis, 17 foundations, 21 impact funds, four venture capital funds, two corporate venture capital funds, and eight large companies have invested in PAYG companies in East Africa. Their details are available in Annex III along with information on nine prominent angel investors. The strong interest among international investors is in stark contrast to the absence of local investor activity.

TYPICAL STRUCTURE OF CAPITAL MOVEMENT IN PAYG COMPANIES SURVEYED



Source: WRI, based on interviews (see Annex I)

Given that the leading investors are mostly international, PAYG companies are developing complex financial structures to raise required capital. We have already noted that most of the PAYG companies operating in Kenya and Tanzania have foreign ownership and management. The parent companies are all incorporated overseas. Figure 1 depicts a typical structure and the way various types of capital move.

Given the need for capital in the sector, one possible option is “off-balance-sheet” financing (where the debt is not on the books of the company) and does not affect the debt equity or other leveraging

ratios. PAYG companies are using securitization (the pooling together of cash flows originating from contractual agreements and selling the cash flows to investors as tradable financial securities) as an off-balance-sheet financing instrument. A securitization deal has already been executed by Oikocredit with BBOXX. A typical securitization deal would work in the following manner:

1. The PAYG company “sells” active customer contracts to a special purpose vehicle (SPV). The sale value of the customer contracts would reflect a discount based on the expectation of defaults.
2. The SPV would issue “notes” to investors.

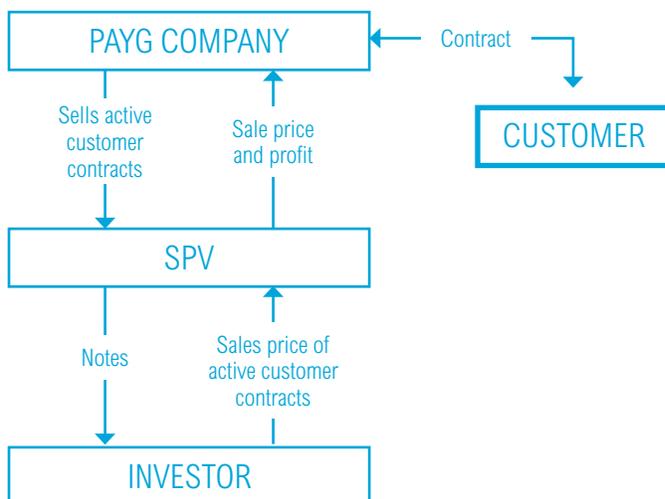
3. The PAYG company would be responsible for bringing in other active customers and for non payment. The PAYG company would need to cover higher-than-expected defaults if necessary.

This kind of arrangement is depicted in Figure 2.

In the case of the Oikocredit deal with BBOXX, the first issue of securities has bundled 2,500 active contracts and raised 52 million Kenyan shillings (US\$500,000). The notes have an interest rate of 21 percent and an average maturity of 2.5 years (Hirtenstein 2012).

FIGURE 2

STRUCTURE OF A TYPICAL SECURITIZATION DEAL



Source: WRI, based on discussion in Nairobi convening, July 2016

Challenges with Foreign Currency Debt

While the tactics devised by PAYG companies to secure capital may have been effective thus far, they are not without risks. There are two main challenges associated with foreign currency debt:

- The structures are complex with high transaction costs (involving legal and tax advisory services).
- The PAYG companies are exposed to currency risks if the local currency depreciates because their assets (customer payments) are in local currencies.

These risks are tangible. The Kenyan shilling and the Tanzanian shilling have been volatile against the dollar. In Annex IV, we track the movement of the Kenyan and the Tanzanian currencies against the U.S. dollar since 2004. The Kenyan shilling fell about 8 percent and the Tanzanian shilling fell by about 17 percent from April 2014 to April 2015. From April 2015 to January 2016, the currencies depreciated a further 8 percent and 10 percent, respectively. In the entire period from April 2004 to January 2016, the Kenyan shilling, on four occasions, depreciated 5 percent or more against the U.S. dollar within one year. The largest depreciation in one year was about 21 percent in 2009. In the same period, the

Tanzanian shilling, on five occasions, depreciated 5 percent or more against the U.S. dollar within one year. The largest depreciation in one year was about 17 percent in 2015.

Companies can either absorb the increased debt-servicing costs or pass them on in the form of higher rates for end customers, who pay in local currency. Indeed, in January 2016, we observed a price increase for consumers. To understand the extent of the increased costs, we compare the product offerings of the market leaders in Kenya and in Tanzania in Table 5.

The currency risks point to the importance of borrowing in local currency. Foreign lenders rarely provide local currency loans. Interest rates for local currency loans are high in Kenya and Tanzania, but the saved hedging costs can outweigh the difference in coupon rates. Risk-mitigation mechanisms exist almost exclusively for high transaction volumes (Muench and Issler 2015). These mechanisms are often not practical for PAYG companies, given their relatively small size, and actively deter the entry of other private sector players, who may not have the capacity to borrow from international markets. However, there are efforts underway to make hedging facilities available to energy access companies. In particular, the German environment ministry has announced that it will make available €30 million through KfW development bank to the hedging specialist TCX, to be used for projects that promote renewable energy and energy efficiency investments in sub-Saharan Africa (The Lab 2016). The currency hedging products are offered through

COMPARISON OF PRICE INCREASES IN THE MARKET-LEADING PRODUCT OFFERINGS IN KENYA AND TANZANIA

2015 package price	2016 package price	Total increase of customer payments in January 2016 over previous year
M-KOPA, KENYA		
40 KES per day for 365 days Upfront: 2,999 KES	50 KES per day for 365 days Upfront: 3,500 KES	24%
OFF-GRID ELECTRIC, TANZANIA		
12,000 TZS per month of subscription 12,000 TZS upfront	15,000 TZS per month of subscription 15,000 TZS upfront	25%
20,000 TZS per month of subscription 20,000 TZS upfront	22,000 TZS per month of subscription 22,000 TZS upfront	10%

Source: WRI, based on interviews (see Annex I)

MFx Solutions, a dedicated currency hedging facility for the microfinance, SME, and impact investment sectors. MFx products can be accessed either by the investor or the company and, unlike more commercial hedging transactions, can provide contracts for relatively small-value transactions (MFx Solutions 2013).

The Competitive Dynamics

In Kenya, 35 million people live without electricity. In Tanzania, the number is 36 million people (IEA 2014a). PAYG represents an opportunity to provide energy access to a significant part of these populations. The GSMA defines the addressable market as people living without access to modern electricity and water but living within range of Global System for Mobile (GSM) communication networks (within range of mobile coverage), as shown in Table 6.

The energy addressable market defined above is in terms of population. PAYG companies provide solar home systems, at a rate of one system per household. Assuming a typical household size of five, the addressable market is 5.7 million households in Kenya and 5.3 million households in Tanzania. Adoption of solar home systems in Kenya and Tanzania is growing rapidly but the addressable market is far from penetrated (the current penetration figures are in the thousands whereas the market is in the millions).

From the customer's point of view, the financial offerings of the PAYG companies are expensive. In part, these high costs reflect the risk of lending to hitherto unbanked customers. They also reflect the lack of general manufacturing infrastructure in these two countries, as well as the high transaction costs

of raising exclusively international capital. We have made some broad assumptions regarding product costs to provide a rough estimate of the effective interest costs to customers, which are presented in Table 7. The high effective interest rate is partly explained by the need for the companies to recover initial investment in product development and distribution infrastructure.

A large market, enthusiastic customer acceptance (rapid sales growth indicates that customers seem willing to pay the effective high interest rates because they see the value of the product over other options), and a level of profitability that adequately covers the risk of lending to unbanked customers are factors likely to lure new entrants. In our analysis, entry barriers are likely to fall because of three developments in the PAYG ecosystem, illustrated in Figure 3.

TABLE 6

ADDRESSABLE MARKETS IN KENYA AND TANZANIA

Country	GSM population coverage (2013)	Mobile connection penetration (4th quarter, 2012)	Electrification rate (2012)	Energy-addressable market (2013)
Kenya	68%	68%	23%	28,398,473
Tanzania	76%	55%	15%	26,663,260

Source: Nique 2013

TABLE 7

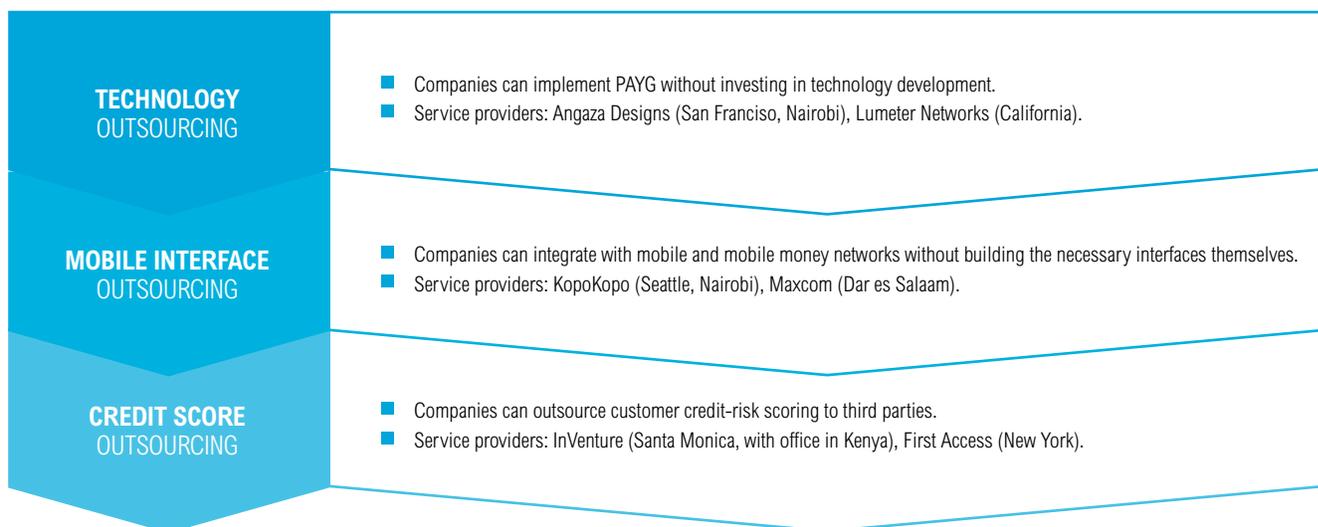
ESTIMATES OF EFFECTIVE INTEREST RATE PAID BY PAYG CUSTOMERS FOR TWO TYPES OF SYSTEM

System size	Small (8W)	Medium (15W)
Estimated system cost including import costs, dealer margin, and inclusion of GSM chip	16,000 KES (US\$153)	19,850 KES (US\$190)
Customer payments for PAYG	50 KES (US\$0.50) per day for 365 days 3,500 KES (US\$34) upfront	950 KES per month (US\$9) for 36 months 950 KES (US\$9) upfront
Internal rate of return (IRR) over lease period	125%	52%

Source: WRI

Notes: Assumptions based on data from product pricing data, cost prices based on enquiries from Chinese suppliers (see Annex I), internal rate of return calculated using XIRR function in Excel.

THREE REASONS WHY ENTRY BARRIERS SHOULD FALL IN THE PAYG SECTOR



Source: WRI, based on literature review and interviews (see Annex I)

There are already examples of partnerships between key ecosystem players and PAYG operators. Angaza has already worked with d.light and with Philips to offer their solar lamp through a PAYG service. KopoKopo has worked with BBOXX in Kenya.

In order to provide energy access to this large population in an affordable manner, it is necessary to create market conditions that allow the entry of a large number of players. Growing competition should increase the product offerings available to unserved and underserved populations and reduce overall costs. The technical barriers of entry to the PAYG market are already falling. There are two business barriers to entry: the need for PAYG companies to have an extensive marketing and distribution network and the ability to finance customer deployments in large numbers. The fact that

capital is available almost exclusively from international investors (whether in the form of debt, impact equity capital, or grant) makes it particularly difficult for local companies. Local businesses often lack the skills, networks, and/or initial resources needed to raise capital in international markets, particularly if complex financial structures have to be developed. If finance were locally available for investment in marketing and distribution and to provide asset finance, then the market would attract a larger number of players, including local companies. A competitive market place, with effective monitoring and verification systems, would enable the provision of energy access solutions to the underserved populations of Kenya and Tanzania with the service attributes of reliability, affordability, legality, and health and safety.

SECTION II: STIMULATING LOCAL DEBT

The Importance of Local Debt

Previous WRI research has indicated the importance of publicly supported efforts to raise awareness and build capacity for distributed renewable energy lending among local financial institutions. The research has led to the recommendation that international initiatives, as well as national government action, could help the sector develop by introducing a suite of policy and regulatory measures aimed at unlocking domestic commercial financing for distributed renewable energy (Doukas and Ballesteros 2015).

International DFIs and donors have a long track record in helping to build the capacity of local financial institutions for specific sectors.

TABLE 8

CAPITAL NEEDED FOR THE PAYG SECTOR IN KENYA AND TANZANIA

	Kenya	Tanzania
Addressable market for PAYG	5.7 million households	5.3 million households
Assuming a market penetration of 35%	2 million households	1.9 million households
ASSUMING THAT:		
10% of households have Tier 1 (very low) energy access with a SHS costing US\$150	US\$30 million	US\$28.5 million
15% of households have Tier 2 (low) energy access with a SHS costing US\$600	US\$180 million	US\$171 million
10% of households have Tier 3 (medium) energy access with a SHS costing US\$1,500	US\$300 million	US\$285 million
TOTAL	US\$510 MILLION	US\$485 MILLION

Source: WRI, based on estimated system prices and stated assumptions.

Indeed, they have a long relationship with banks in Kenya and Tanzania. In Annex VII, we provide the details of lines of credit provided by DFIs to banks in Kenya and Tanzania. Fifteen banks in Kenya have existing active lines of credit with international DFIs. Most of these lines of credit are for general SME development, but recently Agence Française de Développement (AFD) has launched two green lines of credit: one with Co-operative Bank and the other with Chase Bank. In Tanzania, 10 banks have lines of credit with international DFIs. All the key international development finance institutions have a presence in East Africa: AFD and Proparco, European Investment Bank (EIB), the World Bank, the International Finance Corporation (IFC), the Netherlands Development Finance

Company (FMO), KfW Bankengruppe, Deutsche Investitions- und Entwicklungsgesellschaft mbH (DEG), and Oesterreichische Entwicklungsbank AG (OeEB). The China Development Bank and the African Development Bank also have partnerships with existing banks in Kenya and Tanzania.

The institutional relationships between international DFIs and local banks are especially important when we consider the amount of financing needed to provide energy access in Kenya and Tanzania. We have already seen that the GSMA estimates the PAYG addressable market at 5.7 million households in Kenya and 5.3 million households in Tanzania. How much capital would the PAYG sector need in order to make substantial contributions to electricity access?

To obtain the system costs, we made some broad assumptions about the landed cost of systems in Kenya and Tanzania (at the point of customer interface). The US\$150 system cost is based on an 8W–10W system. The US\$600 cost is based on a 50W system and the US\$1,500 cost is based on projected costs of a 200W system (such a system is currently not available in these two countries).

The indicative figures in Table 8 are meant to serve only as an illustration that a substantial amount of capital is required for the PAYG sector to scale to real impact. The rough and ready model indicates that about one billion dollars is necessary for the PAYG sector to have a substantial impact, especially if a reasonable proportion of its target households are to have anything more than the most basic level of energy access.

Relying on their own means, individual early-stage companies would find it extremely challenging to raise this amount of capital and would probably be able to provide only the most basic energy access service to a smaller proportion of the population. **It is important to leverage existing financial institutions to facilitate a capital flow of this magnitude.** This requires the support of both the national government and the international community.

Current DFI Initiatives

Table 9 summarizes the range of initiatives that international DFIs already employ in the area of energy access in Kenya and Tanzania. The specific initiatives indicated under each category are examples and do not provide an exhaustive list. The table is intended to convey the range of initiatives and indicate where the majority of the funding is going.

In terms of fund commitment, most international development financial support goes to large-scale generation capacity and grid expansion. To expand energy access, the connection fee for rural households is reduced for some period of time after the grid expands into new areas.

The limitation, in our opinion, is that support to local financial institutions to develop lending programs for energy enterprises has not been explored actively in Kenya and Tanzania, as can be seen from the above categories of activities. One exception is the US\$10 million Short-term Renewable Energy Companies Credit Line Program, part of the overall US\$200 million World Bank support to Tanzania. The program is designed to make funds available to participating financial institutions through Tanzania's TIB Development

Bank (TIB). The loans to the participating financial institutions will be at a low interest rate to create an incentive in the form of potential higher margins. TIB will also share in the credit risk of the underlying renewable energy company loans. It is expected that both working capital and term loans would be made available to the rural renewable energy companies. An additional technical assistance component is included both for the renewable energy companies, to help them apply for loans and to set up PAYG systems, and for participating financial institutions, to build their capacity in appraising these loan applications. The credit line and the technical assistance should particularly help local Tanzanian solar companies adopt PAYG methods.

We believe that the type of financial support proposed by the World Bank in Tanzania needs to be expanded. Support given to national governments to increase generation capacity and grid infrastructure should be complemented by measures to strengthen the capacity of local financial institutions that can provide the necessary resources for private PAYG companies to provide energy access.

The Energy Africa program of the UK's Department for International Development (DfID) **also aims to address many of the issues we highlight in this issue brief.** Launched in October 2015 and aimed at 14 priority countries (including Kenya and Tanzania), the campaign aims to sign a country-specific compact agreement that outlines policy actions required to foster development of the household solar sector. The policy areas identified under Energy Africa include the following:

- Removing policy uncertainty by including off-grid electrification as part of the national electrification strategy.

- Providing a level playing field for the household solar sector.
- Protecting customers by holding solar system providers accountable and enforcing quality standards.
- Increasing customer awareness.
- Facilitating the import of solar equipment.
- Mobilizing access to finance.

The program envisages support being available to countries following the signing of the compact agreement (DfID 2016).

The World Bank Group, in partnership with the Global Off-Grid Lighting Association (GOGLA), is collecting metrics from a sample of PAYG solar companies to standardize metrics applicable to the industry as a whole. The aim is to enable commercial investors to understand the risks and opportunities of the sector.

Lessons from Bangladesh in Stimulating Local Capital

Previous WRI research has commented on the lessons that can be learned from Bangladesh, which has made extensive progress in the installation of SHSs. The country has created a centralized framework that allows international finance to flow through a national institution to energy access enterprises and serves as an important gatekeeper of technical standards and other issues relevant to providers of clean energy access solutions (Doukas and Ballesteros 2015). In terms of the number of installed systems, the Bangladesh model has been very successful. The program was established in 2003 and, as of April 2014, three million SHSs had been installed, benefiting 13 million

INTERNATIONAL FINANCIAL INSTITUTIONAL SUPPORT TO FINANCE ENERGY ACCESS (FOCUS: KENYA AND TANZANIA)

SUPPORT TO CREATE ADDITIONAL GENERATION CAPACITY AND GRID EXPANSION

- AFD (€50 million) support to Lake Turkana Wind Power (private sector IPP).
- AFD (€60 million) support to KETRACO (Kenya Electricity Transmission Company) for transmission line infrastructure.
- AFD (€67 million) support to TANESCO (Tanzania Electric Supply Company).
- KfW (US\$88.6 million), AFD (€170 million) support to KenGen (Kenya Electricity Generating Company) for geothermal power stations.
- World Bank (US\$330 million) support to Ministry of Energy and the Kenya Power and Lighting Company.
- World Bank (US\$250 million) support to Government of Kenya for the Kenya Power and Lighting Company.
- World Bank (US\$200 million) support to the Government of Tanzania for the Rural Energy Agency.

SUPPORT FOR MINI GRIDS

- AFD (€33 million) for Kenya Power to install renewable energy in 23 mini grids.
- KfW (€15 million grant) and GIZ (€7.5 million) support to the Kenyan government for mini grids in northern Kenya.
- IFC support to Tanzania for mini grid technical standards and advisory work.
- DfID financing for green mini grids (including grants to developers—the grants can also be used as interest rate subsidies and results-based financing).

DIRECT SUPPORT TO PROJECTS AND COMPANIES

- Proposed European Commission (€75 million) support for convertible grants to close “financing gap.” The support is available to projects in multiple global areas.
- DEG (€10.7 million) direct grant, loan, and equity support to Mobisol GmbH
- FMO (US\$2 million) equity to Orb Energy.

DIRECT SUPPORT TO MFIS PROVIDING LOANS TO ENERGY ACCESS

- OPIC (U.S. Overseas Private Investment Corporation) and SDC (Swiss Development and Cooperation Agency) support to the Participatory Microfinance Group for Africa (PAMIGA) in May 2015.

INVESTMENT IN FUND OF FUNDS (THESE FUNDS TARGET SHS AND MINI GRID COMPANIES)

- IFC (US\$10 million) investment in the responsAbility Energy Access Fund.
- DfID (£30 million) proposed commitment to the “Flexible Fund”.
- DfID, along with donors from other countries (US\$244 million), to the Africa Enterprise Challenge Fund (AECF).

SUPPORT TO COMPETITIONS (THAT SUPPORT SHS AND MINI GRID PLAYERS)

- DfID (£30 million) support to the GSMA for funding mobile enabled energy, water, and sanitation innovation in Africa and Asia.

SUPPORT TO SOLAR HOME SYSTEM MARKET

- DfID support through EnDev (Energising Development) for results-based financing (operated in Tanzania by the Dutch NGO, SNV, for pico solar).
- DfID Energy Africa to generate the policy and market shifts necessary to overcome the barriers and rapidly accelerate the growth in the African solar household industry.
- The World Bank Group Harmonized Metrics for the Distributed Solar Industry.

Source: WRI, based on information from institutional websites and interviews (see Annex I)

people—equivalent to 9 percent of the total population (IDCOL 2014a).

We will look at the Bangladesh model in more detail to draw lessons for Kenya and Tanzania. Bangladesh set up IDCOL as a government-owned, non banking finance company. IDCOL channels international capital to the renewable energy sector, and the SHS program has been its largest program to date. The Bangladesh government felt it necessary to set up a specialized organization because, in 2003, its existing financial institutions did not have the required relationships with international DFIs and donors. However, IDCOL not only channeled funding, it also played a major role in development of the whole sector. No such organization, with responsibility for both channeling funds and developing the sector, exists in Kenya or Tanzania today. Despite these differences, the Bangladesh experience is worth investigating, given the magnitude of its success and the striking similarity between the operations of the PAYG companies and those of IDCOL's Partner Organizations (POs).

The POs provide a one-stop shop, as do the PAYG companies. They sell and install the solar home systems in rural households and collect the monthly payments for the system. These home visits give the POs the opportunity to provide any needed technical service.

IDCOL channels funds from international DFIs and donors to these POs. How much money does it take? The aggregate nominal support from 2003 to 2015 of the various international financial institutions, categorized into debt and grant, in the Bangladesh SHS program is summarized in Table 10.

The Partner Organizations in Bangladesh provide the product, the required after-sales service, and the microcredit. In doing so, they build trust among consumers in the same way that PAYG companies do in East Africa. The PAYG companies have the additional advantage of reduced costs and operations risks, achieved using technology.

TABLE 10

INTERNATIONAL DFI SUPPORT COMMITTED TO BANGLADESH SHS PROGRAM (ALL FIGURES IN US\$ MILLION)

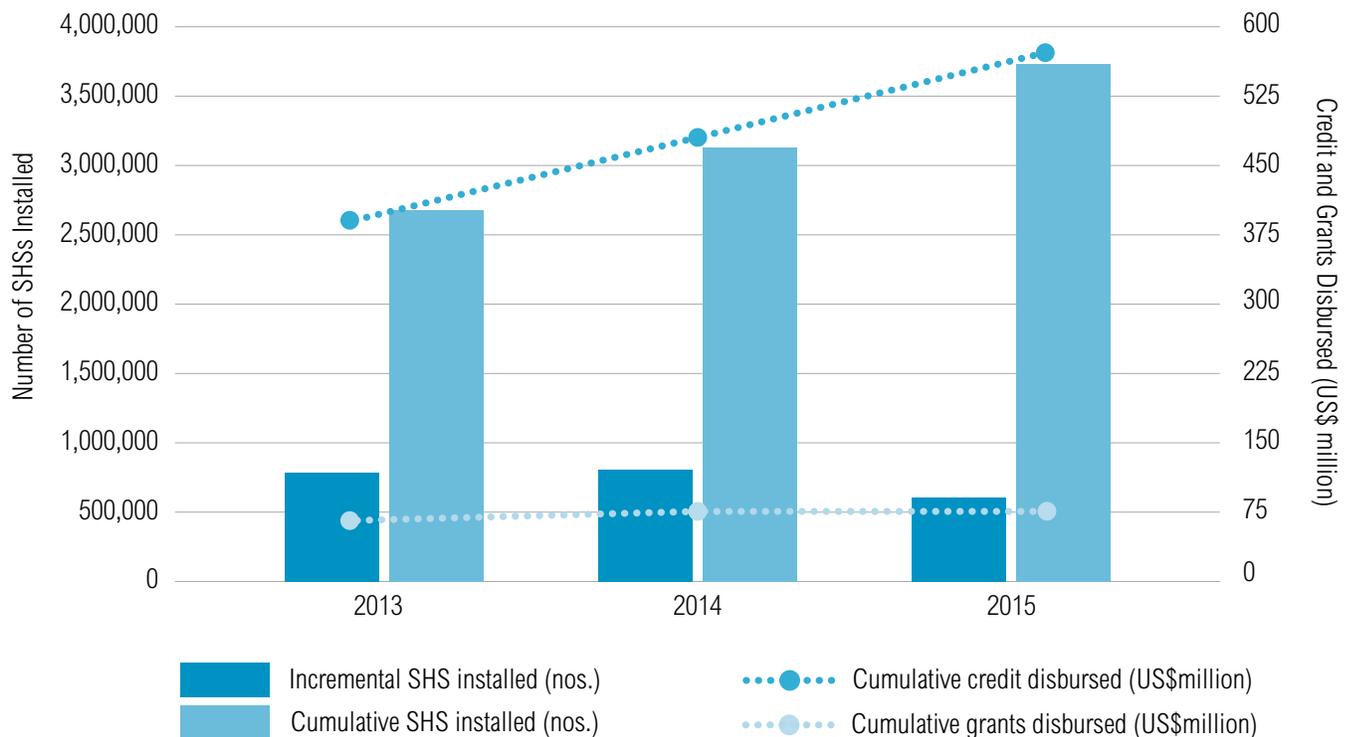
Institution	Credit	Grant
World Bank	449	—
JICA	103	—
ADB	88	—
KfW	—	18.5
GTZ	—	16.5
SIDA	—	7
USAID	—	2.4
DfID	—	28
GPOBA	—	7
Others	—	30.6
TOTAL	640	110

Source: WRI based on information from interviews of IDCOL management (see Annex I)

A total of US\$750 million has been committed, of which about 85 percent is in the form of low-cost debt and the remaining 15 percent in the form of grants. Initially designed by the World Bank, the program has been supported by all major development partners.

The program was designed to attract market participants and become a self-sustaining model. The program started with five Partner Organizations and now has more than forty. While it began with a capital subsidy to households and a grant to the partners (based on the number of solar home systems installed), this mode of operation was intended to be phased out over time. Indeed, in the last two years, the program has continued to sell and install SHSs without additional grant disbursement (Figure 4).

FIGURE 4 NUMBER OF SOLAR HOME SYSTEMS INSTALLED, CUMULATIVE CREDIT, AND GRANTS DISBURSED, 2013–2015 (US\$)



Source: WRI, based on IDCOL annual report.

More information on IDCOL is presented in Annex V. The important thing to note is that, in addition to channeling financing, IDCOL played additional roles to ensure energy access with service attributes of affordability, reliability, and health and safety (Table 11).

The other critical lesson from the IDCOL model is the way IDCOL provided financing to energy access enterprises. WRI (and other) researchers have often commented on the requirements of collateral that severely constrain the ability of energy access enterprises to borrow from local financial institutions

(Doukas and Ballesteros 2015; IFC 2012). The security in the IDCOL model is achieved as follows: hypothecation of receivables, hypothecation of solar assets in the field, and personal guarantee of the founders of the energy enterprise or a corporate guarantee. There is no requirement for additional collateral.

TABLE 11

ROLES PLAYED BY IDCOL (IN ADDITION TO FINANCING)

IDCOL role in ensuring access	Details
Results-based financing	<ul style="list-style-type: none"> ■ IDCOL provided results-based financing (known as the institutional development grant) per system installed. ■ In the last few years the grants have been phased out, but the results-based financing helped the Bangladesh energy enterprises invest in infrastructure in rural areas.
Capital buy-down grants	<ul style="list-style-type: none"> ■ In 2002, when the costs of solar systems were high, IDCOL provided households a capital subsidy to buy solar home systems. This grant has also been phased out.
Technical standards	<ul style="list-style-type: none"> ■ IDCOL set up an independent Technical Standards Committee to ensure product quality and reliability.
Vendor certification	<ul style="list-style-type: none"> ■ IDCOL certified vendors by working with independent testing centers to ensure product quality and reliability.
Installation areas	<ul style="list-style-type: none"> ■ IDCOL established that installations should be carried out only in off-grid areas to ensure that off-grid populations have higher priority.
Environmental standards	<ul style="list-style-type: none"> ■ IDCOL enjoined its partner energy enterprises to provide battery recycling with the certified battery vendors to ensure health and safety.
Monitoring and verification	<ul style="list-style-type: none"> ■ IDCOL has 12 quality control offices, 130 quality inspectors, and 11 field auditors. IDCOL also has a customer call center to receive complaints. ■ The monitoring and verification function was necessary to ensure that the technical standards were implemented.

Source: WRI, based on literature review and interviews.

Each IDCOL borrower (under the SHS program) maintains two accounts with IDCOL:

- **The proceeds account:** Revenue collections from households flow into this account as do the disbursements from IDCOL. The energy enterprises fund all operating expenses from this account. The account is audited by IDCOL and there is a lien in favor of IDCOL in case of default.
- **The debt service coverage account:** This account has to be maintained at twice the quarterly repayment to IDCOL.

By using these two cash flow accounts, IDCOL has been able to obtain a clearer view of underlying cash flows and dispense with the requirements of additional collateral.

Adapting IDCOL for Kenya and Tanzania

The implementation of the IDCOL model led to the distribution of three million SHSs to rural households in Bangladesh. The “market creation” has led to the expansion of local manufacturing capacities. For example, in 2002, Bangladesh had no indigenous battery manufacturer and now there are several (Rahimafrooz, Rimso Battery, Panna Battery, and Hamko Group are the larger battery manufacturers). In Annex VI, we present a comparison of prices for systems currently sold in Bangladesh and in Kenya and Tanzania. Despite the success of the SHS market in Bangladesh, there is limited interest on the part of commercial banks to finance SHS providers (Doukas and Ballesteros 2015).

BOX 2

DEFINITIONS

Hypothecation is the practice whereby the debtor pledges an asset to secure a debt. Hypothecation is used for creating charge against the security of movable assets and the possession of the security remains with the borrower.

Collateral is property or some other asset (typically financial assets such as cash deposits, stocks, or bonds) that a borrower offers as a way for a lender to secure the loan.

The **debt service coverage account** works as an additional security measure for lenders. It is a deposit that is equal to a given number of months of projected debt service obligations (including both interest and principal).

IDCOL was the sole external financier in the SHS market in Bangladesh. Indeed, commercial banks in Bangladesh have been hesitant to finance the SHS providers. By contrast, in Kenya and Tanzania, as we have already observed, there is significant private sector interest. On the other hand, there is no one organization that performs the apex financing and the technical roles played by IDCOL.

In our view, the best way to stimulate local debt in Kenya and Tanzania is to involve the commercial banks at the very beginning. This would make the financing of the SHS market sustainable and scalable because, after the donors and DFIs withdraw, commercial banks can lend to the market from their own funds, once they understand the risk-return opportunities in the sector. The various other roles of IDCOL should be housed within several existing players in the energy and financial

ecosystem in the two countries, while building their capacities to discharge these functions.

A possible division of roles and responsibilities is illustrated in Table 12.

With the above distribution of roles and responsibilities in mind, we will examine a possible structure to stimulate local debt capital, as shown in Figure 5 below. Before we do so, however, we will discuss the role that can be played by a results-based financing program. For the first five years, IDCOL provided a grant to the PO for every SHS installed. The amount of the grant was reduced every year and was withdrawn from the sixth year (see Annex V). Additional useful lessons are now emerging from the EnDev (Energising Development) results-based financing (RBF) program run in Tanzania by SNV, the leading Dutch NGO.

POSSIBLE DIVISION OF FINANCING ROLES AND RESPONSIBILITIES IN KENYA AND TANZANIA

Role/responsibility	Current state	Next steps
Provide credit to the PAYG companies	Major international DFIs have presence in both countries; 15 banks in Kenya and 10 banks in Tanzania have active lines of credit with international DFIs.	Leverage the existing relationships with Kenyan and Tanzanian banks and provide loss guarantee to stimulate lending, supplemented by lines of credit for the off-grid sector.
Provide results-based financing to the PAYG companies	SNV, the Dutch NGO, runs a results-based financing program in one area of Tanzania with funding support from donors including GIZ and DfID.	Use results-based financing incentives, funded by public and private donors, to help early-stage PAYG companies set up marketing and distribution infrastructure in other areas of Kenya and Tanzania.
Implement technical and product standards	The Lighting Africa program of the World Bank Group (WBG) has developed quality standards and certified vendors.	Develop the comprehensive testing and field-level monitoring capacity of public organizations in Kenya and Tanzania.
Implement environmental standards	No country specific standards exist.	Work with the WBG's Lighting Africa and Lighting Global programs to develop standards and procedures and work with the Rural Electrification Authority (in Kenya) and the Rural Energy Agency (in Tanzania) to implement the standards across the country.

Source: WRI analysis based on literature review and interviews.

In the Tanzania program, an RBF fund of €1 million was hosted by the Tanzania Investment Bank (Kleijn, Sebastian, and Veen 2016). The RBF fund was used to pay out incentives that were earned by energy enterprises for every verified sale. Results-based financing can help incentivize early-stage PAYG companies to target specific areas. The companies are more willing to invest in marketing and distribution infrastructure (which, as we have noted earlier, is a key remaining entry barrier, along with finance), based on their sales

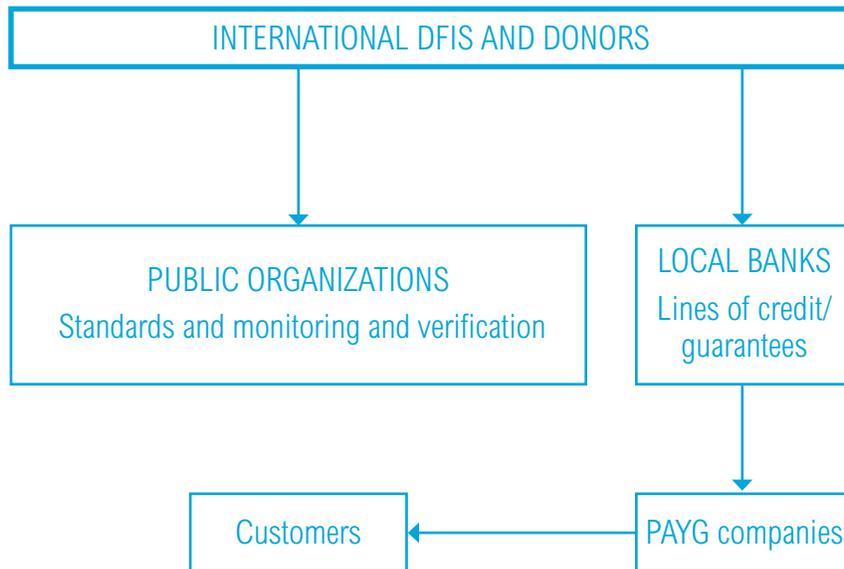
projections. The success of a results-based financing program depends on an in-depth assessment of the market. Companies should have the freedom to follow their business models (therefore, such a facility should not be restricted to PAYG models). For donors, the advantage is that the grant is linked to the end-user beneficiary. The combined experience in Bangladesh and Tanzania seems to indicate that companies will not vacate a target area when the grants are removed because they have already invested in the requisite sales infrastructure.

In this scheme of things, international DFIs and donors can play two key roles:

- Leveraging existing partnerships with local banks, to develop either specific lines of credit or guarantee schemes.
- Helping public organizations in Kenya and Tanzania with efficient implementation of monitoring and verification measures.

FIGURE 5

A POSSIBLE STRUCTURE TO STIMULATE LOCAL DEBT CAPITAL IN KENYA AND TANZANIA



Source: WRI analysis based on literature review and interviews.

We discuss each of these roles below.

Helping Local Banks Develop Lines of Credit

In the workshops that we conducted in Kenya (July 2016) and Tanzania (February 2016), we identified a few key challenges that banks face in lending to the clean energy access sector. Some banks do not see the sector either as commercially viable or as a fit with their priorities. However, even banks that do have an interest in the energy sector may not be enthusiastic about financing PAYG companies. For banks with a large retail presence, the success of the PAYG model could reveal

the opportunity in energy lending, and they could explore offering loans to their retail customers to buy renewable energy systems. We have already seen that previous loan programs of this kind, involving partnerships between financial institutions and energy companies, have not been particularly successful and that the PAYG model filled the void. However, it is possible that the growth of the PAYG companies will make retail financial institutions take a renewed look at this market. However, even the banks that place more emphasis on corporate banking (and therefore could look at the PAYG companies) do not have the technical capacity to understand

renewable energy products and the repayment capacity of rural customers. The PAYG companies are young and often cannot meet the track record and collateral requirements set by the banks. Banks also perceive a significant risk that consumers will default on payment to the PAYG provider, if the grid is extended to the household during the primary lease period. A multipronged approach will be required to help banks overcome these challenges:

- Help banks understand the risks and opportunities in the sector and the business models. In particular, help banks understand the cash flow patterns of PAYG companies so that they can define more accurate methods, based on the data, of valuing the solar assets for collateral and loan-servicing purposes.
- Help banks become more comfortable with the PAYG companies by providing trade finance that facilitates the procurement of equipment (such support can be provided with the extension of existing trade finance support schemes of the African Development Bank) (AfDB n.d.).
- Help banks take the initial steps through a risk-guarantee scheme.
- Help banks expand schemes for asset finance through lines of credit provided by international DFIs.
- Help make grid expansion plans publicly available so that the PAYG companies can provide their systems in areas where the grid is not scheduled to be extended during the repayment period for the system.

Guarantee schemes already exist in Kenya and Tanzania, for example, the Development Credit Authority program of USAID (USAID 2015) and SIDA's guarantee instrument (SIDA 2012), but for a guarantee scheme to be truly effective for a specific sector, the exact terms of a guarantee scheme should be part of an overall financing strategy and be carefully negotiated between the international donor and the local financial institution. The guarantee should be an effective risk-mitigation measure but at the same time ensure that the recipient institution is using the opportunity to build its appraisal and collection skills in the sector. The key guarantee terms include the amount of credit that can be deployed against a guarantee amount on a year-on-year portfolio basis, the maximum individual loan size, the share of the losses that will be borne, and the events that need to occur both for the origination of the loan and the revocation of the guarantee and the costs of the guarantee.

If banks are to lend to PAYG companies, they need confidence in the cash flows of these companies and faith in their accounting standards. The World Bank Group's project on Harmonized Metrics for the Distributed Solar Industry, in partnership with industry associations such as GOGLA, should actively work with the relevant national accounting standard bodies—the Institute of Certified Public Accountants in Kenya, and the National Board of Accountants and Auditors in Tanzania—to define clear guidelines for the following issues:

- Income recognition (how much income is recognized and when?)
- Provision for bad debts (when and how much provision is needed for delayed payments?)
- Capitalization of expenses (how much of marketing and R&D expenses can be capitalized?)
- Stock and capital asset accounting (how are assets at customer sites and future receivables accounted?)
- Grants accounting

Helping public organizations implement monitoring and verification capacity

Monitoring and verification are critical to ensure that energy access services have the necessary attributes of affordability, reliability, legality, and health and safety. Monitoring and verification is also a critical risk-mitigation measure for the industry. Customers are less likely to default if their products function well and they are receiving the required levels of service. Independent monitoring and verification schemes would also help other donors assess the effectiveness of their support.

The international DFIs have existing relationships with banks in Kenya and Tanzania and should leverage these relationships to develop lines of credit or guarantee programs. The banks could utilize the risk guarantee and deploy the initial capital and develop relationships with PAYG companies. As their understanding of the sector grows, they would feel confident to expand the scope of the funding.

The WBG's Lighting Africa program has already made progress in defining standards and certifying products and vendors. Their effective implementation requires the creation of a country-wide monitoring infrastructure. In the case of battery recycling, standards and procedures should be developed that are specific to Kenya and Tanzania.

The task of ensuring that the WBG's Lighting Africa standards are implemented on the ground and that standards for battery recycling are developed and implemented could be the responsibility of public organizations in each country. The key public organizations are the Bureau of Standards in Kenya and Tanzania, the Rural Electrification Authority (REA) in Kenya, and the Rural Energy Agency (REA) in Tanzania. The REA in Kenya was established, under the provisions of the Energy Act No. 12 of 2006, as a body corporate under the Ministry of Energy. The REA in Tanzania is an autonomous body under the Ministry of Energy and Minerals. Both these organizations have the task of promoting rural electrification in their countries. They have experience of renewable energy and both have experience of working with the World Bank. The World Bank could devise a role for itself in helping these public bodies to implement the quality standards.

The key consideration when assigning responsibilities to different entities is efficiency. To this end, we recommend that the local banks take responsibility for implementation of energy access financing, while public organizations ensure that systems to maintain specified quality standards are installed. The public organizations should have incentives for timely and transparent verification. At the same time, verification processes should be applicable to all players in the market. Otherwise, customers may run the risk of being offered products of unverified quality from vendors who have not had to incur the overhead costs of undergoing certification processes. One possible solution is to have the REAs be in charge of the overall rural electrification project with the financial facility housed in specified commercial banks. Whatever arrangement each individual country chooses, the key consideration is to develop an inter-organizational coordination mechanism, and efficient and transparent systems and processes. Above all, efficient coordination requires political will and an understanding that providing energy access with the attributes of affordability, reliability, legality and health and safety is a collective, national goal.

CONCLUSIONS

In this issue brief, we have seen that PAYG technology has significant advantages in terms of helping consumers at the “bottom of the pyramid,” who are accustomed to buying energy in small increments, switch over to renewable energy systems. PAYG companies in Kenya and Tanzania are currently offering products that meet the Tier 1 (very low) and Tier 2 (low) energy access levels of the multi-tier framework for defining and measuring levels of energy access. Even at these levels, numerous benefits are realized, largely through substitution of kerosene and other fuels. The product offerings are currently expensive in terms of the effective interest rate paid by the customer. Nonetheless, target customers seem to accept the products, and PAYG company sales are reportedly growing fast. PAYG companies have also attracted international private sector investor interest and have been successful in raising grants (for product development and launches), equity capital (for business development), and debt (for scale-up as business models have been proven). However, this international capital has not been matched by interest from domestic financial institutions. The dependence of the sector on international debt capital providers, in particular, is risky because of foreign currency volatility. Companies can either absorb foreign currency fluctuations or pass them on to customers, who pay in local currencies. In turn, costs of raising international capital are high because transaction structures tend to be complex and this, in turn, can lead to offerings being more expensive than they otherwise would be.

To provide energy access to the large populations in Kenya and Tanzania, in an affordable manner, it will be necessary to create market conditions that allow the entry of a large number of players. Greater competition should increase the number of product offerings available to underserved populations, make available and decrease the costs of auxiliary services, and reduce the overall risks (and therefore expected market returns) of market players. We argue that many of the technical entry barriers to the PAYG market are already falling and that the key entry barrier is the availability of finance that would enable PAYG providers to finance customer deployments. We argue that, if this source of finance were locally available, it would protect companies and customers from the fluctuations in foreign currency markets. More important, the market would attract a larger number of players, including local companies. Local entrepreneurs find it particularly challenging to navigate international capital markets, especially when the financing structures are complex.

The international DFIs and donors already have long-standing relationships with banks in Kenya and Tanzania. They should leverage these relationships to help stimulate local lending in the PAYG sector. Local banks often have limited understanding of the sector and an exaggerated sense of the risks of lending to companies in the sector. These challenges can be addressed with credit-guarantee schemes, mechanisms to understand the underlying cash flow patterns of PAYG companies, and technical assistance to companies preparing loan applications and to banks seeking to understand loan applications.

The IDCOL program of Bangladesh has some very useful lessons for Kenya and Tanzania. The POs of Bangladesh played the same role as the PAYG companies do in Kenya and Tanzania, providing a one-stop shop for customers. Unlike in Bangladesh, however, where international DFI and donor money was channeled through a non banking financial institution that performed a wide variety of roles, we believe that, in Kenya and Tanzania, commercial banks should be involved early on in channeling capital. Involving the commercial banks should aid in the sustainability and scale-up of the sector because the financing would not depend only on donor funds. The banks can adopt the methods that IDCOL used to monitor cash flow patterns of energy enterprises to define more accurate methods, based on the data, of valuing the solar assets for collateral and loan-servicing purposes. IDCOL played roles other than financing and these additional roles were critical to ensuring access with the necessary service attributes of affordability, reliability, legality, and health and safety. In Kenya and Tanzania, responsibility for these roles could be handled by organizations in the public sector. Public sector organizations—such as those responsible for rural electrification—can develop, adapt, and monitor standards that protect not only consumers but also investors and lenders. In addition, if grid expansion plans were to be made publicly available, companies could focus on areas where the chances of the grid arriving during the repayment period of the system are small.

Results-based financing programs, an important service performed by IDCOL, can be run by NGOs (SNV, the Dutch NGO, runs one such program in Tanzania). Results-based financing programs help companies invest in the last-mile marketing and distribution infrastructure that is necessary to market and service rural energy (including PAYG) systems. To ensure that service attributes are met, public organizations in Kenya and Tanzania should take on the other roles performed by IDCOL. In particular, they can set up country-wide monitoring and verification systems to ensure that products in the field adhere to WBG Lighting Global and Lighting Africa standards. In some areas, such as standards for recycling, standards would need to be developed.

As we have already seen, 17 foundations, 21 impact funds, four venture capital funds, two corporate venture capital funds, and eight large companies have invested in PAYG companies in East Africa. DFIs should consider investing in a “fund of funds” run by professional impact fund managers, rather than taking the riskier option of investing in individual companies.

RECOMMENDATIONS

The solution to the challenge of financing the scale-up of PAYG energy access lies not so much in the development of new initiatives but in the use and redirection of existing approaches for PAYG, particularly the use of credit guarantees, lines of credit, technical assistance, and investment in a “fund of funds.” It does, however, require a coordinated approach, not just between international DFIs and donor agencies but also between national government agencies involved in rural electrification and private sector investors who are increasing their investments in the energy access area. We offer key stakeholders the recommendations below:

International DFIs and Donors

Our recommendation is that international development finance institutions strengthen the capacity of the local financial system to provide debt capital to PAYG companies. The international support for increased generation capacity and grid infrastructure should be complemented (not necessarily within the same project) by measures to strengthen the capacity of local financial institutions that can provide the necessary resources for PAYG private companies to provide energy. An example is the proposed World Bank support to Tanzania, where the overall package includes a risk-sharing arrangement with the TIB Development Bank.

It is important that incentives and risk-mitigation measures are simultaneously created as a package to stimulate local lending. Credit lines should be appropriately priced to create the right incentive. The exact terms of the credit guarantee scheme should be carefully discussed between the international and local institutions to ensure that this is a meaningful risk-mitigation measure while still requiring local banks to develop their appraisals and collection mechanisms. Technical Assistance should be made available both to companies developing loan applications and to banks that appraise them so that both parties understand the use of credit guarantee and risk management tools. Technical Assistance can include use of the the WBG’s Harmonized Metrics (development of which is in progress) and appropriate accounting standards to document industry-level PAYG repayment rates. In addition to local banks that could provide debt, the international DFIs and donors should support equity investment by investing in impact funds run by professional fund managers. The DFIs and donors should use their support to provide the correct market incentives to “crowd in” private sector investment. As we have already seen, 17 foundations, 21 impact funds, four venture capital funds, two corporate venture capital funds, and eight large companies have invested in PAYG companies in East Africa. DFIs should supplement the efforts of professional impact fund managers by addressing key gaps. Investing in funds would also be less risky than supporting individual companies or projects.

International DFIs and donors should use technical assistance to build the capacity of the rural electrification and standards organizations in Kenya and Tanzania to define and adapt standards for reliability, and health and safety, and implement monitoring and verification schemes on the ground to ensure adherence to these standards. They should also support the rural electrification authorities and encourage them to make grid expansion plans publicly available. This would enable PAYG companies to plan their expansion and manage the risk of default in the event that customers stop using the PAYG systems when alternate systems become available.

Finally, international donors should consider “crowding in” other private sector foundations and family offices to support results-based financing programs. The results-based financing programs should allow donors to ensure that their support is linked to end-user beneficiaries and allow companies the freedom to invest in marketing and distribution infrastructure that would yield longer-term benefits.

Local Commercial Banks

We recommend that local commercial banks—especially those with a corporate and SME lending focus—begin to explore the opportunities in distributed renewable energy lending. Local commercial banks could start engaging with PAYG companies (and other distributed renewable energy companies) by providing short-term trade finance. They should work toward understanding the cash flow patterns of PAYG com-

panies and explore the use of mechanisms such as a debt service coverage account to partially cover default risks. Local banks should undertake a review of the sector to assess the exact components of credit, guarantee, and technical assistance they would need.

National Governments

We reemphasize previous WRI recommendations that national governments should help the sector develop by introducing a suite of policy and regulatory measures aimed at unlocking domestic commercial financing for distributed renewable energy (Doukas and Ballesteros 2015). In particular, for PAYG, the government can take the following steps:

- Send strong signals to private sector operators and the commercial sector by making energy access a national priority in which both private and public actors must participate.
- Set up mechanisms for the coordination of different institutions in a transparent and efficient manner to meet the energy access goals, then allow the mechanisms to be run by independent professionals.
- Absorb—fully or in part—the foreign currency fluctuation risks that would enable international DFI capital to flow into the commercial banking sector.
- Make grid expansion plans publicly available so that private sector businesses can manage their investment decisions.

Private Sector Investors

We recommend that private sector investors support companies in structuring their business and financial models in ways that allow companies to access different types of capital and partnerships in response to evolving company needs. This includes the option of raising capital from local commercial banks. Raising capital from local banks requires understanding the lending criteria followed by local banks and examining whether private sector investor expectations could actually hinder the investee company in its attempts to borrow from commercial banks. For instance, the private sector investor may be asking the company to invest in marketing for future growth. This might cause the company to incur losses, which would make it difficult to access bank borrowing. In such an instance, equity investors can set aside some of their investment money as a time deposit with the bank, against which their investee company can borrow. In the short term, this does not lead to any net cash flow for the company, but it does provide an opportunity to develop a relationship with a commercial bank.

Foundations and family offices can provide a guarantee to the local bank (on behalf of individual companies) or contribute to the loss guarantee of a fund that might be set up by a DFI. Foundations and family offices should also consider providing technical assistance (through professional capacity development organizations) to help local companies develop the business processes needed to scale their businesses.

Private Sector PAYG Businesses

Companies should develop and adopt accounting standards for income recognition, inventory valuation, accounting treatment for grants, and bad debt recognition. This should be done collaboratively with the World Bank Group's Harmonized Metrics for the Distributed Solar Industry and local accounting bodies (Institute of Certified Public Accountants, Kenya; National Board of Accountants and Auditors, Tanzania). These accounting standards would be of help when working with commercial banks.

None of these recommendations should be considered in isolation. We strongly recommend that the key stakeholders—international financial institutions and donors engaging in the energy access space, private sector investors and those designing clean energy policy and regulatory interventions, national and subnational governments, and rural electrification organizations—effectively coordinate and engage with each other. Coordination and engagement will be essential in designing effective support and interventions for distributed renewable energy and scaling up energy access where it is needed most. In particular, there is a need for a working group with a functioning secretariat to convene the various stakeholders on a regular basis and facilitate an action-driven agenda. For efficiency, this working group could be aligned with an existing structure or institution, such as a donor coordination group or a country-specific SE4ALL hub. The impact of our specific recommendations for each stakeholder group will be greatly amplified by effective coordination.

ANNEX I: METHODOLOGY

TABLE A1 PAY-AS-YOU-GO SOLAR HOME SYSTEM COMPANIES INTERVIEWED

Company	Person interviewed
Azuri Technologies	Simon Bransfield, founder and CEO
BBOX Limited	Mansoor Hamayun, founder and CEO Christopher Baker-Brian, founder and CTO Joanis Holzigel, former managing director, BBOX Capital Kenya Anshul Patel, VP projects, BBOX Kenya
M-KOPA	Jesse More, founder and managing director
Mobisol GmbH	Thomas Duveau, head of business development Klaus Maier, corporate development manager Robert Zeidler, product manager, East Africa Saad Latif, development manager, Mobisol Tanzania
Offgrid Electric	Graham Smith, vice president of business development Justin Heath, vice president sales Ari Zotloff, vice president new country expansion
Sun Transfer	Dr. Gathu Kirubi

Interview Guide: Companies

The purpose of the interview is to understand how the organization is structured, the key sources and types of financing, challenges faced in raising finance, and the product and service offering.

1. Where is your company head quartered? In which countries do you have operations, and how are you structured in the countries in which you operate?
2. What is the scale of your operations? Particularly in Kenya and Tanzania, what is the indicative volume of sales that you are achieving?
3. What have been the key fund raises so far? Who have been the main investors? In which currencies has the money been raised, and how has the money been deployed in the countries of operation?
4. What is the main product and service offering? Do you have only a pay-as-you-go offering? What are the consumer price points in local currency?
5. What is the supply chain? Do the main vendors of key components provide any credit?

DFIS AND DONORS INTERVIEWED

Organization	Person interviewed	Location
AFD	Diane Jegam	Nairobi
African Development Bank	Walter Odera	Nairobi
DfID	Sebastian Meanney	London
	Steven Hunt	London
	Sabita Thapa	Nairobi
	Leanne Jones (Tanzania)	Dar es Salaam
European Commission	Balthasar Klimbie, rural electrification expert	The Hague
IFC	Andrew Abduel Mnzava	Dar es Salaam
FMO	Marc Buiting	Amsterdam
GIZ	Jasmin Fraatz	Nairobi
KfW	Dr. Jens Drillisch	Frankfurt
	Olive Muthoni	Nairobi
	Viviana Klein	Dar es Salaam
Norway	Katrine Vestbostad	Dar es Salaam
	Monica Blaalid	
USAID	Pamela Baldinger	Washington, DC
World Bank	Monali Ranade	Washington, DC
	Richard Hosier	Washington, DC
	John Coleman MacLean (consultant)	Seattle

Interview Guide: DFIs and Donors

1. The purpose of the interview is to understand your current programs in the energy access area in the countries of Kenya and Tanzania, your interest in decentralized renewable energy and the type of analysis that may be helpful in supporting your projects in this area.
2. What are your current projects in the area of energy access in Kenya and Tanzania?
3. Would you view solar home systems and mini-micro grids as viable options for energy access?
4. Which government electrification authority do you engage with?
5. What kind of analysis would help you support energy access through decentralized renewable energy?

TABLE A3

BANGLADESH STAKEHOLDERS INTERVIEWED

Organization	Organization category	Person interviewed
IDCOL	Manager of the energy access program	Nazmul Haque, director investment, head of advisory Farzana Rahman, VP and unit head, renewable energy Sadia Haque, relationship manager
World Bank	DFI supporter of IDCOL	Zubair Sadeque, senior energy specialist
JICA	DFI supporter of IDCOL	Zaki Ziaul Islam, deputy program manager
DfID	Donor supporter of IDCOL	Roqibul Islam, private sector development, DfID
GIZ	Donor supporter of IDCOL	Sajib Seb, technical advisor
KfW	Donor supporter of IDCOL	Tazmilur Rahman, senior sector specialist
Bright Green Energy Foundation	IDCOL Partner Organization	Dipal Baura, founder
Rahima Frooz	IDCOL Partner Organization	Nitai Saha, general manager Syed Ishtiaque, head of sales

Interview Guide: Bangladesh Stakeholders

1. The purpose of the interview is to understand the factors that contributed to the success of the IDCOL program in Bangladesh, its current challenges, and lessons (if any) regarding how DFIs and donors can support energy access programs in East Africa.
2. How much DFI/donor money was needed for the IDCOL Solar Home System and how much of this was grant?
3. What were the yearly performance figures? What are the types of challenges being faced currently?
4. Who were the main Partner Organizations? How were they supported? What prompted their rapid expansion?
5. What were the processes for loan/grant approval and disbursement, security, technical validation, verification and monitoring?
6. What are the unique features of Bangladesh that made the program successful? Can this be replicated in East Africa? If not, are there lessons that can be derived?

TABLE A4

REPRESENTATIVE CHINESE SUPPLIERS INTERVIEWED

Organization	Organization website	Person interviewed
Bennu Solar	www.bennu-solar.com	Yotam Ariel, CEO
Omnivoltaic Power Co.	www.omnivoltaic.com	Xiaojun Kang, managing director

TABLE A5

ATTENDEES AT THE NAIROBI WORKSHOP ON “STIMULATING LOCAL CAPITAL FOR PAY-AS-YOU-GO ENERGY ACCESS COMPANIES,” JULY 2016 (REPRESENTATIVE SAMPLE)

Organization	Name
DFIS AND DONORS	
IFC	Arthur Itotia Njagi
DfID	Sabita Thapa
KfW	Olive Muthoni
EIB	Nicholas Nzioka
European Union	Sanne Willems
USAID	Benson Kimithi
LOCAL COMMERCIAL BANKS	
Citigroup	Karanja Gichiri
CfC Stanbic Bank	Jeff Alondo
Equity Bank	Eric Naivasha
Faulu MFB Bank	Charles Ndungu
KCB Bank	Zacharia K. Cheruiyot
NIC Bank	Daniel Waweru
AMFI	Paul Kihui
PRIVATE SECTOR INVESTORS	
AECF	Ann Kitonga, Jeet Malde
AlphaMundi Group	Tim Radjy, David Mutheee, William Githui
DOB Equity	Mercy Mutua
Energy Access Ventures	Emmanuel Beau
Lendable	Daniel Goldfarb
Lundin Foundation	Charlotte Ward
Oikocredit	Mark Roesink
Responsibility	Alexander Bashian
OTHER STAKEHOLDERS	
GVEP	Leah Kaguara, Juliette Page, Linda Onyango
GSMA	Ilana Cohen
MX Solutions	Luz Leyva
Open Capital Advisors	Andreas Zeller
Power for All	Kate Montgomery

TABLE A6

ATTENDEES AT THE DAR ES SALAAM WORKSHOP ON “STIMULATING LOCAL CAPITAL FOR PAY-AS-YOU-GO ENERGY ACCESS COMPANIES,” FEBRUARY 2016 (REPRESENTATIVE SAMPLE)

Organization	Name
DFIS AND DONORS	
AFD	Dennis Munuve
IFC	Andrew Abduel Mnzava
Development Partners	Earneus Kaijage
DfID	Daniel Emmanuel
KfW	Viviana Klein
Norway	Monica Blaaid
European Union	Mikael Melin
Sweden	Jorgen Eriksson
World Bank	Richard Hosier, Zubair Sadeque, John Coleman MacLean (consultant)
LOCAL COMMERCIAL BANKS	
Bank of Africa, Tanzania	Wasia Mushi, Deo Chalamila
CBA	Godfrey Munisi
CRDB	Focus Mrosso
Equity Bank	Joseph Ila, David Mukaru
I&M Bank	T. Srikanth
Michael Mungure	NMB Bank
Stanbic Bank	Angela Mandi
GOVERNMENT	
Rural Electrification Agency	Boniface Gissima Nyamo-Hanga
PRIVATE SECTOR INVESTORS	
Sun Funder	Lais Lona
OTHER STAKEHOLDERS	
Open Capital Advisors	David Loew
IMED	Donath Olomi
GVEP	Shashank Verma
SNV	Martijn Veen
Practical Action	Noah Mayieka
TAREA	Eng. Mathew Matimbwi
TAREBI	Fredrick Tunutu

ANNEX II: MULTI-TIER FRAMEWORK FOR ENERGY ACCESS

Multi-tier Framework

The Energy Sector Management Assistance Program (ESMAP) is a trust fund with a global mandate to provide knowledge and technical assistance to low- and middle-income countries for environmentally sustainable energy solutions. ESMAP is funded by 13 bilateral donors and administered by the World Bank.

Under the Sustainable Energy for All (SE4ALL) initiative, the World Bank and the International Energy Agency developed a Global Tracking Framework to chart a course to achieve universal energy access, double the use of renewable energy, and improve energy efficiency. Building on SE4ALL's Global Tracking Framework, and in consultation with development partners, ESMAP developed the Multi-tier Framework (MTF) to evaluate and monitor progress toward energy access goals. The MTF introduces an energy access definition that incorporates the

quality and extent of energy services across several attributes. The MTF measures energy access in "tiers" from 0 (no access) to 5 (high access).

ESMAP offers a more comprehensive definition of energy access that is "meaningful for households, productive enterprises and community facilities...and [has] a number of attributes: it must be adequate in quantity, available when needed, of good quality, reliable, convenient, affordable, legal, healthy, and safe" (Angelou and Bhatia 2015).

MULTI TIER MATRIX FOR ACCESS TO HOUSEHOLD ELECTRICITY SUPPLY, SERVICES AND CONSUMPTION

		TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
ATTRIBUTES	1. Capacity	Power*	Very Low Power Min 3 W	Low Power Min 50 W	Medium Power Min 200 W	High Power Min 800 W	Very High Power Min 2 kWh
		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 1,000 1mhrs per day and phone charging	Electrical lighting, air circulation, television, and phone charging are possible			
	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 hrs	Min 2 hrs	Min 3 hrs	Min 4 hrs	Min 4 hrs
	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 than 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 high risk in the future.		

* The minimum power capacity ratings in watts are indicative, primarily by Tier 1 and 2, as the efficiency of end-user appliances is critical to determining the real level of capacity, and thus the type of electricity services that can be performed.

	TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Tier criteria	Not applicable	Task lighting Phone charging	General lighting Television Fan (if needed)	Tier 2 AND Any medium-power appliances	Tier 3 AND Any high-power appliances	Tier 4 AND Any very high-power appliances

	TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Annual consumption levels, in kilowatt-hours (kWh)	<4.5	≥4.5	≥73	≥365	≥1,250	≥3,000
Daily consumption levels, in watt-hours (Wh)	<12	≥12	≥200	≥1,000	≥3,425	≥8,219

Source: Angelou and Bhatia 2015.

ANNEX III: PRIVATE SECTOR INVESTOR PROFILES

TABLE A8

BRIEF PROFILES OF PRIVATE SECTOR INVESTORS WHO HAVE INVESTED EITHER EQUITY OR GRANTS IN PAYG COMPANIES IN EAST AFRICA

Investor	Website	Office location	Profile	PAYG investees (East Africa)
FOUNDATIONS/FAMILY OFFICES				
1 Alstom Foundation	www.alstom.com/foundation	Global	Supports NGO projects proposed by employees that improve living conditions around Alstom sites	EGG Energy
2 Calvert Foundation	www.calvertfoundation.org	Bethesda, MA, United States	Affordable housing, education, small business, microfinance	Off-Grid Electric
3 Ceniarth	www.ceniarthllc.com	London, New York, San Francisco	Energy access, agriculture, innovation	BBOX, Off-Grid Electric
4 DOEN Foundation	www.doen.nl/web/home-1.htm	Amsterdam	Green and socially inclusive businesses	BBOX, Foundation Rural Energy Services, M-KOPA
5 Godley Family Foundation	www.godleyfamilyfoundation.org	Ponte Vedra Beach, FL, United States	Health, environment, and underserved communities	Angaza Designs
6 Gates Foundation	www.gatesfoundation.org	Seattle	Health, development, policy, and advocacy	M-KOPA
7 Generation Investment Management	www.generationim.com	London, New York	Sustainability	M-KOPA
8 Hivos Foundation	www.hivos.org	The Hague	Sustainable food, renewable energy, transparency, and accountability	Foundation Rural Energy Services
9 Jasmine Social Investments	www.jasmine.org.nz	New Zealand	Social entrepreneurs	Off-Grid Electric
10 Lundin Foundation	www.lundinfoundation.org	Vancouver, Canada	SMEs	M-KOPA
11 Marshall Foundation	www.marshallfoundation.com	Tucson, AZ, United States	Education, healthcare, youth-oriented services	Off-Grid Electric
12 Mulago Foundation	www.mulagofoundation.org	San Francisco	Livelihoods, energy, health, conservation, education	Off-Grid Electric
13 Packard Foundation	www.packard.org	Los Altos, CA, United States	Conservation, science, population, health	Off-Grid Electric
14 Pi Investments	www.pi-investments.com	San Francisco Bay Area	Sustainable and just economy	Powerhive
15 Segal Family Foundation	www.segalfamilyfoundation.org	Watchung, NJ, United States	Health and youth	Off-Grid Electric
16 Shell Foundation	www.shellfoundation.org	Global	Energy access, livelihoods, sustainable transport, agriculture	M-KOPA
17 The World We Want Foundation	www.theworldwewantfoundation.org	Stockholm	Energy, conservation, agriculture, education	Off-Grid Electric

BRIEF PROFILES OF PRIVATE SECTOR INVESTORS WHO HAVE INVESTED EITHER EQUITY OR GRANTS IN PAYG COMPANIES IN EAST AFRICA (CONTINUED)

Investor	Website	Office location	Profile	PAYG investees (East Africa)
IMPACT FUNDS				
1 Acumen Fund	www.acumen.org	Global	Energy, agriculture, healthcare, housing, water, and education	M-KOPA, SolarNow, Devergy
2 Better Ventures	www.better.vc	Oakland, CA, United States	Mobile, health, sustainability	SunFunder
3 Boma Investments	www.bomainvests.com	Santa Barbara, CA, United States	Social and environmental	Lumeter
4 Bamboo Finance	www.bamboofinance.com	Global	Housing, healthcare, education, energy, livelihoods, water, and sanitation	BBOX, Greenlight Planet
5 Blue Haven Initiative	www.bluehaveninitiative.com	Geneva	Affordable and green housing, education, energy and environment, financial inclusion, health	M-KOPA
6 Dob Equity	www.dobequity.nl	LA Veessen, The Netherlands; Nairobi	Socially and financially sustainable African companies	M-KOPA
7 Energy Access Ventures	www.eavafrica.com	Paris, Nairobi	Energy access	Off-Grid Electric
8 Global Partnerships	www.globalpartnerships.org	Global	Health, green technology, rural livelihoods, microentrepreneurship	Greenlight Planet
9 Grey Ghost Ventures	www.greyghostventures.com	Global	Information and communications technology (ICT), clean technology, and other adapted technology for underserved communities	M-KOPA
10 Khosla Impact	www.khoslaimpact.com	Global	Products and services for base of the economic pyramid (BoP)	BBOX, SunFunder
11 Invested Development	www.investeddevelopment.com	Boston, Nairobi	Mobile, ICT, alternative energy, and agriculture	EGG Energy
12 LGT Venture Partners	www.lgtvp.com	Global	Health, education, energy, agriculture, ICT, livelihood, and housing	M-KOPA
13 Novastar Ventures	www.novastarventures.com	Nairobi	East Africa-based businesses	SolarNow
14 Omidyar Networks	www.omidyar.com	Global	ICT, education, financial inclusion, policy and advocacy, and property rights	Off-Grid Electric
15 Oikocredit	www.oikocredit.coop	CC Amersfoort, The Netherlands	Microfinance, fairtrade, agriculture and renewable energy	BBOX
16 OPES Impact Fund	www.opesfund.eu	Milan	Energy and water access, education, waste management, agriculture, health	Devergy

BRIEF PROFILES OF PRIVATE SECTOR INVESTORS WHO HAVE INVESTED EITHER EQUITY OR GRANTS IN PAYG COMPANIES IN EAST AFRICA (CONTINUED)

Investor	Website	Office location	Profile	PAYG investees (East Africa)
IMPACT FUNDS (CONTINUED)				
17 Radicle Capital	www.radiclecapital.com	Louisville, KY, United States	Agriculture, eco-friendly product suppliers, social and environmental entrepreneurial start-ups	Sunfunder
18 Serious Change LP	www.angel.co/serious-change	New York	Sustainability, biodiversity, and social justice	Off-Grid Electric
19 Synergy Growth	www.synergy-energy.co	London	Energy	BBOX
20 TreeHouse Investments	www.treehouseinvestments.com	Dorado, Puerto Rico	Climate change and poverty	M-KOPA, Sunfunder
21 The Social Entrepreneurs Fund	www.tsef.com	New York		Angaza Designs
VENTURE CAPITAL/PRIVATE EQUITY				
1 Vulcan Capital	www.capital.vulcan.com	Seattle	Financial services, Internet and technology, life sciences and media, communication	Off-Grid Electric
2 Fidelity Growth Partners	www.eightroads.com	Global	Software/SaaS, mobile, consumer, Internet, fintech	Greenlight Planet
3 Prelude Ventures LLC	www.preludeventures.com	San Francisco	Climate innovation	Powerhive
4 Tao Capital Partners	www.taocap.com	San Francisco	Alternative transportation and energy, among other sectors	Powerhive
CORPORATE VC				
1 Caterpillar Venture Capital	www.caterpillar.com/en/company/innovation/caterpillar-ventures.html	Menlo Park, CA, United States	Distributed power, analytics, robotics, additive manufacturing, business models	Powerhive
2 Total Energy Ventures	www.total.in/en/total-energy-ventures-innovating-start-ups	Paris	Energy	Powerhive
Large Company				
1 Barclays Social Innovation Facility	www.resources.barclays.com/citizenshipreport/articles/social-innovation-facility.html	Global	Healthcare (Africa), education (United States), financial inclusion	Azuri Technologies
2 E.ON	www.eon.com/en.html	Essen, Germany	Energy	Rafiki Power
3 ENEL Green Power	www.enelgreenpower.com/ena/en-gb	Rome	Renewable energy	Powerhive
4 Engie (previous name GDF)	www.engie.com/en	Courbevoie, France	Energy	BBOX, Fenix International, EGG Energy
5 First Solar	www.firstsolar.com	Tempe, AZ, United States	Solar photovoltaic (PV) solutions	Powerhive
6 MTN	www.mtn.com	Johannesburg	Mobile Network Operator	Fenix International

BRIEF PROFILES OF PRIVATE SECTOR INVESTORS WHO HAVE INVESTED EITHER EQUITY OR GRANTS IN PAYG COMPANIES IN EAST AFRICA (CONTINUED)

Investor	Website	Office location	Profile	PAYG investees (East Africa)
CORPORATE VC (CONTINUED)				
7 SolarCity Corporation	www.solarcity.com	San Mateo, CA, United States	Solar PV solutions	Off-Grid Electric
8 Schneider Electric	www.schneider-electric.co.in/en	Rueil-Malmaison, France	Electrical equipment	Fenix International, SunFunder, Energy Access Ventures
INDIVIDUAL ANGELS				
1 Don Weil	www.angel.co/donweil	San Francisco	Angel investor	Angaza Designs
2 Frank McCrea	www.linkedin.com/in/frankmccrea	Toronto	Founder and CEO of Procom	Off-Grid Electric
3 Jean and Steve Case	www.casefoundation.org	Washington, DC	Founder and former CEO of AOL	M-KOPA
4 Julie Chin	www.angel.co/julie-chin	San Francisco, Bay Area	Ex Google	Angaza Designs
5 Jim and Karen Linder	www.linseedcapital.com	Omaha	Faculty at the University of Nebraska	Angaza Designs
6 Ryan Allis	www.linkedin.com/in/ryanallis	San Francisco	Cofounder and former CEO of iContact	Off-Grid Electric
7 Richard Branson	https://en.wikipedia.org/wiki/Richard_Branson	British Virgin Islands	Founder Virgin Group	M-KOPA
8 Tom Dinwoodie	https://en.wikipedia.org/wiki/Tom_Dinwoodie	San Francisco	Cofounder and former CEO of iContact, PowerLight Corporation	Fenix International
9 Warner Philips	www.angel.co/warner-philips	San Francisco	Cleantech	Fenix International

ANNEX IV: EXCHANGE RATE INFORMATION

TABLE A9

MOVEMENT OF THE KENYAN SHILLING AND THE TANZANIAN SHILLING AGAINST THE U.S. DOLLAR, 2004–2016

Date	U.S. dollar (US\$)	Euro (€)	Kenya shilling (KES)	KE % Δ against US\$	Tanzania shilling (TZS)	TZS % Δ against US\$	Bangladeshi taka (BDT)	BDT % Δ against US\$
30 January 2016	1	0.923	101.7	-8.8%	2,158	-10.2%	77.42	-1.6%
30 April 2015	1	0.907	92.71	-7.8%	1,937	-17.0%	76.17	0.3%
30 April 2014	1	0.722	85.44	-3.7%	1,607	-1.2%	76.42	0.2%
30 April 2013	1	0.765	82.29	-0.4%	1,588	-1.7%	76.55	5.0%
30 April 2012	1	0.754	81.92	0.3%	1,562	-4.8%	80.35	-10.8%
30 April 2011	1	0.674	82.18	-9.6%	1,488	-8.7%	71.67	-5.2%
30 April 2010	1	0.755	74.27	1.4%	1,359	-3.2%	67.92	-0.8%
30 April 2009	1	0.757	75.34	-20.8%	1,316	-10.6%	67.37	0.2%
30 April 2008	1	0.641	59.69	9.3%	1,176	5.1%	67.51	-0.6%
30 April 2007	1	0.732	65.23	8.5%	1,236	-4.6%	67.08	-1.2%
30 April 2006	1	0.791	70.79	7.8%	1,180	-10.8%	66.28	-4.3%
30 April 2005	1	0.777	76.30	2.1%	1,052	3.7%	63.40	-9.6%
30 April 2004	1	0.835	77.88	–	1,091	–	57.32	–

Data sourced from: <http://www.oanda.com/currency/converter/>.

ANNEX V: DETAILS OF THE IDCOL MODEL

The IDCOL program was structured around an innovative lending model with multiple layers. The World Bank lent to the Government of Bangladesh at 1–2 percent interest for 40 years; the Government of Bangladesh then lent to IDCOL at 3–6 percent interest for 15 years. IDCOL on-lent to POs at 6–9 percent interest for 5–10 years. The tenure and finally POs lent to households at 12 percent interest for three years or less. This spread generated income for each entity and created an incentive for interest alignment from households to the government (Bardouille, Aidun, and Muench 2014).

As of 2014, IDCOL had disbursed US\$481 million (BDT 3,619.6 crore)

as credit and channeled US\$75 million (BDT 527.1 crore) as grants to POs (IDCOL 2014c).

The IDCOL model can be diagrammatically represented as shown in Figure A1.

Credit Provided to Partner Organizations

IDCOL provided refinancing of the loans provided by Partner Organizations to the end users. As shown in Table A10 below, the loan interest rates have tended to increase, the repayment periods have tended to shorten, and the refinanced amount tended to decline in recent years (Rai et al. 2015).

This rising interest rate and shortening tenure have been part of the effort to make the program more market-oriented.

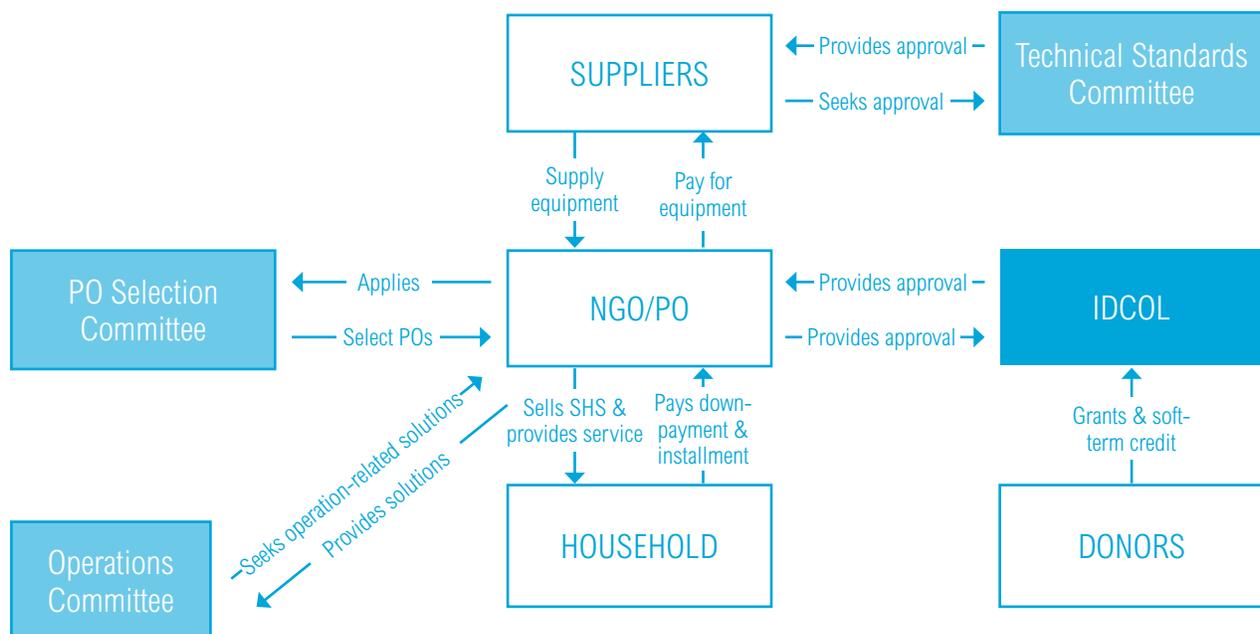
Two Types of Grants Provided to the Partner Organizations

IDCOL has provided a capital buy-down grant to consumers and an institutional development grant to the Partner Organizations (structured as a specific amount per system sold). The grants have reduced significantly over time (Haque 2014) as shown in the Table A11 below.

The capital buy-down grant has reduced over the period mainly because system costs have come down. The US\$20 capital buy-down grant available today is for systems under 30 Wp (these smaller systems are expected to be purchased by poorer customers). The phase-out of grants and subsidies over time is taken as evidence that the program represents a self-sustaining, commercial solution to the energy access

FIGURE A1

DETAILS OF THE IDCOL MODEL



Source: IDCOL 2014d

challenge (Bardouille, Aidun, and Muench 2014). Indeed, there are suppliers today outside the IDCOL system who do not provide financing to customers.

Technical Standards and Vendor Certification

The IDCOL Technical Standards Committee, an independent committee of experts, provides guidelines on the standards for products eligible for inclusion in the SHS program. The Technical Specifications Guidelines provide detailed specifications on the product and associated components, a minimum set of requirements for the installation services and operating environment, and a long list of equipment suppliers and local agents that meet the set standards (IDCOL 2014b).

Installation Areas

IDCOL refinanced SHS installations only if they were refinanced in “off-grid” areas. IDCOL also insisted that POs extend a buy-back guarantee to give households the option to sell their SHS back to IDCOL for a

depreciated price, in the event that households become grid-connected within a specified time period after purchase (Sadeque et al. 2014).

Environmental Standards

IDCOL developed the “Policy Guidelines on Disposal of Warranty Expired Batteries” in June 2005. Based on the guidelines, IDCOL facilitated an agreement between battery manufacturers and POs. According to the agreement, POs are responsible for notifying customers three months before the warranty expiration date and advising customers to replace the battery. PO representatives are responsible for collecting batteries from customers and safely transporting them to regional locations of the battery manufacturer. The manufacturer is responsible for collecting batteries from regional centers and transporting them to a site where the batteries will be recycled or disposed of in an environmentally friendly manner. The buy-back agreement is signed between the PO and the household. According to this clause, the household shall

not sell an expired battery to any second party and the battery shall be returned to any of IDCOL’s POs or the supplier of the battery.

Monitoring and Verification

Initially, IDCOL verified every installation, but from 2005 onward it has been verifying on a sample basis. IDCOL has 12 quality control offices, 130 quality inspectors, and 11 field auditors. It also manages a call center for customer complaints (Sadeque et al. 2014).

Program Management

IDCOL’s selection committee screens potential POs according to program eligibility criteria. The company’s PO selection guidelines specify that POs should be able to demonstrate institutional capacity: audit and accounting management, adequate staffing, a certain number of years of operation, and experience providing credit in off-grid areas (Rai et al. 2015). IDCOL’s Operations Committee consists of both PO and IDCOL representatives, who manage and oversee implementation of the program.

TABLE A10

DETAILS OF LOANS PROVIDED BY POS TO END USERS UNDER THE IDCOL MODEL

Period	2003–8	2009	2010	2011	2012–15
Loan tenors (years)	10	6–10	6–8	6–8	5–7
Interest rate (per annum)	6–8%	6–8%	6–8%	6–8%	6–9%
Refinanced amount	80%	80%	80%	80%	70–80%

TABLE A11

GRANTS PROVIDED BY IDCOL TO THE POS (US\$)

Period	2003	2004–5	2006–7	2008–9	2010–11	2012	2013–14
Capital buy-down grant	70	55	40	40	25	25	20
Institutional development grant	20	15	10	5	3		

ANNEX VI: SOLAR HOME SYSTEM PRICES

TABLE A12

COMPARISON OF PRICES OF SOLAR HOME SYSTEMS IN BANGLADESH AND EAST AFRICA

Category: Small system 1

Bangladesh				East Africa (Kenya)			
Product	Cash price	Lease-to-own terms	Total payments over lease period	Product	Cash price	Lease-to-own terms	Total payments over lease period
	BDT	BDT	BDT (US\$)		KES	KES	KES (US\$)
10 W, 2x3W LED	7,200	Per month: 511 for 12 months Upfront: 1,875	8,007 (US\$99)	8W, 4x1W LED + radio	18,600	Per day: 50 for 365 days Upfront: 3,500	21,750 (US\$208)

Category: Small system 2

Bangladesh				East Africa (Kenya)			
Product	Cash price	Lease-to-own terms	Total payments over lease period	Product	Cash price	Lease-to-own terms	Total payments over lease period
	BDT	BDT	BDT/US\$		KES	KES	KES
20 W, 3x3W LED	10,250	Per month: 440 for 24 months Upfront: 2,200	12,760 (US\$158)	15W, 4x1W LED + radio	73,550	Per month: 950 for 36 months Upfront: 950	35,150 (US\$336)

Category: Mid-level system

Bangladesh				East Africa (Kenya)			
Product	Cash price	Lease-to-own terms	Total payments over lease period	Product	Cash price	Lease-to-own terms	Total payments over lease period
	BDT	BDT	BDT/USD		KES	KES	KES
50W, 4x3W LED, 15" TV	19,500	Per month: 940 for 24 months Upfront: 4,700	27,260 (US\$338)	50W, 4x1W LED + radio + 18" TV)		Per month: 2,150 for 36 months Upfront: 2,150	79,550 (US\$761)

Category: High-capacity system

Bangladesh				East Africa (Tanzania)			
Product	Cash price	Lease-to-own terms	Total payments over lease period	Product	Cash price	Lease-to-own terms	Total payments over lease period
	BDT	BDT	BDT/USD		TZS	TZS	TZS
80W, 7x3W LED, 15"TV + 1 DC fan		Per month: 1,340 for 24 months Upfront: 6,700	54,940 (US\$681)	80W, 3x2W LED + torch + radio + 19" TV	1,421,700	Per month: 49,100 for 36 months Upfront: 128,000	1,895,600 (US\$1,043)

Notes: Cash price is the price the customer would pay if she or he were to pay it upfront. Not all companies in Kenya and Tanzania offer this option.
Source: OANDA

Currency conversion rates (as of Jan 31, 2016):
1 BDT = 0.01239 US\$ | 1 KES = 0.00957 US\$ | 1 TZS = 0.00055 US\$

ANNEX VII: LINES OF CREDIT

TABLE A13

KENYAN BANK PARTNERSHIPS WITH INTERNATIONAL DFIS IN THE AREAS OF MSMEs OR GREEN FINANCING

Bank	DFI partners
Equity Bank	EIB, FMO, KfW, IFC, China Development Bank, AfDB, Norfund (shareholder through Norfininvest AS) ^a
CFC Stanbic	AFD
Co-operative Bank of Kenya	AFD, DEG, EIB, IFC, FMO
Kenya Commercial Bank Group	IFC
I&M Bank	FMO, Proparco (shareholder), DEG (shareholder), IFC ^b
Chase Bank	AFD, EIB, FMO, OeEB (Austrian), Proparco IFC, DEG (shareholder)
Commercial Bank of Africa	AFD
Bank of Africa Kenya	FMO (shareholder), Proparco (shareholder in Bank of Africa Group), IFC, BIO Belgium (shareholder in Bank of Africa Group)
Diamond Trust Bank	DEG, Proparco, IFC (shareholder in Diamond Trust Bank Group)
Family Bank	EIB
NIC Bank Kenya	IFC, Proparco
ABC Bank	EIB
Consolidated Bank of Kenya	EIB
K Rep Bank	EIB
Prime Bank	EIB, Proparco

Notes: Only active lines of credit are mentioned.

^a <http://equitybankgroup.com/blog/2015/04/norfund-and-norfinance-complete-purchase-of-12.223-stake-in-equity-group-holdings-limited>

^b I&M Bank Kenya and Tanzania are wholly owned subsidiaries of I&M Holdings Ltd., of which Proparco and DEG are shareholders.

TABLE A14

TANZANIAN BANK PARTNERSHIPS WITH INTERNATIONAL DFIS

Bank	DFI partner
CRDB	EIB, DANIDA (shareholder), IFC, DEG
Exim Bank	Proparco, FMO, DEG, Norfund
National Microfinance Bank	EIB, FMO
Access Bank	IFC (shareholder), KfW (shareholder), AfDB (shareholder)
Akiba Commercial Bank	FMO (shareholder)
Banc ABC	DEG, Proparco, IFC, OPIC
Bank of Africa Tanzania	Proparco (shareholder in Bank of Africa Group), IFC, BIO Belgium (shareholder in Bank of Africa Group), AFD
I&M Bank	FMO, DEG (shareholder), Proparco (shareholder)
NIC Bank Tanzania	Proparco
TIB Development Bank (former Tanzania Development Bank)	IDA World Bank

TABLE A15

EAST AFRICAN APEX BANK PARTNERSHIPS WITH INTERNATIONAL DFIS

Bank	DFI partner
PTA Bank	EIB, FMO, KfW, JBIC, OPEC, OPIC, AfDB, China Development Bank
East African Development Bank	Nordic Development Fund (NDF), EIB, DEG (shareholders) OFID, AfDB

REFERENCES

- AfDB (African Development Bank Group). n.d. *Trade Finance Program*. Retrieved on September 6, 2016, from: <http://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/trade-finance-program/>.
- Alstone, P., D. Gershenson, D. N. Turman-Bryant, D. Kammen, and A. Jacobson. 2015. *Off-Grid Power and Connectivity Pay-as-You-Go Financing Digital Supply Chains for Pico Solar*. Lighting Global Market Research Report.
- Angelou, N., and M. Bhatia. 2015. "Beyond Connections: Energy Access Redefined." Washington, DC: ESMAP (Energy Sector Management Assistance Program). Available at: http://www.worldbank.org/content/dam/Worldbank/Topics/Energy%20and%20Extract/Beyond_Connections_Energy_Access_Redefined_Exec_ESMAP_2015.pdf.
- A.T. Kearney, and GOGLA (Global Off-Grid Lighting Association). 2014. *Investment and Finance Study for Off-Grid Lighting*. Retrieved from GOGLA website: <http://global-off-grid-lighting-association.org/wp-content/uploads/2013/09/A-T-Kearney-GOGLA.pdf>.
- Bardouille, P., C. Aidun, and D. Muench. 2014. "Annex I: The Nexus between the Successful SHS Program in Bangladesh and the Emerging DESCO Sector in Sub-Saharan Africa and India." New York: Persistent Energy Partners.
- Ballesteros, A., E. Norford, S. E. Alzner, T. Nagle, and L. Yonavjak. 2013. "Implementation Strategies for Renewable Energy Services in Low-Income, Rural Areas." Washington, DC: World Resources Institute. Available online at: http://www.wri.org/sites/default/files/pdf/implementation_strategies_renewable_energy_services_low_income_rural_areas.pdf.
- Bill and Melinda Gates Foundation. 2016. "How We Work: M-KOPA Kenya Ltd." Retrieved on September 30, 2016, from: <http://www.gatesfoundation.org/How-We-Work/Quick-Links/Program-Related-Investments/M-KOPA-Kenya-Ltd>.
- DfID (Department for International Development). 2016. "Energy Africa Summary Document." June. Retrieved in July 2016 from Nairobi Workshop.
- Doukas, A., and A. Ballesteros. 2015. "Clean Energy Access in Developing Countries: Perspectives on Policy and Regulation." Washington, DC: World Resources Institute. Available online at: <http://www.wri.org/sites/default/files/clean-energy-access-developing-countries-issue-brief.pdf>.
- GreenMax Capital Advisors. 2013. *Tanzania Market Intelligence Final Report*. New York.
- Haque, Nazmul. 2014. "Results-Based Financing: Models, Experience and Lessons Learned." IDCOL Solar Home System Program—Bangladesh. Dhaka: IDCOL. Retrieved from Africa Carbon Forum: http://africacarbonforum.com/2014/docs/Presentations/Day%201/W2/W2_Nazmul%20Haque_Bangladesh.pdf.
- Hirstenstein, Ann. 2012. "African Sunshine Can Now Be Bought and Sold on the Bond Market." *Bloomberg News*. Retrieved on January 27, 2016, from: http://www.bloomberg.com/news/articles/2016-01-12/african-sunshine-can-now-be-bought-and-sold-on-the-bondmarket?utm_content=buffer5d8bc&utm_medium=social&utm_source=facebook.com&utm_campaign=buffer.
- Hogarth, R., and I. Granoff. 2015. "Speaking Truth to Power: The Relationship between Energy and Poverty and What It Means for Scaling Ambition." London: Overseas Development Institute and Oxfam America. Retrieved from OA website: http://policy-practice.oxfamamerica.org/static/media/files/FINAL_speakingpowertotruth_SH.pdf.
- IDCOL (Infrastructure Development Company Limited). 2014a. IDCOL website. Retrieved on June 11, 2015, from: <http://idcol.org/>.
- IDCOL. 2014b. "Technical Specifications for Solar Home Systems (SHS)." Dhaka: IDCOL Solar Program, Technical Standards Committee.
- IDCOL. 2014c. *IDCOL Annual Report 2013–14: Toward a Greener Future*. PowerPoint Presentation by IDCOL. April 25, 2014, Pattaya, Thailand.
- IDCOL. 2014d. IDCOL website downloads. Retrieved on March 16, 2016, from: <http://idcol.org/home/downloads>.
- IEA (International Energy Agency). 2011. *World Energy Outlook 2011: Energy for All*. Paris: International Energy Agency.
- IEA. 2013. *World Energy Outlook 2013*. Paris: International Energy Agency.
- IEA. 2014a. *World Energy Outlook 2014*, Electricity Database. Retrieved from: <http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/>.
- IEA. 2014b. *Africa Energy Outlook*. A Focus on Energy Prospects in Sub-Saharan Africa. A World Energy Outlook Special Report. Paris: International Energy Agency. Retrieved from: https://www.iea.org/publications/freepublications/publication/WEO2014_AfricaEnergyOutlook.pdf.
- IFC (International Finance Corporation). 2012. *From Gap to Opportunity: Business Models for Scaling Up Energy Access*. Retrieved from: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/learning+and+adapting/knowledge+products/publications/publications_report_gap-opportunity.
- Kaufman, R., R. Duke, R. Hansen, J. Rogers, R. Scharf, and M. Trexler. 2000. *Rural Electrification with Solar Energy as a Climate Protection Strategy*. Renewable Energy Policy Project.

- Khan, S., and A. Azad. 2014. "Social Impact of Solar Home Systems in Rural Bangladesh: A Case Study of Rural Zone." *IAFOR Journal of Sustainability, Energy and the Environment*: 1–17. Aichi, Japan: International Academic Forum.
- Kleijn, M., J. Sebastian, and M. Veen. 2016. "Pico-Solar for All." The Hague: SNV (Netherlands Development Organization). http://www.snv.org/public/cms/sites/default/files/explore/download/case_study_-_pico-solar_for_all.pdf.
- The Lab (Global Innovation Lab for Climate Finance). 2016. "Germany to Provide €30 Million to TCX for Currency Hedging Instruments." Retrieved on September 6, 2016, from: <http://climatefinancelab.org/press-release/germany-to-provide-e30mn-to-the-long-term-fx-risk-management-instrument-for-sub-saharan-africa-climate-investments/>.
- Lighting Africa. 2015. "Lighting Africa: About Us, What We Do." Washington, DC: Lighting Africa, an Initiative of the World Bank. Retrieved on July 14, 2015, from: <https://www.lightingafrica.org>.
- MFx Solutions. 2013. "Our Products." Retrieved on August 1, 2016, from: <http://mfxsolutions.com/our-products/>.
- Mills, E. 2005. "The Specter of Fuel-Based Lighting." *Science* 308(5726): 1263–64.
- Mills, E. 2014. "Light for Life: Identifying and Reducing the Health and Safety Impacts of Fuel-Based Lighting." Nairobi: United Nations Environment Programme.
- Muench, D. and S. Issler. 2015. "Currency Risk and Mitigation Strategies for the Off-Grid Energy Sector." Persistent Energy Capital and responsAbility. http://media.wix.com/ugd/4c83e3_242d019d9d904df3b6e7caf69447acf0.pdf
- Nique, M. 2013. "Sizing the Opportunity of Mobile to Support Energy and Water Access." GSMA and U.K. Aid. http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/12/Sizing-the-Opportunity-of-Mobile_Nov-2013.pdf
- OPIC (Overseas Private Investment Corporation). 2015. "OPIC, Calvert Foundation Finalize Support to PAMIGA Finance, Spreading Renewable Resources Access in Rural Africa." Washington, DC: OPIC.
- Rai, Neha, et al. 2015. "Financing Inclusive Low-Carbon Resilient Development: Role of Central Bank of Bangladesh and Infrastructure Development Company Limited." London International Institute for Environment and Development.
- Rao, Narasimha, Anjana Agarwal, and Davida Wood. 2016. "Impacts of Small-Scale Electricity Systems: A Study of Rural Communities in India and Nepal." Washington, D.C.: World Resources Institute.
- Rolfs, P., R. Byrne, and D. Ockwell. 2014. "Financing Sustainable Energy for All: Pay-as-You-Go vs. Traditional Solar Finance Approaches in Kenya." STEPS Working Paper 59. Brighton, UK: University of Sussex, STEPS Centre (Social, Technological, and Environmental Pathways to Sustainability).
- Sadeque, Z., D. Rysankova, R. Elahi, and R. Soni. 2014. "Scaling Up Access to Electricity: The Case of Bangladesh." Washington, DC: World Bank. Live Wire. 88702.
- Samad, H. A., S. R. Khandker, M. Asaduzzaman, and M. Yunus. 2013. "The Benefits of Solar Home Systems: An Analysis from Bangladesh." *World Bank Policy Research Working Paper* (6724). Washington, DC: World Bank.
- SIDA. 2012. "Sida's Guarantee Instrument." July 2012, updated June 2016. Retrieved on September 15, 2016, from: <http://www.sida.se/English/partners/our-partners/Private-sector/Innovative-Finance-/>.
- Siegel, J. R., and A. Rahman. 2011. "The Diffusion of Off-Grid Solar Photovoltaic Technology in Rural Bangladesh." Energy, Climate, and Innovation Discussion Paper. Medford, MA: Tufts University, Fletcher School of Law and Diplomacy.
- Tracy, J., and A. Jacobson. 2012. "The True Cost of Kerosene in Rural Africa." Washington, DC: Lighting Africa, an Initiative of the World Bank. USAID (U.S. Agency for International Development). n.d. Development Credit Authority. Retrieved on September 6, 2016, from: <https://www.usaid.gov/what-we-do/economic-growth-and-trade/development-credit-authority-putting-local-wealth-work>.
- USAID (United States Agency for International Development). 2015. "Development Credit Authority: Impact Brief 2015." https://www.usaid.gov/sites/default/files/documents/1865/dca_impactbrief15_v15_link_spreads_160824b.pdf
- Wang, L., S. Bandyopadhyay, M. Cosgrove-Davies, and H. Samad. 2011. "Quantifying Carbon and Distributional Benefits of Solar Home System Programs in Bangladesh." World Bank Policy Research Working Paper Series.

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Our Challenge

Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our Vision

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach

COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT

We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.

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