ENERGIZING FINANCE
REPORT SERIES

TAKING THE PULSE

UNDERSTANDING ENERGY ACCESS MARKET NEEDS IN FIVE HIGH-IMPACT COUNTRIES

SUSTAINABLE ENERGY FOR ALL

E3 ANALYTICS

PRACTICAL ACTION Consulting

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FOREWORD

This new report, Taking the Pulse: Understanding Energy Access Market Needs in Five High-Impact Countries, provides a pathway to elevate financing support for enterprises delivering decentralized renewable energy and clean cooking fuels and technologies to vulnerable populations in Asia and Africa.

The report findings are specifically geared for government leaders, donors, development finance players and energy access enterprises that all play critical roles in accelerating access to electricity and clean cooking—two cornerstone priorities of the globally agreed Sustainable Development Goals.

Our findings are especially relevant for countries in Asia and Sub-Saharan Africa, which have significant energy access gaps and promising opportunities to close those gaps more quickly and at less cost by boosting financing support to decentralized energy access providers. We offer specific recommendations on what's needed.

While many studies have estimated amounts of investment needed to meet energy access goals, none have attempted to systematically capture what developing countries are committing to on energy access and, most importantly, how much is going to decentralized energy access solutions.

This report is part of a unique and broader research effort by Sustainable Energy for All, the World Bank, the African Development Bank, Climate Policy Initiative, E3 Analytics and Practical Action Consulting, that for the first time begins to answer these critical questions.

This report, by Practical Action Consulting and E3 Analytics, presents much-needed evidence on how enterprises delivering access to electricity and clean cooking are being financed in five countries – Bangladesh, Ethiopia, Kenya, Myanmar and Nigeria. These countries represent five highly different energy access markets from the 20 high-impact countries whose effort to increase access to electricity and clean cooking can make the biggest difference on a global scale. Each offers unique lessons for increasing finance flows to Tiers 1-3 access solutions, as set out in the World Bank's Multi-Tier Framework—specifically, improved cookstoves, cleaner fuels, solar lanterns, solar home systems and lower capacity solar mini grids.

The report's biggest takeaway is that overall finance flows are way too low and that enterprises themselves, while still growing and sometimes thriving, face complex financing challenges that differ widely from country to country, with varying levels of debt, equity and grant funding needs.

Despite declining production costs and improved reliability of decentralized solar, finance flows to enterprises in this sector are a fraction of what is needed to scale their businesses exponentially, especially to serve rural areas

where demand for their products is greatest. We offer specific recommendations for elevating finance levels, including steps that will make it easier for enterprises to access capital more readily and at reasonable costs.

In the case of clean cooking, the challenges are far bigger, with enterprises being effectively starved of finance. Fixing this financing gap will require significantly more attention from governments, donors, customers, NGOs and investors who will need to coalesce around bolder market-based solutions. The report also takes a first effort at assessing the overall cost requirements for advancing to cleaner fuels, including LPG, ethanol and natural gas, presenting estimates on finance flows that will be needed from consumers, governments and the private sector.

Our research comes at a critical juncture in achieving – or falling short – on global energy access goals. We have just 13 years left to achieve universal access to affordable, reliable, sustainable and modern energy by 2030. Yet, based on the latest 2017 Global Tracking Framework data, just over one billion people globally still lack access to electricity and three billion lack access to clean cooking. A big segment of these populations is in the five countries we targeted.

These numbers are astounding and unacceptable. Lacking access to electricity means food cannot be refrigerated, vaccines cannot be kept safe and school children cannot do homework at night. Similarly, indoor cooking pollution from burning charcoal, wood and other fuels kills millions every year, while depleting already diminished forest cover. There is a larger economic toll, too. Countries that leave these populations behind undermine long-term economic development as well as national security.

We can and must do better to accelerate energy access progress. We hope this report guides its readers on the pathways for doing so.

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EXECUTIVE SUMMARY

Some 1.06 billion people lack access to electricity and 3.04 billion lack access to clean cooking technologies worldwide (IEA and World Bank, 2017). Delivering modern energy services to all citizens by 2030 is a key Sustainable Development Goal agreed by the United Nations.[1] Achieving it requires major shifts in how financing is provided to enterprises supplying decentralized energy services and a systemic change in global financial mechanisms supporting the sector. This report provides a first-of-a-kind analysis of key unmet financing needs and discusses the barriers that need to be addressed so that private enterprises can deliver energy access solutions at an exponentially larger scale.

Based on nearly 100 in-depth interviews with senior-level officials from enterprises, non-governmental organizations (NGOs) and development finance institutions (DFIs) working in energy access—combined with economic and financial data from each country—this study illustrates how enterprises delivering access to electricity and clean cooking are being financed in Bangladesh, Ethiopia, Kenya, Myanmar and Nigeria. These countries represent five highly different energy access markets across Sub-Saharan Africa and Asia. They also belong to the 20 high-impact countries whose efforts to increase access to electricity and clean cooking can make the most difference on a global scale (IEA and World Bank, 2015).

Each country analysis presented offers unique lessons for increasing the flow of finance to the energy access sector. The core of the analysis focuses on energy access solutions found in Tiers 1-3, which include improved wood and charcoal cookstoves in the cooking sector, as well as solar lanterns, solar home systems (SHS) and lower capacity mini-grids in the electricity sector (Bhatia and Angelou, 2015). Insights are presented on: enterprises' current financing structures; their reliance on debt, equity and grants; the main barriers they face to scaling-up; and the volume and composition of finance needed to reach national energy access targets.

The energy access sectors in the five surveyed countries are highly complex, with most enterprises operating on thin margins in high-risk environments with few protections against downside risks; whether economic, environmental (e.g., droughts) or political. Despite these headwinds, many enterprises are not only operational—numerous enterprises are growing and some are even thriving.

Due to declining production costs and improved reliability of decentralized technologies and appliances—as well as better customer analytics, growing consumer finance, and increasing government recognition of the potential for decentralized electricity and clean cooking solutions—the prospects for achieving a market-driven scale-up of these energy access solutions are stronger than ever.

[1] *In September 2015, world leaders agreed on 17 Sustainable Development Goals (SDGs). SDG 7 calls for secure access to affordable, reliable, sustainable and modern energy for all by 2030.*

THE COSTS OF ACHIEVING NATIONAL ENERGY ACCESS TARGETS

In 2013-14, annual average financing in the 20 high-impact countries for electricity and clean cooking was $19.4 billion for electricity access and $32 million for residential clean cooking (SEforALL, CPI and the World Bank, 2017). Current flows remain a very small fraction of what is ultimately needed to achieve universal energy access, including in the five countries surveyed in this report. This report shows that to reach national targets for Tiers 1-3 energy access in the five countries surveyed, annual finance needs are estimated at approximately $3.97 billion.

The cost of achieving government targets for electricity access is highly dependent on the targeted Tier of access (Table ES.1). Per the World Bank's Access Investment Model (AIM), the per-household cost of providing Tier 1 electricity access is roughly 50 times less expensive than higher service Tier 5 access (World Bank, 2017a). And although Tier 1-3 access does not provide electricity supply around the clock as fully or reliably as higher Tiers, it can trigger significant development gains in terms of public health, education, gender equality, business opportunity and overall human wellbeing.

In the clean cooking sector, the gap between needs and actual supply of finance for meeting national targets is even more substantial. Across the four countries for which cost estimates have been conducted (Bangladesh, Ethiopia, Kenya, Nigeria),[2] the total estimated costs of meeting clean cooking targets—including both technology and fuels—stands at $18.44 billion per year through 2030. Current annual spending for residential clean cooking across the 20 high-impact countries stood at a mere $32 million, indicating how large the financing gap in the clean cooking sector is (SEforALL, CPI and the World Bank, 2017).

While unmet financing needs to achieve universal energy access are enormous, they do not seem insurmountable when compared with each country's GDP.

Table ES1 - Cumulative cost of meeting government energy access targets ($, billion, 2017-30) - Annual cost as a percentage of GDP in brackets

Country	GDP ($ billion)	Tiers 1-3 Electricity ($ billion)	Tiers 1-3 Cooking ($ billion)	Tiers 4-5 Cooking ($ billion)
Bangladesh	221	6.11 (0.20%)	20.93 (0.68%)	55.13 (1.78%)
Ethiopia	72	13.78 (1.37%)	24.94 (2.47%)	30.43 (3.02%)
Kenya	71	14.99 (1.51%)	11.52 (1.16%)	17.75 (1.78%)
Myanmar	67	2.21 (0.24%)	7.91 (0.84%)	13.64 (1.46%)
Nigeria	405	18.44 (0.33%)	31.26 (0.55%)	66.23 (1.17%)

[2] *In Myanmar, no clean cooking enterprises were identified for inclusion in the surveys.*

Table ES.2 provides an overview of the costs per capita from two perspectives, based on average annual commitments between 2013-15 (SEforALL, CPI and the World Bank, 2017) and on estimates of annual future cost requirements to meet national targets, based on 2014 population numbers. These numbers show the significant per capita spend increases required to achieve-and maintain-national clean cooking access targets in each country surveyed. It should be noted that the in-country surveys may not capture all finance flowing, especially from untracked or informal market segments, and this is therefore indicative of the scale of the market gap but not definitive.

The differences in per capita costs are caused by a range of factors—including by the total access gap—as well as by differences in the country-specific targets in terms of the share of the population that will achieve access under each Tier. Note that the bulk of the analysis included in this report is based on the cost per household and that the number of inhabitants per household ranges from 4.4 to 5.1 in the countries surveyed.

Table ES2 - Estimated costs of meeting electricity and clean cooking targets, per capita

Country	Average annual finance commitments for electricity (Tiers 1-5), per capita, 2013-15* ($)	Estimated annual costs of meeting electricity targets (Tiers 1 – 3 only), per capita through 2030 ($)	Average annual finance commitments for clean cooking, per capita, 2013-15* ($)	Estimated annual costs of meeting clean cooking targets, including both technologies and fuels per capita through 2030 ($)
Bangladesh	33	2.34	>0.1	33.76
Ethiopia	13	7.12	0.12	39.79
Kenya	24	16.37	0.15	29.00

** Data sourced from SEforALL, CPI and the World Bank (2017).*

Due to data gaps in determining appropriate average values for the costs of achieving Tiers 4 and 5 of electricity access that would reflect country-specific factors such as grid extension costs, population density, national fuel mix, etc., the totals for the cost of Tiers 4 and 5 of electricity access have not been included here.

While the total investment requirements are large, it must be underscored that investors respond to opportunities, not to funding needs. A critical challenge in the energy sector is therefore to convert the energy access challenge—for both electricity and clean cooking—into investable opportunities. Table ES.3 highlights some of the key features and challenges that will factor into seizing these opportunities.

This research took a rather novel approach to estimate the shares of debt, equity and grants (D:E:G) that would be needed for enterprises focused on Tier 1- 3 energy access in each of the five countries surveyed for the electricity and clean cooking sectors. The objective of this approach was to present an indication of the type of financing needed by these types of enterprises to inform governments, donors, investors and other stakeholders on the nature of the finance instruments and structures that will be necessary to close the energy access gap (Figure ES.1 and ES.2).

Table ES3 - Key market features and enterprise challenges

Country	Key market features and enterprise challenges
Bangladesh	• Low-cost debt financing provided by IDCOL (priced at 6-9 percent and offered in local currency) widely used by energy access enterprises. • Only market with significant shares of debt in enterprises' capital structure. • Many large and highly diversified companies active in many different parts of the energy access sector.
Ethiopia	• Comparatively small and under-developed energy access market. • Primarily equity financed. • Lack of local debt available to small and medium enterprises. • Lack of a functioning foreign exchange market remains a major barrier.
Kenya	• One of the most dynamic countries in the world for energy access and PAYGO solar markets; active mobile money market. • Primarily equity financed. Equity often the founder's own funds combined with additional equity from friends and relatives; international investors, funds and foundations playing a growing role. • Lack of local debt and local currency financing available to small and medium enterprises.
Myanmar	• Comparatively small and under-developed energy access market. • Primarily donor financed with small shares of corporate equity. • Planning heavily weighted toward Tiers 4-5. • Small clean cooking sector, despite the large need for clean cooking.
Nigeria	• Large and complex energy access market with many players, but comparatively few investors. • Primarily owner equity financed. Virtually no equity from friends and relatives. • Large recent negative impact of economic downturn and currency fluctuations.

MAIN FINANCE BARRIERS FOR ENERGY ACCESS

Lenders' high collateral requirements remain a powerful barrier for small and medium enterprises (SMEs) in energy access enterprises trying to obtain finance. This factor was highlighted by respondents in all five countries surveyed.

Currency issues remain problematic in many countries. Fluctuations in exchange rates lead to unpredictability in the unit cost for imported equipment and associated costs that are incurred in US dollars (USD). This volatility makes it all-but-impossible to offer stable, predictable pricing for customers and has significant negative impacts on customers' own ability to pay.

In Ethiopia, the central banking restriction on access to foreign currency, specifically USD, further restricts companies from importing sufficient quantities of products, as these are usually priced in USD. Such delays have direct and sizeable impacts on enterprises' ability to meet customers' needs continuously throughout the year.

In addition, it is notable that access to finance remains much harder for female than for male entrepreneurs across all surveyed countries, for both cooking and electricity access enterprises.

Although several important commonalities could be found—such as the need for working capital, better access to foreign exchange, as well as the crucial importance of mobile money for reducing customer acquisition and loan

Figure ES1 - Total estimated cost and D:E:G shares to achieve national targets for Tiers 1-3 of electricity access ($, billion, 2017-30)

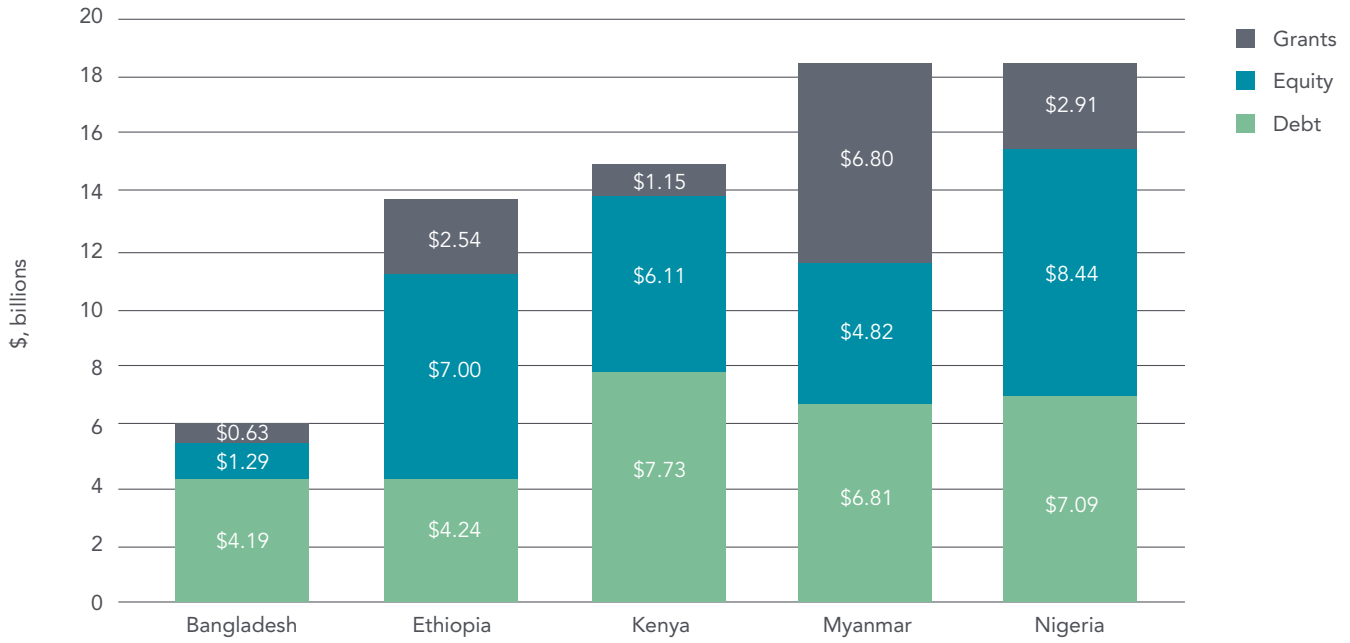

Figure ES2 - Total estimated cost and D:E:G shares to achieve Tiers 1-3 of national clean cooking targets, including both technology and fuel costs ($, billion, 2017-30)

Note: due to the inability to secure interviews from cooking sector enterprises in Myanmar, no D:E:G ratio data was gathered. As a result, Myanmar has been left out of the cooking cost estimate. The cost of meeting Tiers 1-3 cooking access in Myanmar is estimated at $7.91 billion, including both fuel and cookstoves.

collection costs—each individual market differed markedly from the other. In Kenya, for example, private international equity from impact and venture capital investors plays a significant role, while this remains a comparatively small part of the market in the other countries surveyed. In Myanmar and Bangladesh, very little private capital was identified from international investors, with most funds coming from development finance institutions, government-backed infrastructure or development agencies.

ELECTRICITY

At the heart of improving the energy access sector's "investability" is the creation of strong enabling environments—particularly in the energy, investment and banking sectors—through the establishment of effective and transparent rules. Given the levels of debt, equity and grants estimated across the five countries for electricity and clean cooking access, it is imperative that governments, donors, investors, development finance institutions, the private sector and civil society organizations collaborate. Actions across the national policy and regulatory system in the energy, banking, investment and trade arenas must be looked at holistically to accelerate needed finance flows. Clear policy and consistent government planning about grid extension and mini-grid development remain critical to provide more certainty for enterprises, as well as donors and NGOs.

The solar lantern product market is mature, highly competitive, increasingly global in nature and a key part of achieving energy access gains in all five markets surveyed. Solar lanterns remain the most widely used and affordable solution available for Tier 1 electricity access, undercutting kerosene, torches and candles for basic household lighting needs. Solar lantern enterprises face challenges, however, in accessing working capital and consumer finance. The working capital need is frequently exacerbated by issues surrounding foreign exchange markets, currency volatility, import duties and VAT regimes. Significant energy access gains could be achieved by simplifying import procedures and tariffs, reducing or eliminating value-added taxes and introducing dedicated working capital facilities for enterprises working in this field, as well as by improving their access to foreign currency.

The rise of pay-as-you-go (PAYGO) companies in the SHS market signals a major shift from prior business models. PAYGO companies can provide reliable, affordable electricity access at a fraction of the upfront cost of traditional grid extension and often in a fraction of the time. In Kenya, the combination of sophisticated real-time analytics, large networks of on-the-ground sales representatives, customized consumer finance solutions and the spread of mobile money has proved to be a powerful combination that is helping make significant gains in electricity access. While the other four countries surveyed show varying levels of adaption and replication of the PAYGO business model, none is nearly as advanced in this regard as Kenya, which remains a market leader. The latter's success was contingent on a range of factors, including policy clarity, a well-developed financial sector, an active mobile money market, ready access to foreign exchange, a relatively stable currency and simplified import procedures.

The interviews revealed that it is not uncommon for enterprises delivering energy access products and services to also be active in other sectors, including manufacturing, retail, construction and advisory services. Among those interviewed in Bangladesh, many enterprises derive a significant portion of their sales from non-energy access activities. Similarly, several PAYGO companies in East Africa are diversifying their operations. As a growing number of enterprises begin to understand the power of marketing new products and services to existing customers, they are building on continuing customer relationships—and in some cases, credit histories—to sell appliances and productive use technologies, such as pumps and refrigeration, as well as residential and commercial cooking solutions. This diversification can create a stronger customer base, better cash flow, wider business networks and greater adaptability to changing market needs. In addition, spreading high customer acquisition costs over a larger total volume of receivables can strengthen the business case for opera-

ting in rural and remote regions where the financial return on investment is often thin or even negative due to high transaction costs and low per-customer sales volume.

The mini-grids sector as a whole is currently not considered as "bankable" as the solar lantern or SHS market segments. There are several reasons for this, including: 1) a lack of mini-grid developers that have demonstrated a commercially viable and scalable model of mini-grid development; 2) solar lanterns and SHS operate under comparatively few regulatory constraints critical to profitability, such as pricing; and 3) most mini-grids effectively compete with grid-based power either directly or indirectly in terms of price, quantity and quality of service. Since national tariffs are often subsidized, it can be extremely difficult for mini-grid projects to achieve profitability, forcing them to rely heavily on grants or government subsidies. Combined with a host of political and regulatory risks surrounding issues such as the introduction of fixed tariffs or the extension of the national grid, mini-grids continue to be less attractive to commercial investors. However, the development of new regulatory frameworks and supporting policies— such as those recently announced in Nigeria—could galvanize interest and reduce investment risks in this market segment.

CLEAN COOKING

A small number of surveyed companies providing clean cooking solutions, mainly in Kenya and Nigeria, were making profits. A critical factor to this success was ensuring customers had easy access to finance, since the price of most improved cookstoves on the market sits just above what consumers are willing (or able) to pay in cash. As the use of small-scale consumer finance in the cooking sector becomes more common, the sector's commercial viability can be expected to improve.

Despite its urgency and the significant health and development gains it can bring, the cooking sector continues to receive far too little attention and finance. Strikingly, none of the major development finance institutions interviewed in Myanmar reported cooking as a priority, even though approximately 50 million people remain without access to clean cooking (EMC, 2015).

Including the costs of fuel is critical to properly assessing the clean cooking market. An asset-based approach to calculating the cost of energy access works relatively well for the electricity sector, particularly for Tiers 1-3. This is the basis upon which projections of the investment needs to achieve universal clean energy access are often based. However, this approach is insufficient to calculate the total costs of achieving clean cooking, largely because most of the costs of clean cooking fuels and technologies are found in the fuels, not in the stoves. On a lifecycle basis, for most basic stoves on the market that range from $20 - $60 per stove, the cost of the stove is less than five percent of the total amount that a household will spend on clean cooking fuels and technologies through 2030 in the four countries surveyed for clean cooking. As such, the analysis used for the cooking sector considers the fuels and the costs of the stove. While this results in larger absolute numbers, it provides a more holistic picture of the size of the cooking market.

There is tremendous potential to support the emergence of diversified cooking sector enterprises that can provide partially or fully, vertically integrated solutions to the challenges facing the sector. Much of the clean cooking discourse focuses on the supply of advanced cook stoves, whereas the overwhelming majority of revenues in the sector rests with the supply of fuel (e.g., charcoal, kerosene, lignite, liquefied petroleum gas (LPG)). Supporting clean cooking enterprises could involve the expansion of enterprise and consumer finance as well as larger investments in the infrastructure required for expanded supply of cleaner fuels such as LPG, ethanol and natural gas. Some businesses in Bangladesh and Kenya are already diversifying to offer cleaner cooking alternatives

and more can be expected to do so in the years ahead, particularly when assisted by effective policies and access to adequate funding.

The clean cooking sector requires significantly more attention from governments, donors, customers, NGOs and private investors. The finance needs for the cooking sector—when fuel supply costs are factored in—are significant. In Bangladesh, Ethiopia, Kenya and Nigeria, the cumulative costs of meeting government targets for the cooking sector (Tiers 1-5) by 2030 are estimated to be in the order of $258.2 billion. Through 2030, over 95 percent of the sector is found not in the stoves, but in the fuels in these four countries.

Greater investment is needed to raise awareness across all stakeholders of the health, productivity and deforestation impacts of current cooking technologies and high-polluting fuels and practices, as well as of the value proposition of saving time and money by switching to cleaner stoves and fuels. It is often difficult for consumers to appreciate the significant impacts that higher efficiency stoves can bring in terms of both time and money; more is needed to make these benefits clear, intuitive and actionable for consumers, particularly those at the lower-income quintiles.

FINANCING FOR ENERGY ACCESS

Enterprises providing Tiers 1 to 3 electricity access were largely financed via corporate equity (i.e., own funds) and/or grants. Project equity was rarely used by enterprises beyond funding specific productive use projects such as solar-powered pumps. This is a sharp distinction to the financing of larger-scale electrification projects, including grid-connected renewables—that are flowing via project debt and project equity—and is reflected in the estimates of future equity needs.

Private-sector enterprises active in the energy access sector in Ethiopia, Kenya, Myanmar and Nigeria remain primarily equity financed, with Bangladesh being a notable exception.[3] However, energy access enterprises see their reliance on debt financing increasing in the years ahead and understand debt will be necessary to scale. This stands in stark contrast to the almost complete lack of debt, particularly local currency debt, available to them. Bangladesh was the only country surveyed where debt finance was common and widespread for SMEs working in the energy access sector. The Infrastructure Development Company Ltd (IDCOL) of Bangladesh has been providing the readily available and reasonably priced local currency debt, with the result of Bangladesh's several energy access enterprises serving hundreds of thousands of customers and reporting annual sales from this sector exceeding $10 million in 2013-14 and 2015-16. Bangladesh therefore provides one clear example of how greater volumes of debt can be made available to enterprises in the energy access sector.

And yet, across the remaining four countries surveyed, lenders remain unwilling to offer loans to enterprises in the sector, with few exceptions, thus presenting significant financing challenges for those servicing the Tier 1-3 energy access markets. While longer company track records combined with improved analytics and customer data is likely to improve the willingness of banks to lend, loan requirements remain too onerous for most enterprises, particularly local ones. While there is no easy solution for adjusting loan requirements, a softening of lending standards and the admissibility of a wider range of assets (including customer receivables) as factors in the loan evaluation process, could help accelerate local currency lending and improve the availability of local currency debt through demonstrating the "bankability" of local energy enterprises.

[3] It should be noted that some of Kenya's larger PAYGO companies that have attracted external financing either declined to take part in the surveys or declined to share key financial information that may have revealed a different pattern, as well as resulted in different Debt:Equity:Grant (D:E:G) ratios for the sector as a whole. In other countries surveyed, it was primarily corporate equity reinvested into the company. In Myanmar and Nigeria, by contrast, virtually no equity from friends and relatives was registered at all, with equity coming directly from proprietors.

Enterprises require: targeted market support mechanisms such as local currency financing or other means to address extreme currency fluctuations; access to consumer finance to help boost the affordability of products and take consumer loans off companies' balance sheets; and, dedicated working capital facilities to help enterprises scale.

Energy access transactions face high transaction costs. However, the pool of potential funders and investors is constrained by small transactions sizes. This basic problem requires urgent attention if finance is to flow at scale. Several interviewees suggested that transactions on the order of $30-100 million were necessary to bring in larger lenders and investors.

Governments should be assisted in creating enabling environments for energy access businesses operations and investments, including a stable policy environment, light-touch regulatory conditions and supportive conditions for the mobile money sector, as well as business, accounting and management training for local energy access enterprises.

In markets that are generally functioning and scaling well, grant and other donor funds have a significantly greater potential to be disruptive, even transformative. However, donor funds can also be distortive, can crowd out private sector activity, and are often insufficiently targeted. As energy access markets mature, donor funds should be targeted towards households at the lower quintiles of income to provide affordable, reliable and sustainable energy for those facing the highest relative cost of energy services.

Expectations regarding enterprises' future reliance on grants were mixed. In some countries, such as Myanmar and Nigeria, the expectation was that grant reliance would remain a critical part of their business model in the years to come. In comparably advanced markets like Kenya, grant funds were seen more sceptically; some enterprises lamented the lengthy application processes and reporting requirements, while others (particularly locally owned companies) expressed concern that grants could jeopardize customers' perceptions of them as a commercial company.

To achieve profitability, several surveyed companies were targeting urban and peri-urban areas, where the costs of sales, customer acquisition and maintaining distribution networks were considerably lower, leaving many hard-to-reach areas underserved. This is particularly the case in Kenya and Nigeria. Achieving universal energy access will require dedicated donors, DFIs and impact funds to target households at the lower quintiles of income or in very remote areas. This can help ensure that public funds are not distorting market activity that is already being met profitably by private-sector actors, but rather supporting enterprises in their efforts to serve the hardest-to-reach households.


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ABBREVIATIONS

%	Percent
$	US Dollar
ADB	Asian Development Bank
AIM	Access Investment Model
ARE	Alliance for Rural Electrification
BIFFL	Bangladesh Infrastructure Finance Fund Limited
BLEENS	Biogas, LPG, ethanol, electricity, natural gas and solar
Bn	Billion
BNEF	Bloomberg New Energy Finance
CAPEX	Capital expenditure
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CPI	Climate Policy Initiative
DBE	Development Bank of Ethiopia
D: E: G	Debt: Equity: Grant
DESCO	Distributed Energy Services Company
DFI	Development Finance Institutions
DFID	Department of International Development
DRD	Department of Rural Development
FiT	Feed-in tariff
FOREX	Foreign exchange
GACC	Global Alliance for Clean Cookstoves
GENSET	Diesel and/ or electric generator
GERES	Energies Renouvelables, Environment et Solidarités
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GOGLA	Global Off-Grid Lighting Association

GPOBA	Global Partnership on Output-Based Aid
HH	Household
ICS	Improved Cook Stoves
IDCOL	Infrastructure Development Company Ltd
IIED	International Institute for Environment and Development
IRENA	International Renewable Energy Agency
ISO	International Standards Organization
JICA	Japan International Cooperation Agency
KOSAP	Kenya Off Grid Solar Access Programme
kW	Kilowatt
kWh	Kilowatt hour
KSh	Kenyan Shilling
LPG	Liquefied Petroleum Gas
MFI	Microfinance Institutions
MOWIE	Ministry of Water, Irrigation and Energy in Ethiopia
MTF	Multi-Tier Framework
NCC	Nigerian Communications Commission
NEP	National Electrification Plan
NGO	Non-governmental organization
OPIC	Overseas Private Investment Corporation
p.a.	Per annum
PAYGO	Pay-as-you-go
PV	Photovoltaics
R&D	Research and development
SACCOs	Savings and Credit Cooperative Organizations
SCALE	Strengthening improved cookstove access towards a better quality of life and environment
SEforALL	Sustainable Energy for All
SHS	Solar home system
SME	Small- and Medium-sized Enterprises
USAID	United States Agency for International Development
USD	US Dollar
W	Watt
Wh	Watt hour

GLOSSARY

Absolute energy access gap: the total energy access gap in terms of inhabitants or households considered after population growth. It is assumed that all new citizens being born through 2030 need energy access. The absolute energy access gap refers to the current population needing electricity access plus future population growth.

Borrower: the loan recipient.

Capital structure: refers to the structure of debt and equity and other funds in a project or company's overall financing. For instance, if a company has $800,000 in equity and $200,000 in debt invested, then it would have a capital structure that is comprised of 80 percent equity and 20 percent debt (or 80/20).

Cash flows: the revenues generated by a project or venture.

Collateral requirements: the requirements imposed by banks and other financial institutions that borrowers demonstrate they have assets sufficient to cover the costs of the loan in the event of default or bankruptcy. Collateral can include land, cash and other hard assets.

Consumer finance / End-user finance: finance provided directly or indirectly to consumers that allows them to pay for their energy access products (lanterns, cook stoves, etc.) over a period of time (e.g., 30 days, 90 days, 1 year).

Corporate debt: a loan given to an enterprise or company that is issued primarily based on the credit-worthiness of the company itself, rather than of any specific individual project or sector they are active in. In other words, the loan is given to the company to do what it likes, without conditions attached concerning how the money is spent. Corporate debt is therefore typically only awarded to companies with a proven track record of performance.

Credit risk: the possibility that an enterprise or company cannot pay back its loans or financial commitments in time. Companies with a higher perceived credit risk typically pay higher interest rates on their loans, or may fail to obtain loans altogether.

Debt: debt is typically provided in the form of loans either to individuals or companies. Providers of debt are considered "lenders," in contrast to providers of equity, who are typically considered "investors." Crucially, debt providers are generally first (i.e., have priority) in the repayment of financial obligations.

Equity: private or own funds invested in a specific company or venture. Generally, equity is more expensive than debt (i.e., carries a higher interest rate). In many cases, an equity investment made in a specific company comes with certain implications, including an ownership share or voting share commensurate with the amount of equity invested. Equity investors are sometimes considered "shareholders" or "sponsors" of the company.

High-impact countries: the 20 countries with the highest absolute gaps in access to electricity and/or clean fuels and technologies for cooking measured by population, as identified in the 2015 Global Tracking Framework (IEA and the World Bank, 2015). For electricity access the countries are: Afghanistan, Angola, Bangladesh, Burkina Faso, Congo (DR), Ethiopia, India, Kenya, Korea (DPR), Madagascar, Malawi, Mozambique, Myanmar, Niger, Nigeria, the Philippines, Sudan, Tanzania, Uganda and Yemen. For clean cooking access the countries are: Afghanistan, Bangladesh, China, Congo (DR), Ethiopia, India, Indonesia, Kenya,

Korea (DPR), Madagascar, Mozambique, Myanmar, Nepal, Nigeria, Pakistan, the Philippines, Sudan, Tanzania, Uganda and Vietnam.

Liquidity: the ability of a company to satisfy its short-term obligations, either with cash or by rapidly converting some of its assets (e.g., inventory) into cash. For most enterprises, having enough liquidity is vital.

Mezzanine finance: a hybrid form of finance that is neither purely equity nor purely debt, and sits between the two. Mezzanine finance is typically considered a form of debt that enables the investor, or sponsor, to convert their investment into a full equity investment if the company shows signs of failing. This enables the finance provider to gain more control over the operations and management of the company than a traditional loan would allow.

Multi-Tier Framework: to measure the quality of the energy supply provided, household relevant energy access finance is allocated to five "Tiers"—from Tier 1 ("very low level of access") to Tier 5 ("very high level of access"), based on the Multi-Tier Framework developed by the World Bank and supported by SEforALL.

Own funds / Corporate equity: Used in this report to refer to the investments made by the owner and the retained profit held in the company derived from trading.

Pay-as-you-go (PAYGO): an umbrella term that is most commonly used to refer to the financing or business models behind small solar products or SHS. However, this umbrella term can be misleading, as it includes several variations:

- **Rent-to-Own or Leasing models**: where a customer purchases a solar product and commits to make regular (typically monthly) payments over an agreed period of time. Once the upfront cost of the system or product is amortized, or paid for, the ownership over the system or product is typically transferred fully to the customer.

- **Fee-for-Service models**: where a customer pays for access to a system, or product, or mini-grid based power supply on an "as-needed" basis. When they need power, they pay a fee and obtain the service, either via an SMS payment, a direct cash payment, or by purchasing a scratch card. In contrast to the rent-to-own model, the ownership of the system does not transfer to the customer.

Project debt: a loan or debt instrument issued by a financial institution to finance a project or venture. In contrast to corporate debt, project debt is issued based on the track record of the type of project being financed (i.e., how reliable has the repayment history been on projects of this nature in the past?).

Securitization: refers to a structured finance instrument in which many loan contracts (including consumer loans for solar systems, for instance) can be bundled together in packages and sold on to another investor, institution, or fund. The revenues (i.e., repayments) derived from those loans can thereby be packaged into a new financial product, one that will pay a regular revenue stream over the duration of the repayment of those loans.

Working capital: Working capital is defined as an enterprise's current assets (cash flows, receivables, etc.) minus its current liabilities (debts, obligations, etc). It indicates whether a company has enough short-term capital, or funds, to cover its short-term obligations. Funds that are tied up in inventory, for instance, cannot be efficiently used to pay creditors; this can contribute to a shortage of working capital. The goal for an enterprise is ultimately to have adequate working capital to cover the costs of its operations, as well as to pay short-term debt or obligations (rent, etc.). Having enough working capital can make the difference between a company's success and its failure. It is particularly important for enterprises where inventory management (i.e., a continuous turn-over in inventory) is core to the business companies that are heavily invested in fixed assets (manufacturing, R&D, etc.).

Working capital loan or Working capital facility: The portion of a loan that a bank or financial institution makes available to the borrower that is dedicated to enabling the borrower to finance the cash deficit that emerges between purchasing or manufacturing a given product, and the collection of cash from the sale of that product.

1. INTRODUCTION

It is commonly accepted that access to finance is a critical ingredient in the success and growth of businesses. The energy access market is no different.

This report examines how much and what type of finance is needed by enterprises in the off-grid energy access markets of five countries: Bangladesh, Ethiopia, Kenya, Myanmar and Nigeria. These countries are among the 20 high-impact countries for improving access to electricity and clean cooking (IEA and World Bank, 2015) and represent diverse geographies, economies and sector development.

Detailed interviews were conducted in each country with representatives from enterprises, non-governmental organizations (NGOs), Development Finance Institutions (DFIs) and parastatal organizations that provide products or services to the energy access value chain (to view questionnaires, see Annexes B and C). Company executives and investors in each country were asked how businesses are being financed and how finance needs are likely to change in the future. A distinction was made between the reliance on debt, equity and grants (D: E: G:), as well as electricity and clean-cooking market segments.

Building on broadly accepted cost ranges for energy technologies and fuels, a new scenario-building model was developed to estimate the volume and type of finance needed to meet national energy access goals that countries set for themselves for the year 2030. For example, Kenya aims to achieve 100 percent access to electricity and clean cooking (Kenya, 2017) and Nigeria has an 80 percent clean cooking and a 90 percent electrification target (Nigeria, 2016). The analysis focuses on the full costs of meeting clean cooking and Tiers 1 – 3 electricity access targets, as described by the World Bank's Multi-Tier Framework (Bhatia, M. and Angelou, N. 2015).

The methodology is designed to be replicable, so that progress can be monitored regularly and similar analysis can be undertaken in additional countries. (See Annex A).

Table 1.1 Overview of enterprises and financial institutions interviewed

Country	Number of enterprises surveyed	Number of financial institutions and investors interviewed
Bangladesh	27	2
Ethiopia	17	4
Kenya	16	3
Myanmar	9	4
Nigeria	33	3

Country-specific forecasts of population growth are included in the model and finance assumptions, which themselves are built on country-specific insights gathered from interviews. The model considers the cost of access to clean cooking, lighting and electrification primarily at the household level. Costs for achieving and maintaining energy access are calculated on a household basis for each year between now and 2030. Calculations include country-specific multipliers that reflect company overheads, such as the cost of marketing, customer acquisition and staffing.

This analysis assumes cost-optimal energy access development, which in all markets surveyed favors the use of solar-based technologies to meet Tiers 1 – 3 of electricity access.[4]

Sector- and technology-specific cost assessments are based on today's prices but employ a technology-specific annual degression value to capture probable future cost reductions. It is recognized that there are regional differences on existing and future costs of technologies; however, due to a lack of reliable and comparable cost data for each surveyed country, uniform values were used.

Table 1.2 Cost inputs used in this study

Cost per household per year (in $) for maintaining the specified Tier of electricity access in 2017 (IRENA 2017, BNEF 2016, Sendea 2017a, 2017b)	Tier 1	$5.00
	Tier 2	$95.72
	Tier 3	$224.02
	Tier 4	n.a.
	Tier 5	n.a.
Cost per household per year (in $) for relying on given clean cooking solution through 2030 (World Bank, 2015); includes cost of cookstove appliances and fuels	ICS wood	$103.29
	ICS charcoal	$144.71
	LPG	$237.86
	Electric	$314.29
	Ethanol/methanol	$197.43
	Biogas	$117.86
Applied annual cost decline due to technology cost reductions and economies of scale for Tiers 1 – 3 of the electricity sector (degression value)	2% per year	
Applied annual decline for the cooking sector	0% per year	

Note: for Tiers 1-3 of electricity access, the numbers have been updated to reflect current market prices in 2017, based on Sendea 2017a, 2017b.

[4] *For cooking, Tiers 1-3 include wood- and charcoal-based solutions. All others (LPG, electricity, ethanol/methanol, as well as biogas) are considered Tiers 4-5.*

A 2 percent annual cost decline is assumed for Tiers 1 – 3 of electricity access, but no cost improvement is assumed for cooking technologies. The primary reason is that although stove and pot technologies are likely to improve significantly in the years ahead, the future evolution of fuel prices (whether local firewood, charcoal, ethanol or LPG prices) remain highly uncertain and are likely to increase rather than decrease as markets change and population growth and increasing deforestation rates put further strain on fuel resources, notably wood and charcoal.

For the country profiles, in some cases (e.g., population statistics) the numbers are based on the best publicly available source for which uniform and reliable numbers were available for all five countries. In the case of population numbers, this means that 2014 is used as the base year.

Regarding the costs of achieving national clean cooking targets, the scenario analyses conducted for this report differ from many other reports on the cooking sector in that they explicitly include the costs of fuel, rather than focusing strictly on the costs of cookstoves. The aggregated values above therefore include both the costs of fuel (which are based on World Bank, 2015) as well as the additional cost of cookstove amortized over a five-year period (resulting in two stove purchases on average). The exception is biogas, where no replacement is assumed for the period through 2030 (Annex A provides more information on the calculation of cooking costs).

Thus, when considering the total cumulative costs of achieving and maintaining a given level of access to a Tier or technology in the cooking sector, the overwhelming majority of the costs are found in the costs of the fuel. **For wood, charcoal, LPG, ethanol and electricity, the stove (which is assumed to range from $23-$55 per unit, depending on the technology) represents approximately 2-4 percent of the total costs of meeting and maintaining that Tier of access through 2030**, based on the World Bank's average cost per household cited above (World Bank, 2015). For biogas, by contrast, the share rises significantly, to approximately 58 percent, due to the high cost of building a household biogas facility (assumed here to be $950). But because of its low usage cost, biogas compares favorably when lifecycle costs are considered (See Table 1.2).

The country profiles presented in the following sections outline the results of the surveys and scenario modeling conducted. A more detailed overview of the approach developed for this analysis can be found in Annex A.

To find out more, please visit SEforALL.org/EnergizingFinance

2. KENYA COUNTRY PROFILE

Table 2.1 Key statistics for Kenya

Key statistics	
Population (2014)	46.1 million (World Bank 2017b)
Number of households (2014)	10.5 million (World Bank 2017b)
Number of inhabitants per household	4.4 (ArcGIS 2016a)
Population in 2030	65.4 million (World Bank 2017b)
Access to electricity (2014)	36% (IEA and World Bank, 2017)
Access to clean fuels and technologies for cooking (2014)	6.2% (IEA and World Bank, 2017)
National access target by 2030 (electricity)	100%
National access target by 2030 (cooking)	100%

2.1. INTRODUCTION

Kenya's energy access market is one of the most advanced in the developing world. This is due to several factors, including supportive business regulation, a flourishing mobile money market, a dynamic financial sector and a strong entrepreneurial drive. Nevertheless, there are still approximately 29.5 million Kenyans without reliable access to electricity and 43.2 million (93.8 percent of the population) without access to clean cooking (Table 2.1).

The government of Kenya has developed a SEforALL Action Agenda[5] linked to the Kenya 2020 vision (Kenya, 2017). It aims to achieve 100 percent electricity connectivity and 100 percent access to clean cooking by 2030.

Kenya has made considerable progress in delivering off-grid energy services at Tiers 1-2 through the solar lantern and solar home system (SHS) markets. Sales in both market segments have increased steadily and made Kenya the largest market in Sub-Saharan Africa, with over 650,000 unit sales in the second half of 2016.[6] In parallel, the national grid is being extended.

Kenya is one of the most dynamic markets in the world for the growth of the **pay-as-you-go** (PAYGO) SHS market. Introduced by M-Kopa in 2011, this business model gave access to an entirely new customer base for which distributed electricity solutions were previously unaffordable. The convergence of several technologies—including improved cell phone coverage—enabled remote monitoring and activation of solar home systems and facilitated mo-

[5] http://www.se4all.org/sites/default/files/Kenya_AA_EN_Released.pdf

[6] *Sales data from the Global Off-Grid Lighting Association (GOGLA)*

bile payments through the M-Pesa mobile banking system.

It is estimated that over 20 million Kenyans currently have an active **mobile money** account, which makes frequent payment of small amounts easy and cheap, allowing loan repayments from remote locations.

Several other companies have entered the market, bringing innovations to M-Kopa's business model, including the type and size of energy systems, available appliances and the design of payment plans and ownership models, as well as options in the duration of the payment term (usually ranging from 3 to 36 months). It is estimated that there are already more than 700,000 Kenyan households that have obtained small SHS through the PAYGO model (GOGLA 2016).

The Kenyan mini-grid market is not nearly as developed, despite government and donor enthusiasm. There are currently fewer than 10 active companies. The government has converted several diesel-based mini-grid built systems. However, the focus has been on attracting a new generation of developers to the market, including companies such as Powerhive, Powergen, RVE Sol and Virunga.

The efforts seem to be bearing fruit: Powerhive is currently planning 100 new 10kW installations that are expected to be operational within a year.

However, a major obstacle to the growth of the mini-grid market has been the lack of a clear policy and regulatory environment in which companies can operate. The national Regulator and the Ministry of Energy are seeking agreement on an energy bill, which has been ready for ratification since 2015, but decisions are still being made on a case-by-case basis. Companies are currently given short operating licenses of 1-3 years, which makes it difficult to attract the long-term finance necessary for the more capital intense mini-grids.

Demand erosion through strong competition from national grid expansion and growing SHS and solar lantern markets make the mini-grid market segment a tough sell for risk-averse investors or for those with only short-to-medium term (e.g., 3-6 years) investment horizons. Consequently, lenders, private investors and impact funds interviewed expressed concerns about the investability of the mini-grid market segment.

Another important dynamic of the Kenyan market is the emergence of diversified private for-profit companies that straddle multiple sectors (See Figure 2.1). Many companies are also large, with annual revenues between $100,000 to $10 million (See Figure 2.2). These companies use long-standing sales and distribution channels to

Figure 2.1 Enterprise type

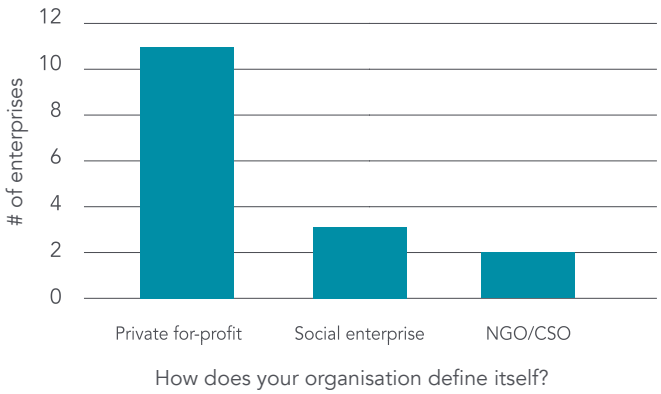


Figure 2.2 Enterprise size in terms of revenue derived from energy access

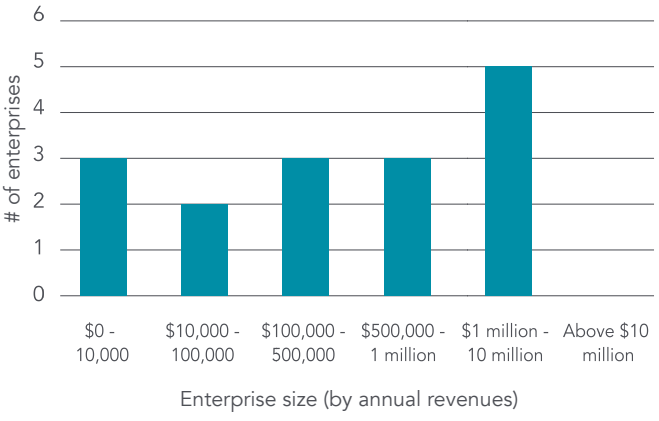
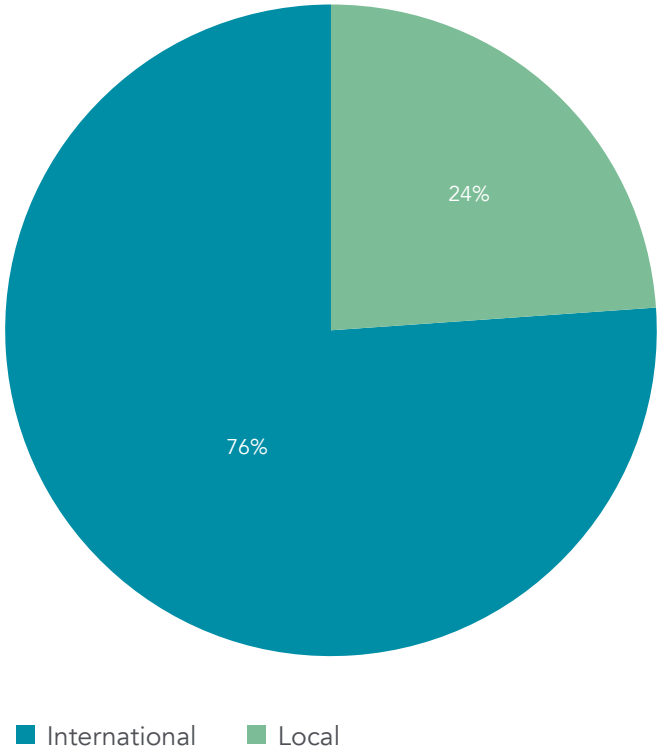


Figure 2.3 - International versus local finance



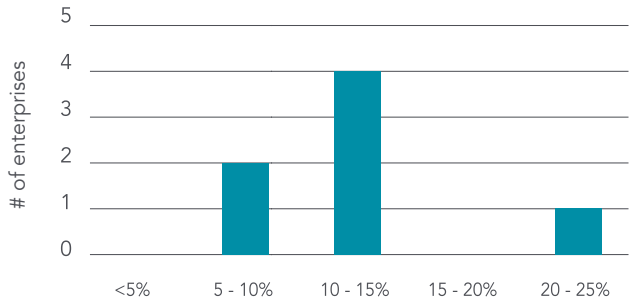
sell cookstoves, solar lanterns and/or SHS, and have now begun to diversify into other segments of the energy access market. This has made it difficult to draw definitive insights regarding how companies operating in different sectors are financed. The more diversified companies become, the harder it gets to attribute their ability to access bank loans, their cost of capital, their ability to secure local currency financing, or any of several other aspects of financing to an energy market segment or a specific business model. This is also the case in Bangladesh where numerous large diversified players are active.

2.2. FINANCING ENERGY ACCESS

Many companies—particularly in the mini-grid sector—have international staff at the top of their organizations and offices, or even their headquarters outside of Kenya. Several respondents considered this important for being able to source international funds, both from a proximity standpoint and regarding the standing and reputation it gave those players.

In August 2016, the Central Bank of Kenya introduced a cap on commercial lending rates charged by financial institutions registered in Kenya, at the base rate, currently at 10.4 percent, plus 4 percent (Figure 2.4). In effect, local bank lending rates are capped at a maximum of 14.5 percent per annum at the time of writing. One consequence of this cap on lending rates is that banks are turning down a growing number of consumer loan requests: one large financial institution in Kenya reported having to reject 7 out of 10 loan applications since the regulations came into force, versus approximately 4 out of 10 prior.

Figure 2.4 Reported cost of capital in local currency (2015-16)

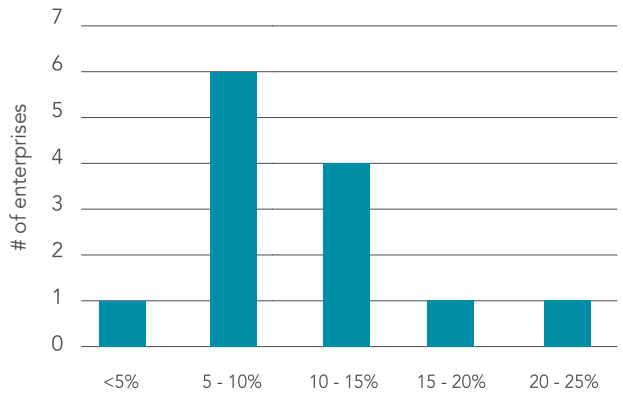


The lending rate cap is also influencing small consumer loans for energy access, whether for clean cookstoves or for SHS. This has resulted in both consumers and enterprises beginning to look elsewhere for funding, including to shorter-term (as well as higher-cost) providers of loans.

Other companies—including most of those operating in the cooking sector—have begun to look at crowd-funding, international impact investors and foundations to support their growth needs. Most of those who sourced finance in international currencies obtained rates of less than 15 percent (See Figure 2.5).

International funding in the past mostly came from impact funders such as Acumen or DOB Equity. More recently, new sources—such as the crowd-funding site Trine—have been activated.

Figure 2.5 Reported cost of capital in international currencies (2015-16)



The relative stability of the Kenyan Shilling against the US Dollar over the past 3-5 years has subdued investor concerns over foreign exchange risk, a factor that has contributed to the large influx of venture and impact capital in the last 2-3 years. Several enterprises nevertheless **expressed a greater desire for local currency financing, particularly local currency debt**.

Because international funders request solid data, investing in measuring and reporting systems and IT was key for companies, so that they could track progress on sales and payments. This helped reassure investors on the security of their investment.

One local funder invested in creating awareness as a way of increasing uptake of their consumer loans. A business development company also underlined the lack of interest from local financial institutions, as they were more comfortable lending to sectors they were familiar with, such as property and cars, rather than the perceived higher-risk, decentralized energy sector.

Several international venture capitalists are already co-investing in energy access companies, often on a syndicated basis with other finance providers. Most investments from venture capital firms have thus far been concentrated in the PAYGO solar sector; mini-grids and cookstoves were not believed to provide sufficiently attractive returns. Interestingly, venture capital investors appeared to welcome the continued reliance on grant funds, as the latter are considered non-dilutive to equity holders.

Companies with shorter working capital cycles of 12 months or less are generally perceived to be less risky than companies with longer cycles, such as mini-grid developers.

The reliance on international equity (particularly dollar-denominated venture, foundation, or impact investor equity) has steadily increased. It is a distinct feature of the PAYGO market, even if there are now signs of a potential cooling in the market (GOGLA, 2017).

The interviewed financial sector players pointed out the need to move to larger-ticket sizes. Deals ranging from $30 - 100 million were seen to be necessary to get the larger financial institutions and lenders involved. Some venture and impact investors only invested in companies with regional aspirations, because they believe that this scale would be necessary to move to larger ticket sizes and to achieve long-term profitability.

Although some of the PAYGO companies are nearing a point where financing deals on the suggested scale seems possible, some investors were beginning to express countervailing concerns about potential over-heating in the market, excessive implied valuations and misaligned incentives.

A related concern remains the high rate at which many of the PAYGO companies are prioritizing growth over profitability. These concerns will likely continue to rank highly in investors' minds for the foreseeable future.

Entities such as the Overseas Private Investment Corporation (OPIC) have begun to provide local currency debt to some players in the PAYGO market. Many investors and enterprises saw this as a welcome development. Also, some financial institutions such as Lendable have recently entered the market to provide first loss protection, ano-

ther key concern of some of the larger players in the market as they seek to reduce their reliance on equity and begin securing more debt in their capital structure.

The Kenyan energy access market remains divided between local and international companies. For local companies, it is still extremely difficult to access international debt and equity. But the significant premiums charged for currency risk protection are a barrier even for larger enterprises and international lenders.

Many local entrepreneurs (from the cooking and the electricity sectors) are reluctant to take on equity (local or international) because they fear the loss of ownership and control. They prefer growing slowly but maintaining control, which given the predominance of equity finance, as discussed below, will likely have important implications for accelerating energy access.

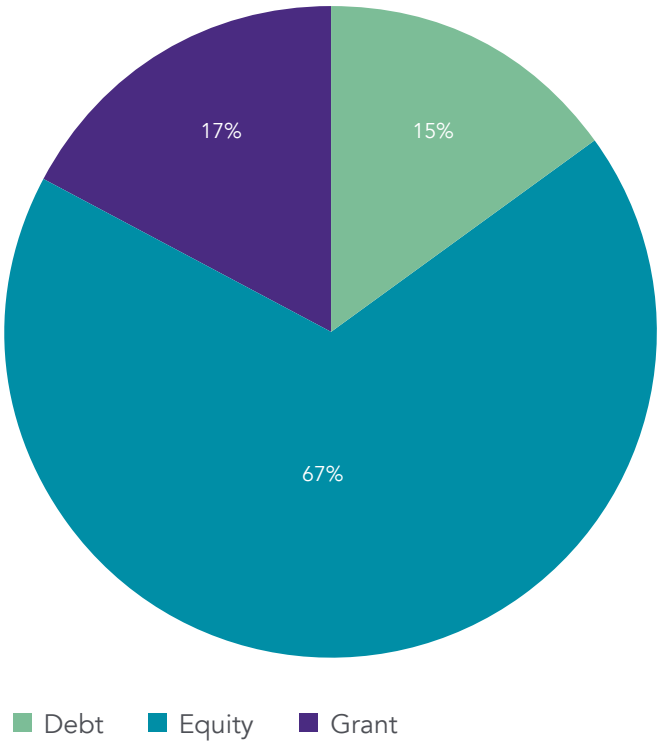
Retailers generally suffer from the inability of customers to access finance with which to buy solar systems and appliances. One manufacturer and distributor had asked customers what purchases they paid for in cash and which ones needed credit. It showed that above KSh 1500 ($15), most customers will need financing.

Microfinance institutions, as well as Savings and Credit Cooperative Organizations (SACCOs), can provide finance for households, but this is not yet happening at scale, largely due to customers' reluctance to have a product from one party and a loan from another. This resulted in changes in the original business models of suppliers, who now provide their own credit lines, facing increased working capital requirements to cover the increased delayed cash flows.

2.3. DEBT, EQUITY AND GRANT MIX

The energy access market in Kenya remains heavily reliant on owner equity. In 2015-16, roughly two-thirds of surveyed enterprises financed their business from equity (Figure 2.6). Of those, all used corporate equity or own funds (as opposed to project equity or mezzanine finance). Over a third were also relying on equity from friends and relatives. This represents a markedly higher share than in other markets, including neighboring Ethiopia.

Figure 2.6 D:E:G ratio across all enterprises surveyed (%, weighted average by revenues)



Still, a few companies managed to secure investments from impact investors and similar funds.

The companies interviewed did not include some of the larger PAYGO SHS companies. Some declined to be interviewed and those who were interviewed did not divulge financial information on sales and enterprise capital structure (D:E:G ratios). This reluctance was also found in other countries surveyed, but was most pronounced in Kenya. This is likely due to a range of causes, including the greater maturity and commercial orientation of energy access companies in Kenya, as well as their comparatively lower reliance on grant funding (notably in the SHS market segment).

Had the larger PAYGO players been more prominent in the sample, it is likely that the portion of debt would be significantly higher and the grant portion correspondingly lower. A solar distinction is not provided, as the sample is not large enough to be representative.

Between 2013-14 and 2015-16, the surveyed companies increased their reliance on equity, most of which has come from a reduced reliance on grants. Sixty-one percent of companies surveyed indicated that they planned to continue to reduce their reliance on grants in the years ahead.

A noticeable difference in the financing structure exists in the cooking sector. The proportion of grant funding in this sector in 2015-16 was 6 percent more than that of the entire energy access market (See Figure 2.7).

Figure 2.7 D:E:G ratio for enterprises active in the cooking sector (%, weighted average by revenues)

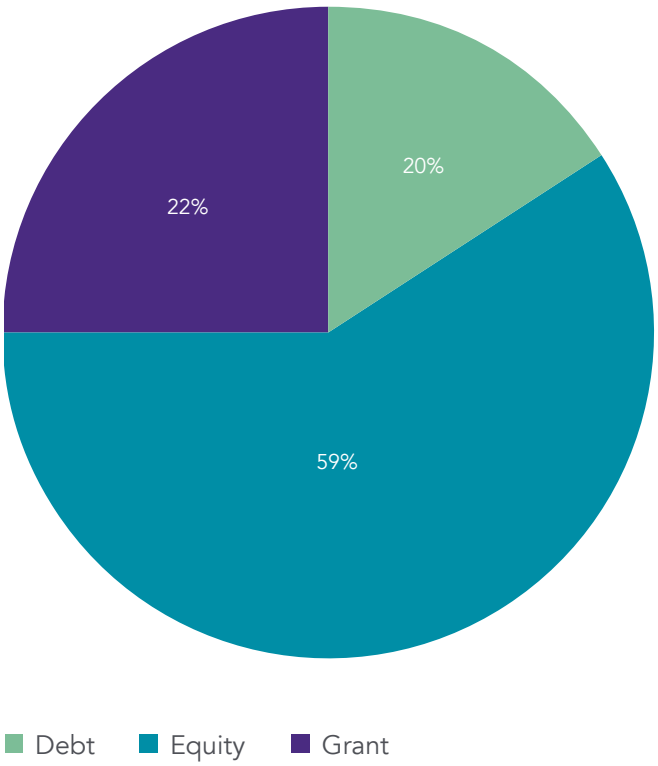


Figure 2.8 Barriers obtaining finance for electricity access enterprises

2.4. CLEAN COOKING MARKET

Kenya's clean cooking market has lagged significantly behind the electricity market. Per the SEforALL Action Agenda, nearly 90 percent of Kenyans living in rural communities rely on either wood or charcoal to meet their cooking needs, rather than improved cookstoves and cleaner fuels.

The early stage of the market may explain why there were a greater number of not-for-profit market actors when compared to the solar products and SHS market segments. It also meant that they sourced a higher proportion of their finance from grants.

About half of the companies interviewed who were active in the cooking sector had an international presence, a factor that also influenced where they sourced their capital. All cooking-sector interviewees pointed out their inability to obtain traditional bank loans, because of either onerous collateral requirements or the perceived immaturity and the lack of a sector track record. (See Figure 2.9). Not one company had successfully raised debt finance from a local provider.

These observations underscore the importance of raising investor awareness of the cooking sector and of strengthening business models and commercial viability (The failure to better market the value proposition behind the purchase of an improved or advanced cookstove was identified as a major shortcoming). Several respondents emphasized the need to advertise the benefits of improved cookstoves and make cost-effective consumer finance solutions available.

Figure 2.9 Barriers to obtaining finance for clean cooking enterprises

2.5. FUTURE SCENARIOS

Table 2.2 provides an overview of the country-specific modeling assumptions used for Kenya. A more in-depth description of the methodology and of the assumptions underlying this analysis can be found in Annex A.

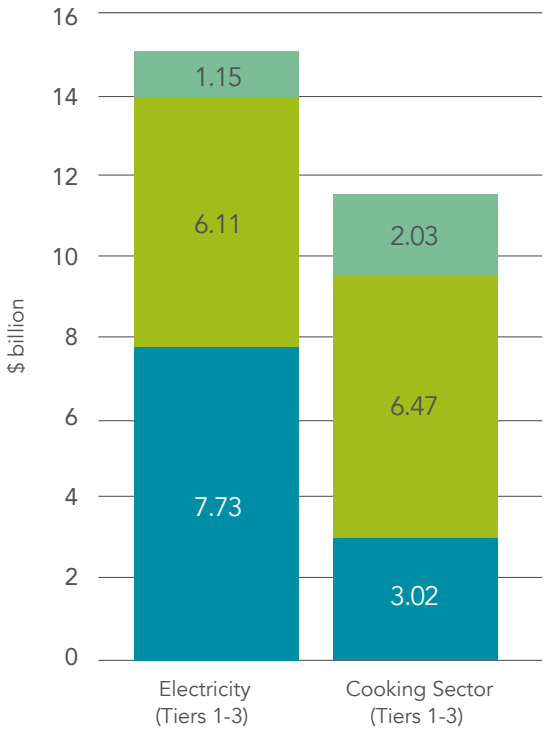
Table 2.2 Key scenario inputs for Kenya

Key scenario inputs		
Current D:E:G for Tiers 1-3 of the electricity sector (Estimate)	30:50:20 Debt: Equity: Grant	
Current D:E:G for the clean cooking sector (2015-16)	20:58:22 Debt: Equity: Grant	
Enterprise overhead ratio (multiplier to the capital cost of energy access technologies)	1.4	
Overhead ratio multiplier assumed for the clean cooking sector	1.2	
Overhead ratio multiplier assumed for Tiers 4 and 5	1.2	
Estimated D:E:G ratio for Tiers 1-3 of the electricity sector by 2030	65:35:0 Debt: Equity: Grant	
Estimated D:E:G ratio for Tiers 1-5 of the clean cooking sector by 2030	30:55:15 Debt: Equity: Grant	
Tier breakdown based on Kenya's SEforALL Action Agenda (percent of all new electricity access connections)	Tier 1	10
	Tier 2	30
	Tier 3	35
	Tier 4	15
	Tier 5	10

Key scenario inputs		
Breakdown by fuel type based on Kenya's SEforALL Action Agenda (percent of all new clean cooking connections)	ICS wood	30.0
	ICS charcoal	27.7
	LPG	35.3
	Electric	2.3
	Ethanol/ methanol	4.5
	Biogas	8.0

Figure 2.10 provides an estimate of the cost of meeting Tiers 1 – 3 of Kenya's electricity and clean cooking targets, broken down into debt, equity and grant shares (D:E:G).

Figure 2.10 Total finance needed to meet Tiers 1 – 3 of Kenya's SEforALL targets by 2030

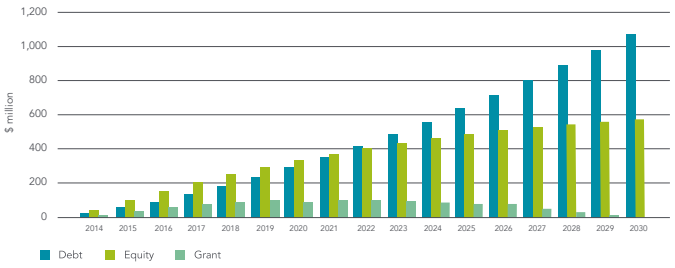


Total finance need for Tiers 1-3 electricity: $14.99 billion
Total finance need for Tiers 1-3 cooking: $11.52 billion

Grant Equity Debt

Figure 2.11 provides an annual breakdown of the costs for the electricity access sector.

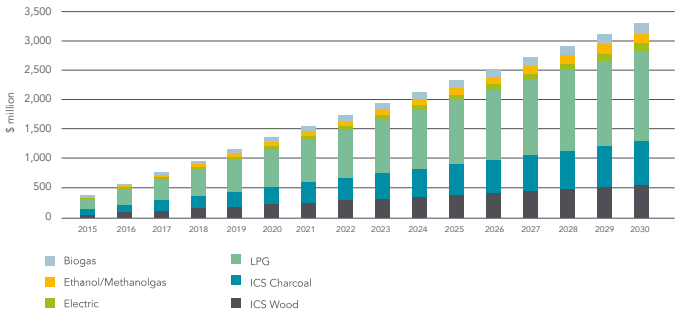
Figure 2.11 - Estimated annual finance need to achieve Kenya's SEforALL Action Agenda Targets for Tiers 1 – 3 of Electricity Access by 2030, broken down into debt, equity and grant shares



One notable factor that sets Kenya's electricity access strategy apart from the other four countries surveyed is its heavy weighting toward Tier 1-3 solutions, which represent fully 75 percent of new connections. In both Bangladesh and Myanmar, it is assumed that Tier 1-3 solutions will only represent 15 percent of new connections, while for Nigeria and Ethiopia the share is estimated at 40 percent. The remainder is expected to be delivered via Tier 4 or Tier 5 solutions.

Figure 2.12 provides an estimate of the total annual amount that will need to be spent by fuel/technology type to meet Kenya's cooking sector targets, including the cost of both the stoves and the fuel supply.

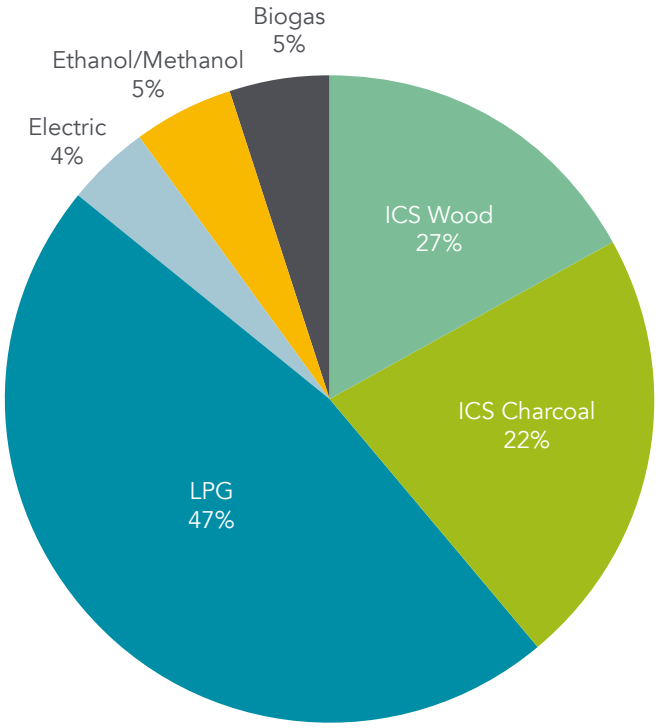
Figure 2.12 - Cost breakdown of meeting universal electricity access in Kenya



The Kenyan government's expectation is that a significant share (35.3 percent) of new clean cooking connections will be delivered via LPG. This makes LPG the largest cost driver, though the costs of both wood and charcoal supply are expected to remain significant due, in large part, to the dominance of both fuel sources in rural areas of the country.

Figure 2.13 provides a breakdown of the cost by fuel/technology type.

Figure 2.13 Estimated cost breakdown of meeting national clean cooking targets, by fuel type



2.6. CONCLUDING REMARKS

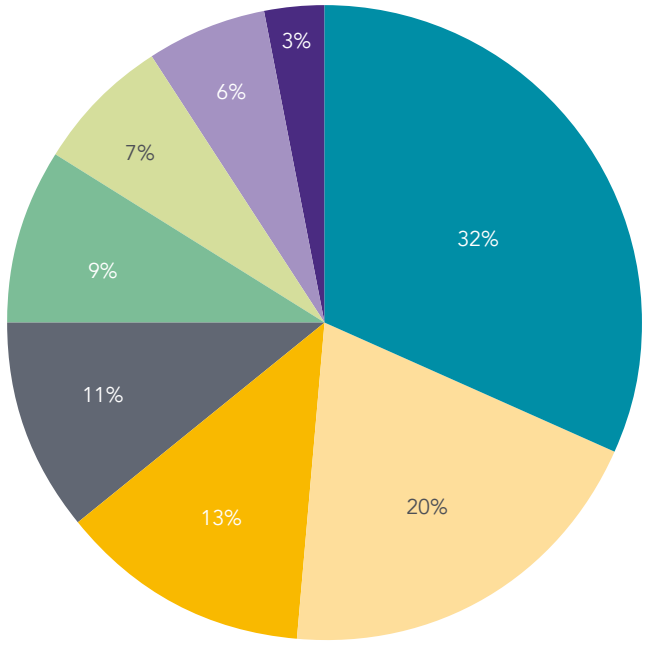
One notable factor that sets Kenya's electricity access strategy apart from the other four countries surveyed is its heavy weighting toward Tier 1-3 solutions, which represent fully 75 percent of new connections. In both Bangladesh and Myanmar, it is assumed that Tier 1-3 solutions will only represent 15 percent of new connections, while for Nigeria and Ethiopia the share is estimated at 40 percent. The remainder is expected to be delivered via Tier 4 or Tier 5 solutions.

In contrast to the other countries examined, Kenya's national electricity access targets include a greater emphasis on decentralized solutions, with 75 percent of new connections targeted by the government to be met by decentralized energy access.

Figure 2.14 provides an overview of how respondents would allocate $100 million of development funds to accelerate energy access.

Over half of all interviewees felt that access to finance for enterprises, either to working capital (32 percent) or to local lending (20 percent), was the biggest priority for new spending in the sector. If access to capital for end-users (13 percent) is added, roughly two-thirds of respondents see access to appropriate finance products as the greatest market need, with the remaining one-third prioritizing supportive policies and measures.

Figure 2.14 How would you allocate $100m for energy access?



3. ETHIOPIA COUNTRY PROFILE

Table 3.1 Key statistics for Ethiopia

Key statistics	
Population (2014)	99.4 million (World Bank 2017b)
Number of households (2014)	19.5 million (World Bank 2017b, 2013)
Number of inhabitants per household	5.1 (World Bank 2013)
Population in 2030	138 million (World Bank 2017b)
Access to electricity (2014)	27.2% (IEA and World Bank, 2017)
Access to clean cooking fuels and technologies (2014)	2% (IEA and World Bank, 2017)
Access target by 2030 (electricity)	100% (Government Target)
Access target by 2030 (cooking)	100% (Government Target)

3.1. INTRODUCTION

Ethiopia's energy access market is characterized by a large access gap in rural regions. **Of the 85 percent of the population that lives in rural areas, an estimated 2 percent had reliable access to electricity** (Table 3.1). By contrast, in urban areas, access is estimated at or near 100 percent. Most of the rural population has basic (Tier 0) lighting needs characterized by using expensive and high -emission fuels, such as kerosene. However, a growing number of rural households have access to solar lanterns, with estimates ranging as high as 2.4 million units sold (World Bank, 2017c).

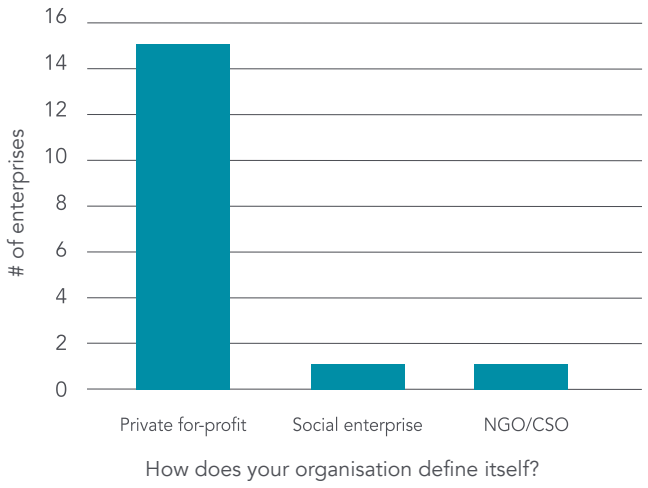
Regarding **cooking, an estimated 19.1 million households, representing approximately 97.4 million people, lack access to modern clean cooking**. A large majority is concentrated in rural areas. Such households still depend on solid biomass fuels and inefficient open fire cooking methods with an estimated energy efficiency of 10 percent or less. As of 2013, 4-5 million improved cookstoves were estimated to be in use. That has increased since, but at a gradual, rather than exponential pace.

In addition to the major development organizations active in the country—including the GIZ and the World Bank—enterprises are playing an important and growing role in providing energy access solutions. Indeed, private, for-profit players currently dominate the market and represent fully 88 percent of the enterprises interviewed. The combined capacity of the current private sector players,

however, is far below what is needed to fill the country's large energy access gap.

Approximately 40 enterprises (including private for-profit, social enterprises and non-profits) provide energy access services (Figure 3.1). That number is significantly lower than more advanced energy access markets, such as Kenya and Bangladesh, and the average size of the enterprises surveyed is markedly smaller. In other words, despite the large access gap in cooking and electricity, Ethiopia does not yet have the scale, the financial sector development, or the diversity of companies found in some of the other markets surveyed, reflecting an early stage of market development. This suggests a clear need for targeted support and policy intervention, including in sectors beyond energy access.

Figure 3.1 Enterprise types



A key market barrier cited by several enterprises surveyed is the presence of mandatory national quality standards that require local testing of every product by the Ethiopian Bureau of Standards. Though they emphasized the importance of quality in the market, the standard is difficult to meet because local manufacturing of quality-compliant products is virtually non-existent. Quality-compliant products are significantly more expensive (and therefore harder for rural residents to afford) and major barriers remain to the import of energy access products from abroad, specifically access to foreign exchange. These factors significantly limit the availability and affordability of energy access products.

The market is instead being served by a thriving informal sector that interviews suggest currently meets more than 60 percent of demand. The informal sector offers more competitive prices that make energy access affordable for a larger number of consumers. This, however, undercuts formal (including donor-backed) businesses that are otherwise trying (or obligated) to comply with the national quality standards. Also, the quality of products being sold in the informal sector—in rural and urban markets—is difficult to ascertain and is believed by some market players to be low. This increases the risk of product defects and shorter product lives, which can further erode trust in the sector and undermine sales. In turn, a lack of trust in solar lanterns and other energy access products serves to further entrench the reliance on kerosene and torches for lighting, as well as traditional cooking methods and stoves. These various challenges and trade-offs in the debate over the role of quality standards were particularly prominent in interviews conducted in Ethiopia.

The shortage of foreign exchange in Ethiopia is a major barrier. Low exports and a high reliance on imports, due to an absence of local manufacturing, more broadly have made foreign exchange scarce and the government has imposed heavy capital controls to restrict the use of foreign exchange. Enterprises, including those focusing on energy access, are not allowed to directly hold foreign exchange and it can only be bought on a case-by-case basis with approval from the government. Any foreign exchange owned abroad by an enterprise must be first converted to Ethiopian Birr by the bank through which money is being remitted before reaching an enterprise. Due to the shor-

tage, wait times to buy foreign exchange are between 8-10 months. Thus, energy access enterprises relying on imports have found it difficult to maintain supplies.

When it comes to electricity access, enterprises tend to focus on Tier 1 and Tier 2 products such as solar lanterns and small SHS, in part due to the comparatively low-income levels of rural customers. The World Bank estimates that average annual per capita income was $590 in 2015, well below the regional average (World Bank, 2017c). Critically, average income levels in rural areas are known to be not only significantly lower, but also more intermittent and highly seasonal (World Bank, 2017c). Of the enterprises interviewed, a greater number were focusing on solar lanterns versus SHS. A reason behind the relative popularity of solar lanterns is that they are small and highly portable; they can be purchased in one cash payment (and in virtually all cases are); and they can meet specific consumer basic needs flexibly, while saving customers money compared to alternatives.

A further barrier is the comparative absence of mobile money and the low percentage of the population that has access to a bank account. The most recent estimates put the percentage of citizens over 15 years of age that have a bank account at 21.8 percent nationwide and that figure drops to as little as 15.9 percent for citizens in the lowest two quintiles (lower 40 percent) of income (World Bank, 2017d). By contrast, for neighboring Kenya those figures are 55.2 percent and 36.3 percent, respectively, and the use of mobile money as an element of customer acquisition has been a driver of Tiers 1-2 access here. This suggests that the growth of energy access needs to be thought of in the context of the overall access to financial services.

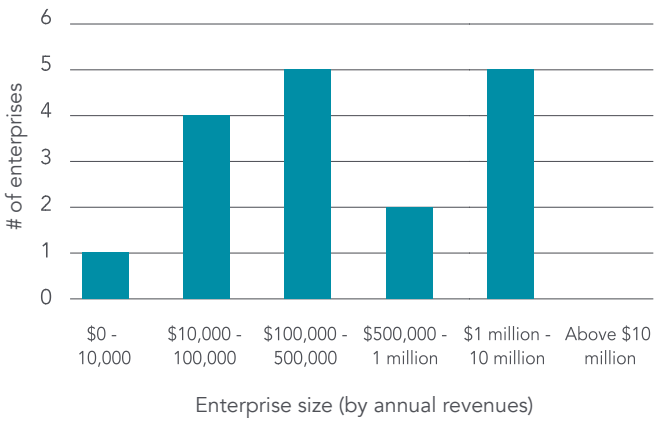
Mini-grids, as typically a Tier 3 or Tier 4 source of electricity supply, are yet to take off in Ethiopia. Several enterprises and financial institutions interviewed were of the view that the Ethiopian market is not yet "mini-grid ready". Population densities in rural areas are often too low and prospective customers' willingness to pay is limited by low and highly seasonal income levels. Thus, various market participants (including international companies looking at developing micro-grids in Ethiopia) are attempting to adapt business models to local realities around tariff levels, how systems are locally managed, a lack of local human capacity and willingness of consumers to pay for the electricity services that a mini-grid can provide. Additionally, a lack of area-specific grid extension plans creates uncertainty on the long-term viability of micro-grid systems, discouraging entrepreneurs and international and local companies from investing. Of the enterprises interviewed, only one is currently involved in setting up micro-grids and this remains on a pilot basis.

The clean cooking companies interviewed tend to focus on urban households as a primary market. Companies conveyed a low level of consumer awareness of clean cooking methods in rural areas and low incomes as a barrier to sales.

A large part of the economy is focused on agriculture and there are few secondary or tertiary sector business opportunities. Interviews indicated that private entrepreneurs from other industries are keen to explore the potential of a new and growing business sector such as energy access, including the cooking sector.

Of the enterprises interviewed, none had a turnover of greater than $10 million, suggesting an absence of very large industrial conglomerates in the market (Figure 3.2).

Figure 3.2 Enterprise size in terms of revenue derived from energy access



Each enterprise interviewed focused exclusively on Ethiopia, with no business presence in other markets. A quarter of the sample surveyed included companies between $1 to $10 million. Such companies typically have a broader energy and/or construction business, of which energy access is a small but growing part. Such companies stated that they are attracted to the sector because of its high demand and long-term growth potential. Their strong relationships with government and financial institutions, due to their broader business, makes it easier to secure more attractive terms on debt financing and gain access to foreign exchange, which is a barrier for smaller companies. Such players have a relatively strong retail presence that they can use to distribute their products, in addition to relying on third-party distributors.

More than half the sample includes enterprises with annual turnover between $10,000 to $500,000, which is evidence of a wide base of small companies and early-stage entrepreneurs that are entering the market. In contrast to Kenya and Nigeria, where revenues from energy access have demonstrated significant growth from 2013-14, growth in Ethiopia's energy access market is more subdued, with only one of the companies interviewed reporting a leap from one revenue bracket into another (e.g., $100,000 to $500,000 up to $500,000 to $1 million) during this period.

The mid-size players ($100,000 to $1 million) in the market differentiate themselves by building strong partnerships with local microfinance institutions to leverage consumer-financing options. Many have established partnerships with telecom retailers that have high last-mile reach, to build a deeper distribution network.

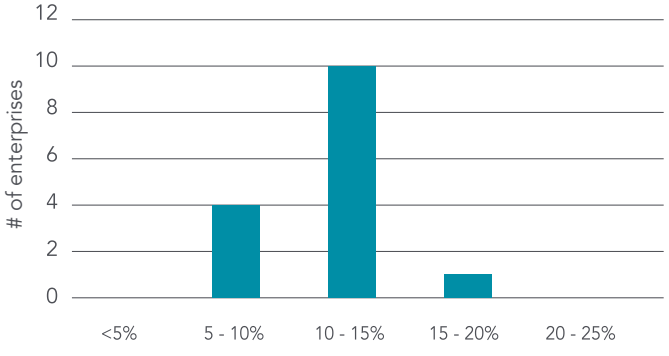
3.2. FINANCING ENERGY ACCESS

While debt financing is available in the market, it can be very difficult to access. The most significant barrier for enterprises is lenders' collateral requirements: banks have a blanket requirement for collateral worth 100 percent of the value of the commercial loan, applying across all sectors, including energy access. Most enterprises interviewed lacked the capacity to provide such collateral. Additionally, public-sector banks, such as the Development Bank of Ethiopia (DBE), value enterprises' assets at a third or lower than their market value. For the few enterprises that have the assets to back their loans, such an approach limits their ability to raise debt to a few rounds of financing for larger growth phases of their business. For almost all, accessing debt for working capital is nearly impossible and was cited as a major barrier to scaling-up.

By contrast, commercial banks value assets at market rates and enterprises have the option of borrowing from them. Enterprises can obtain a higher, market-based valuation for their assets at commercial banks for a bank guarantee that can then be presented to DBE as collateral. However, both approaches add a cost of approximately 4 percent on the debt as commercial banks charge this premium for loans directly with them, or charge it to issue a market-based asset valuation (renewed annually at that cost). This was cited as a significant barrier to the ability to raise debt.

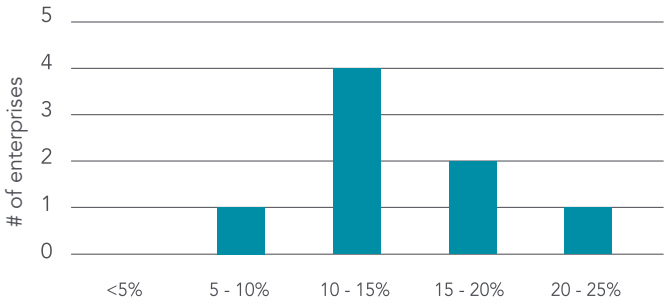
Interest rates for local currency commercial loans average around 15 percent (Figure 3.3). Some larger companies faced a strain on their margins at this rate, but mentioned it as tolerable. For smaller companies, this rate was considered unviable. Concessional loans at 12 percent are available from the DBE. This rate was believed to be tolerable for early-stage entrepreneurs and some smaller compa-

Figure 3.3 Tolerable cost of capital in local currency



nies in the market (Figure 3.4). Yet, at this rate, margins are low and enterprises expressed an inability to continue their businesses unless they can reduce costs elsewhere in the business to compensate.

Figure 3.4 Reported cost of capital in local currency (2015-16)



Enterprises typically have high overhead costs between 30-50 percent, which is a major strain on profitability. Customer acquisition costs are very high as customer awareness is still limited and rural customers are difficult to reach.

In addition, distribution channels are weak and often lack transparency. It is seldom clear how many customers are buying products through a distribution channel and at what price.

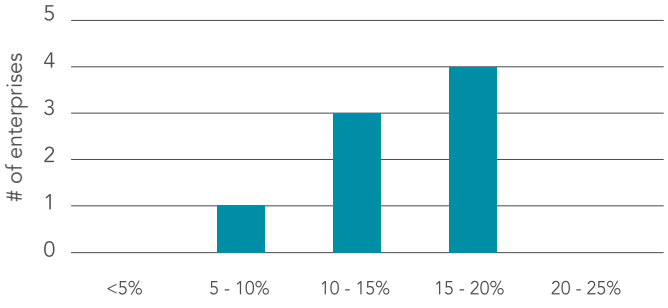
Cyclical cash flows are a major barrier for enterprises, in part due to seasonality. The peak time for businesses is the post-harvest period of January to April, when farmers have the spending capacity to buy energy access products. The remainder of the year, business suffers as residents in rural areas adjust their consumption habits to significantly reduced monthly incomes.

For smaller companies and start-ups, 8 percent interest would allow for a healthier, more sustainable margin. While this was previously offered by the DBE, as discussed above, this has been increased to 12 percent, which pushes capital costs well beyond the limit tolerable for most local enterprises (upwards of 16 percent). The lack of early-stage investment vehicles is a major barrier for electricity access and clean cooking enterprises.

The loan disbursement process—especially for concessional financing from DBE—is slow and largely opaque. A single loan request typically requires approval of several government institutions, including the Ministry of Water, Irrigation and Electricity; the Ethiopian Conformity Agency; Ethiopian Revenues and Customs Authority; and Ministry of Trade. Each institution adds a long and bureaucratic process of approvals, which can take weeks, if not months, for completion. Per the DBE, this is a key reason behind it taking three years to disburse a $20 million concessional financing facility sponsored by the World Bank.

Local enterprises conveyed a markedly higher tolerance for the cost of capital of foreign currency loans (Figure 3.5). The major shortage of foreign exchange in Ethiopia, which delays imports and requires lengthy approval processes, is the primary reason for this. Their willingness to pay more for foreign funds is an expression of the extent of the need of foreign currency and an important indicator of the severity of the crisis.

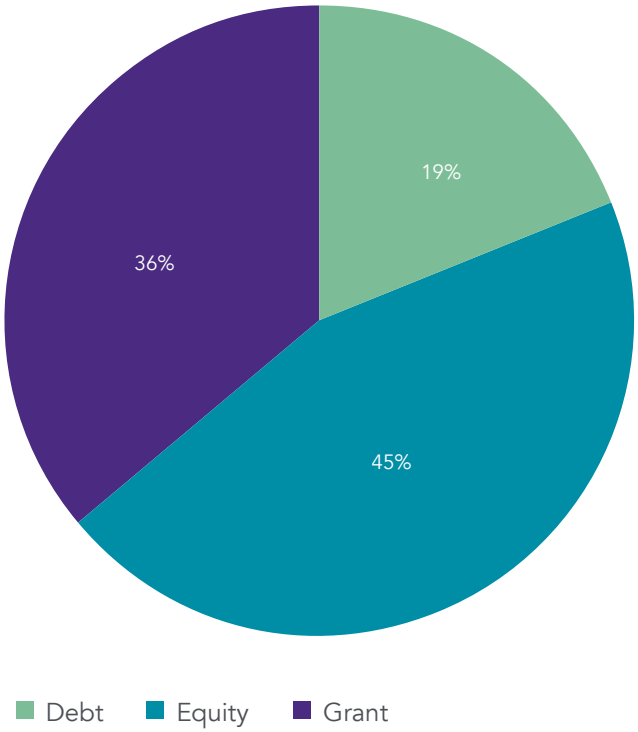
Figure 3.5 Tolerable cost of capital in international currencies



3.3. DEBT, EQUITY AND GRANT MIX

Equity is the single largest source of financing, forming 45 percent of enterprises' capital structure (Figure 3.6). None of the enterprises interviewed reported relying on equity from friends and relatives. Equity came almost exclusively in the form of corporate equity (or companies' own funds), while debt came primarily in the form of corporate debt. Indeed, over 40 percent of respondents relied upon corporate debt in 2015-16, with a further 15-20 percent deriving part of their financing from project debt. Most of the debt came either as a loan from a local commercial bank or development finance institution.

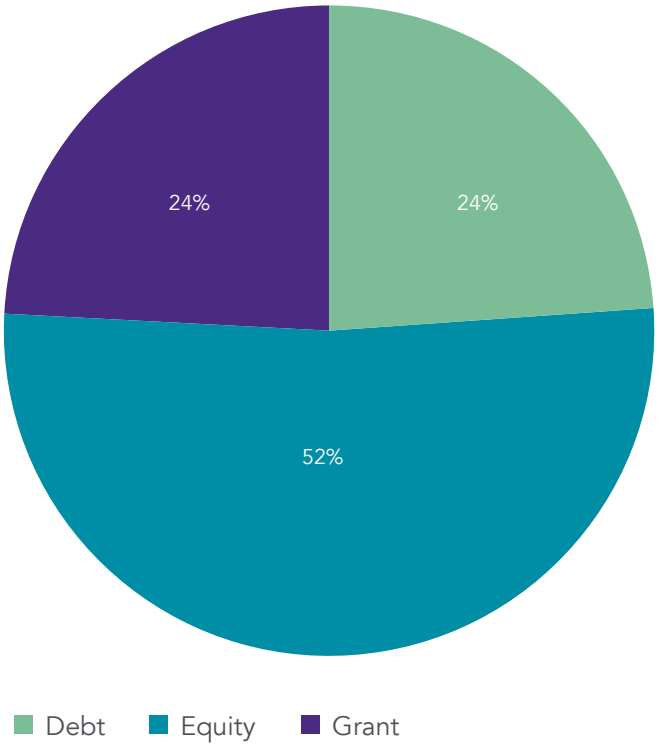
Figure 3.6 D:E:G ratio across all enterprises surveyed (%, weighted average by revenues)



Grants—which are the other key source of financing (36 percent)—are widely available and currently preferred to debt. However, enterprises view grants as a source of early-stage financing and recognize that the availability of such funds is limited. They also noted that grant financing comes with onerous reporting and compliance requirements that place an unsustainable cost in terms of time and manpower on them as their businesses grow. Most enterprises reported being keen to shift to debt to further scale their businesses, with 82 percent of respondents believing that their reliance on debt would grow.

For the solar enterprises interviewed, financing is primarily equity based (Figure 3.7). This sector is highly entrepreneurial and businesses are predominantly financed by entrepreneurs' own funds and the reinvestment of corporate earnings into the business. It is also the segment where most larger enterprises of $1 to $10 million in annual turnover are focused.

Figure 3.7 D:E:G ratio for enterprises active in the electricity sector (%) (weighted average by revenues)



Concessional debt financing from the DBE has been a major financing source for solar electricity access enterprises. The financing facility has been available for companies selling certified products. Most financing has been used for solar lanterns that are Lighting Global approved. SHS have accounted for a smaller share of the financing.

Consumer financing—driven by microfinance institutions (MFIs)—plays an important role in the market, given that rural consumers with low cash on hand are the primary buyers of electricity access products. The DBE has earmarked such funds, which it lends to MFIs rather than end-consumers. MFIs then on-lend these funds to consumers.

The number of MFIs involved in consumer financing has increased from five to nine in the last three years. This is largely because of a strong business case for MFIs, where the DBE provides loans to them at 6 percent interest, which they on-lend to consumers at a rate ranging from 15 to 20 percent. DBE mentioned that the absorption capacity of the private sector and MFIs has increased significantly and the disbursement rate will likely improve in the next year. DBE recently approved the disbursement of a new ETB 155 million ($6.68 million) to 14 MFIs to use exclusively for energy access consumer financing. It is envisioned that more than 60 percent of this will go to solar electricity products, with the majority going to SHS.

A significant barrier for electricity access enterprises is a lack of policy clarity (Figure 3.8). For example, a lack of clarity around the power output benchmarks used to categorize solar products as either solar appliances or SHS. Development finance institutions typically use these categories to differentiate and allocate funding between, for example, smaller solar lanterns and larger SHS. In the absence of clarity on these categories, enterprises have little information on whether their products qualify for financing.

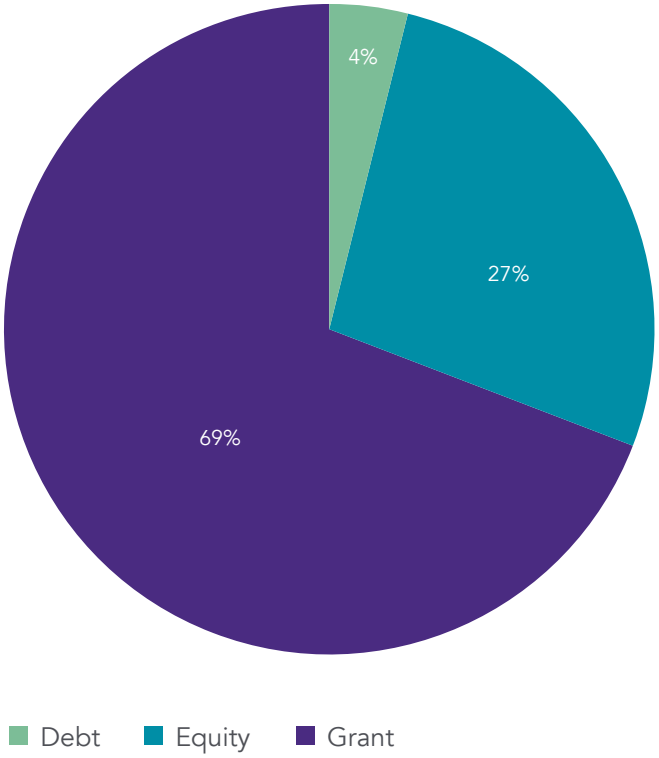
Another challenge is uncertainty around the government's grid extension plans. This is more so a challenge for mini-grids, but SHS enterprises are also concerned about the viability of their business models in the advent of the grid.

Figure 3.8 Barriers to obtaining finance for electricity access enterprises

3.4. CLEAN COOKING MARKET

Grant financing plays a major role in driving the clean cooking segment (Figure 3.9). GIZ, which is the largest ac-

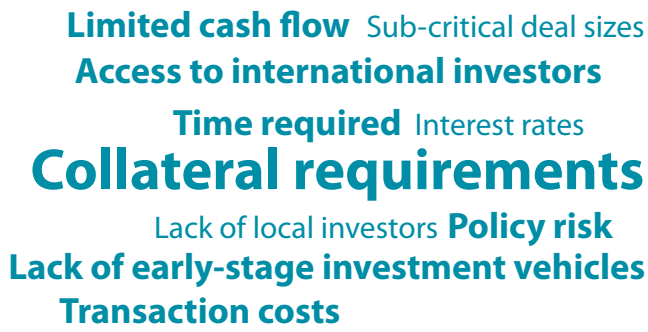
Figure 3.9 D:E:G ratio for enterprises active in the cooking sector (%, weighted average by revenues)



tor among enterprises surveyed, is entirely grant-based and significantly influences the entire sector's reported capital structure.

Several smaller clean cooking enterprises are present but face challenges to scale. Low margins and small volumes make profitability difficult. High overhead costs due to the labor for manufacturing is an additional strain. Enterprises have had little room to generate enough equity to reinvest in their business and grow, and have struggled to raise debt. They are often too small and lack the asset base necessary to offer collateral for commercial loans (Figure 3.10).

Figure 3.10 Barriers to obtaining finance for clean cooking



It is more common for enterprises to access debt financing from MFIs rather than commercial banks. This is because the clean cookstove market is based largely on community-level engagement for product sales, which is the level at which MFIs lend to farmers and small village businesses. The cookstove business model is therefore a good fit for MFIs and the two have a strong relationship in the market.

Clean cooking products are largely sold by pure-play enterprises that specialize in them. For enterprises that sell them as part of a broader energy access business that includes electricity products, clean cooking typically makes up less than 30-40 percent of the business. Households are the major market segment (50 percent) for clean cookstoves, with the remainder consisting of SMEs and industrial customers. Enterprises typically work together with regional government organizations and MFIs to distribute clean cookstoves to urban and rural communities. Regional government organizations facilitate agreements with MFIs to make consumer financing available for households.

Improved cookstoves are almost entirely manufactured locally, except for electric and gas stoves, most of which are imported. Without the need for imports, the shortage of foreign exchange is less of a barrier for such enterprises. On the other hand, enterprises have high capital requirements due to the upfront costs of setting up manufacturing.

3.5. FUTURE SCENARIOS

For the electricity access sector, the breakdown of the share of new connections provided across the different Tiers of service is based on the SEforALL's 2015 Finance Committee Report (SEforALL, 2015), while the cooking sector breakdowns are based on the targets published by the Ministry of Water, Irrigation and Energy (MOWIE) in Ethiopia (MOWIE, 2011).

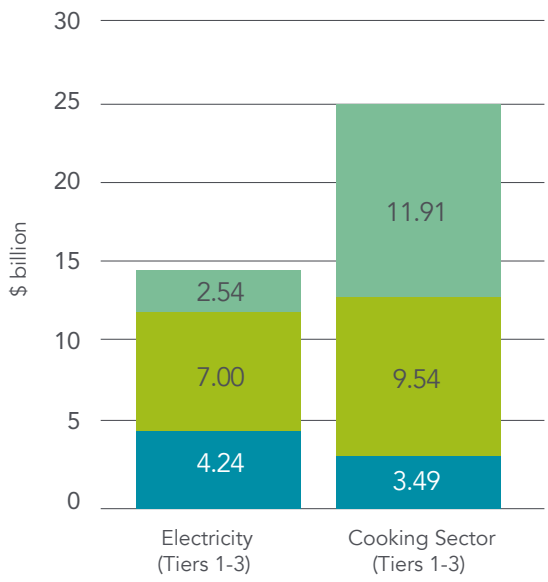
Table 3.2 provides an overview of country-specific assumptions used for Ethiopia.

Table 3.2 Key scenario inputs for Ethiopia

Key scenario inputs		
Current D:E:G for Tiers 1-3 of the electricity sector (2015-16)	24 : 52 : 24 Debt: Equity: Grant	
Current D:E:G for the clean cooking sector (2015-16)	4 : 27 : 69 Debt: Equity: Grant	
Enterprise overhead ratio (multiplier to the capital cost of energy access technologies)	1.33	
Overhead ratio multiplier assumed for the clean cooking sector	1.2	
Overhead ratio multiplier assumed for Tiers 4 and 5	1.2	
Estimated D:E:G ratio for Tiers 1-3 of the electricity sector by 2030	35 : 50 : 15 Debt: Equity: Grant	
Estimated D:E:G ratio for Tiers 1-5 of the clean cooking sector by 2030	20 : 45 : 35 Debt: Equity: Grant	
Tier breakdown based on the SEforALL Finance Committee Report, 2015 (percent of all new electricity access connections)	Tier 1	5
	Tier 2	20
	Tier 3	15
	Tier 4	20
	Tier 5	40
Breakdown by fuel type based on Ethiopia's targets (percent of all new clean cooking connections)	ICS wood	33
	ICS charcoal	33
	LPG	4
	Electric	28
	Ethanol/ methanol	0
	Biogas	2

Figure 3.11 provides an estimate of the total costs of meeting Tiers 1 – 3 electricity and clean cooking targets, including both fuel and technology costs, broken into D:E:G shares.

Figure 3.11 Total finance needed to meet Tiers 1 – 3 of Ethiopia's SEforALL targets by 2030



Total finance need for Tiers 1-3 electricity: $13.78 billion
Total finance need for Tiers 1-3 cooking: $24.96 billion

Grant Equity Debt

Figure 3.12 provides an annual breakdown of the costs for the electricity access sector.

Figure 3.12 Estimated annual finance need to achieve Ethiopia's SEforALL action agenda electricity targets for Tiers 1 – 3 by 2030, broken down into debt, equity, and grant shares

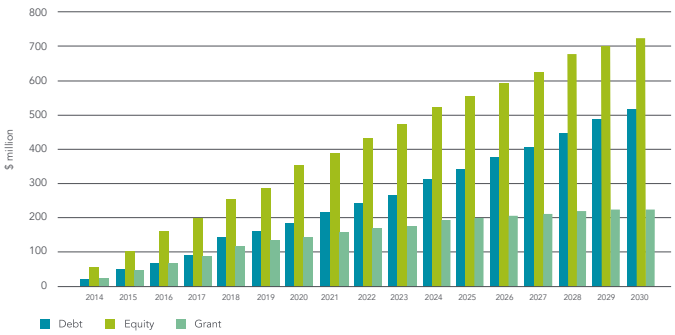


Figure 3.13 provides an overview of the estimated total spending entailed, including both the cost of the stove as well as well as the cost of the fuel supply to meet Ethiopia's national cooking sector targets.

Figure 3.13 Estimated cost breakdown of meeting universal access to clean cooking in Ethiopia

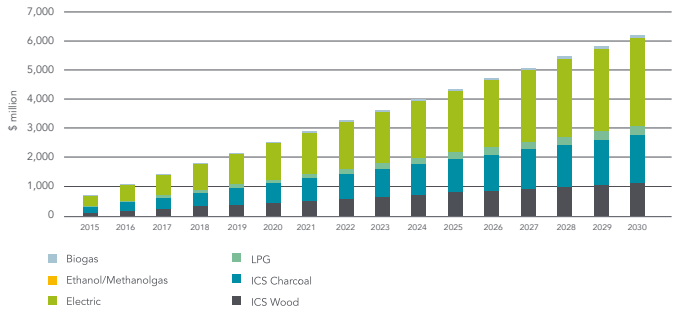
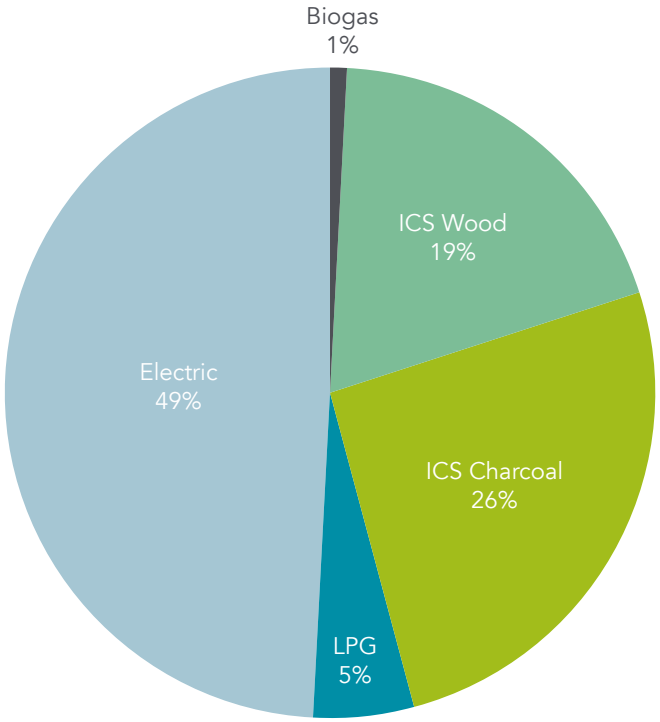


Figure 3.14 summarizes the breakdown of the clean cooking costs by fuel/technology type.

Figure 3.14 Estimated cost breakdown of meeting national clean cooking targets, by fuel types



3.6. CONCLUDING REMARKS

Although enterprises are stepping up to provide energy access in a commercially viable and scalable manner in Ethiopia, they face significant barriers to growth. The design and enforcement of quality standards appears to be more of a market bottleneck than a support for better en-

ergy access. The lack of foreign exchange, if continued, will likely hinder access to imported products, stifling supply and increasing costs for end-users. Greater availability of foreign exchange would make it easier for enterprises to meet quality standards by enabling certified imports; however, the affordability of these products vis-à-vis uncertified products remains an open question.

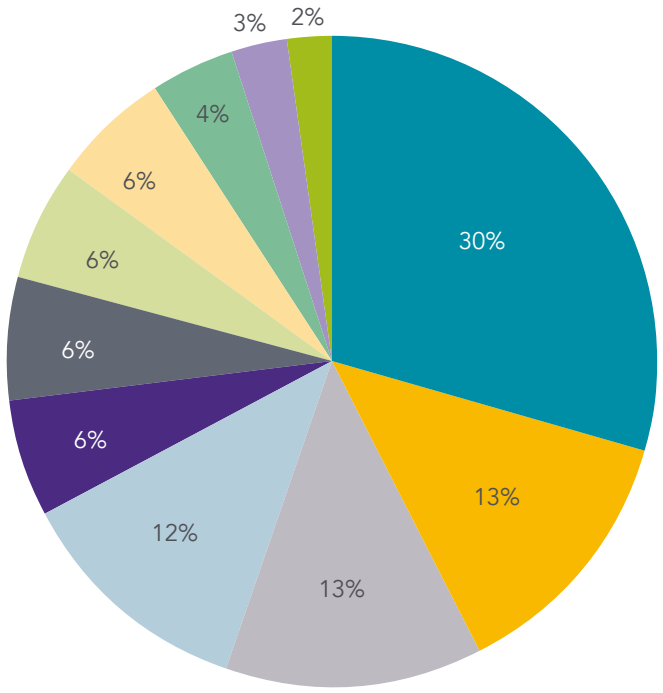
Enterprises' priorities for greater financing are focused on finding ways to improve and stabilize cash flows, particularly considering the significant seasonal fluctuations in sales volumes. Finding better ways to help companies weather seasonal ups and downs—either through improved credit facilities, better access to loans, or diversification into other products—is critical to helping enterprises meet Ethiopia's ambitious energy access goals.

When asked to consider how $100 million of development funds to accelerate energy access could be deployed across a range of program design elements, enterprises prioritized greater access to working capital. (Figure 3.15). This reiterates the underlying financing barrier of high collateral requirements by banks that make it difficult for enterprises to raise debt for operational expenditures beyond what they might use for larger, growth-oriented investments.

Greater funding for end-user or consumer finance is also desired, acknowledging its importance in unlocking larger groups of customers needed to grow businesses.

The need for funding for inventory or asset purchases is greater than other options. This suggests that enterprises are reaching a limit on their ability to use collateral to raise debt for larger asset investments. Furthermore, several electricity access enterprises expressed the goal of starting local manufacturing. This is partly because they hope to improve margins through vertical integration and partly to circumvent the supply constraints due to foreign exchange restrictions. Only a few enterprises have the technical know-how and financial strength to launch manufacturing. Most, however, recognize that new manufacturing is bound to take off and will require funding for new asset purchases.

Figure 3.15 How would you allocate $100 million to support energy access in your country (ranked)?



- Access to working capital
- End-user finance
- Others
- Asset purchases
- Establishing and enforcing quality standards
- Early stage, proof of concept funding products
- Consumer awareness and education
- Finance products that facilitate access to local capital markets
- Development of supportive policy and r egulatory environments
- Training for local financial institutions
- Technical and managerial capacity/skills development

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4.NIGERIA COUNTRY PROFILE

Table 4.1 Key statistics for Nigeria

Key statistics	
Population (2014)	182.2 million (World Bank 2017b)
Number of households (2014)	40.5 million (World Bank 2017b, ArcGIS 2016b)
Number of inhabitants per household	4.5 (ArcGIS 2016b)
Population in 2030	262.6 million (World Bank 2017b)
Access to electricity (2014)	57.65% (IEA and World Bank, 2017)
Access to clean cooking fuels and technologies (2014)	2.3% (IEA and World Bank, 2017)
Access target by 2030 (electricity)	90% (Government Target)
Access target by 2030 (cooking)	80% (Government Target)

4.1. INTRODUCTION

Nigeria is Africa's largest economy and most populous nation. Its energy situation is one of the most challenging in the continent, with a huge deficit in production and demand, a rapidly growing population and significant disparities in energy access between urban, rural and remote areas. Nigeria has the largest absolute energy access gap in electricity (35 million households after population growth) and clean cooking (57 million households after population growth) of the countries surveyed.

In 2013, Nigeria privatized its electricity market and divided the country's electricity system into 37 territories, each with its own Distributed Energy Services Company (DESCO).

These DESCOs are facing financial problems, which is resulting in a worsening of the electricity supply they offer, meaning longer and more frequent power outages. One DESCO has recently declared bankruptcy and there are said to be at least three others facing severe financial problems.

This picture is underpinned by the poor performance of the Nigerian economy over the past two years, where the recession has been hard and all sectors of the economy have been suffering.

A key reason for this recession has been the falling prices of oil and the subsequent crash of the Naira, particularly against the US dollar. For years, the rate stood at around 200 Naira/USD and then in a sudden drop in June 2016, it depreciated to around 280 Naira/USD and continued to slide until stabilizing around 315 Naira/USD in the first

half of 2017, where it has stood since. With so much of the equipment used in energy access projects coming from overseas—from solar panels, inverters and batteries, to many of the clean cook stoves—the cost of local energy products has more than doubled in price in just over one year. Combined with citizens' reduced purchasing power, on-going governance challenges and deepening economic uncertainty, the energy access sector is undergoing a difficult phase.

The unreliability of the power supply that households, community institutions and businesses face daily has resulted in most of the market focusing on "genset displacement" rather than reaching those without any electricity. This, coupled with security risks in certain areas, has meant that only a few enterprises focus on rural and remote energy access. Most enterprises target opportunities to improve the quality of access in urban and peri-urban areas, rather than pushing deeper into northern and eastern regions.

There is an almost total absence of mobile money. The banking sector has argued before regulators that mobile money should be considered part of the financial services sector and be limited to regulated financial institutions. They argue that they face strict banking regulations and allowing mobile companies or other mobile money providers to operate outside regulations would be unfair. They have expressed concerns about allowing the large mobile companies to gain a huge percentage of the market via mobile money, a development they argue could put the traditional, regulated banking business in jeopardy.

Incumbent banks are in effect responsible for providing banking services and rolling out mobile money across the country. This contrasts with Kenya, where Safaricom and M-PESA were widely seen to have helped accelerate innovation and significantly improve customer access to banking services, and thus energy access in rural and remote areas.

In Nigeria, the share of the population using mobile money to pay bills remains small. The Nigerian Communications Commission (NCC) estimates that despite 90 million unique mobile phone subscribers, mobile money penetration stands at 1 percent. There are plans to improve this through telecom-backed services—rather than bank-backed services— but progress remains slow. For an economy that is otherwise highly dynamic and entrepreneurial, the restrictions imposed on the mobile money sector may stifle growth of the energy access sector, particularly where there are fewer banks.

Consumer finance and mobile money for energy access remain rare. Some companies in the SHS market are extending credit to clients with contract sizes between $1,000 - $2,000, much as PAYGO companies are in other parts of Africa. But doing so at scale is proving difficult, particularly due to the lack of working capital and businesses' overall sensitivity to non-performing loans due to the limited market size.

The only major player in energy access that has been able to use mobile banking has been Lumos. They partnered with MTN, the telecom provider, to facilitate mobile payments. However, unlike true mobile banking, payments are made with airtime rather than converting airtime to mobile money. It was observed that this lack of mobile money penetration has hindered market growth by making it much harder to provide cost-effective and timely services in rural areas, due to the difficulties in tracking and securing loan repayments.

Until the numbers of people signed on to mobile money increases, it will remain very hard to serve this segment of the population in a cost-effective manner. This suggests that under the current banking industry rules, finding ways to get the regulated banks on board in providing consumer finance for energy access products and services will be critical to scaling up the market.

Many respondents felt that growth in the sector is likely to remain patchy and that innovation and overall penetration levels will continue to trail other markets across the region. This notwithstanding, the number of Nigerians above 15 years of age that have a bank account is markedly higher

than other countries in West Africa at over 44 percent, with almost 34 percent of the low-income population (represented as those in the bottom two quintiles, or bottom 40 percent, of income) having an account at a registered financial institution.

The primary international donor projects have been funded by DFID (Solar Nigeria programme) and GIZ, which is funding a mini-grid expansion program. USAID is active in supporting the government with policy and capacity.

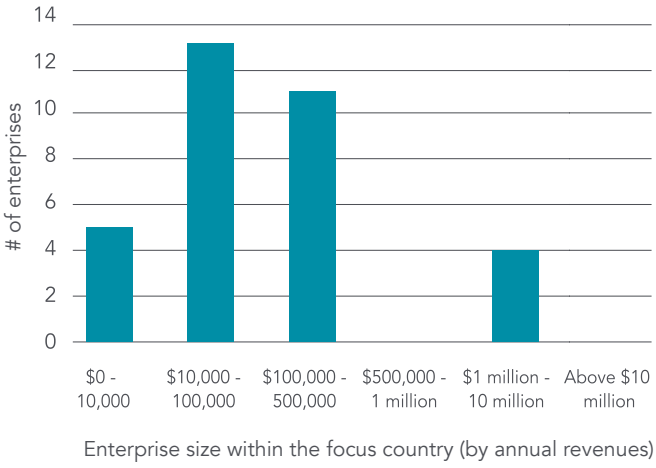
A recent achievement of this aid has been the adoption of a new mini-grid strategy in 2016, which has improved investment prospects through clarity on the regulatory process. The Solar Nigeria project mainly supports companies providing off-grid solar lanterns and home systems.

Figure 4.1 provides an overview of the number and types of organizations interviewed.

Figure 4.1 Enterprise types

Of the 33 enterprises surveyed, the majority (73 percent) had revenues from energy access (cooking and electricity) of between $10,000 and $500,000 in 2015-16 (Figure 4.2). Sales in Nigeria remained broadly flat between 2013-14 and 2015-16. This is likely attributable to the economic recession, which began in 2014 and was compounded by a significant currency crisis, making it difficult for many developers and distributors in the off-grid market to source

Figure 4.2 Enterprise size in terms of revenue derived from energy access



funds to purchase inventory and expand business.

4.2. FINANCING ENERGY ACCESS

Raising finance was considered a major challenge for virtually all Nigerian companies interviewed. The enterprises had very little success in sourcing finance from local financial institutions or local investors. With few exceptions—such as the emerging PAYGO players—many respondents found that raising finance internationally was not an option either, due to the highly volatile nature of the country's foreign exchange rate. Most enterprises were relying on corporate equity (mainly in the form of operating profits being plowed back into the company) as the main source of finance. Of the 26 enterprises that agreed to answer questions on how the company was financed, over 80 percent were relying on corporate equity for part or all of their financing. Only two companies reported having drawn on equity from friends or relatives over 2013-16 and for a fairly small share of total financing needs (7 percent and 10 percent respectively).

Equity represented 70 percent of the finance used by energy access companies. However, the heavy reliance on equity and the company's own funds was felt to li-

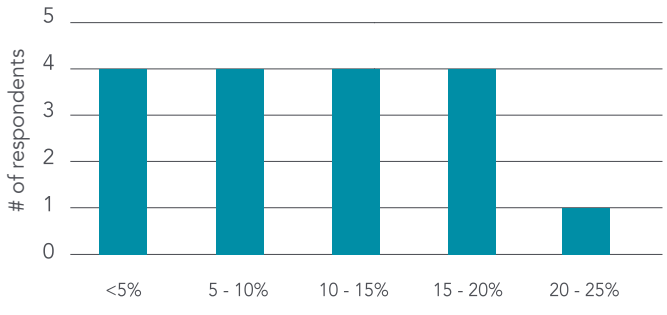
mit growth prospects significantly. Many companies expressed a desire for easier, faster access to finance to scale businesses, but frequently encountered roadblocks in the form of high collateral requirements or, in the case of women entrepreneurs, an inability to own land, which often acts as a business owners' primary collateral to back small business loans.

The only local finance institution frequently cited by respondents was the Bank of Industry (BoI). They have a local currency debt facility offering loans to local companies for a rate between 5-8 percent. However, respondents noted that the facility was hard to access and, despite its purpose to support SMEs, collateral and other requiremens meant that it was generally perceived as only appropriate for larger, more established companies.

Several respondents noted there had been very little international investment and that accessing international finance in general remained difficult. Most companies attributed this to investors' fear of entering the Nigeria market due to its complexity, poor governance, corruption and fluctuating forex rates. Some respondents reported that, in recent months, international investors were beginning to look at the Nigerian market again and starting to invest in local companies to gain knowledge and establish a presence in the large and rapidly growing country.

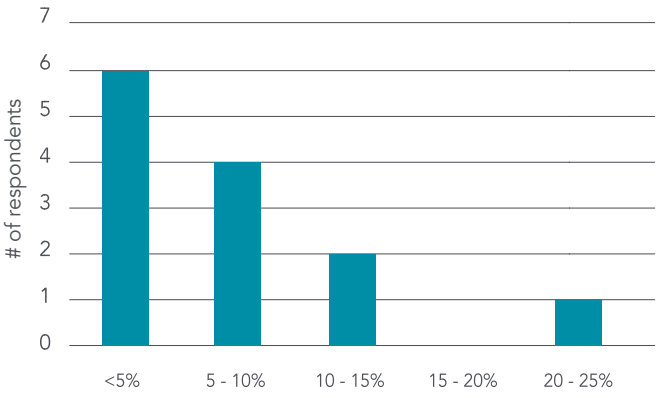
Enterprises reported a fairly wide cost of capital, ranging from less that 5 percent to 25 percent (Figure 4.3).

Figure 4.3 Reported cost of capital in local currencies



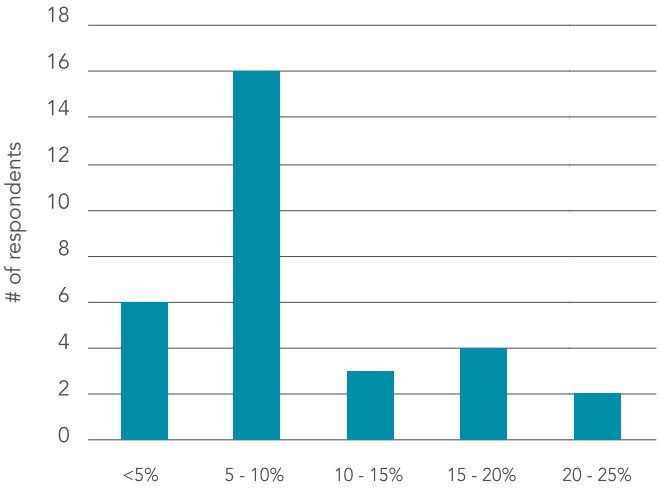
Ten companies reportedly obtained some share of financing from international sources for under 10 percent in 2015-16, and only a few reported a higher cost (Figure 4.4).

Figure 4.4 Reported cost of capital in international currencies



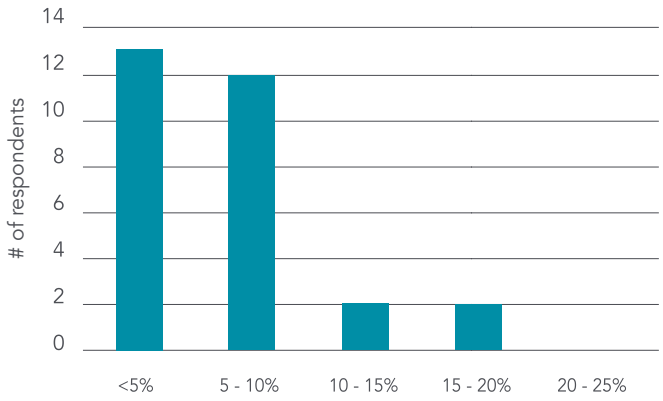
Regarding the tolerable cost of capital in local currencies, enterprises surveyed indicated a wide spectrum of views (Figure 4.5).

Figure 4.5 Tolerable cost of capital in local currencies



Most respondents (86 percent) claimed that their tolerable cost of capital for international finance (whether debt or equity) was under 10 percent (Figure 4.6).

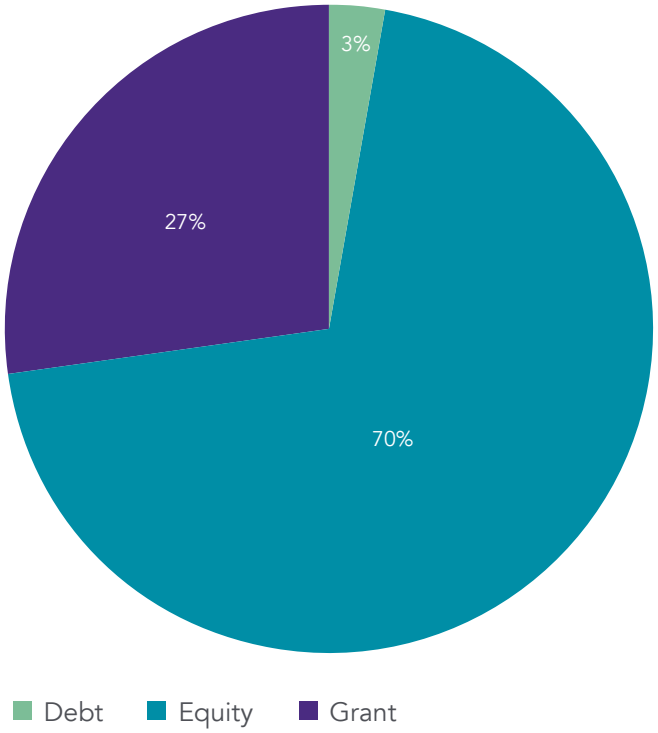
Figure 4.6 Tolerable cost of capital in international currencies



4.3. DEBT, EQUITY AND GRANT MIX

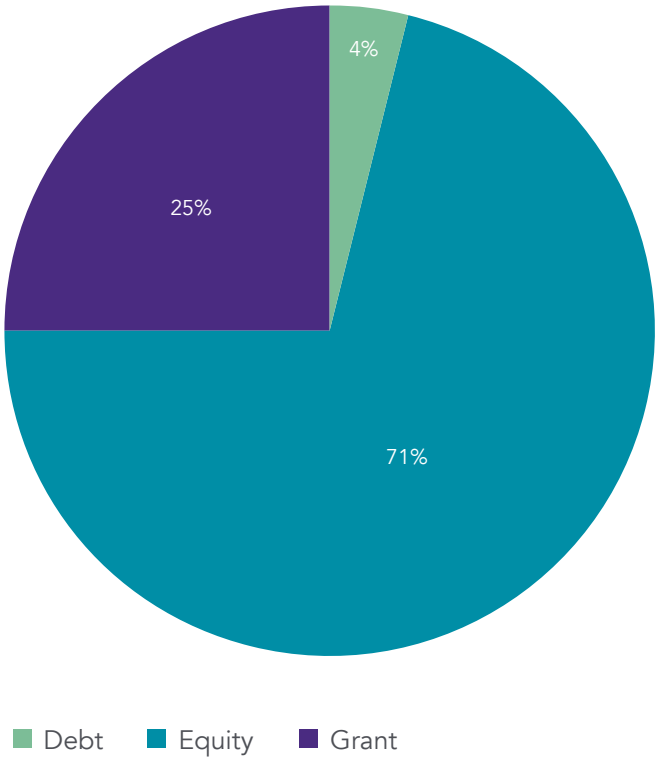
Figure 4.7 provides an overview of the enterprise capital structure for the electricity access sector as a whole.

Figure 4.7 D:E:G ratio for enterprises active in the electricity access sector (%, weighted average by revenues)



The breakdown between debt, equity and grants for the solar sector (including lanterns and SHS) mirrored that of the energy access as a whole (Figure 4.8).

Figure 4.8 D:E:G ratio for enterprises active in the solar sector (lanterns and SHS) (%, weighted average by revenues)



Debt financing for Nigerian companies is almost non-existent. And yet, despite being unable to obtain debt, over half of respondents planned to increase their reliance on debt. Like Kenya, most enterprises are heavily equity-financed; but in contrast to Kenya, they appear to have fewer avenues available to securing financing: crowd-funding does not seem to be playing a major role in the energy access sector; local banks are focusing elsewhere; and international investors are largely taking a wait-and-see approach until currency, economic and political risks dissipate further.

When debt financing was accessed, the most common type was project finance, used for working capital be-

cause most local financing was priced in the range of 25-35 percent per annum interest and companies were limiting exposure to debt by restricting their loan period to when the money was needed for a specific purpose. There was no recorded use of local corporate debt to fund expansion.

One respondent, who had a prior background in financial markets, was in the process of concluding a deal with US investors to provide international lending at a more affordable level, but this was an exception. The deal was specifically building in safeguards against foreign exchange fluctuation, though few details were public at the time of the interview.

Otherwise, investors in the Nigerian electricity access market were hard to find. A new funding mechanism called All-ON, established and backed by Royal Dutch Shell Inc., has recently been set up (All-On, 2016). This is designed mainly to support bankable projects and companies to expand their energy access vision. The facility mainly focuses on the development and expansion of existing businesses.

There was no noticeable difference in the barriers for obtaining finance between cooking and electricity. All respondents ranked banks' high collateral requirements, interest rates and foreign exchange risk among the top concerns (Figures 4.9 and 4.11).

In the mini-grid sector, a project managed by GIZ selected five local companies to implement projects. This contrasts with the situation in Kenya, where the government's Green mini-grid facility had selected exclusively internationally based companies under a comparable program.

Respondents in mini-grid and other solar sectors explained that, despite having successfully courted international investors in the past, they continued to find it difficult to do so under current circumstances.

Figure 4.9 Barriers to obtaining finance for electricity access entreprises

4.4. CLEAN COOKING MARKET

The overall Debt:Equity:Grant ratios in the cooking sector are quite similar to those in the electricity access sector, with the small exception that none of the cooking sector players interviewed had successfully obtained debt (Figure 4.10).

Figure 4.10 D:E:G ratio for enterprises active in the cookstoves sector (wood and charcoal) (%, weighted average by revenues)

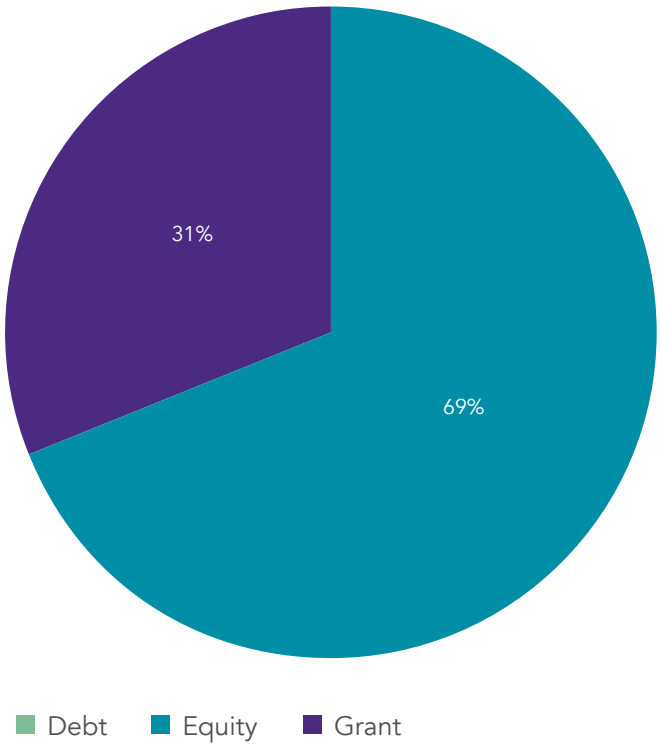


Figure 4.11 Barriers to obtaining for clean cooking interprises

Over 70 percent of Nigerians use wood as their main cooking fuel. This has contributed to extensive deforestation. Women and children in some areas are traveling up to five hours a day to collect fuel, limiting time for study or income-generating activities.

The clean cooking market has not been a priority focus for the government and key local players. A recent initiative to distribute 500,000 cookstoves through a government-funded program resulted in the delivery of less than 10 percent of these stoves.

There have been some positive developments: in January 2017, a new initiative was launched by the Global Alliance for Clean Cookstoves (GACC) in Nigeria to provide "catalytic small grants" to the clean cooking sector of $110,000, disbursed in three payments over a one-year period. The grants are being issued to short-listed companies to scale-up clean cook stoves. While the amounts of the grants remain small and won't support the scale and sustainable growth of the sector, they are important to jump-start activities in a country with such a sizable need.

There has been some development of the LPG and biogas markets and several different cooking technologies and fuels were identified in interviews, including solar cookers, methanol and ethanol gels. The development of a new bioethanol cookstove market is also underway. Two local actors are rolling out new stoves; one has recently started manufacturing stoves locally and is seeking investment for a local fuel production center as its fuel is currently sourced in South Africa.

Despite these positive signs, the cooking sector needs greater investment and targeted interventions to scale-up improved cookstove adoption and commence market development of cleaner fuels and technologies.

4.5. FUTURE SCENARIOS

Table 4.2 provides an overview of the country assumptions used to model future finance scenarios for Nigeria.

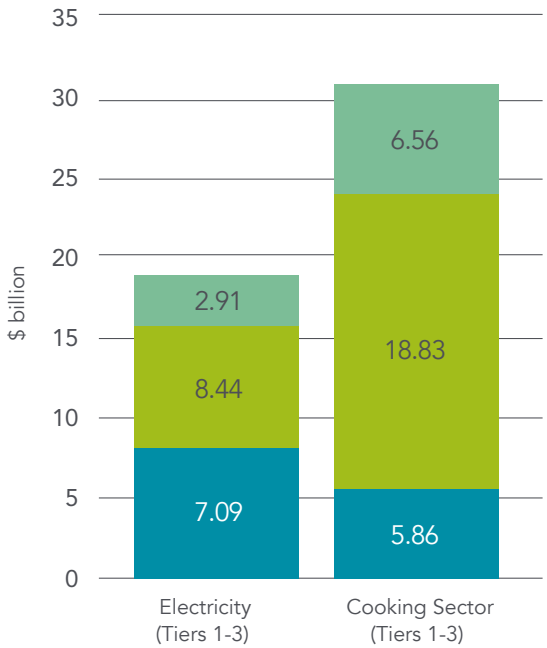
Table 4.2 Key scenario inputs for Nigeria

Key scenario inputs		
Current D:E:G for Tiers 1-3 of the electricity sector (2015-16)	4 : 71 : 25 Debt: Equity: Grant	
Current D:E:G for the clean cooking sector (2015-16)	0 : 69 : 31 Debt: Equity: Grant	
Enterprise overhead ratio (multiplier to the capital cost of energy access technologies)	1.33	
Overhead ratio multiplier assumed for the clean cooking sector	1.2	
Overhead ratio multiplier assumed for Tiers 4 and 5	1.2	
Estimated D:E:G ratio for Tiers 1-3 of the electricity sector by 2030	60 : 30 : 10 Debt: Equity: Grant	
Estimated D:E:G ratio for Tiers 1-5 of the clean cooking sector by 2030	30 : 55 : 15 Debt: Equity: Grant	
Tier breakdown based on the SEforALL Finance Committee Report, 2015 (percent of all new electricity access connections)	Tier 1	5
	Tier 2	20
	Tier 3	15
	Tier 4	20
	Tier 5	40

Key scenario inputs		
Breakdown by fuel type based on Nigeria's targets (percent of all new clean cooking connections)	ICS wood	30
	ICS charcoal	20
	LPG	20
	Electric	20
	Ethanol/ methanol	6
	Biogas	4

Figure 4.12 provides an indicative overview of the total costs of meeting Tiers 1 – 3 of Nigeria's electricity and clean cooking targets.

Figure 4.12 Total finance needed to meet Tiers 1-3 of Nigeria's electricity and clean cooking targets by 2030



Total finance need for Tiers 1-3 electricity: $18.44 billion
Total finance need for Tiers 1-3 cooking: $31.26 billion

Figure 4.13 provides an overview of the annual finance need to reach the national electricity access target of 90 percent, focusing specifically on the costs for Tiers 1 - 3.

Figure 4.13 Estimated annual finance needed to meet Nigeria's electricity access targets for Tiers 1 – 3 by 2030, broken down into debt, equity, and grant shares

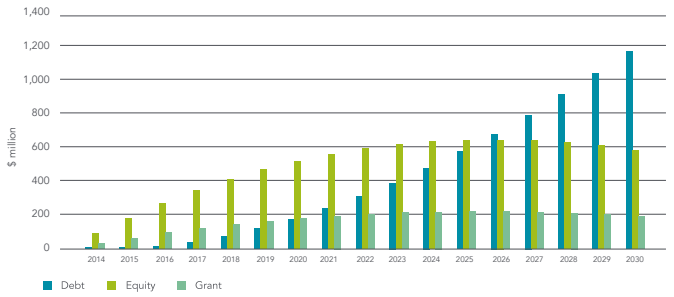
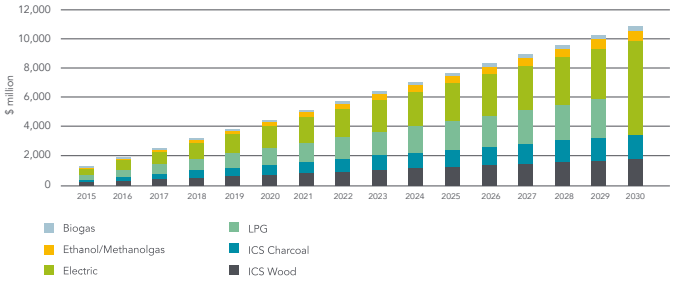


Figure 4.14 provides an estimate of the total amount needed to achieve Nigeria's clean cooking targets, including the cost of stoves and the fuel supply.

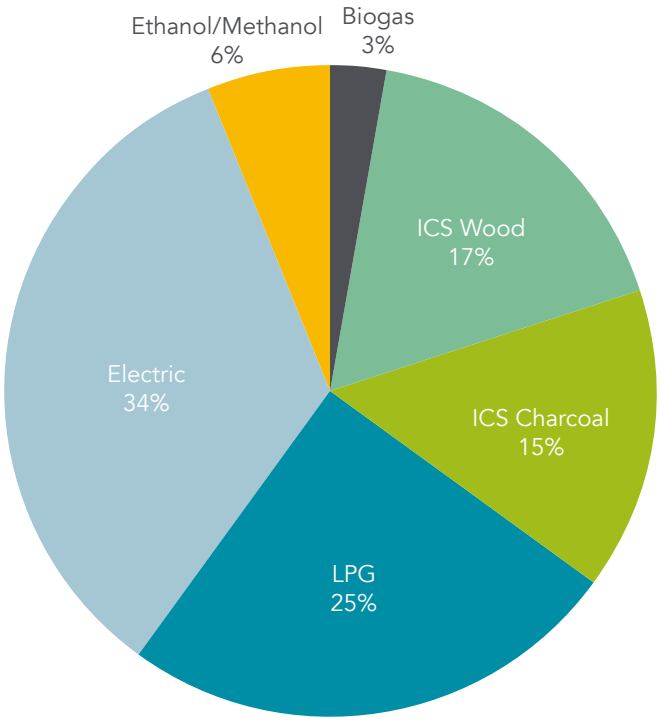
Figure 4.14 Cost breakdown of meeting Nigeria's national clean cooking targets



The cooking mix in Nigeria has not yet been officially forecast by the government. Thus, interviews were conducted with local stakeholders and experts—including the GACC offices in Nigeria—to arrive at basic estimates of the future fuel mix for the cooking sector. However, the shares for the future cooking mix and the cost of achieving clean cooking targets remain indicative estimates.

Figure 4.15 analyzes the cost breakdown of achieving the cooking targets by fuel/technology type.

Figure 4.15 Estimated cost breakdown of meeting national clean cooking targets



4.6. CONCLUDING REMARKS

The Nigerian market for energy access needs greater attention nationally. In the absence of this, the private sector has focused on the middle- to higher-income households looking for an affordable and reliable back-up to the grid. To make deeper inroads into rural and remote regions, particularly in the cooking sector, more grant investment and targeted policy support is required.

Currency risk remains a top concern of virtually all market actors and better solutions are needed to support the mobilization of local currency financing or better-hedged international financing. Some currency risk mitigation instruments are being deployed, but in many cases are considered too expensive or only suitable for larger ticket sizes and/or international DFIs. More targeted support for companies with large working capital requirements—such as better lines of credit or access to working capital facilities—and improved access to foreign exchange could help companies better weather future economic or currency-related shocks.

Some women entrepreneurs in Nigeria, which represent a significant share of all executives interviewed, pointed to the inability of women to own land—which is often necessary to post collateral—as a major barrier to them growing their businesses.

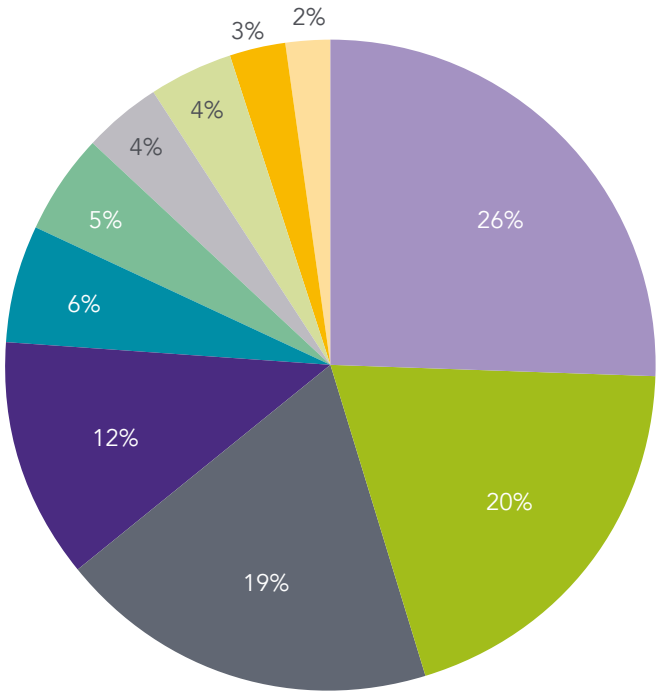
Despite recent new mini-grid regulations, several concerns remain over the central role played by DESCOs and the poor financial health of the utility industry in general. A clear opportunity exists in hybridizing existing residential and commercial sites run by diesel gensets, but this will require significant financial and human capital investments.

Unsurprisingly, most respondents to the question of how they would spend $100 million to support energy access felt that pure finance was not the answer and that education of the local financial sector was the most important activity to improve access to finance for market actors (Figure 4.16).

They felt that there was a need to increase funding for training and skill development within the industry at the engineering and managerial levels.

As Nigeria gradually pulls out of recession, the energy access sector could be positioned for rapid, even breakneck growth as millions of families gain access to clean fuels and technologies for cooking and improved lighting and electricity solutions. The challenge for donors, international organizations, investors and local financial institutions is to ensure that the overall financing environment is fit for purpose when it does, and is ready to provide capital at the scale and speed required.

Figure 4.16 How would you allocate $100 Million $ to support energy access in your country (ranked)?



5. BANGLADESH COUNTRY PROFILE

Table 5.1 Key statistics for Bangladesh

Key statistics	
Population (2014)	161.0 million (World Bank 2017b)
Number of households (2014)	35.8 million (World Bank 2017b, ArcGIS 2016c)
Number of inhabitants per household	4.5 (ArcGIS 2016c)
Population in 2030	186.5 million (World Bank 2017b)
Access to electricity (2014)	62.4% (IEA and World Bank, 2017)
Access to clean cooking fuels and technologies (2014)	10.1% (IEA and World Bank, 2017)
Access target by 2030 (electricity)	100% (Government Target)
Access target by 2030 (cooking)	100% (Government Target)

5.1. INTRODUCTION

Bangladesh has a shrinking energy access gap. Just over 62 percent of Bangladesh's population has access to electricity as of 2014 and government estimates give a figure of above 70 percent in 2016 (World Bank, 2016). Per government estimates, there has been a 27 percent increase since the beginning of this decade and a doubling in access since the early 2000s.

Government support through the Infrastructure Development Company Limited (IDCOL), that has provided grants and concessional loans, has been a key contributor to progress, especially in rural areas. As of May 2017, IDCOL estimates that there are 4.12 million SHS installed in off-grid areas covering over 10 percent of the population (IDCOL, 2017).

Almost 90 percent of the population lacks access to clean fuels and technologies. Instead, most the population relies on cow dung, jute sticks, other agricultural waste and wood for cooking. So widespread is their use that they are becoming scarce and increasingly traded as commodities. Moreover, many households rely on inefficient and poorly ventilated clay stoves that produce smoke, carbon monoxide and carcinogens, posing a serious health risk for women and children.

Local enterprises rely primarily on domestic financing sources to meet most of Bangladesh's energy access needs. Some are supported by international development organizations, including the World Bank. Around half of the enterprises interviewed define themselves as private, for-profit entities, with the remaining categorizing themselves either as NGOs or social enterprises (Figure 5.1).

Figure 5.1 Enterprise types

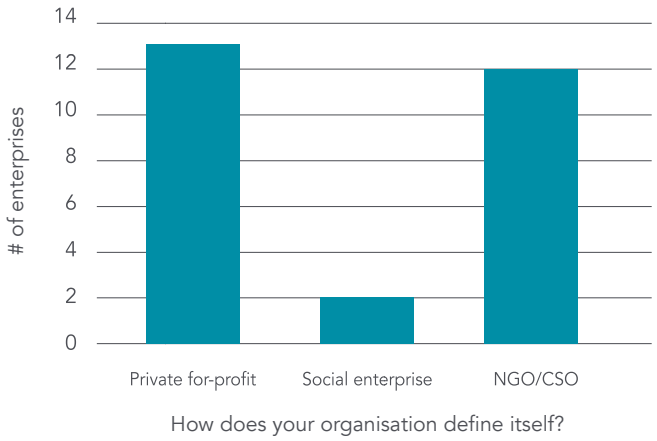
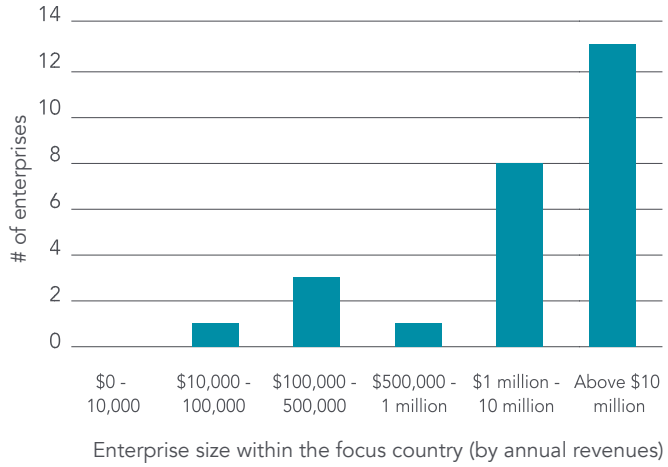


Figure 5.2 Enterprise size in terms of revenue derived from energy access



Several NGOs run operations in a manner and scale like larger private businesses. Some, like Grameen Shakti, hold very large market shares and are active across multiple energy access technologies, including SHS, micro-grids and clean cookstoves. The large presence of such NGOs is due, in part, to the long practice of grant-based energy access support driven by IDCOL, international development finance institutions and other donors.

Bangladesh's market is dominated by large and, in many cases, highly diversified enterprises. Of those interviewed, more than 80 percent had revenues above $1 million, with almost half the entire sample above $10 million (Figure 5.2). Although many enterprises are focused on energy access, others are highly diversified over a wide range of energy and infrastructure-related activities. For these businesses, energy access typically represents only a small fraction of their annual turnover.

The business models in the energy access sector are more advanced than other countries surveyed. They are larger in size and some have deep distribution capabilities with hundreds of rural branches and affiliates to reach customers. They offer different energy and livelihood support solutions (e.g., irrigation pumps) packaged to match the specific needs of customers. It is common to offer three-to-five-year loans to consumers to finance purchases. Enterprises offer product assembly and repair options, as well as after-sales service and warranties.

PAYGO models for SHS and mini-grids are not yet common but are expected to take off this year, in part prompted by changes at IDCOL. Since March 2017, the use of PAYGO technologies with SHS has become mandatory for organizations seeking IDCOL's financial support. Given the dominance of IDCOL financed enterprises, this is a game changer. Even for enterprises outside the IDCOL financing net, switching to PAYGO often makes sense: the use of mobile money is increasing rapidly and it makes it easier for companies to collect and monitor payments. The market leader, bKash, is estimated to have over 24 million customers, of whom 35 percent make more than one transaction per month. Moreover, due in part to Bangladesh's high population density, network coverage is effectively universal. With the benefits of payment collections made possible through PAYGO, enterprises across the country are expected to incorporate the technology into their business model.

Most enterprises are increasingly focusing on sales to urban, grid-connected areas and less to rural or off-grid customers. This is partly because the off-grid electrification market (especially for SHS) is highly saturated, given the highly effective deployment of systems under the IDCOL program, which began in 2003. New customers are more easily and more readily available in urban areas

as a growing number of urban and peri-urban customers seek to switch to solar to improve the reliability of electricity supply.

With the significant slowdown in SHS deployment, several enterprises are focusing more and more on mini-grids. A further driver is that many customers in rural areas are beginning to move beyond basic Tier 1 or Tier 2 energy access, seeking levels of service to support higher demand loads, as well as energy for higher consumption commercial uses. Bangladesh's high population density—combined with growing electricity demand and rising incomes—are working in lockstep to support the emergence of commercial mini-grids.

The government has recognized ongoing changes in the marketplace and, through IDCOL, has begun to increase support for the mini-grid sector. As of April 2017, IDCOL had approved 18 solar mini-grid projects, out of which seven were already operational and the rest were under construction. IDCOL targets the installation of 50 solar mini-grids by 2018. Table 5.2 outlines the lending terms for mini-grids.

Table 5.2 Loan term details for IDCOL loans in Bangladesh

	Term details
Loan amount	Up to 40 percent of the project cost
Tenure and grace	10 years including up to 2 years grace period
Interest rate	6 percent per annum

Source: http://idcol.org/home/r_lending_terms

Other government and commercial banks, such as the Bangladesh Infrastructure Finance Fund Limited (BIFFL), provide loans at 9 percent interest. World Bank, KfW, GPOBA, JICA, USAID, ADB and DFID—supporters of IDCOL's SHS program—are financially supporting its mini-grid program. Thus, Bangladesh is benefiting from a highly concentrated donor- and government-led effort to support universal electricity access.

In addition to ongoing changes in the mini-grid sector, efforts are underway to expand the national grid. In response, several enterprises were beginning to shift focus in this direction. One company's main business, for example, is supplying and installing transformers and substations. In addition to strictly energy access-related activities, many enterprises are developing grid-connected, MW-scale solar plants or actively looking to do so. A key driver is a major shift by the government towards grid-connected electrification. A rapid and large-scale ramp up in grid connections and utility-scale power capacity is now part of the government's primary electrification strategy. The government aims to increase grid-tied electricity connections at a rate of around 250,000 per month. New off-grid systems—such as those championed under earlier phases of IDCOL's roll-out of SHS—are being considered primarily for remote, hard-to-access areas. The government has introduced FiT (Feed-in Tariff) and IPP (Independent Power Producer) policies for utility-scale renewable energy generation to reach its goal of increasing its share of renewables in the national energy mix to 10 percent by 2020 (UN Chronicle, 2015).

Given the shift towards larger-sized systems, packaged/hybrid energy solutions and grid-connected electrification, many enterprises interviewed considered the IDCOL driven grant-based model to be losing its relevance as the market matures. This is further driven by the increasing commercial viability of small- and large-scale energy solutions. What is instead sought is market-based, low-cost financing that can allow commercially driven, scalable solutions, including the continued availability of low-cost loans.

5.2. FINANCING ENERGY ACCESS

Since several enterprises—particularly the smaller ones—continue to rely on IDCOL for concessional debt financing, any bottlenecks there can constrain access to capital. Many enterprises mentioned that IDCOL loan approval procedures can be bureaucratic and time consuming. In one case, an enterprise said that to receive previous IDCOL funding, it had to meet a condition that restricted it from raising a loan from other sources.

Enterprises echoed banks' concerns on the lack of commercial viability. Many felt that the sector has been unable to develop viable business models due to a long-term reliance on IDCOL-based grants and concessional financing. SHS enterprises, in particular, mentioned that their profitability has been hurt due to a drop-in sales volume in the past years, as the market has become saturated and grid connectivity has increased.

Many enterprises have moved away from IDCOL grants and concessional loans towards more commercial sources of capital. Some have done so to scale businesses beyond what is possible with limited IDCOL financing. Others have chosen to move out of IDCOL financing to have the freedom to sell un-accredited systems that can be several times cheaper but of reasonable quality, making them highly competitive. Indeed, the price gap can be so large that customers have been willing to abandon a partially paid IDCOL system (defaulting on payments and expecting repossession) to buy a new non-IDCOL system for less than the outstanding loan amount.

The shift away from IDCOL financing is another factor adding pressure on enterprises' profitability. Interest rates for loans with IDCOL are between 6-9 percent while commercial loans from other sources are between 10-15 percent (Figure 5.3). Several enterprises expressed a notably low tolerance for the cost of capital, with over 80 percent claiming a tolerance of below 5 percent (Figure 5.4), another indicator of the extent to which concessional loans have defined manager expectations.

Figure 5.3 Tolerable cost of capital in local currency

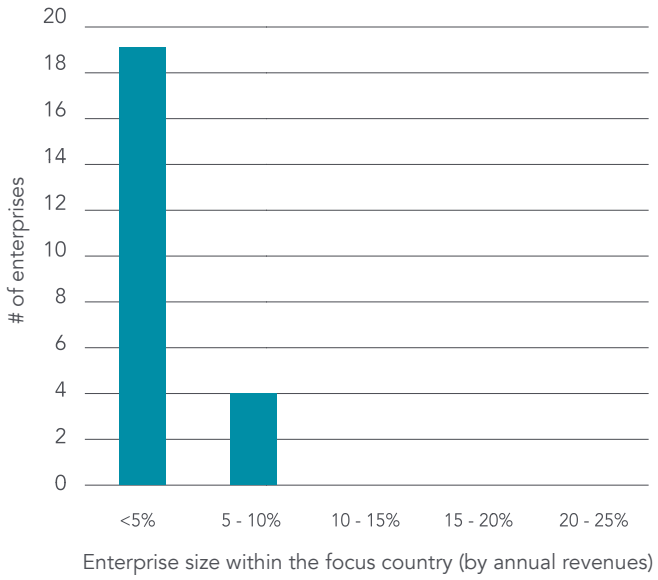
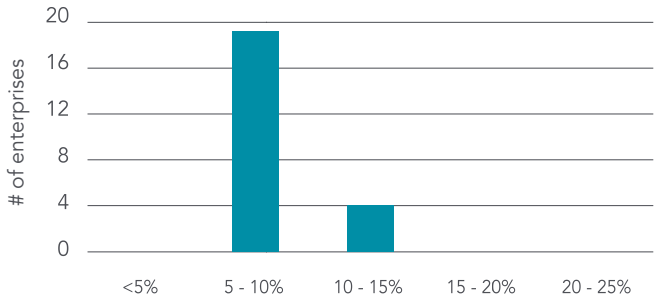
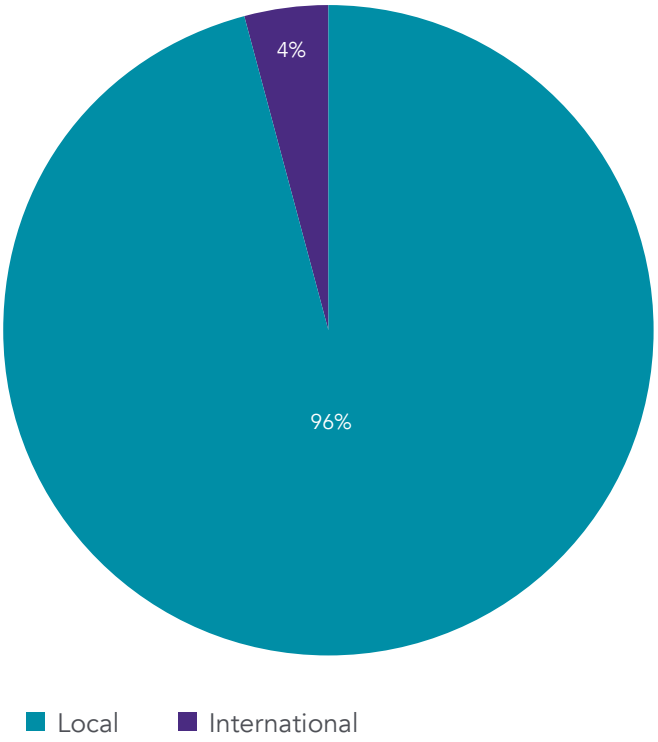


Figure 5.4 Reported cost of capital in local currency (2015-16)



Bangladesh is almost entirely financed in local currency. Only a few of the larger enterprises access finance in international currencies, reportedly incurring a cost of capital between 2 percent and 7 percent. Of those interviewed, only one was "primarily" financed in international currencies (Figure 5.5). It is important to note that enterprises considered IDCOL loans as local, even though many loans originate through international development finance institutions.

Figure 5.5 Percentage of respondents financed in local vs international currencies



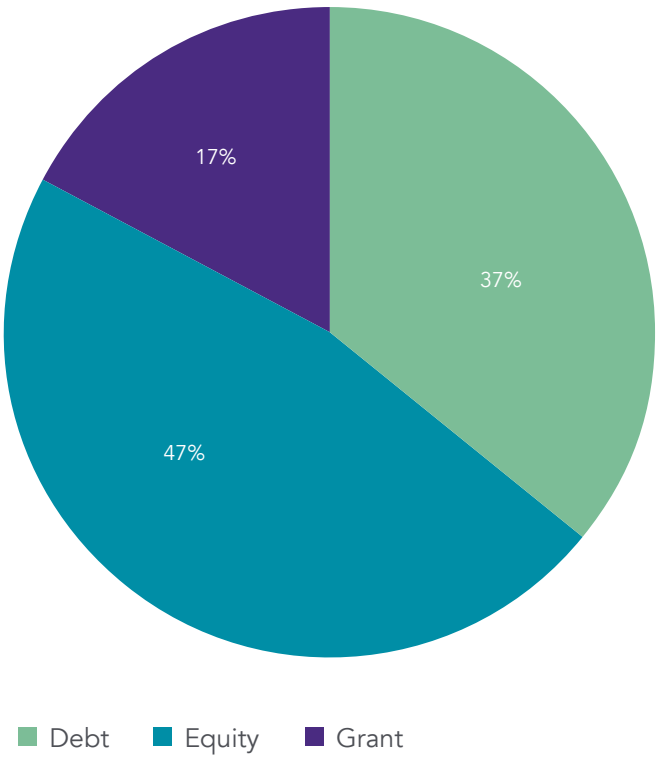
Over the last five years, the local currency (the Taka) has been largely stable against the USD, with only a brief spike in 2016. Thus, currency risk mitigation instruments are less important than in other markets surveyed and are unlikely to be sought out by investors.

Though the shift to commercial loans is underway, IDCOL remains the largest source of local currency debt, with exceptionally low interest rates, compared to tolerable rates in other markets, and markedly lower than interest rates typically found in emerging markets.

5.3. DEBT, EQUITY AND GRANT MIX

The capital structure in 2015-16 was almost half equity, with the remainder split between debt at 36 percent and grants at 17 percent (Figure 5.6). Bangladesh stands out for having a higher share of debt in the energy access sector's overall capital structure. This points to the significant influence of policy and donor interventions on the financing landscape.

Figure 5.6 D:E:G ratio for all enterprises surveyed (electricity and cooking) (%, weighted average by revenues)



Within that, almost half is equity financing, as players find it easiest to reinvest earnings into business. Interestingly, few enterprises reported a change in debt, equity and grant ratios in 2015-16 compared to 2013-14. This is likely because many key players are highly diversified companies with activities spanning multiple sectors.

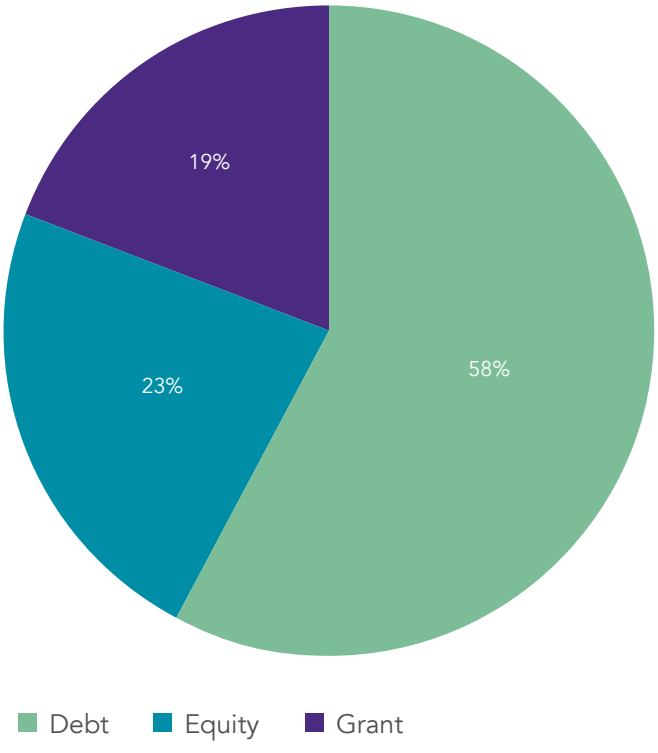
Overall, market actors felt that their reliance on debt and grants was going to increase in the next five years, with 46 percent of respondents saying that their reliance on equity would correspondingly decrease. The continuation in the increase of grant share suggests that a wider number of enterprises expect to move into newer energy access segments beyond SHS and clean cookstoves, such as mini-grids and grid extension. With the larger players taking the lead in this migration, it is also understandable that they are keen to replace their more expensive equity financing with cheaper debt to remain financially sustainable. Debt financing will allow companies to grow, a goal of many enterprises.

Commercial banks do not yet fully understand the risks associated with energy access and are hesitant to lend to it. Given the continued, high reliance on subsidies, grants and government-backed loans, commercial banks have the impression that the sector is not yet commercially viable, further discouraging them from lending. Enterprises mentioned that they often lacked sufficient knowledge about the financing options available through banks and the requirements they would need to fulfill to be eligible for lending.

Banks mentioned that enterprises seeking loans rarely offered bankable business plans that they could assess and compare with alternative lending options. Of the few banks that have considered lending to the sector, the deal sizes of loans sought by enterprises have been too small to justify the transaction costs. Banks mentioned minimum deal size requirements of $350,000-400,000. Until recently, such loan sizes have been too big to be effectively utilized, even by some of the larger enterprises. However, as the energy access market shifts toward mini-grid development and grid extension, the share of corporate debt being funneled into the sector is likely to grow along with ticket sizes.

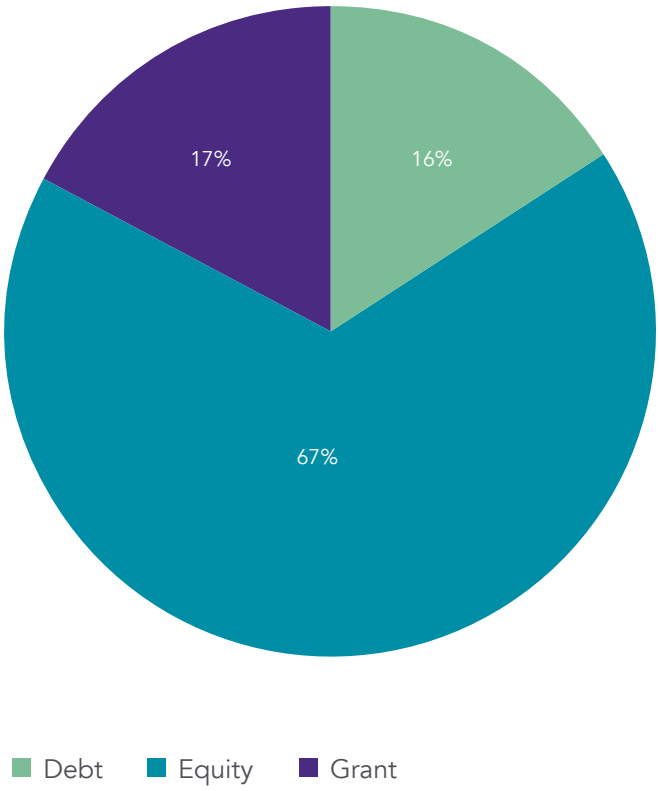
For electricity access, there is a significant difference in the capital structure of SHS and mini-grid enterprises. SHS enterprises, due to the relative maturity in the market, are majority debt financed (Figure 5.7). Many enterprises focused on this segment raise concessional loans from IDCOL. The remainder of their capital need is split between a mix of grant and equity financing.

Figure 5.7 D:E:G ratio for enterprises active in the solar sector (lanterns and SHS) (%, weighted average by revenues)



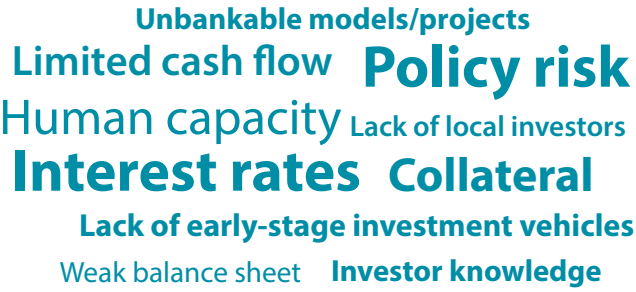
For mini-grid enterprises, equity is the primary source of financing (Figure 5.8). This is because the mini-grid segment is still in its early stages in the market. Banks have largely not yet considered the segment for financing. Grant funding is only slowly picking up as installations in the segment gain pace. Several enterprises focusing exclusively on this segment are doing so by taking on high entrepreneurial risk. The capital structure will likely change as IDCOL ramps up its financing for mini-grids. Mini-grids are highly capital intensive and enterprises will shift more towards debt financing as they move beyond their first projects and begin to scale.

Figure 5.8 D:E:G ratio for enterprises active in the mini-grid sector (%, weighted average by revenues)



Across technologies, electricity access players identified interest rates as a key barrier (Figure 5.9). They expressed a need for loans below 5 percent and in some cases as low as 2 percent. While most companies mentioned an ability to maintain profitability at the higher end of IDCOL's interest rate of 9 percent, some expressed difficulties in tolerating even 6 percent interest rates that IDCOL charges for smaller loans.

Figure 5.9 Barriers to obtaining finance for electricity access



With increasing difficulties tapping into new customers, SHS enterprises are finding it difficult to maintain healthy cash flows. Many enterprises offer micro-credit or consumer loans that increase capital requirements. Enterprises that remain committed to the SHS segment are beginning to shift business models towards larger capacity PV systems by targeting customers in urban and peri-urban areas. To serve these customers, being able to offer larger loans is often critical, which further explains the continued priority that access to low-cost loans have among enterprises.

While international financing may provide a new source of funding for some companies, particularly the larger ones, accessing such financing can be difficult. Often, they are unaware of how to tap into international investment pools

or are unfamiliar with the terms of loans or equity investments. A lack of human capacity was identified as a key barrier.

The difficulty in accessing financing at low rates is especially challenging for electricity access product importers that supply to distributers in wholesale. One company interviewed mentioned that, as a wholesaler, it is not allowed to access IDCOL's concessional financing. Instead, it is forced to rely on commercial banks and pays interest rates of up to 13 percent. In addition, it does not have access to any grants. For commercial debt financing, such enterprises are required to provide collateral. This is another major barrier, as enterprises are unable to meet requirements for funding rounds beyond initial capital raises.

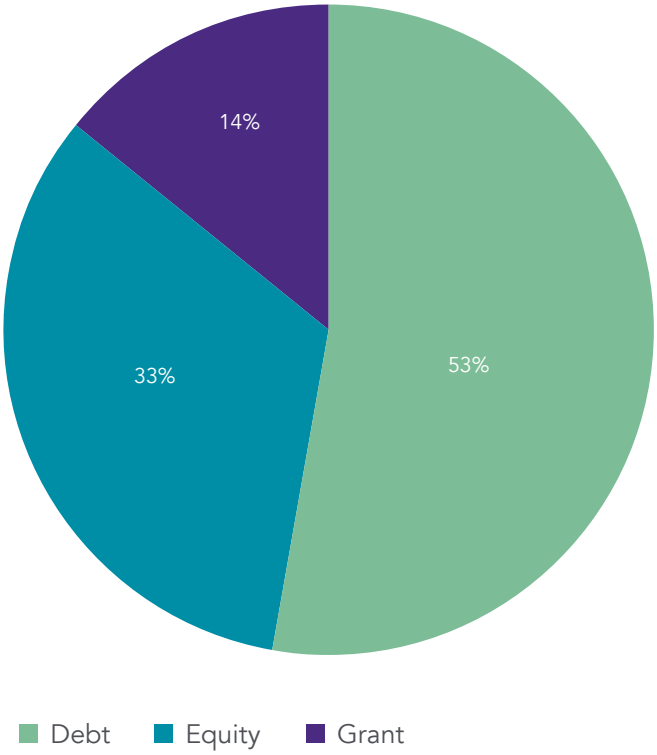
Within electricity access, a focus is shifting towards providing solutions based on productive use rather than lighting. Products such as solar irrigation, solar cold storage and dryers, battery charging stations and community biogas projects in combination with electricity systems are flourishing. The focus is now more on providing value-added use to customers through, for example, selling systems of sizes large enough to support the use of fans, TVs and radios, in addition to phone charging and lighting. One enterprise is involved in manufacturing batteries for solar systems.

There were examples of enterprises engaged in the supply of advanced and hybrid energy access systems. One enterprise constructs hybrid micro-grids with off-grid solar energy systems and biogas plants, incorporating smart control features into the plant. This combination can be sized from 30-50kW, providing energy for up to 250 households or 1,250 beneficiaries.

5.4. CLEAN COOKING MARKET

Debt is the single largest source of financing for enterprises interviewed in the clean cooking sector (Figure 5.10). This includes wood, charcoal, fuel supply and biogas. The dominance of debt is unusual compared to other markets surveyed that relied more heavily on a mix of grant and equity.

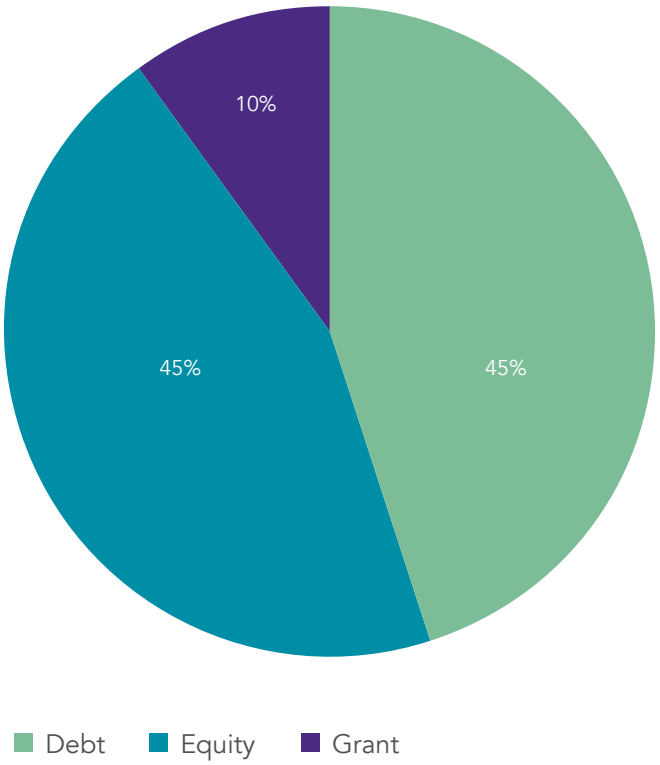
Figure 5.10 D:E:G ratio for enterprises active in the cooking sector (%, weighted average by revenues)



Part of the reason for the notably higher share of debt is related to the significant role played by larger, diversified players that have activities in many different infrastructure and energy-related sectors. The involvement of larger, diversified companies contributed a higher debt weighting than other countries surveyed.

Biogas plays a significant role in the cooking sector. Debt and equity are the main sources of financing for the biogas market (Figure 5.11). Enterprises interviewed had posted combined annual revenues of $9.38 million in 2015-16, of which biogas enterprises constituted 72 percent or $6.77 million.

Figure 5.11 D:E:G ratio for enterprises active in the biogas cooking sector (%, weighted average by revenues)



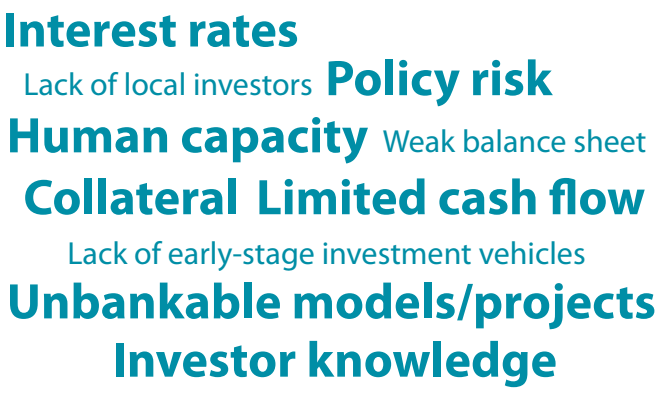
It is common for the share of sales to the business or institutional sector to range from 10-30 percent, a notably higher percentage than in countries like Kenya or Ethiopia.

Outside of the biogas enterprises, the clean cooking market is comparatively underdeveloped. Several recent initiatives—combined with a significant push from the government—are helping to bring greater focus to this sector. The government has announced an objective to achieve 30 million improved cookstoves from different technologies (wood, charcoal, biogas, electricity and LPG) and has pledged to bring about "smoke free kitchens" by 2030 (SREDA, 2013).

The non-biogas enterprise space is driving the development of community-led production models. One company relies on women's groups and leaders to collect cow dung and other raw materials. The company buys the raw material and processes it into pellets and briquettes in their factory before selling it back to the local market.

Given the high reliance on debt (admittedly skewed by the biogas sector), high interest rates and the need for collateral are the two greatest barriers in accessing financing (Figure 5.12). On average, cooking sector enterprises reported a lower willingness to pay higher interest rates than the electricity sector.

Figure 5.12 Barriers to obtaining finance for clean cooking enterprises



5.5. FUTURE SCENARIOS

This section provides an analysis of the estimated costs and Debt:Equity:Grant breakdown to meet Bangladesh's energy access targets.

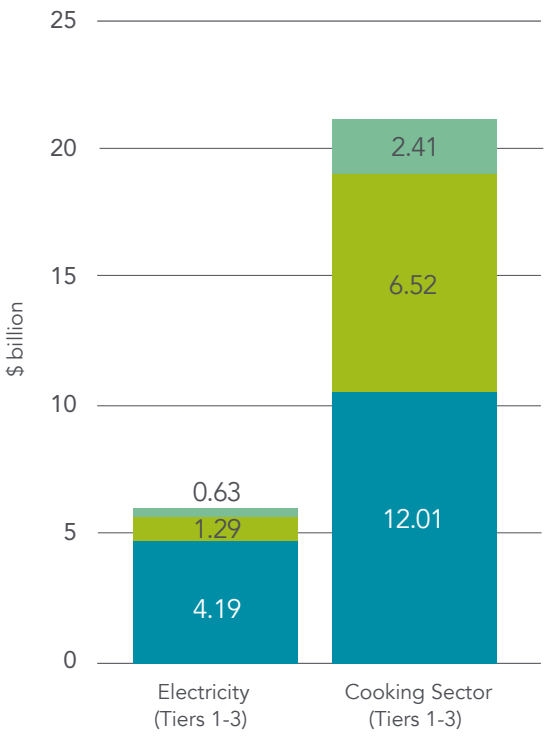
Table 5.3 Key scenario inputs for Bangladesh

Key scenario inputs		
Current D:E:G for Tiers 1-3 of the electricity sector (2015-16)	58 : 23 : 19 Debt: Equity: Grant	
Current D:E:G for the clean cooking sector (2015-16)	53 : 33 : 14 Debt: Equity: Grant	
Enterprise overhead ratio (multiplier to the capital cost of energy access technologies)	1.33	
Overhead ratio multiplier assumed for the clean cooking sector	1.2	
Overhead ratio multiplier assumed for Tiers 4 and 5	1.2	
Estimated D:E:G ratio for Tiers 1-3 of the electricity sector by 2030	75 : 20 : 5 Debt: Equity: Grant	
Estimated D:E:G ratio for Tiers 1-5 of the clean cooking sector by 2030	60 : 30 : 10 Debt: Equity: Grant	
Tier breakdown based on the SEforALL Finance Committee Report, 2015 (percent of all new electricity access connections)	Tier 1	0
	Tier 2	5
	Tier 3	10
	Tier 4	20
	Tier 5	65

Key scenario inputs		
Breakdown by fuel type based on best estimates (percent of all new clean cooking connections)	ICS wood	30.0
	ICS charcoal	24.3
	LPG	20.0
	Electric	15.7
	Ethanol/ methanol	0.0
	Biogas	10.0

Figure 5.13 provides an indicative estimate of the total costs of meeting Tiers 1 to 3 electricity access targets and

Figure 5.13 Total finance needed to meet Tiers 1 – 3 of Bangladesh's energy access targets by 2030



the full cost of meeting cooking sector targets. The electricity sector estimates for Tiers 1 to 3 are comparatively small, due to the government weighting toward Tiers 4 and 5.

Figure 5.14 provides an annual estimate of the costs for the electricity access sector, broken into Debt:Equity:Grant shares.

Figure 5.14 - Estimated annual finance need to achieve Bangladesh's targets for Tiers 1 – 3 by 2030, broken down into Debt:Equity:Grant shares

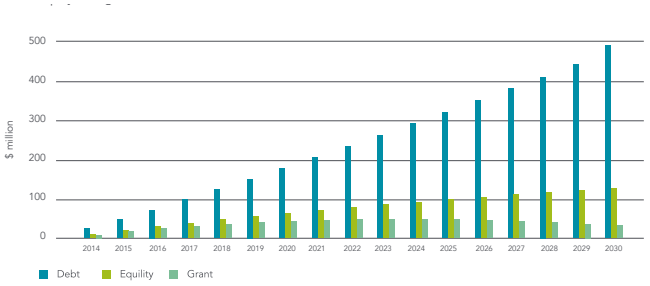


Figure 5.15 provides a breakdown by Tier of the indicative total cost of meeting universal electricity access for all five Tiers of access. Note that in Bangladesh, the costs of meeting Tier 4 and Tier 5 access represent the overwhelming majority of the total costs, due to the government's weighting of the access targets toward these higher Tiers.

The costs of ensuring that 65 percent of new connections come from Tier 5 and 20 percent from Tier 4, significantly amplify the overall costs of meeting universal energy access. This breakdown is broadly in line with the government's current strategy of prioritizing mini-grid development and grid extension nationwide. The total estimated costs of meeting universal energy access reaches $225.82 billion when all five Tiers are included.

Figure 5.15 Cost breakdown of meeting universal electricity access by Tier in Bangladesh

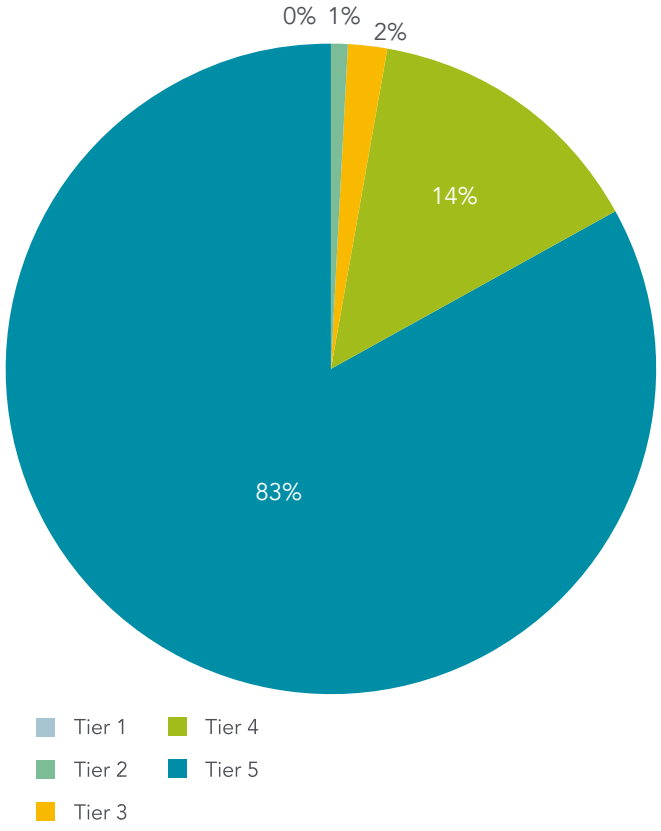
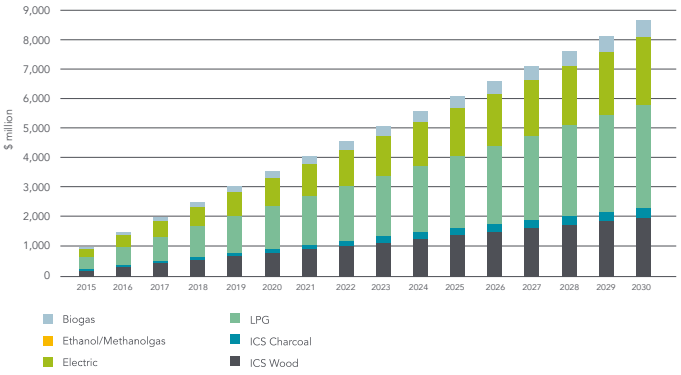


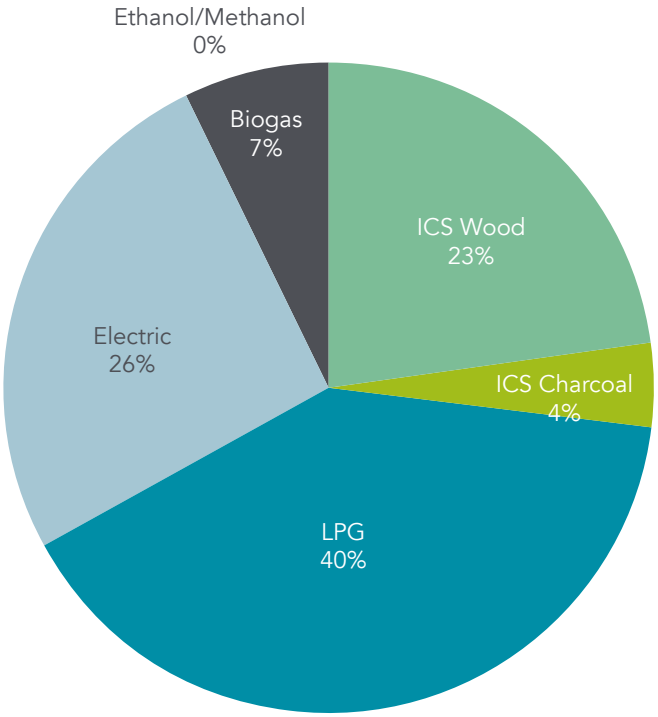
Figure 5.16 provides an estimate of the annual spending that will be required to meet Bangladesh's national clean cooking targets, including the cost of stoves and the fuel supply, broken down by fuel/technology source.

Figure 5.16 - Cost breakdown of meeting national clean cooking access targets in Bangladesh



In Bangladesh, electricity and LPG represent the two largest cost components. Figure 5.17 provides an estimate of the cost breakdown by fuel type.

Figure 5.17 Estimated cost creakdown of meeting national cooking targets in Bangladesh, by fuel types



5.6. CONCLUDING REMARKS

One clear insight that emerges is that for the SHS market, at least, the sector is under contraction relative to the boom days of 2013-14. Propelled forward by booming demand and the ready availability of concessional loans and grants from IDCOL, the SHS market segment contributed significantly to increasing energy access in the country to more than 18 million people. Demand saturation in the SHS market has led to declining sales, which in some cases was dramatic between 2013-14 and 2015-16.

Enterprises are reacting quickly. The downturn in the SHS market has kicked off a diversification towards mini-grids and grid-connected solutions, in step with the government's prioritization of those segments.

Considering the SHS downturn and difficult economics of clean cooking solutions, enterprises are keen to reduce costs and to diversify. Across the board, enterprises see lower capital cost as a key factor in enabling them to do so. The need for collateral to access debt is another major barrier holding enterprises back from shifting their business models as the market changes.

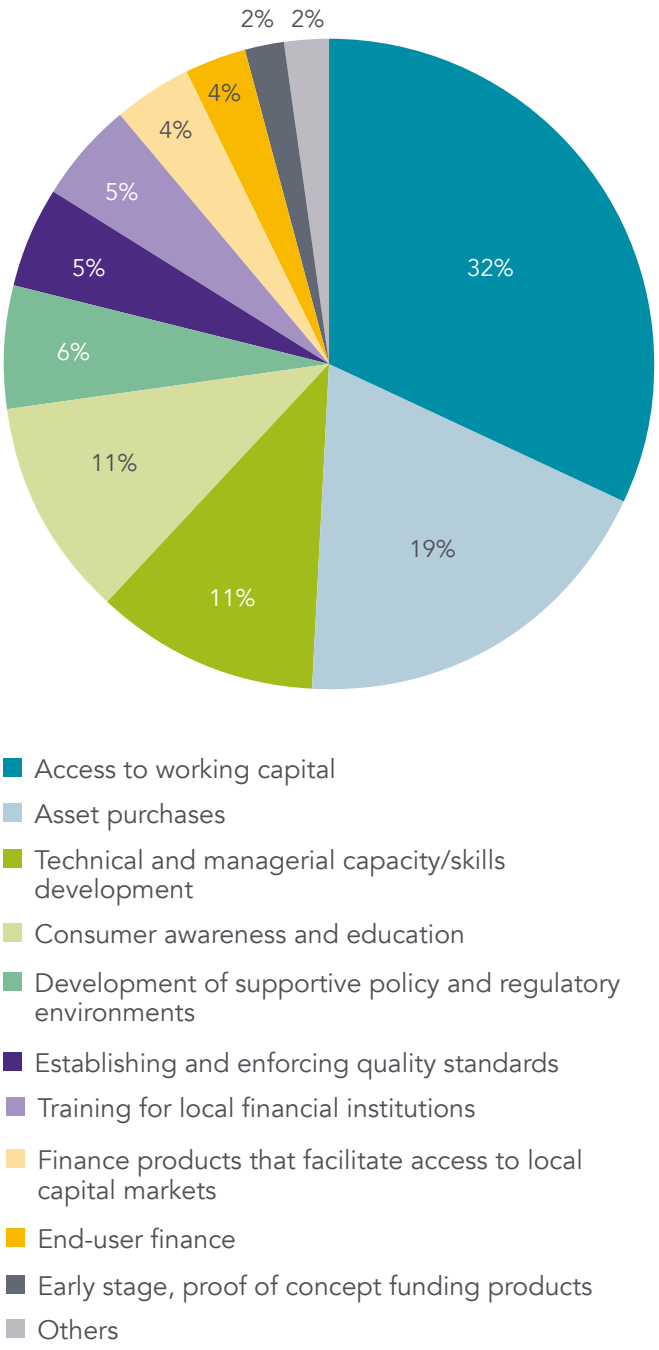
On the clean cooking side, biogas businesses oriented towards commercial and productive uses are currently driving much of the segment's growth, although activity in wood and charcoal-based improved cookstoves is picking up. Indeed, the prospects of household-level clean cooking solutions continue to improve as the sector's economics—combined with a concerted push from the government and international donors, as well as NGOs—are poised to begin driving significant changes throughout the market.

The clean cooking sector, with access levels of just 10 percent, is deserving of more targeted efforts. However, profitability remains a challenge and the barriers (commercial, behavioral and financial, as well as others) underscore the difficulties the sector faces. Considering the sheer scale of the financing needs, over $76 billion through 2030, this challenge should perhaps be seen rather as an opportunity.

When asked what their number one priority would be for spending $100 million to improve the energy access business environment, almost one-third (32 percent) of interviewees answered that the money should be invested in working capital (Figure 5.18). Every fifth respondent preferred the purchase of assets. It is remarkable that in Bangladesh 40 percent of energy access professionals see a priority for investment in the support of non-lending activities, with advancing consumer awareness, staff capacity-building and the development of supportive policies and quality standards each scoring 11 percent of the priority vote.

In contrast to other markets, only a small number of respondents see improved access to finance for end-users and access to local capital for businesses as the priority for an external money injection, likely a consequence of the successful introduction of grants and concessional loans through IDCOL.

Figure 5.18 How would you allocate $100 million to support energy access in your country (ranked)?



6. MYANMAR COUNTRY PROFILE

Table 6.1 Key statistics for Myanmar

Key statistics	
Population (2014)	53.9 million inhabitants (World Bank 2017b)
Number of households (2014)	11.4 million (World Bank 2017b, UNHCR 2014)
Number of inhabitants per household	4.72 (UNHCR 2014)
Population in 2030	60.24 million inhabitants (World Bank 2017b)
Access to electricity (2014)	52% (IEA and World Bank, 2017)
Access to clean cooking fuels and technologies (2014)	9.1% (IEA and World Bank, 2017)
Access target by 2030 (electricity)	100% (Government Target)
Access target by 2030 (cooking)	80% (Government Target)

6.1. INTRODUCTION

Myanmar faces a substantial energy access gap. Only half of the population has access to electricity and only a third is connected to the grid, with electricity access concentrated in urban areas. More than 80 percent of the rural population lacks access and relies primarily on diesel lamps, batteries or candles for lighting (Castalia, 2014). For areas that are grid-connected, the quality of electricity access is low due to an aging national grid that experiences 20 percent system losses.

Over 90 percent of Myanmar's population lacks access to clean cooking fuels and technologies (Table 6.1). Access to any modern cooking method is limited to urban areas. Traditional biomass (wood and animal dung) is widely used and accounts for over 70 percent of cooking-related energy consumption (EMC, 2015).

Regarding electricity access, Myanmar's National Electrification Plan (NEP) is driving progress. Launched in 2014 with technical assistance from the Asian Development Bank (ADB), the World Bank, the Japan International Cooperation Agency (JICA) and Sustainable Energy for All, the NEP aims to electrify 7.2 million households and achieve universal access to electricity for all by 2030. Although the plan focuses on increasing the installation of SHS and micro-grids for rural electrification, it prioritizes grid-connected electrification for the country.

Most electricity access companies have been active for more than four years and a small number for more than 10

(Figure 6.1). Yet, their growth has been slow. A key barrier to their growth is the inability to sustain viable business models. This is partly because the government, several donor agencies and other international institutions promoting electricity access have relied almost entirely on subsidies—which can be as high as 90 percent for SHS. With systems available to consumers at close to no cost, enterprises have struggled to find consumers willing to pay for services.

Figure 6.1 Enterprise type

Another barrier, especially for SHS enterprises, has been the rapid increase in the availability of cheap—but often low quality—SHS and solar lantern products, predominantly from China. Several enterprises selling Lighting Global certified products have faced declining sales over the past two years, as they have been unable to compete with such products. Across the board, enterprises feel that consumer purchase decisions are driven almost entirely by lower price rather than higher quality. With no room for a higher quality/higher price strategy that might result in greater margins, combined with the substantial donor-led efforts to promote electricity access in the country via grants and subsidies, most enterprises have doubts about the near-term viability of their business.

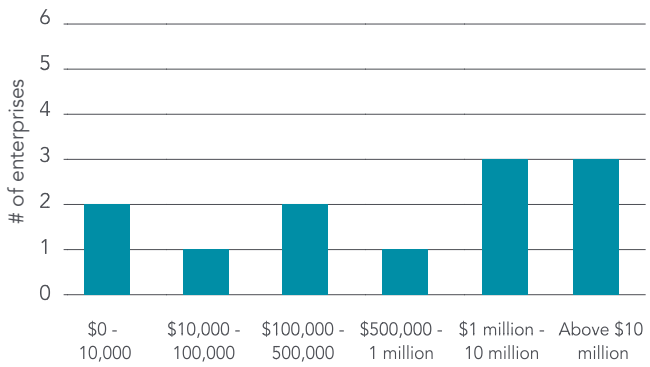
In the case of micro-grids, government programs subsidize close to 60 percent of a project's cost. Thus, potential buyers of solar lanterns or SHS, in areas where enterprises can offer micro-grid solutions, have rejected them in anticipation of a cheaper electricity supply subsidized by the government. This has made it difficult for enterprises to expand their reach faster than what is possible through the government subsidy program.

Most local enterprises have been unable to use the government micro-grid subsidy program because its projects are allocated through International Competitive Bidding (ICB), which requires a long-reaching track record and substantial performance guarantees. Most local enterprises are unable to meet these obligations and lose out to international companies with greater project experience and financial strength.

Most energy access companies are diversified companies engaged in other energy sectors. Many have reduced their involvement in SHS as they consider the segment no longer viable. Others are focusing more on micro-grids and some are looking to develop utility-scale or smaller systems for commercial and industrial consumers without access to the grid.

For many enterprises, the SHS or solar lanterns business is no longer profitable and continued sales are only possible because of the financial strength of other business segments. Due to their broader business operations, about half of the interviewed enterprises had an annual turnover of more than $1 million (Figure 6.2).

Figure 6.2 Enterprise size in term of revenue derived from energy access



(Figure 6.1). Yet, their growth has been slow. A key barrier to their growth is the inability to sustain viable business models. This is partly because the government, several donor agencies and other international institutions promoting electricity access have relied almost entirely on subsidies—which can be as high as 90 percent for SHS. With systems available to consumers at close to no cost, enterprises have struggled to find consumers willing to pay for services.

Another barrier, especially for SHS enterprises, has been the rapid increase in the availability of cheap—but often low quality—SHS and solar lantern products, predominantly from China. Several enterprises selling Lighting Global certified products have faced declining sales over the past two years, as they have been unable to compete with such products. Across the board, enterprises feel that consumer purchase decisions are driven almost entirely by lower price rather than higher quality. With no room for a higher quality/higher price strategy that might result in greater margins, combined with the substantial donor-led efforts to promote electricity access in the country via grants and subsidies, most enterprises have doubts about the near-term viability of their business.

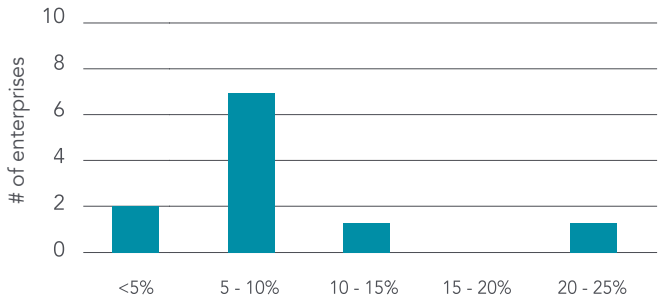
In the case of micro-grids, government programs subsidize close to 60 percent of a project's cost. Thus, potential buyers of solar lanterns or SHS, in areas where enterprises can offer micro-grid solutions, have rejected them in anticipation of a cheaper electricity supply subsidized by the government. This has made it difficult for enterprises to expand their reach faster than what is possible through the government subsidy program.

Most local enterprises have been unable to use the government micro-grid subsidy program because its projects are allocated through International Competitive Bidding (ICB), which requires a long-reaching track record and substantial performance guarantees. Most local enterprises are unable to meet these obligations and lose out to international companies with greater project experience and financial strength.

Most energy access companies are diversified companies engaged in other energy sectors. Many have reduced their involvement in SHS as they consider the segment no longer viable. Others are focusing more on micro-grids and some are looking to develop utility-scale or smaller systems for commercial and industrial consumers without access to the grid.

For many enterprises, the SHS or solar lanterns business is no longer profitable and continued sales are only possible because of the financial strength of other business segments. Due to their broader business operations, about half of the interviewed enterprises had an annual turnover of more than $1 million (Figure 6.3).

Figure 6.3 Reported cost of capital in local currency in 2015-16



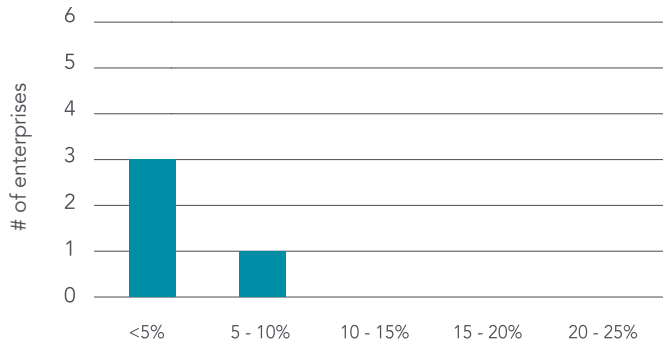
The diversification towards micro-grids and utility-scale systems is driven by a broad preference in the population—including in remote areas—to access electricity for more than just basic lighting and charging (Tier 1). Consumers are more inclined towards higher Tier systems that support the use of home appliances and, importantly, the maintenance of small, village-level businesses. In the dry-region of the country, the use of solar energy for irrigation purposes has emerged as a key driver of sales.

6.2. FINANCING ENERGY ACCESS

Most energy access enterprises in Myanmar reported a cost of capital in local currency of between 5-10 percent

and gave the same range for the cost of capital that they could tolerate (Figure 6.3 and Figure 6.4).

Figure 6.4 Reported cost of capital in international currency in 2015-16



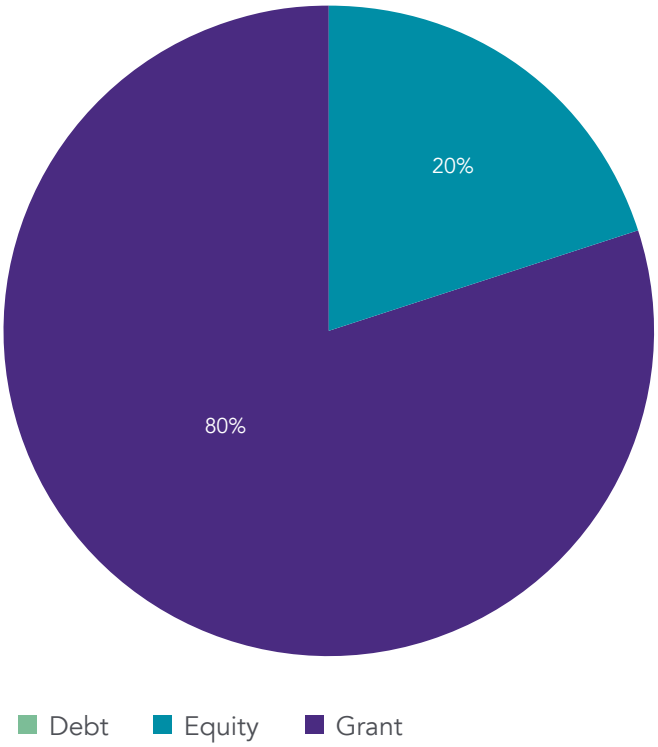
Only a few enterprises interviewed mentioned high capital cost as a challenge in the market. After a major collapse of the banking sector in 2003 and continued cases of corruption and money laundering at the board level in banks across the country, enterprises' trust in the banking system is very low. Many enterprises mentioned an unwillingness to borrow money from local banks, even if the terms of lending were favorable.

6.3. DEBT, EQUITY AND GRANT MIX

Financing for electricity access is overwhelmingly based on grants. Only around a fifth of financing is equity based (Figure 6.5). None of the interviewed enterprises reported any debt financing.

The primary reason for such a skew in the market is the preference by the government, donor and international finance agencies for a subsidy-driven approach to expand energy access. As consumers have held back from paying for solutions in anticipation of subsidized ones, enterprises have been unable to develop business cases that are viable for debt financing and have continued to rely on grants.

Figure 6.5 D:E:G ratio for the electricty access sector (lanterns, SHS, and mini-grids) (%, weighted average by revenues)



This is a key reason for an even split between the percentage of enterprises that plan to increase their reliance on debt and those that don't expect to. Of the firms that aimed to increase their reliance on debt, most planned to seek international debt financing rather than domestic debt. Consequently, enterprises anticipated remaining highly reliant on grants for the foreseeable future.

The dominance of grants is driven in part by the relative dominance of non-profit and international development organizations in the energy access sector. For private sector enterprises, grant funds constituted only 3-4 percent of the total enterprise capital structure. Such enterprises remain almost exclusively equity financed, largely in the form of corporate equity or own funds.

Though most enterprises are reliant on grants, the lack of access to debt has been a significant barrier to sca-

ling operations. For some enterprises, this has prevented them from increasing their inventory and expanding customer acquisition. Perhaps the greatest shortcoming of the banking system has been the inability of enterprises to raise performance guarantees to successfully bid for procurement orders by the government and international agencies. In the absence of this, enterprises have lost out on capturing the market for subsidized energy access products. This contrasts markedly with Bangladesh, where most companies capturing significant shares of IDCOL-related loans and supports have been local enterprises.

The preference for international financing by enterprises can be traced primarily to a lack of trust in local banks. Despite the willingness to attract international financing, however, none of the enterprises interviewed have thus far secured debt financing from international sources. Most international financing used by enterprises is grants.

The capital structure of SHS enterprises, mini-grid enterprises, as well as the solar lanterns market participants is very similar across the board at 80 percent grants and 20 percent equity.

In terms of grant financing for micro-grids, the ADB has played a prominent role in the market. It has so far supported 12 solar micro-grids in 2016, through a total grant of $2.3 million. This funding is from its dedicated poverty reduction-financing window supported by the Government of Japan. The ADB has pursued a business model for its solar mini-grids that entails 20 percent village community financing, which could be in the form of cash and in-kind labor and materials for civil construction and grid erection; 20 percent equity financing from the local developer (or engineering or energy service company); and 60 percent outright grant. The funds are channelled through the government's Department of Rural Development (DRD) and include a government contribution. ADB intends to shift its support to a loan program but awaits the development of viable micro-grid business models in the market.

The World Bank is another major source of grant funding for electricity access. Under a support program started within the framework of the NEP, it has allocated $120 million for the off-grid rural electrification program. In 2016, the World Bank allocated $22 million targeting the SHS market segment. For its part, the DRD, the main national agency responsible for rural electrification, has reported disbursements of funds totalling $19.8 million to the actors in the SHS market in 2016 and $200,000 to the mini-grid market segment. These two investments make them the largest actors interviewed. Due to their role in providing grant funding to the market, they have a significant impact on the D:E:G ratios reported.

Since local enterprises active in the electricity access sector have been unable to meet all the bid requirements, such as International Standards Organization (ISO) certifications, performance guarantees and a substantial track record, most bids have been won by foreign companies, largely from China. Local companies have instead provided labor, logistics and rural community engagement to the foreign winners.

A lack of human capacity and low technical expertise are additional factors that enterprises mentioned as disadvantages they face in winning contracts in competitive bids. These include shortcomings in technical areas of project development, business planning and business modelling, technical design capabilities and technical capacity for servicing systems including operation, repair and maintenance. These are the barriers that hold local companies back from receiving the kind of grant financing provided by development financing institutions.

Enterprises feel very strongly that policy risk is a major barrier in obtaining financing (Figure 6.6). In the case of SHS, enterprises feel that the lack of a clear import policy has allowed cheaper, lower-quality products to take over the market and render them uncompetitive. This in turn has weakened their balance sheets and prevented them from raising equity beyond family and friends and their own funds, which are otherwise the primary source of such capital. For micro-grids—and to a lesser degree for the SHS market segment—there is the risk that po-

Figure 6.6 Barriers to obtaining finance for electricity access enterprises

tential extension of the national grid in off-grid areas will drive customers away from their systems and halt future cash flows. Enterprises see a lack of policy as a major risk to their business model and a barrier to attracting equity investors and future debt financing.

Weak balance sheets have made it difficult for enterprises to use their existing assets as collateral to raise debt financing, whether from international or domestic sources. Additionally, the mention of interest rates as a barrier suggests that enterprises see lower financing costs as a key lever to improve their profitability.

6.4. CLEAN COOKING MARKET

In Myanmar, since no representatives of clean cooking enterprises could be identified for interviews, only electricity companies were surveyed. The clean cooking sector, despite the large access gap, is still in its infancy. There are currently no noteworthy government policies or programs to promote the sector. Of the development finance institutions surveyed, none reported any activity in the clean cooking sector.

One independent program was identified. Since 2014, the non-profit Groupe Energies Renouvelables, Environment et Solidarités (GERES) runs the "Strengthening improved Cookstove Access towards a better quality of Life and Environment" (SCALE) program to initiate a market-based mechanism for fuel-efficient improved cookstoves. A few small, clean cooking enterprises have received training from the program but could not be reached for interview.

6.5. FUTURE SCENARIOS

Table 6.2 Key scenario inputs for Myanmar

Key scenario inputs		
Current D:E:G for Tiers 1-3 of the Electricity Sector (2015-16)	0 : 20 : 80 Debt: Equity: Grant	
Enterprise Overhead Ratio (Multiplier to the Capital Cost of Energy Access Technologies)	1.33	
Overhead Ratio Multiplier Assumed for the Clean Cooking Sector	1.2	
Overhead Ratio Multiplier Assumed for Tiers 4 and 5	1.2	
Estimated D:E:G Ratio for Tiers 1-3 of the Electricity Sector by 2030	60 : 30 : 10 Debt: Equity: Grant	
Tier breakdown based on the SEforALL Finance Committee Report, 2015 (percent of all new electricity access connections)	Tier 1	0
	Tier 2	5
	Tier 3	10
	Tier 4	20
	Tier 5	65
Breakdown by fuel type based on Myanmar's targets (percent of all new clean cooking connections)	ICS wood	20
	ICS charcoal	38
	LPG	2
	Electric	40
	Ethanol/ methanol	0
	Biogas	0

Annex A provides a more in-depth description of the methodology and of the assumptions underlying this analysis.

Figure 6.7 provides an indicative estimate of the total finance needed to meet national electricity access targets, broken down into Debt:Equity:Grant shares.

Figure 6.7 Total finance needed to meet Myanmar's electricity access targets for Tiers 1 – 3 by 2030

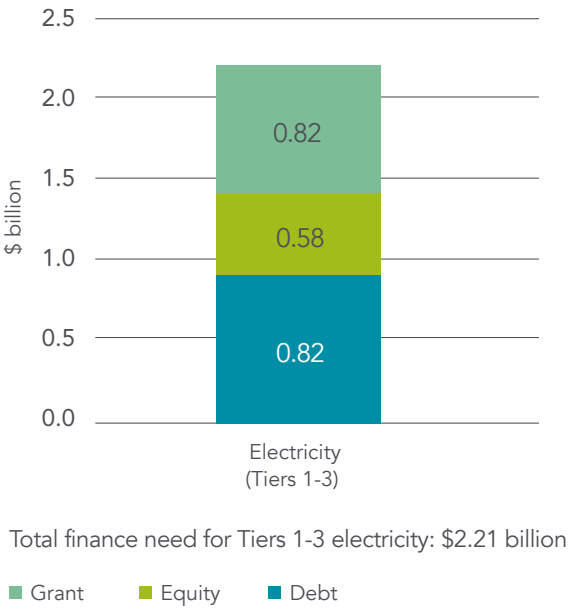


Figure 6.8 provides an indicative overview of the annual finance required to reach Myanmar's national electricity access target of 90 percent, focusing specifically on the costs for Tiers 2 and 3, as the SEforALL Finance Committee Report's assumptions for the region assumes 0 percent for Tier 1 and 5 percent and 10 percent for Tiers 2 and 3, respectively (SEforALL, 2015).

Figure 6.8 - Estimated annual finance needed to meet Myanmar's electricity access targets for Tiers 1 - 3 by 2030, broken down into debt, equity and grant shares

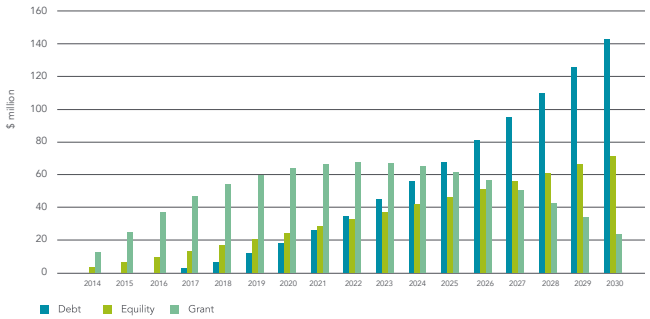
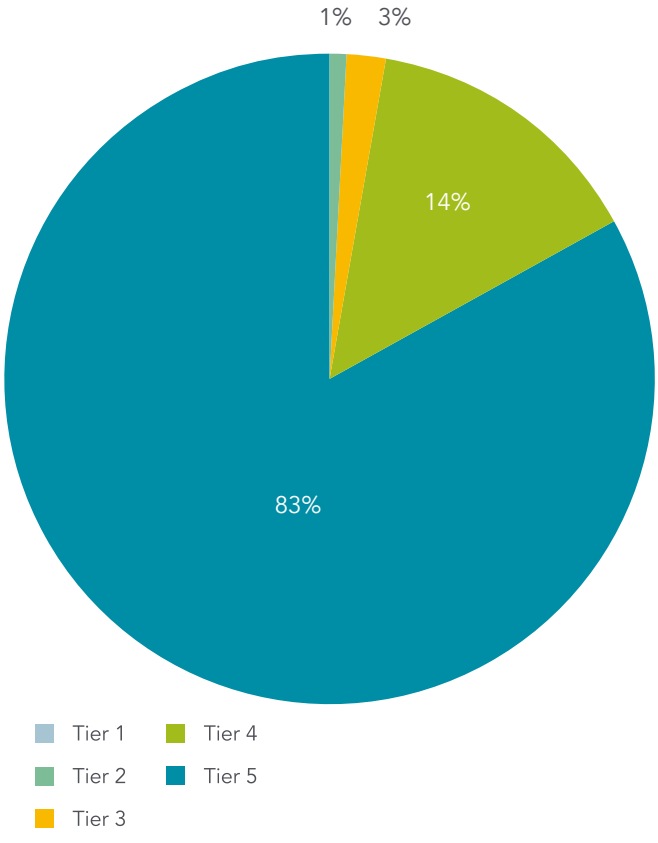


Figure 6.9 provides a breakdown of the total cost of meeting universal electricity access by Tier.

Figure 6.9 Cost breakdown of meeting Myanmar's electricity access targets by Tier



A heavier weighting towards Tiers 4 and 5 results in significantly higher total costs of meeting universal energy access, reaching as high as $80.65 billion when all five Tiers are included.

Although no official cooking fuel mix forecasts are available, current government sources and secondary literature suggest a fairly high weighting toward electricity, as the population continues to urbanize and the government aims to reduce reliance on firewood for cooking.

6.6. CONCLUDING REMARKS

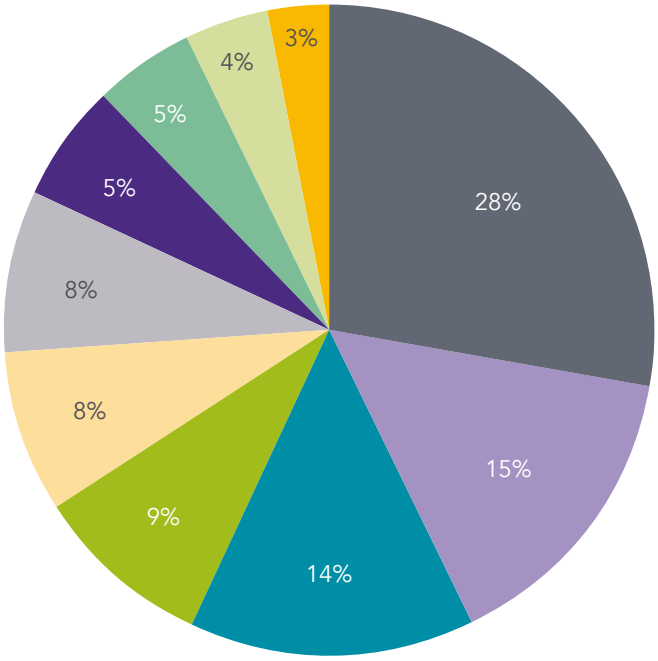
Energy access enterprises are struggling to maintain profitability as they lose customers to systems subsidized by the government and DFIs. For those companies that can retain paying customers, lower-cost products— primarily from China—are pulling customers away and affecting profitability. To stay afloat, many enterprises are diversifying their businesses to higher Tier energy solutions and/or expanding to non-energy business activities.

Given the low viability of electricity access segments, international development organizations continue to play a leading role in the market. Myanmar's reliance on grant financing has made it the primary source of capital. For private enterprises that would prefer debt financing, a weak domestic banking sector has left little choice but to continue relying on equity financing and grants.

The absence of clean cooking enterprises is conspicuous. Yet, it is unsurprising given the relatively few clean cooking companies in the country and the lack of initiatives supporting the sector by the government and development finance institutions. Given the sizable clean cooking gap, far more needs to be done to support the sector.

When asked to consider how $100 million of development funds to accelerate energy access could be deployed, enterprises prioritized the need for early stage, proof-of-concept funding products (Figure 6.10). This is in line with the need of enterprises to access financing for pilots as they shift their businesses towards new, higher-Tier energy access solutions.

Figure 6.10 How would you allocate $100m for energy access?



Enterprises have prioritized training for local financing institutions. This highlights the need for a more professional and reliable banking sector that could allow enterprises to access greater debt financing. For private businesses, this would be a far cheaper alternative to the more expensive equity financing that they currently rely upon and would increase the amount of capital available. This would allow them to expand the scale of their businesses.

Access to working capital is another priority for enterprises. This is because the purchase of SHS and solar lanterns is seasonal, with sales increasing after spring as consumers have money to spend coming out of the harvesting season and seeking electricity for cooling as they face the summer months. The seasonality of customers' revenues remains a concern for enterprises, as it hinders cash flows and restricts their ability to maintain the required inventory to meet market demand. With cash tied up for inventory, enterprises are unable to spend funds on customer acquisition to expand their businesses.

ANNEX A
METHODOLOGY

The report assesses the financing needs of market actors that enable access to reliable, affordable and modern energy services in five high-impact jurisdictions (Kenya, Ethiopia, Bangladesh, Nigeria and Myanmar). It focuses on enterprises meeting Tiers 1 - 3 of energy access needs in these markets. It investigates the current (or near-past) finance needs of enterprises and other energy access market actors to determine how enterprises active in the energy access sector are being financed, what their unique finance needs are and what are the estimated future finance needs for Tiers 1 - 3 of energy access in each country surveyed. The methodology set out here describes the research and analysis to support future replication or improvement.

The model developed to conduct the scenarios on future finance needs has been built up over the course of several months and adjusted, improved and reviewed over the course of the project by both internal and external experts. Countless sensitivity analyses have been conducted on different variables and assumptions as the model developed. As with any modeling exercise, the assumptions made are decisive in shaping the final outputs. Moreover, the authors recognize that every assumption made here could be debated and challenged. The hope is that by being transparent about these assumptions, this report can help inform subsequent research and support the replicability of this work in the future.

SCOPE

In-country work began with an analysis of the current energy access landscape to develop a comprehensive list of companies, NGOs and international development organizations active in these markets. In most cases, this preliminary market research yielded between 40 and 75 market actors. This initial list was used to reach out to individual enterprises for interviews.

The analysis focused on organizations or market actors whose activities enable energy access through the deployment of decentralized energy technologies. This includes organizations who design, manufacture, transport, sell, maintain or repair energy access products and equipment; who construct, install, manage or operate decentralized energy systems; who supply mini-grid electricity to end users; who supply cooking fuels; or who provide marketing, administration, knowledge or end-user finance services that encourage uptake of energy access.

This definition does not restrict the focus to finance for enduring physical assets, but encompasses finance used by market actors for any purpose, including business support functions.

The in-country analysis included social enterprises as well as NGOs and captured formal and informal actors, where necessary. In some cases, this involved interviews with kiosk owners selling solar lantern and other lighting products in urban and peri-urban markets, to better understand the distribution and supply channels, business models and finance needs of different market actors.

Given that the focus was on enterprises serving Tiers 1 - 3 of energy access, national utilities or other government-backed entities leading large-scale, grid-extension or mini-grid initiatives were not interviewed.

In the cooking sector, market actors working in the kerosene fuel supply chain were not included, because it is diffi-

cult to separate kerosene for lighting from other uses and the market for kerosene supply is not expected to have significant unmet finance needs. The supply of cookstoves that could use kerosene was included as improved cookstoves.

Organizations providing finance to market actors (including end-user finance) were interviewed, as these actors possess valuable information about the needs of finance recipients. Between two and four finance providers were interviewed in each country to incorporate their perspectives on the market gaps and current finance needs, and to garner insights on barriers to finance and energy access priorities in each country.

ENERGY ACCESS TIERS AND TECHNOLOGIES

The report focuses entirely on markets for off-grid or decentralized technologies and systems that provide Tiers 1, 2 or 3 energy access per the Multi-Tier Framework (Bhatia and Angelou, 2015).

ELECTRICITY

For electricity access, the most common and relevant technologies that meet this definition are solar lanterns that incorporate phone charging; SHS, non-solar standalone systems (e.g., diesel generators, wind); and low- to medium-capacity (per-user) mini-grids. While solar lanterns can only deliver Tier 1 services, other technologies can and do deliver energy access at Tiers 1, 2 and 3. High-quality mini-grids may deliver Tier 4 electricity access or above. Enterprises enabling energy access through Tier 5 alone were excluded from the analysis.

COOKING

The access Tier provided by a cooking solution depends on how it is used, and can only strictly be known for an individual user by taking demand-side measurements. The analysis assumes standard usage conditions to predict the tier of access. Assuming standard usage, the Tiers 1 to 3 scope includes all uses of firewood, pellets, briquettes, and charcoal, and excludes BLEENS solutions (biogas, LPG, ethanol, electricity, natural gas and solar). However, in Bangladesh (where biogas and LPG are quite prevalent) and in Nigeria (where LPG and ethanol are prevalent), certain enterprises were surveyed that derived a portion of their revenues from these cleaner, Tier 4 fuels. This notwithstanding, most cooking sector enterprises surveyed focused either on manufacturing, distributing or retailing clean cookstoves for wood and/or charcoal fuels, or supplying cooking fuels.

END-USER TYPES

While the focus is mainly on household energy access providers, enterprises whose activities include serving non-domestic users (such as commercial, agricultural or other productive uses) were included and interviewed, where appropriate. In cases like Bangladesh, many of the enterprises interviewed derived a non-negligible portion of their revenues from serving institutional, commercial, or small business sectors. However, the core focus of the analysis was on enterprises providing energy access to the domestic sector, largely because this is where the greatest gap—and therefore the greatest finance need—exists for Tiers 1 to 3 energy access solutions.

TIME PERIODS

The survey questions focused on the following years: 2013-14 and 2015-16.

Analysis of future needs focuses on the financing needed to meet national government targets through 2030. This is the target year for delivery of Sustainable Development Goal 7 and SEforALL goals.

GEOGRAPHIC BOUNDARIES

Where survey respondents are active in multiple countries—including countries beyond the scope of this study—in-depth interviews were used to separate the finance needs for the survey country from those of the overall company or enterprise. In other words, enterprises were asked to focus on revenues derived from energy access in

the survey country, excluding revenues derived from other sectors or countries. This ensured that data gathered on finance-related needs accurately reflects the situation in the survey country.

FINANCE TYPES

Table A.1 provides an overview of the finance technology used in the analysis.

Table A.1 Overview of the main financial instruments

Instrument	Type
Debt	**Corporate debt from:** ○ a local bank ○ an international bank ○ a development finance institution ○ a micro-finance institution ○ a government agency ○ crowd-funded debt
	Project debt from: ○ a local bank ○ an international bank ○ a development finance institution ○ a micro-finance institution ○ a government agency
	Asset-backed security
	Loan from friends or relatives
Equity	**Corporate equity:** ○ own funds, on-balance sheet financing ○ venture capital ○ angel investor ○ impact investor ○ private equity
	Project equity
	Mezzanine finance
	Equity from friends or relatives
Grants	**Donor funds from:** ○ an international institutional donor ○ a philanthropic organization ○ the national or local government ○ government subsidy (e.g., tax exemption)
	Carbon credits (CDM, voluntary market)
	Guarantees

RESEARCH PROCESS

IDENTIFYING MARKET PARTICIPANTS

A master list of the key energy access market participants in each of the five countries was created drawing on publicly available data and reports including: the UN Foundation's Energy Access Practitioners' Network, the SEforALL Finance Committee report, market reports from the Global Off-Grid Lighting Association (GOGLA), BNEF and member lists for GOGLA and GACC. (See Bibliography). This was supplemented with additional outreach in-country through national industry associations and other international organizations—such as Energy4Impact, IRENA, IIED, Hivos, Arc Finance and Worldwatch—to broaden the scope of prospective interviewees.

To counter any potential bias in favor of larger, more-established market actors, the analysis included a wide representation of different enterprise sizes. Debt:Equity:Grant ratios for larger enterprises tended to have greater influence when weighted by revenues, since they have a greater number of unit sales.

ORGANIZING SURVEYS OF MARKET PARTICIPANTS

Country-specific survey lists were organized per market segment (e.g., clean cookstoves, SHS), focusing primarily on organizations with technologies corresponding to Tiers 1 to 3 of the Multi-Tier Framework. End-use technologies, customer segments (e.g., residential, commercial and institutional) and activities (e.g., consulting, other services) were recorded with an identifier for each market actor. These three dimensions provide a concise way of qualitatively describing entities in the energy access sector. It should be noted that customer segments are not necessarily end-users, but can also be other market actors further down the value chain.

Each actor's turnover—or an estimate of their turnover—and, where possible, sales numbers were recorded to provide a picture of the size of enterprises active in the sector. To ensure as high a level of data sharing, the surveys provided ranges of revenues (e.g., $500,000 – $1 million) and respondents were invited to provide more specific revenue numbers. In approximately 10 percent of cases, respondents provided actual sales revenues. A significant portion of these came from Bangladesh.

Table A.2 shows the categories that were used.

Table A.2: Overview of the descriptor segments and activities

End use technology or market segment	Customer segment	Activities
- Solar lanterns - Solar home systems - Mini-grids Renewables/hybrids - Mini-grids, fossil fuels - Improved cookstoves (wood) - Improved cookstoves (charcoal) - Solid cooking fuel supply - Other (biogas, LPG, ethanol, solar cookers, solar pumping, etc.)	- Households - Community institutions (e.g., schools, health clinics, churches, etc.) - Small businesses and local enterprises - Industry (e.g., manufacturing, agriculture, mining, etc.) - Other	- Manufacture, assembly and/or processing (e.g., product/equipment/fuel) - Distributor (e.g., products/equipment/fuel) - Retailer (products/equipment/fuel) - Vertically integrated supplier (e.g., covering most/all parts of the supply chain) - Mini-grid based electricity supply - Construction/installation - Maintenance, repair and after-sales services - End-of-life disposal/recycling - Project/product design - Management of energy facilities/operations - Marketing - Knowledge services - Legal or administrative services - End-user finance - Commercial or distributor finance, including support services

The long list of market participants was organized as follows to facilitate selection.

Table A.3 Overview of enterprise categorization

Enterprise size in country ($'000 in annual turnover)	Market Segment					
	Solar lanterns	Solar home systems	Mini-grids (renewable, hybrid, and conventional)	Solid fuel improved cookstoves	Solid cooking fuel supply	Other
0 – 10						
10 – 100						
100 – 500						
500 – 1,000						
1,000 – 10,000						
Above 10,000						

APPLYING THE FILTER

To short-list market participants for the survey, the analysis used a filtering methodology based on two factors:

- Market segment (clean cooking, solar home systems, etc.)
- Enterprise size (annual turn-over in $'000)

Turnover was selected as a measure of enterprise size, rather than the number of customers, as a stronger driver of finance needs.

Figure A.1 provides a visualization of the process in each country.

Figure 1 Visualization of filtering process

MARKET SEGMENT

Of the five to seven market segments identified, three or four segments were selected for the rest of the research based on number of organizations and perceived market size. In some countries, like Myanmar, no cooking enterprises were interviewed and none of the leading DFIs interviewed has resources allocated to the cooking sector. The survey in Myanmar therefore focused on solar lanterns, SHS and mini-grid market segments.

In some cases, it was difficult to find enterprises active or focusing specifically on the solid cooking fuel market segment (e.g., wood, charcoal, pellets, briquettes). In many cases, cookstove manufacturers also provided fuel, but there were comparatively few enterprises focusing specifically on fuel supply, outside the LPG sector.

ENTERPRISE SIZE

Within each of the selected segments, the goal was to select at least two organizations from each size bracket to form the core sample. In the instance that one size bracket contained fewer than two organizations, the "missing" selection(s) were allocated to the size bracket(s) in which the largest number of organizations were identified. To ensure that cooking received attention proportionate to its importance, an effort was made to ensure that the cooking sector was adequately represented in each country surveyed. Within each market segment, the survey covered a range of organizations for the following functions identified in Table A.4.

While selecting organizations, preference was given to the largest organizations within each turnover bracket.

Table A.4 Overview of market segments

Solar lanterns / Solar home systems / other standalone / cookstoves	Mini-grids	Cooking fuel supply
Sale of physical assets (product/equipment)	Electricity supply	Sale of physical assets (fuel)
Transformation of physical assets (product/equipment)	Construction/installation	Transformation of physical assets (fuel)
Transport of physical assets (product/equipment)	Maintenance or repair provision	Transport of physical assets (fuel)
Non-financial service activities: • maintenance or repair provision • marketing • knowledge services (advice, education, information) • administration services	Management of energy facilities/operations	

Note - Vertical integration refers to organizations that cover several, or even all, functions listed. Most vertically integrated companies were operating in the solar home system market, particularly among PAYGO enterprises.

SEGMENT-SPECIFIC SECONDARY RESEARCH

Information was gathered on the following topics through a literature review and consultations with key stakeholders:

- dominant and emerging business models within each market segment
- number of active companies/organizations within each market segment (order of magnitude)
- typical maturities and types (private enterprise, social enterprise, NGO, etc.) of active companies/organizations within each market segment
- (estimated) size of each market segment, measured by revenue and number of sales or customers
- end-user subsidy, if applicable (the gap between the cost of the product/service and the price the end-user pays)
- major investments known to have flowed into the sector, or summed investment flows, in 2013-14 or 2015-16, broken down by Debt:Equity:Grant (where information was available)
- barriers to finance flows to market actors
- projections of future finance needs (where available)

CORE SAMPLE INTERVIEWS

Interviewees were approached by in-country experts, in line with business and cultural norms. Verbal (phone or face-to-face) contact was supplemented by written communication, so that every prospective interviewee had a copy of the introductory text, the interview questionnaire

and the non-disclosure agreement. The introduction/invitation explained the purpose and significance of the study and its expected benefits for the energy access sector.

The interviews were semi-structured and based on a questionnaire (See Annex C and D). Virtually all interviews were conducted in person with senior officials at the company or organization (e.g., CEO, CFO, managing director, executive director, or other senior office holder). Senior-level access did not prove to be a challenge except for larger, more established PAYGO companies, where access and data disclosure both proved challenging.

The data gathered covered two time periods: 2013-14, and 2015-16. However, several enterprises interviewed were not in business or had not recorded sales in 2013-14. In some markets, like Bangladesh, it was possible to trace the change in enterprise revenues and D:E:G ratios from 2013-14 to 2015-16, but in most other countries, the emergence of new actors and the disproportionate influence of larger donors (e.g., in Ethiopia and Myanmar) meant that changes seen from 2013-14 to 2015-16 could not be relied upon to provide indicative trends. The core analysis focused on the best data available, which in all countries was for the period 2015-16.

The interviews aimed to capture the following key data, as a minimum, to develop a nationwide analysis of the overall energy access financing landscape:

1. Share of debt as a share of the organization's overall financing (to be specified whether it is corporate debt, project debt, a concessional loan from a DFI, a government-backed loan, or other)

2. Share of equity (corporate equity, project equity, private equity, VC funds)

3. Share of grant or donor funding (whether from the national government, philanthropic grants, international donors, or from carbon or other revenues)

4. Overhead ratio (overheads to include among other things: marketing, R&D, insurance)

5. Volume of sales to end-users (or equivalent, if the segment is not concerned with sales)

6. An estimate of the current cost of capital in both local and international currency financing

7. An estimate of the tolerable cost of capital for both local and international currency financing.

A "rank and explain" question about the most influential barriers to obtaining finance was also included in the survey with barriers separated into those cited most often for electricity access versus clean cooking.

FUTURE ENERGY ACCESS SCENARIOS

National order of magnitude estimates of the anticipated amount of debt, equity, and grant finance required to meet national targets were developed for each country. In some cases, like Kenya, these targets were included in the SEforALL Action Agenda (Kenya, 2017; Nigeria, 2016); in others, targets were based on government reports or strategies. Estimates were aligned with the best available government forecasts for the electricity and cooking sectors and include country-specific assumptions, such as the final share of the population that will achieve various Tiers of energy access.

The analysis included a basic population analysis, including anticipated population growth, through 2030. The best year for which uniform data, including forecasts, was available in the World Bank's population database was 2014. In addition, since energy access is provided at the household level, the basic unit of analysis considered was the household. Numbers for the average number of inhabitants per household were found on individual websites, either from the government, the World Bank, or from ArcGIS.

Table A.5 summarizes they key population figures by country.

Table A.5 Key population data by country

	Current population (inhabitants, 2014)	Number of inhabitants per household	Current population (households, 2014)	Population in 2030 (inhabitants)	Population in 2030 (households)
Bangladesh	160,995,640	4.5	35,776,809	186,460,000	41,435,556
Ethiopia	99,390,750	5.1	19,488,382	138,297,000	27,117,059
Kenya	46,050,300	4.4	10,465,977	65,412,000	14,866,364
Myanmar	53,897,150	4.7	11,418,888	60,242,000	12,763,136
Nigeria	182,201,960	4.5	40,489,324	262,599,000	58,355,333

This population forecast was combined with current energy access numbers to calculate the absolute energy access gap by 2030, citizens currently lacking access to electricity and/or clean cooking, plus new clean cooking and electricity connections needed by 2030 to meet population growth. For countries with 100 percent energy access targets (for electricity and cooking), the absolute energy access gap was taken as the total number of new connections or systems needed to reach universal energy access. For governments with access targets less than 100 percent (such as Nigeria, with a 90 percent electricity access target and an 80 percent clean cooking target, and Myanmar, with an 80 percent clean cooking target), a separate calculation was used: the total population by 2030 was multiplied by the access target (percent) and then the number of households that currently have access was subtracted to leave the absolute number of households still needing access to meet the target.

Table A.6 provides an overview of the access gap by country, based on this methodology.

Table A.6 Overview of the access gap by country (by number of households)

	Actual electricity access gap based on government targets by 2030 (households)	Percent of households (2030)	Actual clean cooking access gap based on government targets by 2030 (households)	Percent of households (2030)
Bangladesh	19,110,827	46.1	37,822,098	91.3
Ethiopia	21,816,219	80.5	26,727,291	98.6
Kenya	11,098,612	74.5	14,217,473	95.5
Myanmar	6,825,314	53.4	9,171,390	71.9
Nigeria	29,177,704	50.0	45,753,012	78.4

ESTIMATING FUTURE FINANCE NEEDS

The analysis is based on a bottom-up model focused primarily on the costs of meeting Tiers 1 to 3 energy access. It includes the following factors:

1. A forecast of population growth, reflecting the absolute share of the population needing access through 2030

2. Updated cost data for Tiers 1 to 3, using the most recent costs available to reflect the significant declines in unit costs that have occurred since 2015

3. A technology degression value to capture future cost declines set conservatively at 2 percent for Tiers 1 to 3, based on the World Bank's AIM model assumptions, and 1 percent for Tier 4 mini-grids, to capture future cost and efficiency improvements.

ELECTRICITY ACCESS COST ASSUMPTIONS

To calculate the costs, the analysis used baseline numbers from the World Bank's Access Investment Model (AIM)[15] for the costs of meeting different Tiers of access. Table A.7 provides an overview of cost inputs.

Table A.7 Tier definition and key cost inputs

Definition of each Tier of access	Peak power	Daily demand	Annual demand	Cost per household (per AIM, 2015)[16]	Capital cost per system/ connection (2017)	Total capital cost per household through 2030, including inverter/battery/ product replacement, as well as a 20 percent premium over cash sales price for Tiers 2 and 3 to factor in the cost of a PAYGO finance plan (2017)
Units	**W**	**Wh**	**kWh**	**$**	**$**	**$**
Tier 1	5	20	7	94	10[17]	70
Tier 2	70	275	100	798	564[18]	1,340.06
Tier 3	200	1000	365	1,680	1,320[19]	3,136.32
Tier 4	800	3,400	1,241	6,720	6,720	6,720
Tier 5	2,000	8,200	2,993	16,800	16,800	16,800

[15] *Progress Toward Sustainable Energy 2015, Global Tracking Framework, Annex 2, Access Investment Model (AIM)*

[16] *These figures were obtained directly from the World Bank's recently updated AIM model.*

[17] *See : https://data.bloomberglp.com/bnef/sites/4/2016/03/20160303_BNEF_WorldBankIFC_Off-GridSolarReport_.pdf*

[18] *http://www.sendea.biz/product-catalogue/productdetail/market/show/product/mobisol-basic-nyatibuffalo-80w/*

[19] *http://www.sendea.biz/product-catalogue/productdetail/market/show/product/mobisol-basic-temboelephant-200w/*

Darker blue cells indicate the cost inputs that were modified and updated based on an analysis of current costs. Green cells indicate the total cost per household of obtaining and maintaining that Tier of access over 2018-30, including the replacement of batteries, inverters, and—for Tiers 2 and 3—the costs of finance. The technology degression value is applied to this aggregate cost value and applied each year to new households gaining access. (See below for more on the incorporation of the degression value to track technological cost improvements). As the analysis focuses on the costs of meeting Tiers 1 to 3, the assumptions and detail on Tiers 4 and 5 cost calculations are at best indicative.

To capture the cost of operations and maintenance, a different approach was used: during the interviews, enterprises were asked about their approximate overhead ratio, which covers the costs of staff, office space, customer acquisition, after-sales services, as well as maintenance, among others. In most cases, this overhead ratio was estimated by enterprises to be between 25-50 percent. Once the final capital cost numbers were generated by the model, the model applies a multiplier to capture overhead and business services costs that are a real part of enterprise finance needs. So rather than including the operations and maintenance costs at the level of the capital cost calculation, they were added on after the fact as part of the costs of managing and running an energy access enterprise. For simplicity, three different multipliers were used: 1.2 for enterprises active in the cooking sector; 1.33 for the electricity access sectors of Ethiopia, Nigeria, and Myanmar, and Bangladesh; and 1.4 for the electricity access sector of Kenya. These numbers broadly reflect the responses received to the question about enterprises' overhead costs. In practice, if the capital costs of meeting and maintaining Tier 2 access for a share of the population of Ethiopia are estimated at $1 billion, adding the real enterprise-related costs of meeting that Tier of access would result in a total finance need of $1.33 billion.

For Tiers 1 to 3 of electricity access, we have assumed a lowest-cost approach, which in all countries surveyed currently favors the use of either solar lanterns or of SHS to reliably meet and, perhaps more importantly, maintain that Tier of access over time.

For the cost input values that were modified for Tiers 1 to 3, the most recent data available for lantern products and for SHS was used. For each level of access, the solar product was matched to the rated capacity corresponding to that Tier of access and priced accordingly.

To capture the fact that a household lighting product (e.g., lantern) has an average useful life of two years, and that SHS need to have batteries and inverters replaced every five-to-seven years, it was assumed that households in Tier 1 must buy multiple lanterns to "maintain" access. For 2017-30, the model assumes that an average of seven solar lanterns per household are needed to reach and maintain access. Some customers may move up the energy access ladder, which would increase the overall money needed.

For Tier 2, the model draws on the most recent IRENA cost data available for off-grid solar (IRENA, 2017), indicating that for SHS, the costs of batteries and inverters represent 49 percent of the total initial cost of the system. The model assumes that two replacements will occur through 2030. This results in a total cumulative price almost twice (1.98 times) as high to meet and maintain access as the initial product price. While virtually all Tier 1 lantern products are purchased as cash sales, the model assumes that Tiers 2 and 3 SHS products will be purchased via a PAYGO finance plan. To reflect this, the model assumes a 20 percent price premium over cash sales for SHS in Tiers 2 and 3, based on price premiums observed in markets such as Kenya and Tanzania (Sendea 2017a, 2017b).

For mini-grids, the replacement cost of inverters and batteries is estimated at 39 percent of the total costs of the mini-grid system (IRENA, 2017) and a single replacement per mini-grid is assumed through 2030. This is partly to recognize that for mini-grids, the majority are likely to be built in 2019-25 and only one battery and inverter replacement is likely to be required through 2030. A (conservative) technology degression value of 1 percent has been

built in to capture some of the cost declines in the mini-grid sector as business models, storage technologies and other factors improve in the years ahead.

For Tier 5 grid connections, the World Bank's AIM assumptions are used and divided by 14 to represent an approximate annualized cost of meeting and maintaining Tier 5 access through 2030. While this is a simplification, as grid investments typically have useful lives of upwards of 30 or even 40 years (suggesting that a longer amortization should be assumed), the cost of building and delivering the connection (assumed at $16,800 per household) is assumed to contain the cost that the utility needs to recover, and which tariffs are themselves designed to do, over the period through 2030. Moreover, while most households in the countries surveyed are unlikely to spend $1,200 per year on electricity access, this is assumed to be the cost that the utility building the connection would have to recover, either via government subsidies, grants, or from other ratepayers. And while the grid infrastructure built to meet Tier 5 access through 2030 will continue operating beyond 2030 (which means that the cost calculations for Tiers 4 and 5 imply a certain "front-loading" of the costs), the financing needs required to build that infrastructure out will need to be largely incurred over 2017-30 to meet universal energy access, making this is a reasonable period over which to assume these investments will occur.

For Tier 5 access, as in Tier 4, a multiplier to cover enterprise overheads of 1.2 has been added to the CAPEX to more accurately reflect the real overall finance needs of meeting Tier 5 supply.

Based on these assumptions detailed above, the end values assumed in the cost model are detailed in Table A.8.

Table A.8 Cost inputs per household per day and per year for electricity access

	Cost to remain in each Tier of access over the duration of the period through 2030 ($/household/day)	Cost per household per year of meeting and maintaining each Tier of electricity access ($/household/year)
Tier 1	0.0137	5.0
Tier 2	0.2622	95.7
Tier 3	0.6138	224.0
Tier 4	1.8279	667.2
Tier 5	3.2877	1200.0

For simplicity, the same cost input values are assumed for all five markets surveyed, although it is recognized that important regional differences can exist, for example, in import and VAT duties, distribution channel development costs and local finance costs.

COOKING ACCESS COST ASSUMPTIONS

For the cooking sector, fuel mix assumptions are based on the best available government sources at the time of writing. In cases like Kenya, a detailed breakdown of the anticipated future fuel mix in the cooking sector was avai-

lable and could be used directly to calculate the approximate cost of meeting the government's energy access target. When forecasts were not available, assumptions were made about the future evolution of the fuel mix, based on interviews and industry sources such as GACC.

The future fuel mix assumptions are outlined in Table A.9 for each country surveyed.

Table A.9 Future fuel mix assumptions for the cooking sector by country (to 2030)

Fuel source	Anticipated future cooking fuel mix in Kenya (%)	Anticipated future cooking fuel mix in Ethiopia (%)	Anticipated future cooking fuel mix in Nigeria (%)	Anticipated future cooking fuel mix in Bangladesh (%)	Anticipated future cooking fuel mix in Myanmar (%)
ICS wood	30.0	33.0	30.0	40.0	20.0
ICS charcoal	27.7	33.0	20.0	5.0	38.0
LPG	35.3	4.0	20.0	30.0	2.0
Electric	2.3	28.0	20.0	15.0	40.0
Ethanol/methanol	4.5	0.0	6.0	0.0	0.0
Biogas	8.0	2.0	4.0	10.0	0.0

Sources: Kenya, (2017), MOWIE, (2013), Accenture, (2011), SREDA (2013), Myanmar, (2014), plus local stakeholder interviews.

The cost assumptions are drawn from the World Bank's recent report on cooking costs (World Bank, 2015).

Table A.10 Cost inputs for the cooking sector

Fuel source	Stove/system cost ($, 2017)	Annual usage cost ($, 2017)	Total cost of clean cooking solutions, stove plus fuel, spread out over time (in $/household/year)
ICS wood	23	100	103.29
ICS charcoal	33	140	144.71
LPG	55	230	237.86
Electric	30	310	314.29
Ethanol/methanol	52	190	197.43
Biogas	950	50	117.86

The model conservatively assumes that there will be no reduction in the cost of cooking solutions through 2030. Although stove and pot technologies are likely to improve significantly in the years ahead, the future evolution of fuel prices (whether local firewood, charcoal, or LPG prices) remains highly uncertain and they are just as likely to increase as they are to decrease, particularly as population growth puts further strain on resource availability, notably wood and charcoal.

Note that while an asset-based approach to calculating the cost of energy access works relatively well for the electricity sector—particularly for Tiers 1 to 3—it is an unreliable basis upon which to calculate the real costs of achieving universal access to clean cooking. This is primarily because most of the costs of clean cooking fuels and technologies are found in the fuels, and not in the stoves. On a lifecycle basis, the cost of the stove is less than 5 percent of the total amount that a household will spend on cooking.

As such, the analysis used for the cooking sector considers both fuels and the costs of the stove. It should be noted that consumers of cooking fuels such as firewood, charcoal, LPG, or other fuels, often pay for fuels out of their own income or gather fuels from the surrounding environment, rather than financing their fuel costs. As such, the spending on fuel does not represent a "finance need" per se, although customers may benefit from or require consumer finance to pay for the initial cost of the stove, as well as periodic fuel purchases. As households move up the clean cooking ladder from charcoal to LPG, ethanol or other cleaner fuels, government subsidies or incentives may be required to accelerate this transition. Thus, the total "costs" of cooking covered here are more accurately referred to as the total "spending" required in the countries surveyed in the cooking sector to achieve government targets, rather than the finance need as such.

DEGRESSION

The decline in per-unit costs is likely to have a significant impact on the forward-looking growth in finance-related needs, as the cost decline enables each dollar invested to buy more energy than in the past. These underlying cost declines, which also reflect the increasing maturity of the sector and the improved efficiency of technologies, have been considered when estimating future finance needs by adding a degression value. Table A.11 provides an overview of the degression values used on an annual basis to the Tier-specific cost per household per year.

Table A.11 Degression values by market segment

Market segment	Assumed degression value (percentage reduction per year on the cost of each new connection delivered in that year)
Tiers 1 – 3 electricity access	2
Tier 4 electricity access	1
Tier 5 electricity access	0
Cooking sector	0

APPLYING THE DEBT:EQUITY:GRANT RATIOS

To estimate D:E:G shares by 2030, the current share of D:E:G for the cooking sector and Tiers 1 to 3 of the electricity sector were developed based on interview data. The survey asked companies whether they anticipated their reliance on debt, equity, and grant to increase, decrease, or remain about the same through 2030. This provided an indication of the anticipated trend in types of finance needed. In some cases, important data gaps remained. In Kenya, for instance, it proved difficult to secure interviews with senior officials at the leading PAYGO companies, which are currently serving much of the Tier 2 and Tier 3 energy access needs. When enterprises were interviewed, PAYGO companies were generally reluctant to share their current capital structure. This means that the baseline D:E:G ratios in some countries are not as reliable in estimating the overall role of debt, equity, and grants in meeting current energy access needs. To bridge this data gap, several additional interviews were held with investors—including impact funds, foundations and venture capital firms who are currently investing in energy access in the countries surveyed—to get their perspective on the likely evolution of the industry's capital structure.

Table A.12 provides an overview of the current capital structure in each country for cooking and Tiers 1 to 3 of electricity access. Note that for Myanmar, no enterprises or DFIs active in the cooking sector were available for interview.

Table A.12 Current enterprise capital structure by country

Country	Market segment	Debt	Equity	Grant
Bangladesh	Tiers 1 – 3 electricity	58	23	19
	Clean cooking	53	33	14
Ethiopia	Tiers 1 – 3 electricity	24	52	24
	Clean cooking	4	27	69
Kenya	Tiers 1 – 3 electricity	30	50	20
	Clean cooking	20	58	22
Myanmar	Tiers 1 – 3 electricity	39	33	28
	Clean cooking	N/A	N/A	N/A
Nigeria	Tiers 1 – 3 electricity	4	71	25
	Clean cooking	0	69	31

The current D:E:G ratios for each country and sub-sector were compared with responses on the anticipated future reliance on debt, equity and grant funds to extrapolate D:E:G ratios into the future and supplement them with additional insights based on current industry trends, the likely impact of sector maturity on enterprise capital structure, and interviews with investors and financial institutions with a deep knowledge of the sector and operating business models.

For instance, in the PAYGO sector, the future capital structure of the industry relies to a significant degree on how

the PAYGO companies evolve. Depending on whom one asks, they could evolve to become closer to conventional utilities, universal service providers selling a range of other products and services (including clothing, Wi-Fi, household supplies), or financial institutions providing consumer finance of varying maturities to their growing customer base. The D:E:G ratios for the energy access sector could change significantly for each of these pathways.

The analysis, therefore, considered a range of different future scenarios that drew on secondary literature on enterprise capital structure (e.g., Forte et al. 2013) and discussions with industry stakeholders. Table A.13 provides an overview of the potential direction in which D:E:G ratios could evolve from a starting point of 30 : 50 : 20.

Table A.13 Evolution of D:E:G ratios over time

D:E:G Ratio		Grant share										
		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Debt share	0%	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	
	10%	90%	80%	70%	60%	50%	40%	30%	20%	10%		
	20%	80%	70%	60%	50%	40%	30%	20%	10%			
	30%	70%	60%	50%	40%	30%	20%	10%				
	40%	60%	50%	40%	30%	20%	10%					
	50%	50%	40%	30%	20%	10%						
	60%	40%	30%	20%	10%							
	70%	30%	20%	10%								
	80%	20%	10%									
	90%	10%										
	100%											

Grey represents the equity share

Table A.14 shows the estimated D:E:G ratios in 2030. This extrapolation assumes that the D:E:G ratios derived from the enterprise interviews conducted are broadly representative of the sector as a whole in each country.

Table A.14 Anticipated enterprise capital structure in 2030

Fuel source	Market segment	Debt	Equity	Grant
Bangladesh	Tiers 1 – 3 electricity access	75	20	5
	Clean cooking sector	60	30	10
Ethiopia	Tiers 1 – 3 electricity access	35	50	15
	Clean cooking sector	20	45	35
Kenya	Tiers 1 – 3 electricity access	65	35	0
	Clean cooking sector	30	55	15
Myanmar	Tiers 1 – 3 electricity access	60	30	10
	Clean cooking sector	N/A	N/A	N/A
Nigeria	Tiers 1 – 3 electricity access	60	30	10
	Clean cooking sector	30	55	15

BARRIERS TO ACCESSING FINANCE

A wide range of qualitative insights was gathered from enterprises on the main barriers to obtaining finance. This data was instrumental in drafting the country profiles and providing insights on the country-specific circumstances that energy access enterprises are facing.

FINANCIAL INSTITUTION INTERVIEWS

Between three and five semi-structured interviews were conducted with finance providers in each country. These included entities providing finance to energy access market actors, DFIs and entities providing end-user finance. In some cases, financial sector interviews were supplemented by interviews with impact funds, foundations, venture capital organizations and market actors providing specialized services to the energy access sector, such as currency risk mitigation. The survey questions differed somewhat from the questions asked of enterprises, but there were several overlaps in terms of the main barriers, the financing challenges of investing in energy access companies, and country-specific priorities. (Annexes B and C).

ANNEX B
ENTERPRISE QUESTIONNAIRE: KENYA

Present Confidentiality Statement. Also, emphasize at the outset that we do not expect exact dollar amounts, just ranges, or percentages, for most the questions. If conducting the interview via phone or Skype, please ensure that the interviewee has access to either an online or printed copy of the questionnaire before beginning.

1. Name and organisation of interviewee:

Interviewee information	Please insert information
Interviewee name:	
Contact info: email	
Contact info: mobile	
Position or title:	
Company/Organisation name:	
Location of headquarters (Country):	
How does your organisation define Itself? *(Please check one)*	☐ Private for-profit ☐ Social enterprise ☐ NGO/Community service organisation ☐ Hybrid/other non-profit
Approximate number of years the organisation has been working in the energy access sector:	_____ years

2. What are your enterprise's target markets (Step 1)? If known, please insert **approximate** percentages (%) for the share of sales/revenues derived from each category (Step 2).

Check all that apply (x)	Market	Approximate percentage (%) of sales/revenues
	Solar lanterns	
	Solar home systems (SHS)	
	Mini-grids: renewable/hybrid	
	Mini-grids: fossil fuels	
	Improved charcoal stoves	
	Improved wood stoves	
	Solid cooking fuel supply (e.g. charcoal, pellets)	
	Other energy technologies: ☐ Grid-connected generation ☐ Transmission and distribution ☐ Natural gas or LPG infrastructure ☐ Other cookstoves	

3. Into which **size category** does your organization belong (exclusively considering the activities and services provided within Kenya)?

Enterprise size within the focus country Please check one (x)	$0 – 10,000	$10,000 – 100,000	$100,000 – 500,000	$500,000 – 1 million	$1 - 10 million	Greater than $10 million
	(0 – 1 million KSh)	(1 – 10 million KSh)	(10 – 50 million KSh)	(50 – 100 million KSh)	(100 – 1 billion KSh)	Greater than 1 billion KSh
$ in annual turnover/revenues						
KSh in annual turnover/revenues						

4. Please indicate the **approximate number of units sold** (or connections provided) for each of the two time periods listed below (2013 – 14, and 2015 – 16).

Market	Approximate number of units sold (connections provided) (2013 – 14)	Approximate number of units sold (connections provided) (2015 – 16)
Solar lanterns		
Solar home systems (SHS)		
Mini-grids: renewable/hybrid		
Mini-grids: fossil fuels		
Improved charcoal stoves		
Improved wood stoves		
Solid cooking fuel supply (e.g. charcoal, pellets)		

5. What is the enterprise's **approximate annual volume of sales** - specifically those derived from energy access-related products and services - to customers in 2013 – 14 as well as in 2015 – 16?

Approximate annual volume of sales Please check one Per time period (x)	$0 – 10,000	$10,000 – 100,000	$100,000 – 500,000	$500,000 – 1 million	$1 - 10 million	Greater than $10 million
	(0 – 1 million KSh)	(1 – 10 million KSh)	(10 – 50 million KSh)	(50 – 100 million KSh)	(100 – 1 billion KSh)	Greater than 1 billion KSh
Approximate annual volume of sales in 2013 – 14 (x)						
Approximate annual volume of sales in 2015 – 16 (x)						

6. Which of the following best describes the market segment(s) in which your company is active?

Please check all that apply	Please insert information
	Manufacture, assembly and/or processing (product/equipment/fuel)
	Distributor (products/equipment/fuel)
	Retailer (products/equipment/fuel)
	Vertically integrated supplier (covering most/all parts of the supply chain)
	Mini-grid based electricity supply
	Construction/installation
	Maintenance, repair and after-sales services
	End-of-life disposal/recycling
	Project/product design
	Management of energy facilities/operations
	Marketing
	Knowledge services
	Legal or administrative services
	End-user finance
	Commercial or distributor finance, including support services
Other (please specify)	

7. In 2015, what percentage of your organization's sales targeted the following market segments? Please ensure your estimates add up to 100 percent.

Approximate percentage (%)	Customer Segment
	Households
	Community institutions (e.g., schools, health clinics, etc.)
	Small businesses and local enterprises
	Industry (e.g., medium to large scale manufacturing, agricultural production, mining, etc.)
	Other

8. What is the approximate percentage share that each of these types of finance have contributed to your overall business operations in the energy access sector in the period from 2013 – 14? Please ensure your total estimates add up to 100 percent.

Please insert approximate percentage (%) share, as a share of total finance (NB: % should add to 100 percent)		Type of finance
Debt Total: (%)		**Corporate debt from:** ☐ a local bank ☐ an international bank ☐ a development finance institution ☐ a micro-finance institution ☐ a government agency ☐ crowd-funded debt
		Project debt from: ☐ a local bank ☐ an international bank ☐ a development finance institution ☐ a micro-finance institution ☐ a government agency
		Asset-backed security
		Loan from friends or relatives
Equity Total: (%)		**Corporate equity from:** ☐ own funds, on-balance sheet financing ☐ venture capital ☐ angel investor ☐ impact investor ☐ private equity
		Project equity
		Mezzanine finance
		Equity from friends or relatives
Grant Total: (%)		**Donor funds from:** ☐ an international institutional donor ☐ a philanthropic organization ☐ the national or local government ☐ government subsidy (e.g. tax exemption)
		Carbon credits (CDM, voluntary market)
		Guarantees
Other (please specify)		

9. What is the **approximate percentage share** that each of these types of finance have contributed to your overall business operations in the energy access sector in the recent past (2015 – 16)? **Please ensure your total estimates add up to 100 percent.**

Please insert approximate percentage (%) share, as a share of total finance (NB: % should add to 100 percent)		Type of finance
Debt Total: (%)		**Corporate debt from:** ☐ a local bank ☐ an international bank ☐ a development finance institution ☐ a micro-finance institution ☐ a government agency ☐ crowd-funded debt
		Project debt from: ☐ a local bank ☐ an international bank ☐ a development finance institution ☐ a micro-finance institution ☐ a government agency
		Asset-backed security
		Loan from friends or relatives
Equity Total: (%)		**Corporate equity from:** ☐ own funds, on-balance sheet financing ☐ venture capital ☐ angel investor ☐ impact investor ☐ private equity
		Project equity
		Mezzanine finance
		Equity from friends or relatives
Grants Total: (%)		**Donor funds from:** ☐ an international institutional donor ☐ a philanthropic organization ☐ the national or local government ☐ government subsidy (e.g. tax exemption)
		Carbon credits (CDM, voluntary market)
	Total:	Guarantees
Other (please specify)		

10. Do you envision your enterprise becoming more, or less, reliant on debt, equity, and donor funds or each remaining approximately the same, over the next five years (through 2021)?

Market	Reliance on debt through 2021 Please check one (x)	Reliance on equity through 2021 Please check one (x)	Reliance on donor funds through 2021 Please check one (x)
Will become more reliant			
Will become less reliant			
Plan to remain about the same			
Uncertain / don't know			

11. What is your enterprise's recent and current **overhead ratio** (the share of operating costs as a share of total income)? In other words, how much of the company's total use of funds is actually being allocated to providing energy access-related products and services, and how much to covering other costs such as marketing, insurance, etc.?

Please check one (x)	Approximate overhead ratio (share of operating costs as a share of total income, %)
	<25
	25 – 50
	50 – 75
	75 – 100
	Uncertain / don't know

12. Please check all **barriers that you think are critical or highly important to obtaining finance to scale-up energy access** in the region/country you are active in.

Please check all that apply (x)	Main barriers to obtaining finance
	Lack of availability of early-stage investment vehicles
	Weak balance sheet
	Lenders' collateral requirements
	Subcritical deal sizes (small players lack visibility)
	High transaction costs
	Developing bankable business plans
	High foreign exchange risk
	High interest rates
	Lack of access to international creditors or investors
	Lack of local lenders/investors
	Lack of policy clarity in market, high risk perception
	High legal costs
	Limited cash flow
	Limited liquidity of assets
	Limited track record of the enterprise
	Limited track record of the sector or product being financed
	Insufficient knowledge of the investors and/or banks
	Management and staff capacity, lack of skills
	Time required to raise funds
Others? Please insert	

13. Has access to finance been a significant barrier to growing your enterprise and expanding energy access in the country in which you operate? If so, what is your best estimate of your **unmet financing need** in the near-past (2013 – 14 and 2015 – 16)? Put differently, how much additional funds do you believe you and your team would have been able to productively use in 2013 -14, and 2015 – 16 to increase energy access?

Unmet financing need	$0 – 10,000 (0 – 1 million KSh)	$10,000 – 100,000 (1 – 10 million KSh)	$100,000 – 500,000 (10 – 50 million KSh)	$500,000 – 1 million (50 – 100 million KSh)	$1 - 10 million (100 – 1 billion KSh)	Greater than $10 million Greater than 1 billion KSh
Unmet financing need in 2013 - 14						
Unmet financing need in 2015 - 16						

14. What was your enterprise's **approximate cost of capital** in the recent past (2015-16), whether from debt, equity, or other sources of capital, in either international or local currency?

Cost of capital (percent)	0-5	5-10	10-15	15-20	20-25	Other	Uncertain/ don't know
Approximate cost of capital for finance obtained in international currencies (e.g. $, EUR) Please check one (x)							
Approximate cost of capital for finance obtained in local currencies (e.g. KSh) Please check 0ne (x)							

15. Based on your enterprise's current access to finance (whether to loans, grants, equity investments, or other) **what is the highest interest rate your enterprise would be willing to accept**, based on current market conditions, to expand your enterprise in the future?

Cost of capital (percent)	0-5	5-10	10-15	15-20	20-25	Other	Uncertain/ don't know
Approximate cost of capital for finance obtained in international currencies (e.g. $, EUR) Please check one (x)							
Approximate cost of capital for Finance obtained in local currencies (e.g. KSh) Please check one (x)							

ANNEX C
FINANCIAL INSTITUTION QUESTIONNAIRE

Insert **Confidentiality Statement**, which each interviewer will be instructed to read before the interview commences. If conducting the interview via phone or Skype, please ensure that the interviewee has access to either an online or printed copy of the questionnaire before beginning.

1. Name and organisation of interviewee:

Interviewee information	Please insert information
Interviewee name:	
Contact info: email	
Contact info: mobile	
Position or title:	
Company/Organisation name:	
Location of headquarters (Country):	

2. Which energy access markets has your fund or bank provided finance to in the past 3-4 years (Step 1)? If the information is known, please insert **approximate** percentages for the share of finance provided to each category, as a share of your total investments in the energy access sector (Step 2).

Check all that apply (x) Step 1	**Market**	**Approximate percentage of finance provided Step 2**
	Solar lanterns	
	Solar home systems (SHS)	
	Mini-grids: renewable/hybrid	
	Mini-grids: fossil fuels	
	Improved charcoal stoves	
	Improved wood stoves	
	Solid cooking fuel supply (e.g. charcoal, pellets)	
	Other energy technologies: ☐ Grid-connected generation ☐ Transmission and distribution ☐ Natural gas or LPG infrastructure ☐ Other cookstoves	

3. What deal sizes has your fund or bank invested in the energy access sector in the past?

	$0 – 10,000	**$10,000 – 100,000**	**$100,000 – 500,000**	**$500,000 – 1 million**	**$1 - 10 million**	**Greater than $10 million**
Historical deal sizes	(0 – 1 million KSh)	(1 – 10 million KSh)	(10 – 50 million KSh)	(50 – 100 million KSh)	(100 – 1 billion KSh)	Greater than 1 billion KSh
Historical deal sizes Please check all that apply (x)						

4. What deal sizes is your fund or bank interested to invest in the energy access sector in the future?

Future deal sizes	$0 – 10,000 (0 – 1 million KSh)	$10,000 – 100,000 (1 – 10 million KSh)	$100,000 – 500,000 (10 – 50 million KSh)	$500,000 – 1 million (50 – 100 million KSh)	$1 - 10 million (100 – 1 billion KSh)	Greater than $10 million Greater than 1 billion KSh
Future deal sizes Please check all that apply (x)						

5. Is your institution providing consumer finance to support energy access? If not, please proceed to the question 6. If yes, then please indicate which size of consumer loans you have been providing. Please check all that apply.

Consumer finance loan sizes	$0 – 10 (0 – 100 KSh)	$10 – 25 (100 – 250 KSh)	$25 – 50 (250 – 500 KSh)	$50 – 100 (500 – 1,000 KSh)	$100 – 250 (1,000 – 2,500 KSh)	Greater than $250 Greater than 2,500 KSh
Please check all that apply (x)						

6. Within the energy access sector, which of the market segments would you consider to be the most bankable or investable, based on the current conditions in the market in which you are operating? Please select 3 to 5.

Please check all that apply (x)	Market segment
	Manufacture, assembly and/or processing (e.g., product/equipment/fuel)
	Distributor (e.g., products/equipment/fuel)
	Retailer (e.g., products/equipment/fuel)
	Mini-grid based business models
	Solar home system business models (e.g., rent-to-own models)
	Construction/installation oriented enterprises
	Enterprises focusing on maintenance or repair (e.g., of mini-grids)
	Enterprises focusing on end-of-life disposal/recycling
	Enterprises focused on the operation of energy facilities
	Enterprises providing end-user finance
	Vertically integrated suppliers
Other? Please specify	

7. What do you think are the **most important financial instruments** to help scale-up energy access?

Please check all that apply (x)	Type of finance
	Corporate debt from:
	☐ a local bank
	☐ an international bank
	☐ a development finance institution
	☐ a micro-finance institution
	☐ a government agency
	☐ crowd-funded debt
	Project debt from:
	☐ a local bank
	☐ an international bank
	☐ a development finance institution
	☐ a micro-finance institution
	☐ a government agency
	Asset-backed security
	Loan from friends or relatives
	Corporate equity from:
	☐ own funds, on-balance sheet financing
	☐ venture capital
	☐ angel investor
	☐ impact investor
	☐ private equity
	Project equity
	Mezzanine finance
	Equity from friends or relatives
	Donor funds from:
	☐ an international institutional donor
	☐ a philanthropic organization
	☐ the national or local government
	☐ government subsidy (e.g. tax exemption)
	Carbon credits (CDM, voluntary market)
	Guarantees
Others? Please specify	

8. What would you consider to be **the ideal capital structure** for financing an enterprise providing energy access services? Please insert approximate percentages either in an aggregated way (percent of debt/equity/grants), or based on the specific types of finance listed.

Please insert approximate percentage share, as a share of total finance (NB: % should add to 100 percent)		Type of finance
Debt Total: (%)		**Corporate debt from:** ☐ a local bank ☐ an international bank ☐ a development finance institution ☐ a micro-finance institution ☐ a government agency ☐ crowd-funded debt
		Project debt from: ☐ a local bank ☐ an international bank ☐ a development finance institution ☐ a micro-finance institution ☐ a government agency
		Asset-backed security
		Loan from friends or relatives
Equity Total: (%)		**Corporate equity from:** ☐ own funds, on-balance sheet financing ☐ venture capital ☐ angel investor ☐ impact investor ☐ private equity
		Project equity
		Mezzanine finance
		Equity from friends or relatives
Grant Total: (%)		**Donor funds from:** ☐ an international institutional donor ☐ a philanthropic organization ☐ the national or local government ☐ government subsidy (e.g. tax exemption)
		Carbon credits (CDM, voluntary market)
	Total:	Guarantees
Other (please specify)		

9. How would you **characterize the finance needs** of smaller, early stage enterprises currently active in the energy access sector versus those of the larger, more established enterprises? Put differently, **how do size and company maturity impact an enterprise's financing needs**? Please explain.

10. **How do different enterprises' finance needs differ based on the sector in which they are operating** (e.g., solar products distributor, manufacturer, or retailer, versus a mini-grid developer or operator, vs. a cook stove manufacturer or distributor). Please explain.

11. **How do you expect the increasing size and maturity of enterprises in the energy access sector to impact their future financing needs** (in relation to their use, or reliance upon, debt, equity, and grants)? Please describe in your own words.

12. What was the **approximate cost of capital**, whether from debt, equity, or other types of capital, in either international or local currency, for energy access projects or enterprises you have financed in the recent past (2015-16)?

Cost of capital (percent)	0-5	5-10	10-15	15-20	20-25	Other, please specify
Approximate cost of capital for projects or enterprises financed in international currencies (e.g. $, EUR) Please check (x)						
Approximate cost of capital for projects or enterprises financed in local currencies (e.g. KSh) Please check (x)						

13. In your opinion, how important are **currency risk issues** in financing enterprises or projects in the energy access sector?

How important are currency risk issues?	Please check One (x)
Extremely important	
Very important	
Somewhat important	
Not very important	
Not important at all	

14. What is your perception of the potential of financial instruments such as **securitization** to help improve the long-term flow of capital to the energy access sector (e.g., through 2030)?

How do you perceive financial instruments such as securitization?	Please check one (x)
Extremely important	
Very important	
Somewhat important	
Not very important	
Not important at all	
Securitization is risky, and should be avoided	
Uncertain / don't know	

15. Please check all **barriers that you think are critical or highly important to investing in the energy access sector** in the region/country you are active in.

Please check all that apply	Main barriers to investing in the energy access sector
	Better investment opportunities in other industries
	Subcritical deal sizes
	Weak balance sheet of companies/ lack of collateral
	High transaction costs
	Lack of bankable business models/business plans
	Foreign currency risk
	Pay back times are too long
	Lack of policy clarity in market; high perceived regulatory risk
	Limited track record of enterprises or project proponents
	Limited track record of the sector or product being financed
	Management and staff capacity, lack of skills
Others (please list)	

16. If you were asked to advise on **the best use of $100 million dollars** of development funds to accelerate energy access, how would you allocate those funds across the various market needs listed below?

Approximate percentage of $100 million spend (Please insert perceent)	Market need
	Early stage, proof of concept financing for new products and business models
	Access to working capital
	Trainings for local financial institutions
	Technical and managerial capacity/skills development for enterprises
	Consumer awareness and education
	Developing harmonized financial indicators for enterprises operating in the sector
	Establishing and enforcing quality standards, including both on energy access products as well as individual installations
	Development of supportive policy and regulatory environments
	Finance products that facilitate access to local capital markets (e.g. currency risk instruments)
	Supply of end-user finance
Others (please explain)	
Others (please explain)	
Others (please explain)	

BIBLIOGRAPHY

Accenture, Global Alliance for Clean Cookstoves. 2011. "Nigeria Market Assessment. Intervention Options." http://cleancookstoves.org/resources_files/nigeria-market-assessment.pdf

Accenture, Global Alliance for Clean Cookstoves. 2011. "Nigeria Market Assessment. Sector Mapping." http://cleancookstoves.org/resources_files/nigeria-market-assessment-mapping.pdf

Accenture, Global Alliance for Clean Cookstoves. 2012. "Bangladesh Market Assessment. Sector Mapping." http://cleancookstoves.org/binary-data/RESOURCE/file/000/000/155-1.pdf

Accenture. 2012. "Enhancing Markets for Delivery of Improved Cookstove Development and Promotion Support in Ethiopia." http://cleancookstoves.org/binary-data/RESOURCE/file/000/000/160-1.pdf

All On. 2016. "Accelerating access to energy in Nigeria." http://www.all-on.com/publications/_jcr_content/par/textimage.stream/1478620080134/265777d9f1e4cbb7ed35bf7081bfde5622efdf0932c8b5883bcb9086d84c3f30/ALL_ON_BROCHURE_NOV_2016.pdf

ArcGIS. 2016a. "Kenya Average Household Size." http://www.arcgis.com/home/item.html?id=d8c1d70fbb2d49028e0713d425b26805

ArcGIS. 2016b. "Nigeria Average Household Size." http://www.arcgis.com/home/item.html?id=cab92ace06e4416fb8c04dde9e3669a6

ArcGIS. 2016c. "Bangladesh Average Household Size." http://www.arcgis.com/home/item.html?id=692cee7e5a5e47dd86531ab0c6a00cff

Bacon, Robert., Bhattacharya, Soma., and Kojima, Masami. 2010. "Expenditure of Low-Income Households on Energy. Evidence from Africa and Asia." http://siteresources.worldbank.org/EXTOGMC/Resources/336929-1266963339030/eifd16_expenditure.pdf

Bhatia, M. and Angelou, N. 2015. "Beyond Connections: Energy Access Redefined. ESMAP Technical Report." Washington, DC: World Bank. Available at: https://openknowledge.worldbank.org/handle/10986/24368

Bloomberg New Energy Finance and Lighting Global. 2016. "Off-grid solar market trends report 2016." https://data.bloomberglp.com/bnef/sites/4/2016/03/20160303_BNEF_WorldBankIFC_Off-GridSolarReport_.pdf

Castalia Strategic Advisors. n.d. "Myanmar National Electrification Program (NEP) Roadmap and Investment Prospectus."

Craine, Stewart., Mills, Evan., Guay, Justin. 2014. "Clean Energy Services for All: Financing Universal Electrification." http://www.energynet.co.uk/webfm_send/1712

Emerging Markets Consulting. 2015. "Myanmar Cookstoves Market Assessment." https://cleancookstoves.org/binary-data/RESOURCE/file/000/000/404-1.pdf

Federal Republic of Nigeria. 2016. "Sustainable Energy For All Action Agenda (SE4ALL-AA)." https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_AAs/NIGERIA_SE4ALL_ACTION_AGENDA_FINAL.pdf

Forte, D., Barros, L.A., Nakamura, W.T. 2013. "Determinants of the Capital Structure of Small and Medium Sized Brazilian Enterprises." ANPAD. http://www.scielo.br/pdf/bar/v10n3/v10n3a07.pdf

Global Alliance for Clean Cookstoves. 2015. "Market Enabling Roadmap." http://cleancookstoves.org/binary-data/RESOURCE/file/000/000/338-1.pdf

Global Off-grid Lighting Association (GOGLA). 2017. "GOGLA Symposium highlights latest research on off-grid market and consumers." https://www.gogla.org/news/gogla-symposium-highlights-latest-research-on-off-grid-markets-and-consumers

Global Off-grid Lighting Association (GOGLA). 2016. "Global Off-grid Solar Market Report: Semi-Annual Sales and Impact Data." https://www.gogla.org/sites/default/files/recource_docs/final_sales-and-impact-report_h22016_full_public.pdf

GVEP International, Global Alliance for Clean Cookstoves. 2012. "Kenya Market Assessment. Sector Mapping." http://cleancookstoves.org/binary-data/RESOURCE/file/000/000/166-1.pdf

IDCOL. 2017. "Solar Home System Program." http://idcol.org/home/solar

International Monetary Fund (IMF). 2017. "World Economic Outlook Database." https://www.imf.org/external/pubs/ft/weo/2017/01/weodata/index.aspx

International Energy Agency (IEA) and the World Bank. (2013). Global Tracking Framework. Washington DC: World Bank. http://gtf.esmap.org/data/files/download-documents/gtf-2013-full-report.pdf. *Global Tracking Framework*.

International Energy Agency (IEA) and the World Bank. 2017. "Global Tracking Framework: Sustainable Energy for All 2017—Progress toward Sustainable Energy." World Bank, Washington, D.C. Retrieved from: http://gtf.esmap.org/data/files/download-documents/eegp17-01_gtf_full_report_for_web_0516.pdf

International Energy Agency (IEA) and The World Bank. 2015. "Global Tracking Framework: Sustainable Energy for All 2015—Progress Toward Sustainable Energy." World Bank, Washington, D.C. Retrieved from: http://gtf.esmap.org/data/files/download-documents/gtf-2105-full-report.pdf

International Renewable Energy Agency (IRENA). 2016. "Solar PV in Africa: Costs and Markets." https://www.irena.org/DocumentDownloads/Publications/IRENA_Solar_PV_Costs_Africa_2016.pdf#16-10467_Solar_PV_Costs_Africa.indd%3A.60261%3A2497

Jeuland and Tan Soo. 2016. "Analyzing the costs and benefits of clean and improved cooking solutions." https://cleancookstoves.org/binary-data/RESOURCE/file/000/000/459-1.pdf

Kenya. 2017. "Kenya Action Agenda," SEforALL. http://www.se4all.org/sites/default/files/Kenya_AA_EN_Released.pdf

Lighting Global. 2015. "The Rise of Solar Market Evolution of Off-Grid Lighting in Three Kenyan Towns." https://www.lightingglobal.org/wp-content/uploads/2016/10/2015-RiseOfSolar-10182015-withSurvey.pdf

Ministry of Power, Energy & Mineral Resources, Government of the People's Republic of Bangladesh. 2013. "Country Action Plan for Clean Cookstoves." http://cleancookstoves.org/binary-data/RESOURCE/file/000/000/235-1.pdf

Ministry of Water and Energy of Ethiopia (MOWIE). 2011. "Fuelwood-Efficient Stoves Investment Plan 2012-2015." http://www.mowie.gov.et/documents/714785/1953720/Ethiopia+ICS+IP+FINAL/afb55787-2a10-4034-adc2-10bddf1d9b1a?version=1.1

Nigeria 2016. "Sustainable Energy for All Action Agenda". Federal Republic of Nigeria. http://www.se4all.org/sites/default/files/NIGERIA_SE4ALL_ACTION_AGENDA_FINAL.pdf

Nigerian Alliance for Clean Cookstoves. 2017. "GACC Launches Catalytic Small Grant Program in Nigeria." https://nigeriacleancooking.org/gacc-launches-catalytic-small-grant-program-in-nigeria

PricewaterhouseCoopers (PwC). 2016. "Electricity beyond the grid. Accelerating access to sustainable power for all." https://www.pwc.com/gx/en/energy-utilities-mining/pdf/electricity-beyond-grid.pdf

Republic of the Union of Myanmar. 2014. "Myanmar Renewable Energy Policy." http://www.technosol.de/Down/1408MYA-RE_PolicyD.pdf

Sendea. 2017a. "Off-Grid Product Catalogue. Mobisol Basic Nyati/Buffalo (80W)." http://www.sendea.biz/product-catalogue/productdetail/market/show/product/mobisol-basic-nyatibuffalo-80w/

Sendea. 2017b. "Off-Grid Product Catalogue. Mobisol Basic Tembo/Elephant (200W)". http://www.sendea.biz/product-catalogue/productdetail/market/show/product/mobisol-basic-temboelephant-200w/

Stockholm Environment Institute. 2016. "Bringing clean, safe, affordable cooking energy to Kenyan households: an agenda for action." https://www.sei-international.org/mediamanager/documents/Publications/SEI-NCE-DB-2016-Kenya-Clean-Cooking.pdf

Sustainable Energy for All (SEforALL). 2015. "Scaling Up-Finance for Sustainable Energy Investments". http://www.se4all.org/sites/default/files/SE4All-Advisory-Board-Finance-Committee-Report.pdf

Sustainable Energy for All (SEforALL) Africa Hub. 2017a. "4th Annual Sustainable Energy for All Africa Workshop. Joining forces for universal energy access in Africa." https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Abidjan_Workshop_2017/SEforALL_AfricaHub_plenary_presentation_final.pdf

Sustainable Energy for All (SEforALL). 2017b. "Country Data, Kenya." https://www.se4all-africa.org/se4all-in-africa/country-data/kenya/

Sustainable Energy for All (SEforALL) and the African Development Bank (AfDB). 2017. Missing the Mark, Gaps and lags in disbursement of development finance for energy access. SEforALL, Washington, DC. License: NonCommerical-NoDerivatives 4.0, International (CC BY-NC-ND 4.0).

Sustainable Energy for All (SEforALL), Climate Policy Initiative (CPI) and the World Bank. (2017). Understanding the Landscape, Tracking finance for electricity and clean cooking access in high-impact countries. SEforALL, Washington, DC. License: NonCommerical-NoDerivatives 4.0, International (CC BY-NC-ND 4.0).

Sustainable Energy for All (SEforALL) and Federal Republic of Nigeria. 2016. "SUSTAINABLE ENERGY FOR ALL ACTION AGENDA (SE4ALL-AA)."

UN Chronicle. 2015. "Achieving Sustainable Energy Targets in Bangladesh." https://unchronicle.un.org/article/achieving-sustainable-energy-targets-bangladesh

UNHCR. 2014. "The Population and Housing Census of Myanmar, 2014. Summary of the Provisional Results." Republic of the Union of Myanmar. www.data.unhcr.org/thailand/download.php?id=318

The World Bank. 2017a. "Overview. State of Electricity Access Report." http://documents.worldbank.org/curated/en/285651494340762694/pdf/114841-ESM-PUBLIC-P148200-32p-FINALSEAROverviewWEB.pdf

The World Bank. 2017b. "Population estimates and projections." http://databank.worldbank.org/data/reports.aspx?source=Health%20Nutrition%20and%20Population%20Statistics:%20Population%20estimates%20and%20projections

The World Bank. 2017c. "Affordable and clean energy." http://datatopics.worldbank.org/sdgatlas/SDG-07-affordable-and-clean-energy.html

The World Bank. 2017d. "DataBank, Global Financial Inclusion." http://databank.worldbank.org/data/reports.aspx?source=1228

The World Bank. 2017e. "World Bank Country Overview in Ethiopia." http://www.worldbank.org/en/country/ethiopia/overview

The World Bank. 2016. "Access to electricity: % of the population." http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS

The World Bank. 2015. "The State of the Global Clean and Improved Cooking Sector." Energy Sector Management Assistance Program (ESMAP), and Global Alliance for Clean Cookstoves (GACC). 2015. "Technical Report 007/15." https://openknowledge.worldbank.org/bitstream/handle/10986/21878/96499.pdfhttps://openknowledge.worldbank.org/bitstream/handle/10986/21878/96499.pdf

The World Bank, 2013. "Ethiopia Rural Socioeconomic Survey (ERSS)." Central Statistical Agency & the World Bank. http://siteresources.worldbank.org/INTLSMS/Resouces-rc/3358986-1233781970982/5800988-1367841456879/9170025-1367841502220/ERSS_Survey_Report.pdf

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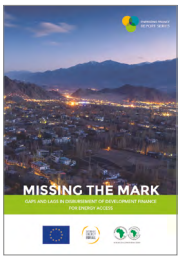

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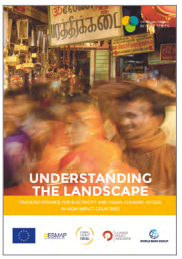

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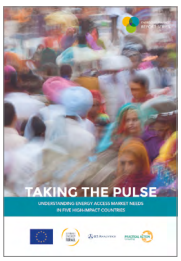

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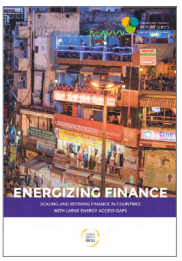

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