



ENERGIZING FINANCE
REPORT SERIES



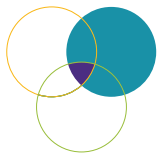
ENERGIZING FINANCE: TAKING THE PULSE

2019

EXECUTIVE SUMMARY



CATALYST
OFF GRID ADVISORS



FOREWORD

Sustainable Development Goal 7 (SDG7) – affordable, reliable, sustainable and modern energy for all – presents a monumental challenge, one that the world is nowhere near on track to achieving. We have only a decade left to bring electricity access to 840 million people and clean cooking solutions to 3.3 billion people. But what is the price tag for delivering energy access to these people? How much finance must be mobilized, what type of finance, and where should it flow?

These are the questions that Sustainable Energy for All (SEforALL) seeks to answer as part of its *Energizing Finance* research series. This series was developed to provide a clear and comprehensive view of current finance commitments for energy access solutions and determine what finance is needed to attain SDG7.

Taking the Pulse 2019 details the energy access financing challenge faced in three countries: Madagascar, the Philippines and Uganda. The report provides crucial insights into how national contexts shape finance flows for electricity and clean cooking access. Each of these countries has its own unique set of energy needs, existing infrastructure, policies and regulations. *Taking the Pulse 2019* drills down into these contexts to assess each country's financing needs to achieve universal energy access through mini-grids, stand-alone solar and various clean cooking solutions. It also takes into account the costs of overcoming affordability gaps, which, if left unfilled, will leave many people behind.

The work was carried out by Catalyst Off-Grid Advisors in association with E3 Analytics.

The granularity of analysis presented in *Taking the Pulse 2019* is of paramount importance at a time

when the world needs data and evidence to inform and empower a broad set of stakeholders. Data and evidence underpin the investment decisions that will determine whether we succeed in delivering SDG7.

Taking the Pulse 2019 finds that USD 6.4 billion in aggregate investment is needed by 2030 in the three focus countries to deliver the mini-grid, stand-alone solar and improved cookstove solutions that will enable SDG7. The report then probes what kind of capital this is, providing estimates of the different grant, equity, debt and affordability gap financing that will be necessary to deliver these energy access solutions.

In forecasting those technologies that will fill existing energy access gaps by 2030 and the source of funds required to scale them, the report highlights financing needs, mainly for national governments, development partners, impact investors and commercial financiers. It then goes a step further by presenting policy recommendations that would help ensure these opportunities are seized.

As an example, *Taking the Pulse 2019* highlights how Uganda, which historically relied on grid expansion and densification to provide residential electricity access, now has stand-alone solar connecting an equal percentage of households. The report forecasts that stand-alone solar will account for 52 percent of new household connections by 2030 and require an average of USD 160 million per year, of which about USD 30 million will be utilized to address the affordability gap. By comparison, *Energizing Finance: Understanding the Landscape 2019* tracked USD 34 million in commitments for stand-alone solar in Uganda in 2017.

This is just a small flavor of the findings in the pages that follow, which are relevant well beyond the borders of Madagascar, the Philippines and Uganda. Pathways and strategies to mobilize the right types of finance for electricity access and clean cooking solutions can support the 20 high-impact countries identified in *Energizing Finance*, and many others, with a more granular understanding of specific decisions needed to deliver sustainable energy for all.



Glenn Pearce Oroz

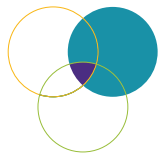
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EXECUTIVE SUMMARY

Some 840 million people lack access to modern, affordable, and reliable electricity, while some 3 billion lack access to clean cooking technologies worldwide.¹ Delivering modern energy services to all citizens by 2030 is a key Sustainable Development Goal agreed by the United Nations General Assembly.² Achieving it requires major shifts in how finance is provided to enterprises supplying decentralized energy services and a systemic change in global financing mechanisms supporting the sector. This report is a follow on to the *Taking the Pulse 2017* report. It provides detailed 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.

This edition of *Taking the Pulse* relied heavily on an empirically-based model to derive projected financing needs for each of the report's three focus countries: Madagascar, the Philippines and Uganda. This quantitative research was informed and complemented by dozens of interviews conducted in each country with senior-level officials from government agencies, enterprises and development organizations working to increase energy access. The report examines past trends with respect to grid, mini-grid and stand-alone solar electrification activities. It then establishes business as usual scenarios to illustrate the Sustainable Development Goal 7 (SDG7)³ deficit and models

forecast scenarios of the expected contributions that the electricity grid, mini-grids, and stand-alone solar solutions would make to achieve universal access to electricity. In respect of clean cooking, the report documents past trends with respect to the use of clean fuels (specifically liquefied petroleum gas (LPG), biogas, and ethanol) and improved cookstoves (ICS), which rely on wood and charcoal as fuel sources, but are industrially manufactured to be cleaner than artisanal stoves. It models forecast scenarios for uptake of clean fuels and ICS to achieve universal clean cooking access in each of the focus countries. The report then utilizes the electrification and cooking forecasts to establish the volume and blend of capital that would be required for enterprises to deliver energy services to individual households.

The report contains chapters for each of the focus countries. These countries belong to the 20 high-impact countries (HICs) whose efforts to increase access to electricity and clean cooking can make the most difference on a global scale,⁴ and represent three highly different energy markets across Sub-Saharan Africa and Asia. Each chapter begins with a summary of key findings in respect of that focus country. It then provides an overview of the sector context, a description of the current state of household electrification and cooking, descriptions of the forecast scenarios to achieve universal electrification and cooking, and a detailed discussion of the financing requirements associated with these scenarios. Each chapter discusses affordability considerations with

¹ United Nations Economic and Social Council. "Special edition: Progress towards the Sustainable Development Goals, Report of the Secretary General". 2019.

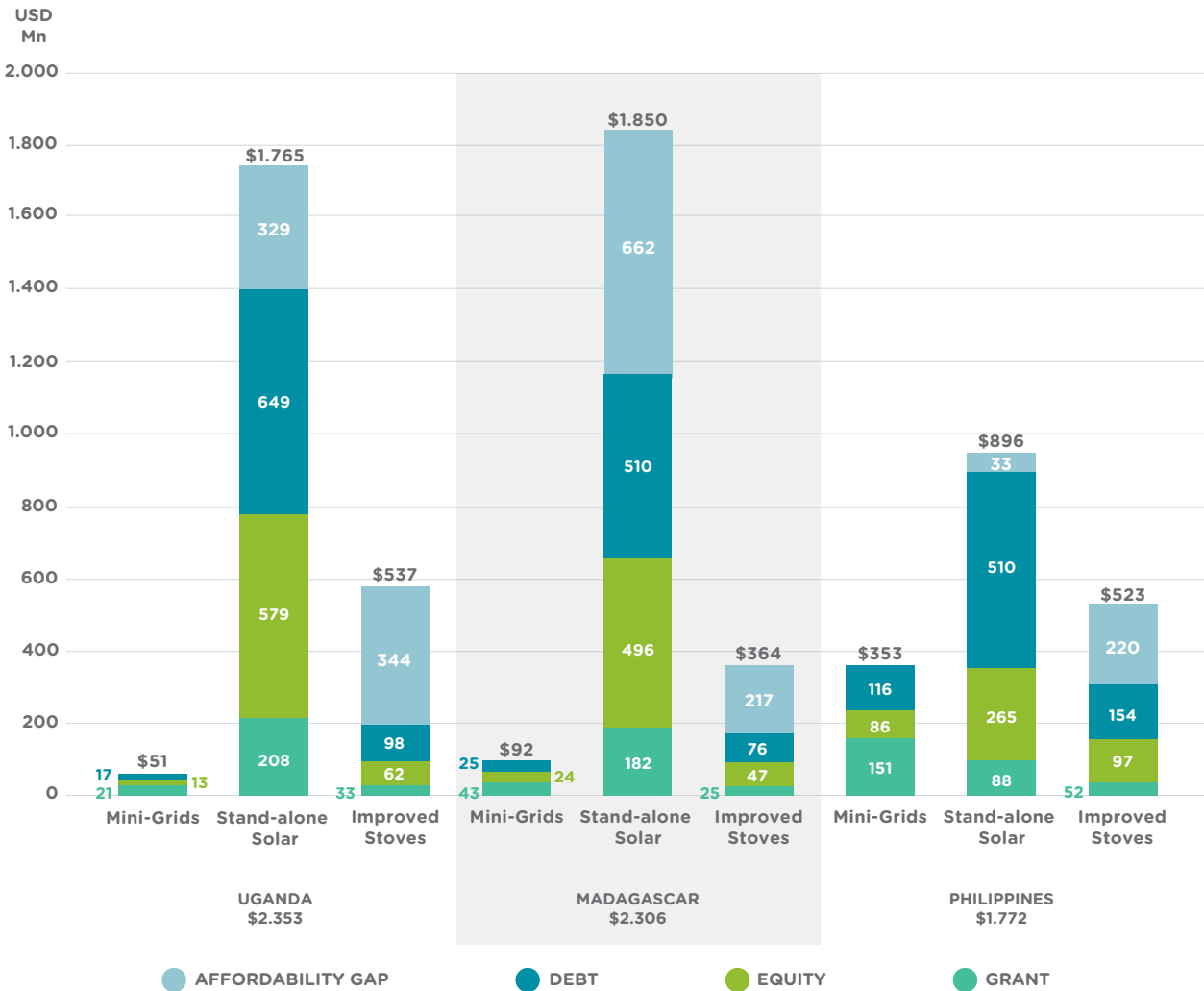
² In September 2015, world leaders agreed on 17 Sustainable Development Goals (SDGs). SDG7 calls for secure access to affordable, reliable, sustainable and modern energy for all by 2030.

³ SDG7 seeks to ensure access to affordable, reliable, sustainable and modern energy for all. For additional details, please see: <https://sustainabledevelopment.un.org/sdg7>

⁴ 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.

Figure ES 1

Volume and Blend of Financing Required per Technology and Country to Close the Energy Access Gap



respect to household electrification and cooking, and touches upon the key challenges and opportunities that confront the focus countries. In addition to the country chapters, the report includes a methodology chapter, providing a detailed description of *Taking the Pulse 2019's* quantitative methodology, including outlining the structure, inputs, and assumptions that underpinned the Excel-based model developed as part of this report, which generated the key financing outputs that are its primary focus. It also describes the way in which qualitative methods were used as part of the research process in each of the focus countries.

THE COSTS OF ACHIEVING UNIVERSAL ENERGY ACCESS IN MADAGASCAR, THE PHILIPPINES, AND UGANDA

This edition of *Taking the Pulse* forecasts that by 2030 the electricity grid will service 87.5 percent of households in the Philippines, 47 percent in Uganda, and 13.8 percent in Madagascar. The access deficit in each of these countries will require **USD 6.4 billion** in total financing for off-grid electricity and clean cooking solutions to achieve SDG7 in the three focus countries (Madagascar – USD 2.3 billion; the Philippines – USD 1.8 billion; and Uganda – USD 2.3 billion). These totals do not include the

financing requirements associated with grid expansion or the increased use of clean fuels for cooking, both of which were beyond the scope of this report. Figure ES 1 summarizes the volume and blend of financing that is required in each of the focus countries.

- Of this total, just over **USD 800 million** will need to be in the form of **grants** to electricity and clean cooking enterprises. These grants are non-repayable funds given by one party, often a government agency, corporation, foundation or trust, to an energy access enterprise. Grant providers are typically seeking impact via their financial support and can play an important catalytic role in attracting follow-on funders.
- Approximately **USD 1.7 billion** of this financing should be in the form of **equity**. Equity financing is the process of raising capital through the sale of shares in a business.
- One third of the financing needs in the three focus countries is projected to be in the form of **debt (USD 2.1 billion)**. Businesses selling stand-alone solar products or improved cookstoves will frequently borrow funds to enable them to purchase product inventory. For businesses that utilize a pay-as-you-go model whereby customers pay in installments for a product or service over time, there is also a need for enterprises to borrow capital from external parties to have sufficient liquidity to extend loans to their customers. Mini-grids entail significant up-front capital investment in the assets themselves. Ideally, a significant portion of these costs would be financed via debt which would be paid back over a 10-15 year term as they generate revenues from their customers.
- Household ability to pay for energy access often presents a major obstacle to adoption (for households) and scaling (for enterprises). This edition of *Taking the Pulse* has modeled out the forecast affordability challenge in each of the fo-

cus countries. An estimated **USD 1.8 billion** is required in **affordability gap financing**. There are several approaches that can be taken to address the affordability challenge. One option is to provide public assistance to consumers, which can be structured through “energy safety net” mechanisms⁵ such as conditional cash transfers, vouchers and coupons or other modalities to enable households to afford the out of pocket expense for energy access solutions.

Taking the Pulse 2019 findings with respect to the volume and blend of capital needed to deliver universal energy access in Madagascar, the Philippines, and Uganda are striking. So too are the report’s findings with respect to how each country’s access targets will be met. As the report demonstrates, grid electrification will play a meaningful role in achieving SDG7 in all three focus countries. However, constructing grid infrastructure is extremely resource and time intensive, and in each of the focus countries it cannot deliver access to all households because of geographic and demographic considerations, financing realities, or the capacity of power utilities to significantly outpace their past performance in delivering new connections to households. This is where mini-grids and stand-alone solar solutions come into play. These technologies and associated business models can deliver access, often more quickly and less expensively than the grid.

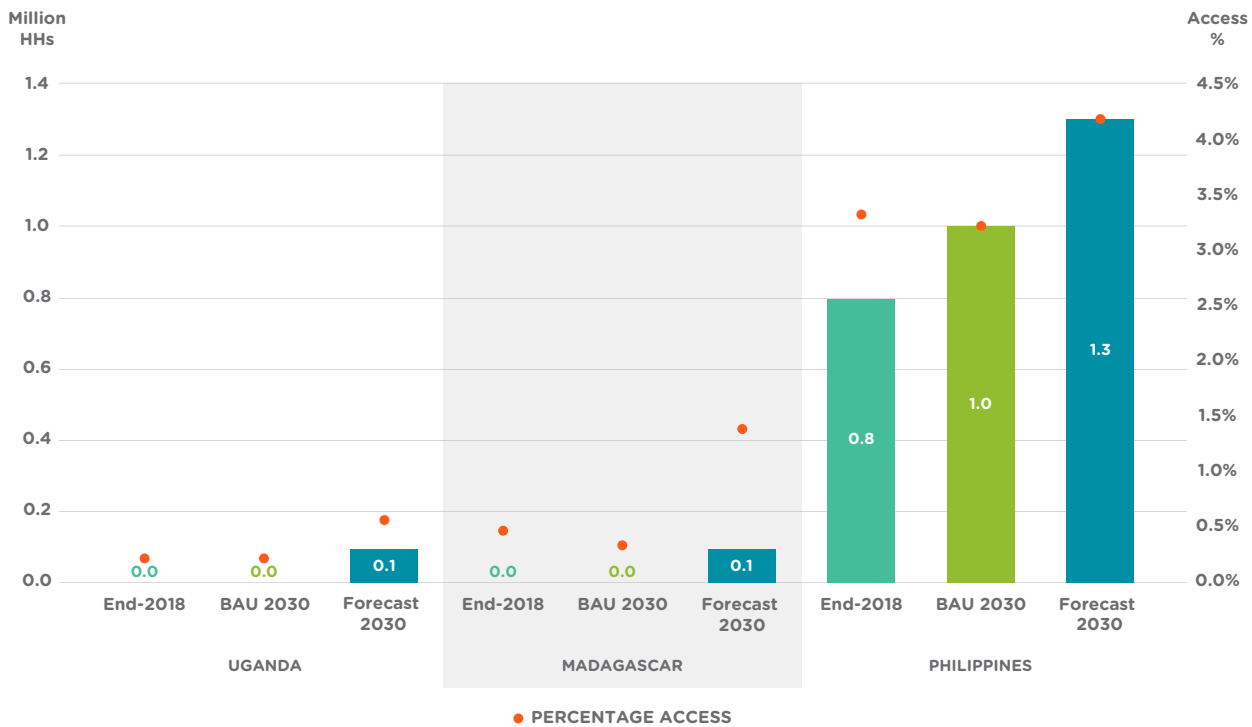
On the cooking side, the increased use of clean fuels faces similar challenges to those confronting the electricity grid. Massive capital investment is required and entire value chains associated with the use of clean fuels at scale must be created.

While *Taking the Pulse 2019* forecasts meaningful increases in the availability and uptake of clean fuels, it relies upon existing cookstove technology to deliver the deficit. Modern, industrially produced cook-

⁵ SEforALL, in partnership with ODI and CAFOD, will release a report in early 2020 exploring the use of energy safety nets-social assistance mechanisms to enable and secure access to affordable modern energy for the poorest in society.

Figure ES 2

Mini-Grid Historical, Business as Usual, and Forecast Scenarios, Total Household Connections



stoves deliver performance that provides acceptable cooking efficiency and reduces emissions. However, as is the case with mini-grids and stand-alone solar solutions, the main challenge associated with achieving universal access to ICS lies in getting these products to consumers and making sure that industrial stoves are adopted at household level once they are made available.

MINI-GRID CONTRIBUTIONS TO UNIVERSAL ACCESS

The mini-grid markets of each of the three focus countries are a study of contrasts. This statement is applicable both to their historical contributions toward universal access, and to their future role in delivering SDG7. Figure ES 2 summarizes the number of total households electrified under three different scenarios: a current snapshot of mini-grid access as of the end of 2018, a business as usual (BAU) scenario where historical rates of new connections are maintained through to 2030, and the forecast sce-

nario that underpins the financing requirements described in the preceding section. Beyond financing, the forecast scenario will require strong execution capabilities by mini-grid developers.

In the **Philippines**, mini-grids currently deliver electricity access to approximately 800,000 households. As an archipelago comprised of over 7,500 islands, delivering energy access through mini-grid installations has been an absolute necessity. Many sites that host these mini-grids were characterized as having sufficient population density, associated economic activity, and load demand to justify the substantial capital investments they require. Furthermore, the government made significant efforts to establish an enabling environment that would permit these mini-grids to be deployed, and to provide the capital required for their realization. Given the Philippines’ existing high access rate and the prevalence of mini-grids throughout the country, the forecast scenario has mini-grids delivering access to approximately 1.2

million households in total with a capital requirement of USD 354 million, translating to an average annual financing need of approximately USD 32 million through 2030. However, the *Understanding the Landscape 2019* report did not track any mini-grid financing commitments for the Philippines in 2017.

In stark contrast, **Uganda** currently only has 11 mini-grids that deliver access to approximately 4,000 households. Uganda's historical focus has been on grid expansion and densification as the primary modality to deliver residential electricity access. Uganda recently completed a least-cost master planning exercise, through which it identified 320 new sites for mini-grids. *Taking the Pulse 2019* uses these plans and forecasts a significant scaling up of mini-grid contributions to access targets, with approximately 70,000 households receiving access from them by 2030 and a total capital requirement of USD 51 million, averaging out to USD 4.6 million per year. *Understanding the Landscape 2019* tracked only USD 1.4 million in commitments for Ugandan mini-grid financing in 2017. To achieve these ambitious targets, Uganda must prioritize the development of a mini-grid regulatory framework that will clarify the roles and responsibilities of the public and private sectors, and provide visibility around licensing, tariff setting, grid encroachment, technology standards, and subsidy policies to address affordability constraints.

Madagascar's significant infrastructure deficits (particularly road infrastructure) made the build out of mini-grids in isolated pockets of population a necessity. As such, there are approximately 110 mini-grids currently in the country, serving about 24,000 households. The report forecasts 530 new mini-grids, yielding just over 130,000 households that would gain new access, and a total capital requirement of USD 92 million, averaging USD 8.4 million per year. As was the case in Uganda, better clarity around the rules of the game and associated regulations would crowd in the private sector to help finance and develop the mini-grids in the forecast scenario. Absent this clarity, the government would need to rely on substantial concessional financing

from development partners to fund the mini-grids and would likely limit its leveraging of the private sector to build and perhaps operate the mini-grids on the government's behalf.

STAND-ALONE SOLAR CONTRIBUTIONS TO UNIVERSAL ACCESS

The stand-alone solar story that emerges from the three focus countries is a similar study in contrasts to that of mini-grids. Each country has a distinct trajectory, though common themes explain their relative performance. As Figure ES 3 illustrates, stand-alone solar's contribution toward SDG7 in each of the markets is considerable and will necessitate substantial capital and execution capabilities to deliver on the forecast scenarios. These scenarios assume that stand-alone solutions will need to deliver access to those households not served either by the grid or mini-grids, creating varying degrees of challenge in each country.

Uganda has been one of stand-alone solar's success stories to date. The country hosts three major international players (M-KOPA, Fenix International, and Solar Now) that have attracted significant volumes of investment over the past 5 years. This financing, coupled with robust consumer demand and strong delivery from businesses, has yielded a significant contribution towards access to electricity in Uganda. The forecast scenario envisages stand-alone solar will account for 5.3 million new household connections over the 2020-2030 period (accounting for over 52 percent total new connections) and require USD 1.76 billion in finance⁶, of which USD 329 million will be utilized to address the affordability gap. As illustrated in Figure ES 3, this represents a substantial increase compared to the BAU scenario. For this to be realized, the Ugandan market will need to see several additional enterprises begin to operate at scale, and those that are already at scale will need to sustain their pace of growth. Also, while an increasing number of households are served with stand-alone solutions, those that do not adopt will likely be constrained by

⁶ This translates to an average annual financing need of USD 160 million. In contrast, the 2019 edition of *Understanding the Landscape* tracked USD 33.7 million in commitments for stand-alone solar in 2017.



Figure ES 3

Stand-Alone Solar Historical, Business as Usual, and Forecast Scenarios, Total Household Connections



affordability challenges. As such, Uganda will need to develop creative ways to ensure that all households can afford access to modern and reliable electricity services.

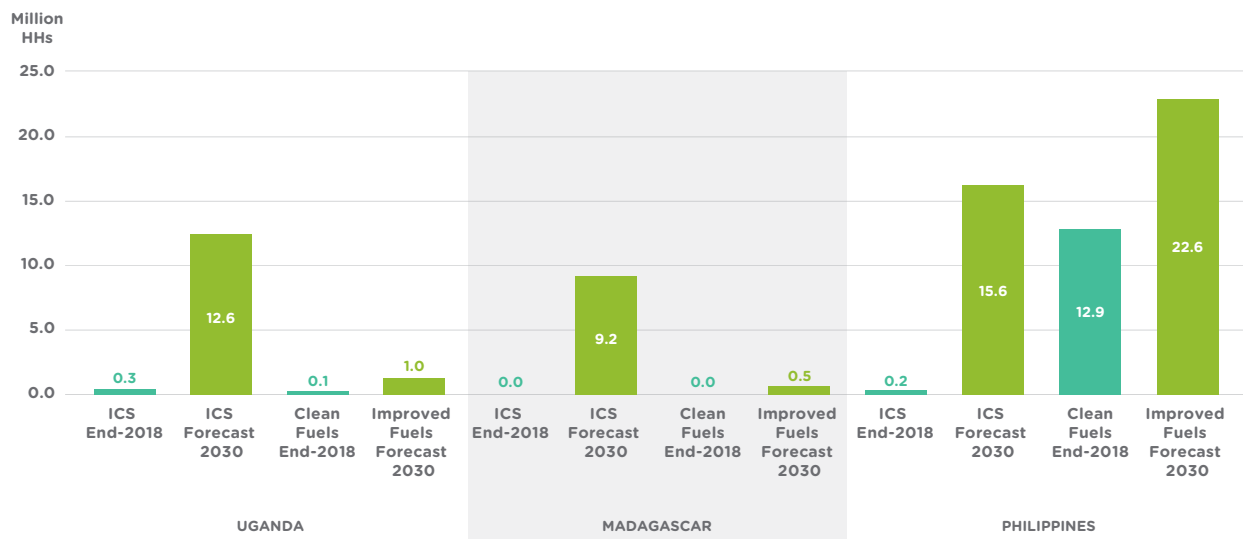
Given infrastructure deficits and recent political challenges in **Madagascar**, it is somewhat surprising to see the current, relatively low level of stand-alone solar adoption. Nevertheless, stand-alone solar’s contribution in the forecast scenario is massive. This in turn gives rise to huge financing needs, and more importantly, the need for scalable enterprises to be fostered in the market. The forecast scenario envisages stand-alone solar will account for 8 million household connections over the 2020-2030 period and require USD 1.85 billion in finance, of which USD 662 million will be utilized to address the affordability gap. At present, there are few sig-

nificant players and those that exist are still experimenting with their business model and therefore not yet operating at scale. Madagascar’s affordability challenge is even more acute than Uganda’s – over 60 percent of households would be unable to afford the most basic level of access absent some form of intervention to lower the consumer-facing product cost.

The **Philippines** is a different story altogether. Given the high penetration rates of the grid and mini-grids, uptake of stand-alone solar has been relatively modest to date. However, it has been meaningful enough to paint a picture whereby the BAU scenario is not wildly different from the forecast scenario. The forecast scenario envisages stand-alone solar will account for 2.5 million household connections over the 2020-2030 period and require USD 897 million

Figure ES 4

Role of Improved Cookstoves and Clean Fuels in Access to Clean Cooking: Historical, Business as Usual and Forecast Scenarios



in finance⁷, of which USD 33 million will be utilized to address the affordability gap. However, these figures mask the implementation challenge that underpins this forecast. The households that need to benefit from stand-alone solar in the Philippines will be the true last mile, representing those that are in isolated areas, often characterized by low population density. The cost of reaching these households will be high and running a profitable enterprise in serving these pockets will be very difficult. Here again, stakeholders in the Philippines may need to be creative, and think of blending public-private approaches to both finance and delivery to these households.

ACHIEVING UNIVERSAL ACCESS TO CLEAN COOKING

As explained above, the *Taking the Pulse* report series has to date not attempted to model out the costs associated with delivering cooking solutions via clean fuels. This would include the cost of building out large-scale LPG and ethanol distribution infrastructure as well as capturing the finance required to distribute

and/or install cooking hardware. Nevertheless, *Taking the Pulse 2019* does make projections regarding increased uptake of clean fuels and presents these in the forecast scenarios. For the currently underserved households, the report assumes that improved access will be delivered by an ICS that either burns wood (or other biomass) or charcoal. As outlined in Figure ES 4, current utilization rates in Uganda and Madagascar are almost zero, while the Philippines has a compelling clean fuels usage rate already.

More than half of the households in the **Philippines** cook with electricity or a clean fuel (predominantly LPG). The success of the country’s LPG industry is a testament to household utilization rates once LPG is available in the market. This trend can also partly be explained by the fact that Filipino households have much higher incomes on average than those in Madagascar or Uganda, making affordability less of a barrier to uptake. Going forward, clean fuels are expected to encounter some of the challenges of their electrification counterparts: it will be difficult to allocate the significant costs associated with building out the infrastructure and supply chain needed to serve the more rural, remote and less populated

⁷ Necessitating USD 81.5 million in annual financing; *Understanding the Landscape* tracked a mere USD 3 million in commitments for stand-alone solar in the Philippines in 2017.

areas. As a result, the use of ICS will need to flourish. This in turn will require significant investment in business models that can overcome the challenges associated with serving dispersed, hard to reach households. The forecast scenario requires USD 523 million in finance, of which USD 220 million will be utilized to address the affordability gap.

Uganda has several enterprises and development partner programs that have worked on commercializing ICS. Despite these efforts, uptake remains extremely low and is attributed to households' unwillingness to shift away from traditional cooking methods and affordability constraints on purchasing industrial ICS. Though there has been some experimentation with clean fuels and the forecast scenario envisages a significant uptick in clean fuel use, its overall contribution towards the SDG7 target will remain modest. The forecast scenario requires USD 537 million in finance, of which USD 344 million will be utilized to address the affordability gap.

Madagascar faces the same challenges as Uganda, only more acutely. Affordability constraints are even greater, and infrastructure deficits in-country will severely challenge the ability of enterprises to serve remote households. The forecast scenario will require USD 365 million in finance, of which USD 217 million will be utilized to address the affordability gap.

KEY TAKEAWAYS FOR STAKEHOLDERS

For **development partners** (multilateral and bilateral organizations):

- Help create the appropriate enabling environment for mini-grids, including supporting integrated electrification planning that more clearly identifies the proportion of households that will require off-grid solutions, before committing capital to the sector.
- Support efforts to build a methodology to collect and analyze data on environmental and social impacts as well as financial performance of the electricity and cooking sectors.

- On stand-alone solar, avoid the temptation to declare victory because one or two stand-alone solar companies or markets see rapid growth. As previous research shows, this pales in comparison to what is needed.⁸
- Promote inclusive definitions of electricity access, based on the Multi-Tier Framework typology⁹. The role that solar lanterns can play in delivering fractional Tier 1 access at household level must be considered and is a crucial given the affordability challenge many households will face with respect to a multi-light point stand-alone system.
- With respect to clean cooking, support efforts to better understand clean fuels business models and what it would take to dramatically scale their use. Adoption of clean fuels is the key to unlocking a more climate and health friendly cooking future.
- Companies, funders and investors require a much deeper understanding of the factors that will produce sustainable consumer adoption of clean cooking solutions. Understanding, testing, and prioritizing the clean cooking product fit with consumers, predominately women, must be prioritized alongside sustained consumer awareness programs.

For **governments** of the 20 HICs:

- When it comes to energy access, transparent and predictable policy and regulation are critical enablers. To accelerate access, governments should champion the development of robust policy and regulatory regimes, particularly with respect to mini-grids, whose development is greatly inhibited without it.
- Invest in developing an integrated electrification pathway, an inclusive planning approach that supports using grid, mini-grid, and off-grid technologies to provide electricity and the associated energy services necessary to meet human needs and

⁸ See <https://shellfoundation.org/app/uploads/2018/10/Achieving-SDG-7-The-Need-to-Disrupt-Off-Grid-Electricity-Financing-in-Africa.pdf>

⁹ Bhatia, M. & Angelou, N., 2015. Beyond Connections – Energy Access Redefined, Washington: Energy Sector Management Assistance Program.

contribute to sustainable development.¹⁰ These pathways provide clarity to entrepreneurs as to where to focus their resources and will also help them crowd in the private capital needed to scale their businesses.

- Take the lead in enabling blended finance for energy access. Governments have the ability to secure concessional financing from multilateral and bilateral development partners that can be used to provide risk-tolerant financing to enterprises. This can in turn crowd in more commercial capital from investors.
- Make sure the delivery of energy access is inclusive and benefits all households in a given country. This may necessitate incentives for enterprises to expand into underserved areas and will certainly require significant funding and new measures to enhance consumer affordability. Inclusivity also requires a definition of electricity access that recognizes the important role that single light point products (e.g. solar lanterns) can play in contributing toward SDG7.

For **investors** (including commercial, impact, and development finance institutions):

- Each focus country needs dozens of energy access enterprises that deliver mini-grid, stand-alone solar, or clean cooking solutions. Investors need to support early stage enterprises, and even go so far as to provide start-up capital to new generations of businesses.

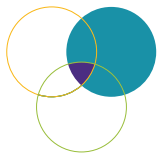
¹⁰ For more information on integrated electrification pathways, see <https://www.seforall.org/publications/integrated-electrification-pathways-for-universal-access-to-electricity>

- Investors bring important global perspectives and good practice, particularly in regard to what it takes to build and scale energy access enterprises. This knowledge should be shared with enterprises through bespoke advisory support.
- In addition to international firms, investors also need to support indigenous enterprises that know their local markets and customers well.
- Development finance institutions need to continue to play a prominent role, providing significant volumes of risk-tolerant capital that will help prove out energy access enterprise business models and crowd in more commercially oriented investors.

For energy access **enterprises**:

- Be realistic regarding the amount of time and resources (both human and financial) that are required to build and scale energy access enterprises. Setting appropriate ambitions will be critical to succeeding in raising investor capital, delivering on expectations and validating the role that enterprises can play in delivering energy access.
- There is much to be learned from industry peers, at global, national, and local levels. Most energy access business models are yet to prove themselves profitable and doing so will require significant adjustments to ensure they are viable in each market. While competition can be a good thing, so too can collaboration. Enterprises should look to learn from one another and help find solutions to the challenges that make scaling energy access difficult.





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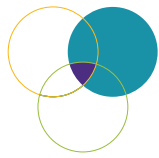
Special Representative of the UN Secretary-General for Sustainable Energy for All.

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