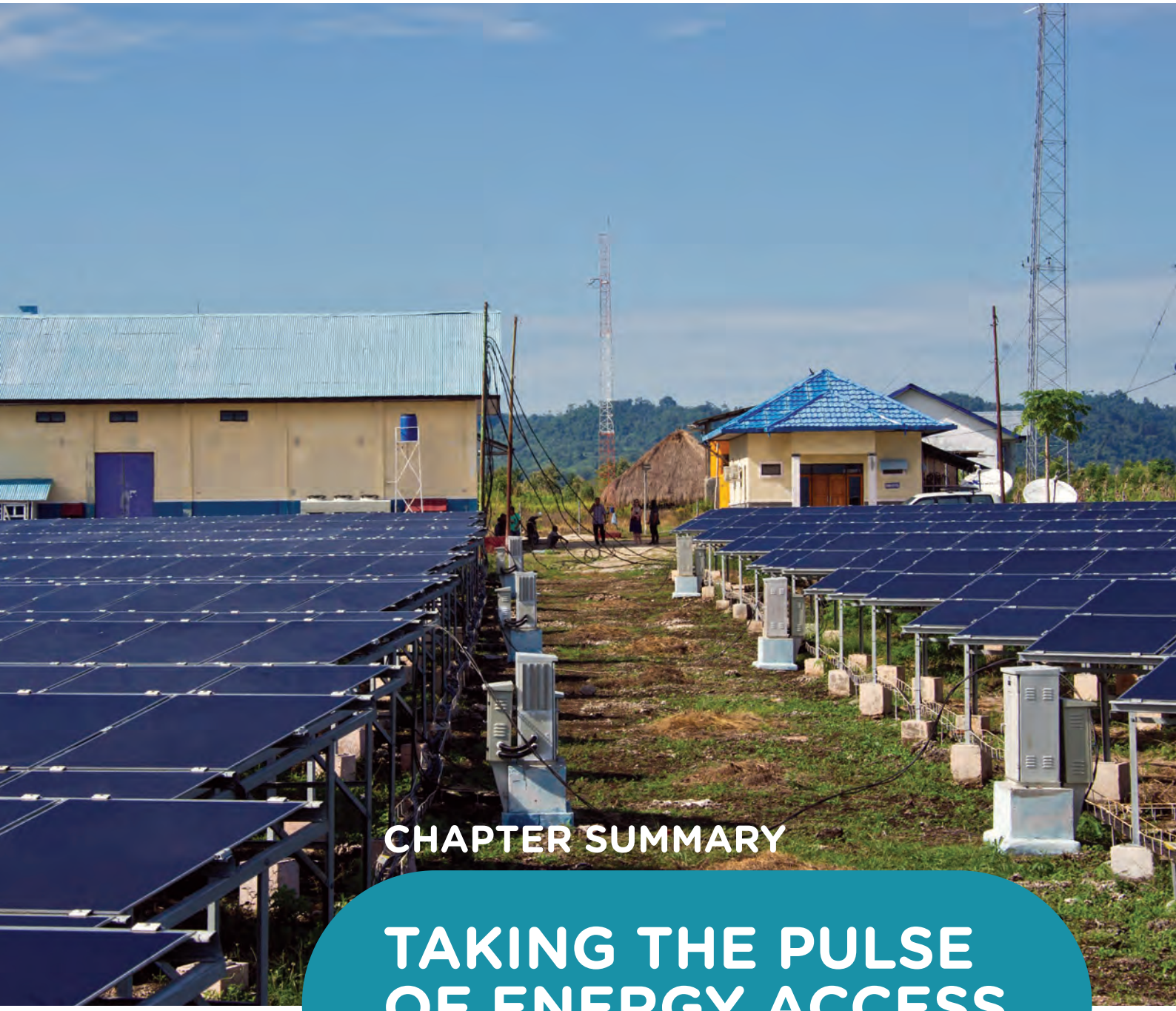


CHAPTER SUMMARY

TAKING THE PULSE OF ENERGY ACCESS IN THE PHILIPPINES

Table CS 1

Philippines: Key Figures[77]

Year end	2018	2030
Population (millions)	106.5	125.4
Households (millions)	24.5	30.9
Grid Access (%)	82.3	87.5
Mini-Grid Access (%)	3.3	4.1
Stand-Alone Solar Access (%)	2.9	8.4
Clean Fuels Use (%)	53	73
ICS Usage (%)	0.9	100

The Government of the Philippines has made universal electrification a national priority and has an urbanization rate over 50 percent[78], which helps to explain why it has already achieved nearly 90 percent household electrification and universal electrification of all municipalities. Off-grid electrification has been central to accomplishing this since the Philippines' island geography makes achieving universal electrification through grid extension too costly. As such, mini-grids and stand-alone systems have a critical role to play. While mini-grids in particular have transformed the electricity market in the Philippines, universal access by 2030 will still require acceleration across grid-based and off-grid technologies to keep pace with rapid population growth. If the Philippines follows a business as usual scenario, allowing markets to continue developing based on current levels of support from government agencies and development partners, grid coverage would remain relatively unchanged by 2030, with 82 percent of households electrified.

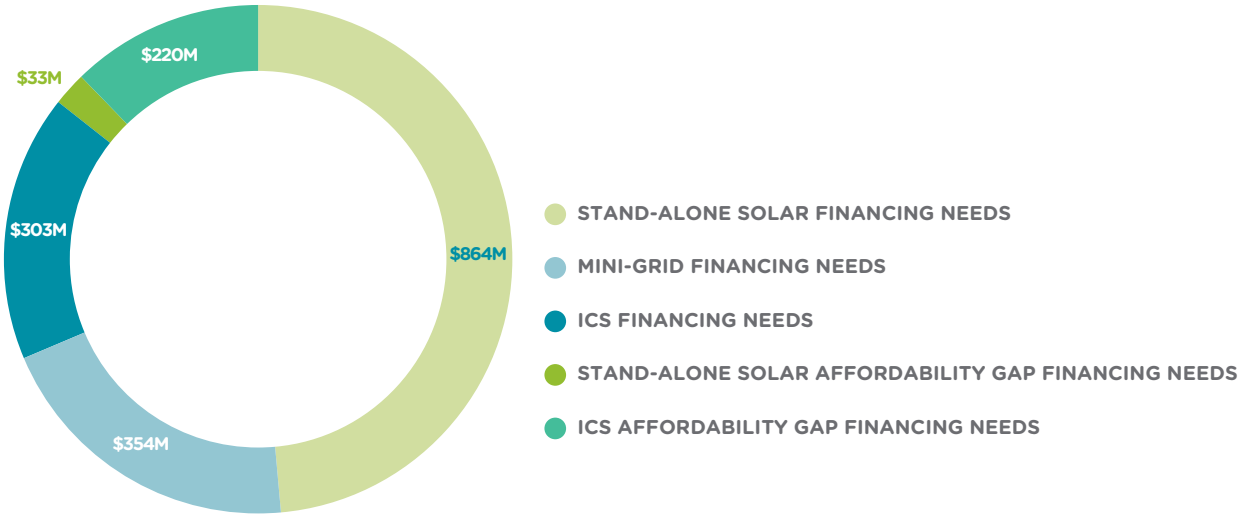
The Philippines is in an advanced stage of mini-grid deployment, with the technology serving over 800,000 households (three percent of households in the country) and various commercial and small industrial customers. The majority of these mini-grids were built and operated by the National Power Corporation – Small Power Utility Group (NPC-SPUG), which benefited greatly from subsidies by the government, and thus enabled the company to extend below-commercial tariffs to rural populations, overcoming the affordability challenge faced in other countries with mini-grid deployment targets. In the forecast scenario, where key stakeholders in the Philippines' electricity sector commit all resources required to achieve universal access, grid connections would increase to 88 percent of households and mini-grids would increase to approximately 4 percent of households and deliver electricity access to over 1.25 million households by 2030. Achieving this growth will require a total of USD 354 million in financing. By way of comparison, the *Energizing Finance* Series' *Understanding the Landscape 2019* report did not track any commitments for mini-grids in the Philippines in 2017. While stand-alone solar has had an impact similar to that of mini-grids with regards to electrifying the country, its 3 percent penetration rate is relatively low compared to other markets working hard to achieve universal access. In the forecast, stand-alone solar will account for 2.1 million new household connections between 2020-2025 (or 35 percent of new connections over the same period). However, stand-alone solar is also expected to decline beyond 2025, as a share of households with access to stand-alone solar is eventually expected to become grid- or mini-grid-connected as grid and mini-grid services expand. To fill the gaps left by the grid and mini-grids, significant capital and private sector capacity will still be required for stand-alone solar, with a cumulative of USD 897 million in financing needed. A total of USD 1.25 billion in financing will be required in the Philippines to achieve the forecast scenarios across all off-grid solar (OGS) technologies. When looking at financing flows, the *Understanding the Landscape 2019* report tracked a mere USD 3 million in commitments for stand-alone solar in the Philippines in 2017.

[77] Key figures in this table reflect, for end-2018, best estimates based on the most up-to-date figures available from various official and unofficial sources, extrapolated by leveraging recent trends. For end-2030, figures reflect model outputs for the forecast scenario, i.e., whereby SDG7 is met for electricity and clean cooking access.

[78] Philippines Statistics Authority. 2019. Urban Population in the Philippines (Results of the 2015 Census of Population). Link: http://www.psa.gov.ph/content/urban-population-philippines-results-2015-census-population

Figure CS 1

Closing the Access Gap in the Philippines: USD 1.8 Billion Required for Off-Grid Electricity and Improved Cooking Solutions



The Philippines does not have any clean cooking policy in place, and nearly 70 percent of households are known to cook at least part of the time with charcoal or other biomass. Of these households only a small fraction is using improved cookstoves (ICS). That said, by the end of 2018, approximately 53 percent of Filipino households were cooking at least some of their meals with a clean fuel, such as liquefied petroleum gas (LPG) or electricity, and approximately 1 percent of households cooking with charcoal or wood were doing so on ICS. Meanwhile, there is limited activity in the biogas and ethanol sector. However, more than 17 million Filipino households (72 percent of households) still lack full access to clean cooking due to the prevalence of stove stacking and the limited uptake of industrial wood and charcoal ICS. The vast majority of Filipino households that continue to use traditional fuels do so on artisanal or semi-industrial cookstoves that do not improve cooking efficiency enough to be considered an ICS.

In the forecast, the use of clean fuels will increase significantly to a total of 73 percent of households, representing nearly 10 million new households cooking with modern fuels. However, a considerable share of households cooking with electricity or LPG are expected to continue fuel stacking, with charcoal remaining an important secondary or tertiary household fuel. As such, in 2030, nearly 16 million households (51 percent of total households in the Philippines) are expected to continue to cook at least some of their meals with charcoal and wood or other biomass. ICS will need a total of USD 303 million of enterprise financing alone. The Philippines will also require up to USD 220 million in affordability gap financing to help the estimated 14.3 percent of households who currently struggle to purchase an ICS.

There are a number of supportive actions that will need to be taken to facilitate investment and achieve universal electrification. These are summarized as follows:

For mini-grids:

- Develop a comprehensive mini-grid regulatory framework that encourages cooperation between cooperatives and technology providers as well as increases access to subsidies in underserved areas.

- Establish a regulation that differentiates large-scale projects from small-scale projects to encourage broader private sector participation in this sector.

For stand-alone solar:

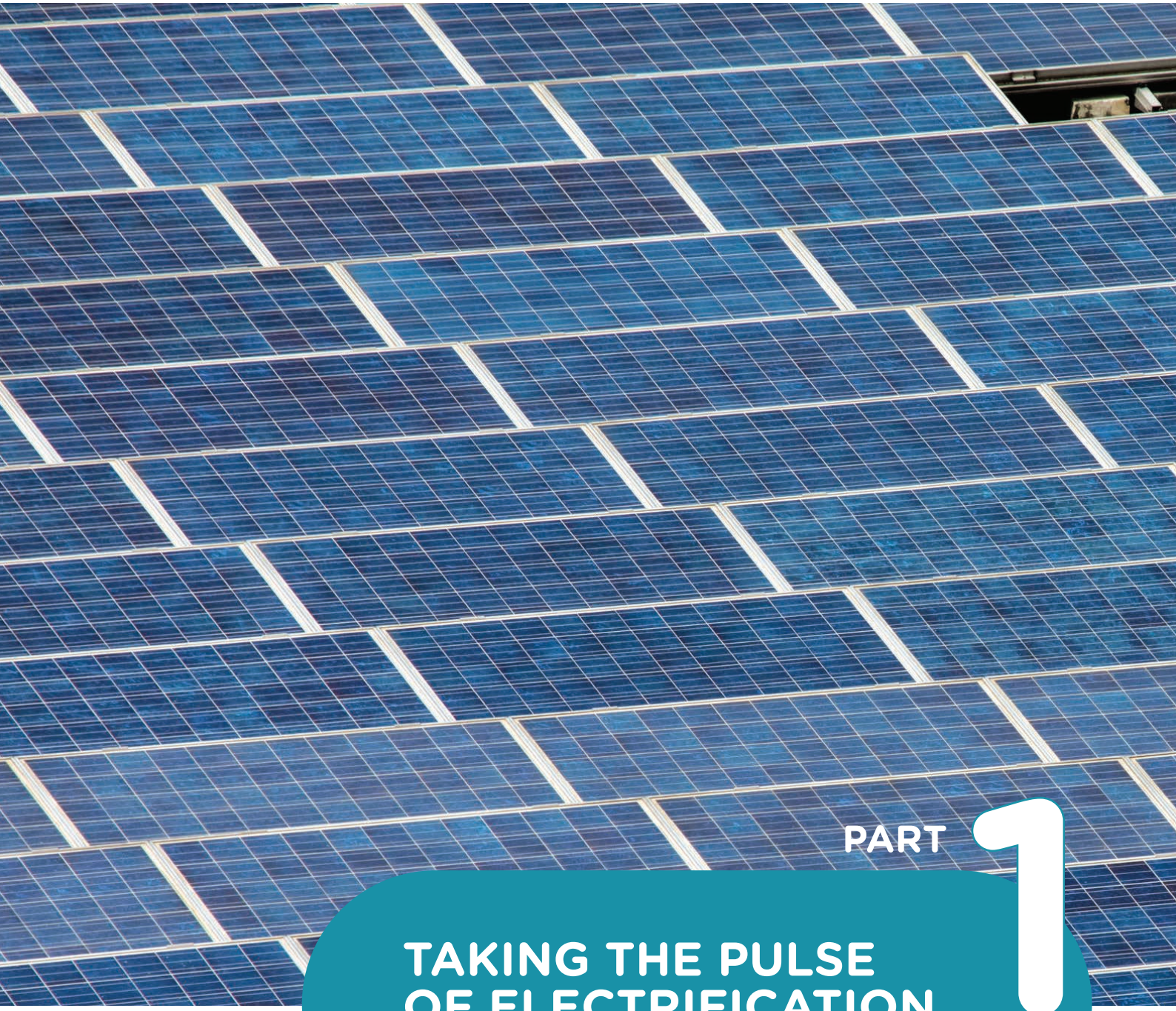
- Streamline and simplify the registration processes to encourage additional private sector participation in the stand-alone solar market.

- Improve data collection efforts on stand-alone solar in the country to obtain in-depth and up-to-date market data for both companies and consumers.

For improved cooking:

- Introduce clean cooking targets and associated policy measures to reach Sustainable Development Goal 7 (SDG7), mirroring the country's universal electrification efforts, through regulatory reforms, subsidies and other related support programs.

- Develop and deliver public awareness campaigns on the benefits of clean cookstove adoption to encourage behavior change.



PART 1

TAKING THE PULSE OF ELECTRIFICATION IN THE PHILIPPINES

SECTOR CONTEXT

Government Electrification Strategy

The Philippines consists of more than 7,100 islands, of which approximately 2,000 are inhabited. This complex geography and population distribution places technical and financial limitations on how much grid expansion can contribute to last mile electrification, which is why distributed electricity has already played an essential role in the country's electrification to date. In fact, all cities and municipalities in the Philippines have already been electrified, and government supported programs and activities have resulted in near universal barangay (i.e., village-level) electrification as well.[79] Electrifi-

[79] Department of Energy. 2016. "Missionary Electrification Development Plan".

cation at household level increased from just under 80 percent in 2010 to near 90 percent by the end of 2018. Ultimately, some 21.8 million of a total 24.5 million households have been electrified via the grid, mini-grids, or stand-alone solar systems. The majority of the 2.6 million remaining un-electrified households are located in the remotest areas of the country and deemed the most difficult to serve.[80] The government's plan for achieving energy security is detailed in the Department of Energy's Philippine Energy Plan (PEP) 2017-2040. The National Renewable Energy Program (NREP) was also developed in 2011 to set out a roadmap for maximizing the use of local renewable energy resources, through efforts such as a 2015 feed-in tariff program.[81]

The Household Unified Strategic Electrification (HOUSE) Team coordinates the Government of Philippines' (GoP) overall electrification efforts. The team is comprised of representatives from the Department of Energy (DoE), the National Electrification Administration (NEA), NPC-SPUG, the Department of Budget and Management and the Department of Interior and Local Government, and it has developed several programs to tackle electrification of off-grid areas. Responsibility for "missionary" electrification, or the "provision of basic electricity service in unviable areas with the aim of bringing the operations, in these areas, to viability levels" as outlined in the Electric Power Industry Reform Act, is divided among a number of public and private actors. Either a distributed utility (DU), Qualified Third Party (QTP), New Power Provider (NPP) or NPC-SPUG may be responsible for missionary electrification depending on viability and profitability of electrifying an area. For example, NPC-SPUG, whose mandate as a government-owned and controlled corporation is to implement missionary electrification projects, is responsible for the electrification of areas which are unviable for DUs and QTPs to electrify.[82]

Off-Grid Solutions

Mini-grids are at an advanced stage of development in the Philippines, serving over 800,000 households (approximately 3 percent of households) and various commercial and small industrial customers. The majority of these mini-grids were built and operated by NPC-SPUG. NPC-SPUG is granted immediate access to the Universal Charge for Missionary Electrification (UCME) subsidy. This allows NPC-SPUG to extend an affordable tariff to rural households serviced by their mini-grids, despite incurring substantial operational and transportation costs from diesel generation, and solves one of the main affordability challenges that plague mini-grid development in other countries. The large-scale areas still available for private-sector participation in the Philippines are composed of 14 missionary areas called First Wave Areas and 15 medium-scale areas called Second Wave Areas. The government, electric cooperatives, and the NPC-SPUG have already developed the more viable areas. Eight NPPs have taken over the First Wave Areas, but efforts to privatize the Second Wave Areas have not been as successful, due to the low desirability of these sites. Also, few mini-grid companies were selected through the competitive selection process to register as a QTP or NPP to deliver energy services.[83] In real terms, only one company has managed to register as a QTP and only 15 companies as an NPP, due to the onerous and bureaucratic process.[84] Finally, the DoE also applies the same rigorous approval processes it designed for large-scale energy projects to approving sub-megawatt off-grid electrification projects. According to one mini-grid company, getting all the requisite approvals can take up to six months which is costly from a working and overhead capital perspective.[85] While this level of oversight is necessary for national-scale projects, it dramatically increases the transaction cost of smaller projects and renders them commercially difficult to pursue.[86]

[80] Ibid.
[81] Asian Development Bank. 2018. "Philippines Energy Sector Assessment, Strategy, and Road Map".
[82] International Renewable Energy Agency. 2017. "Accelerating Renewable Mini-grid Deployment: A Study on Philippines".
[83] Ibid.
[84] Ibid.
[85] Ibid.
[86] Ibid.

Table 1.1

Major Development Partners and Their Main Programs[87]

Development Partners	Key Programs Targeting Private Sector
European Union (EU)	EU-Philippines Access to Sustainable Energy Program (ASEP) • ASEP provides solar home systems coupled with livelihood activities to poor households • EU provided USD 23.5 million for the ASEP project
Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ)	• Provides capacity building initiatives to DoE as part of the ASEP program • Supports the DoE on policy and strategy, developing planning tools and business models
The World Bank	• Partner of ASEP project • Provided USD 44 million in guarantees to electric cooperatives, which is expected to support them to expand their electricity network, invest in renewable energy and enhance energy access to the poor
Asian Development Bank (ADB)	• Development of renewable business models using five energy sources: micro hydro, solar PV, small wind, and other indigenous sources • Provide technical assistance to community-based organization to enhance ownership of projects • Provide microcredits to household to cover cost of electricity

It should be noted, however, that despite the high levels of regulation, the DoE's solar PV mainstreaming program has provided a framework for mini-grid developers to enter the market in the Philippines and leverage the tariff for solar as a service, which is set by the Energy Regulatory Commission at PHP 8.00 / day for 88 watt-hours of solar.[88]

According to an International Renewable Energy Agency (IRENA) study, accelerating mini-grid deployments in the Philippines will require:

- Clarifying roles and responsibilities on rural electrification.
- Ensuring comprehensive electrification planning.
- Clarifying the government subsidy approach.
- Streamlining regulatory and administrative policies.
- Increasing availability of financing[89].

Stand-alone solar has played a limited role in the electrification of the Philippines, and to date, has delivered energy access to just 3 percent of households across the country, mostly in remote, hard to reach areas. There are a limited number of off-grid solar companies operating in the Philippines due to

[87] GIZ. 2016. GIZ.de. https://www.giz.de/en/worldwide/62913.html
[88] Based on in-country Interviews.
[89] International Renewable Energy Agency.2017." Accelerating Renewable Mini-Grid Deployment: A Study on Philippines".

the government's strict regulatory controls on electrification and the need to obtain accreditation as a QTP or NPP to benefit from the government's subsidy fund and access franchise territories. Lack of accreditation limits access to financing for these companies, and the majority of electrification through stand-alone solar systems is currently being driven by distribution utilities in a fee-for-service business model, where the distribution utilities own, install and maintain photovoltaic (PV) solar home systems and the consumer pays a one-time participation fee and a monthly fixed fee equivalent to the government-approved solar home system tariff.[90]

Many international development partners are supporting initiatives to improve the policy and enabling environment for the wide range of government ministries involved in the power sector and missionary electrification more broadly. Partners include the Asian Development Bank (ADB), the World Bank, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and European Union (EU) among others. One of the programs, Access to Sustainable Energy Program (ASEP), has partnered with the DoE to electrify 100,000 households by 2020.

[90] Ibid.

CURRENT STATE OF ELECTRICITY ACCESS

Defining Energy Access

Taking the Pulse uses the globally accepted Multi-Tier Framework (MTF) to define energy access.[91] The MTF establishes five "tiers" of household electrification that are based on capacity, duration, reliability, quality, affordability, legality and health and safety impacts. The MTF is often referred to as the "energy access ladder", whereby households may graduate from one level of service to another depending on what sources of electrification they have access to, what they need, and what they can afford. Tier 0 represents a household that uses stopgap measures to meet their basic electrification needs, often using fuel-based lighting (e.g. kerosene lanterns, candles) or battery-operated flashlights for lighting needs, and relying on third-parties to power their devices (most notably cell phones). Tier 1 and 2 services are most often delivered by "stand-alone solar solutions", frequently in the form of single or multi-light point systems that derive their power via solar PV panels. Tiers 3 through 5 are most typically met by connections to a centralized or localized grid (i.e. a "mini-grid"). However, it is important to note that having

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

Figure 1.1

Historical Electricity Access in the Philippines

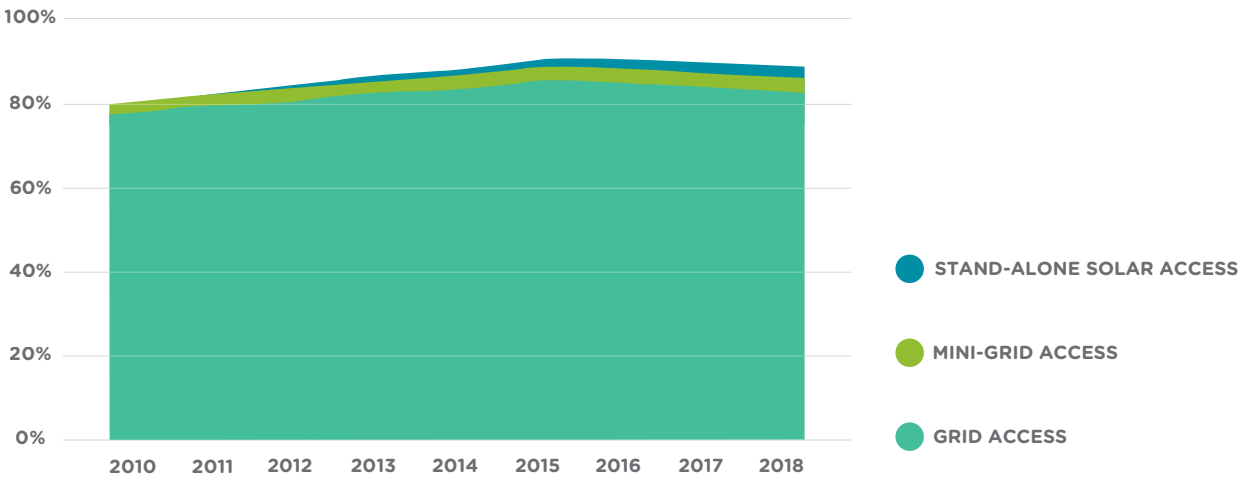
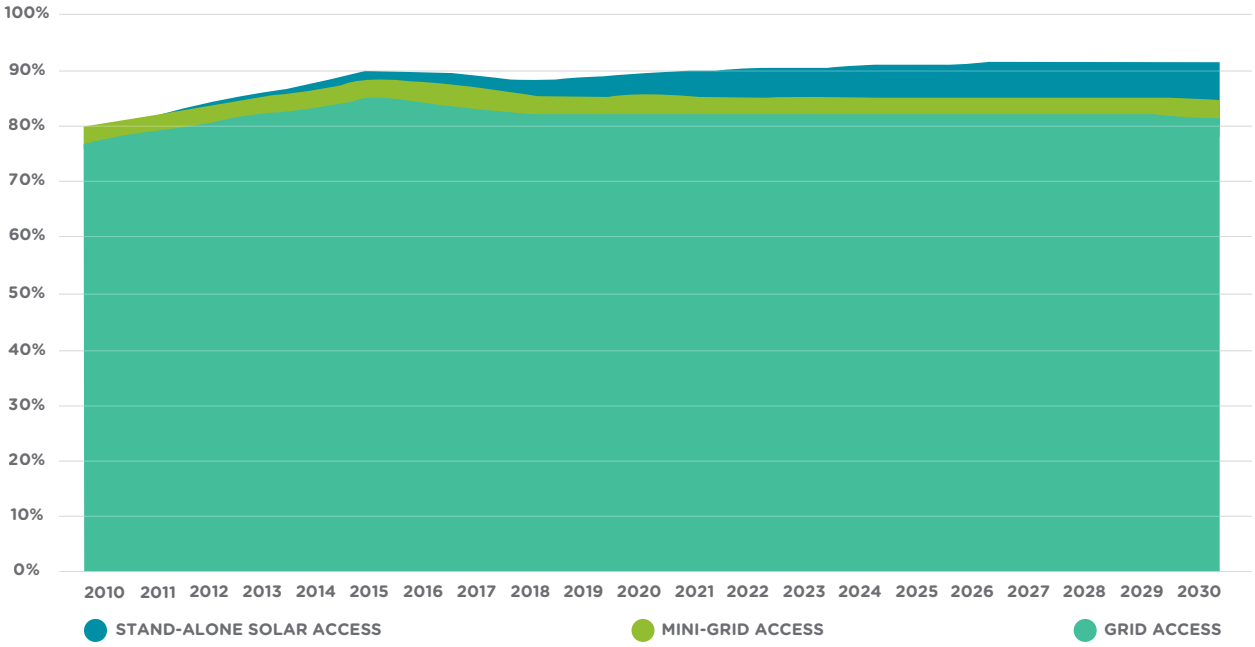


Figure 1.2

Philippines Business as Usual Electricity Access Scenario



a grid connection can also qualify as Tier 1 (or as low as Tier 0 if power is available for less than four hours per day) if the MTF duration criteria are not met. More details on the MTF can be found in the *Taking the Pulse* methodology chapter.

Tier 1 stipulates either a certain level of installed capacity (in terms of power and capacity) or a level of service, which is expressed in lumen hours. Lumen hours is the unit of measure for the brightness of light. *Taking the Pulse* establishes the minimum level of electricity service based on the MTF service metric in lumens. It stipulates that fractional Tier 1 access counts toward the SDG7 goals. This means a single-light-point solar lantern that has the functionality to charge phones (one of the MTF service criteria) counts toward access goals. However, since the lumen output of most solar lanterns is less than the MTF Tier 1 requirement of 1,000 lumen hours per day, this contribution is "fractional" given that the lantern does not deliver full service to all members of a typical household. *Taking the Pulse* assumes in its modeling that a lantern delivers sufficient lumen output to provide access to 60 percent of household members—in line with the capabilities of the typical modern lantern. As such, households would need to have two lanterns in order to achieve full Tier 1 access.

This is a critical methodological point, as lanterns are often more affordable than multi-light point systems. As such, this impacts the overall financing needs required to achieve universal access in a given market. The methodology chapter discusses how levels of service are derived in the model, and the assumptions that underpin them.

State of Electricity Access in the Philippines

At the end of 2018, 88.5 percent of households in the Philippines had electricity access.[92] As seen in Figure 1.1 above, the Philippines has expanded grid access almost 9 percent since 2010. Stand-alone solar access, which was negligible at the start of the decade, now accounts for about 3 percent of Filipino household connectivity. Mini-grid access as a share of total electricity access in the Philippines, covering over 800,000 households in a country of 24.5 million households, is also about 3 percent.

[92] 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

As seen in Figure 1.2, the model outputs show that if the Philippines continues to expand grid access at the pace seen in recent years, following a business as usual (BAU) scenario, population growth in the Philippines is likely to fully offset the impact of new grid connections, resulting in grid coverage of 82 percent in 2030—similar to today. Stand-alone solar access, following its current trajectory, can be expected to reach 7 percent. This projection assumes an annual net increase of 110,000 households gaining access through 2030. Extrapolating forward, the BAU mini-grid scenario would remain unchanged at a 3 percent share of total household access. In the aggregate, the BAU scenario shows that the Philippines would provide energy access for 92 percent of households in 2030, leaving an access gap of 8 percent.

CLOSING THE PHILIPPINES' ELECTRIFICATION ACCESS GAP

Achieving and maintaining universal electricity access by 2030 in the Philippines will require acceleration across grid-based and off-grid technologies. In fact, the forward-looking projections modeled in Figure 1.3 below illustrate the targets for the Philippines to achieve universal energy access by the end of 2025,[93] per the government's current objectives, and then maintain universal access through 2030. The key assumptions driving this scenario are as follows:

- Grid connectivity increases to 85 percent in 2025 and 88 percent in 2030, with some 6.6 million new connections added over the entire period.

- Mini-grid initiatives backed by the government have already greatly contributed to the high electrification rate in the Philippines; new mini-grid connections will be leveraged to connect some 0.24 million additional households by the end of 2025 and a further 0.2 million through the end of 2030. These 2,200 new mini-grids will result in mini-grid access reaching 4.1 percent.

- The electrification access deficit that remains from grid and mini-grid expansion will need to be filled by off-grid solar. As a result, the Philippines will be counting on stand-alone solar to deliver access to the remaining 8 percent of households in 2030 that do not have grid or mini-grid access. This will prove challenging since the economics of reaching the last mile via stand-alone solar are not attractive for most private companies because the areas are hard to reach, affordability is low, and access to public funding for private companies is nonexistent for those not registered as an NPP or QTP.

[93] Department of Energy. 2016. "Power Development Plan: 2016- 2040".

Figure 1.3

Forecast Electricity Access in the Philippines

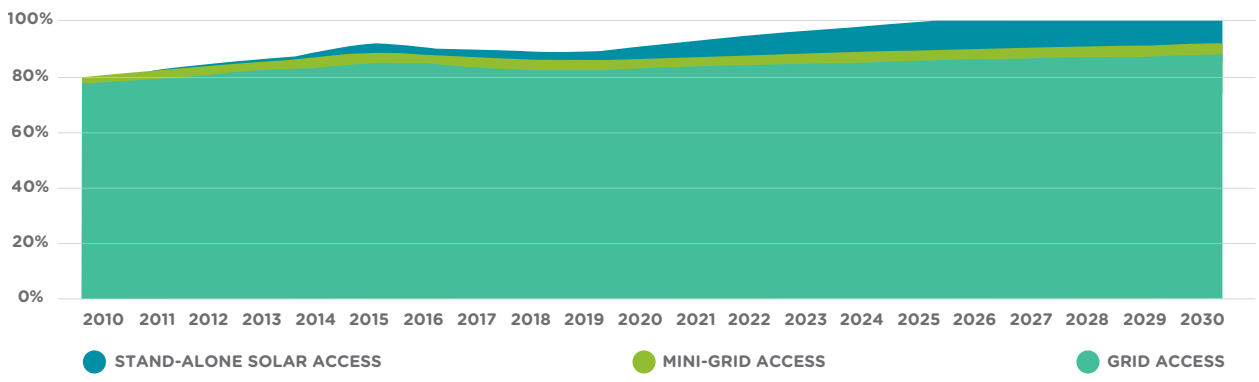
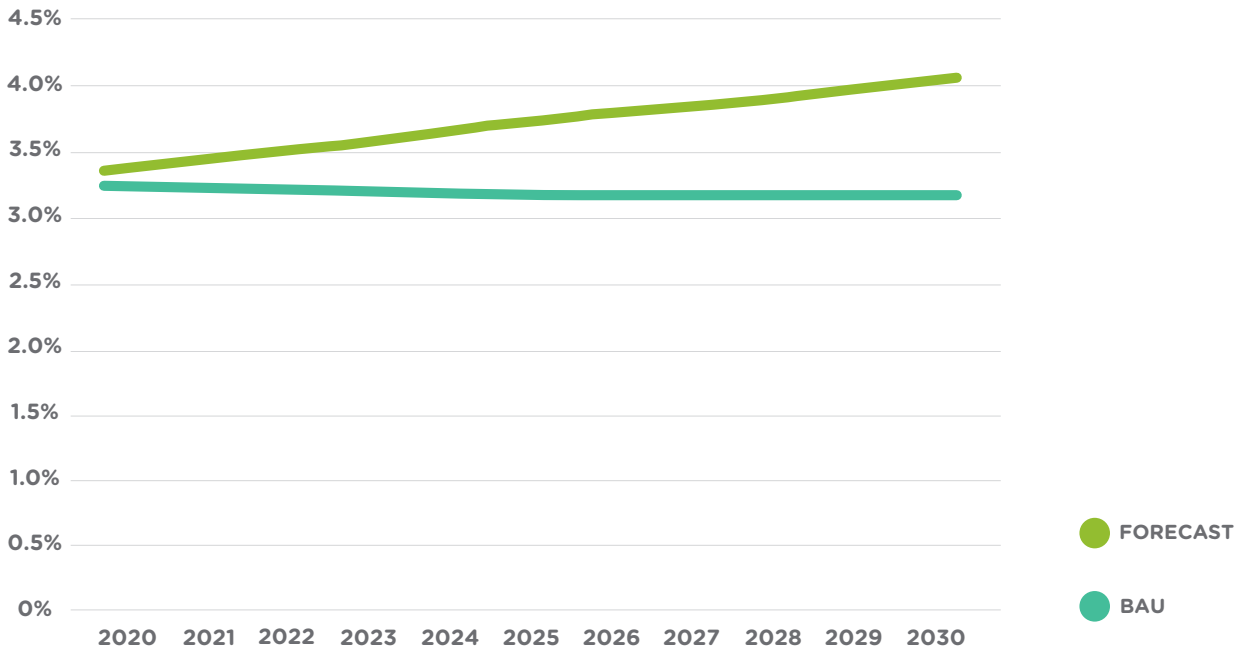


Figure 1.4

Mini-Grid Electricity Access Forecast in the Philippines



Mini-Grid Contributions Toward Achieving SDG7

The forecast model projects that new mini-grids will account for some 440,000 new household connections in the Philippines over the period 2020-2030. This represents an approximately 57 percent increase in new connections compared to the end of 2018. This also means that mini-grids will deliver electricity access to over 1.25 million households by 2030. Though this is a substantial increase from the base case and a much larger portion of households than the other case studies in this report, it still means that mini-grid contributions to the SDG7 challenge will remain relatively modest, at 4.1 percent of total connections.

Mini-Grid Financing Needs

Taking the Pulse establishes that mini-grids will deliver a minimum of Tier 3 electricity services. The model therefore includes assumptions around the cost or delivering this level of service. This is a minimum and

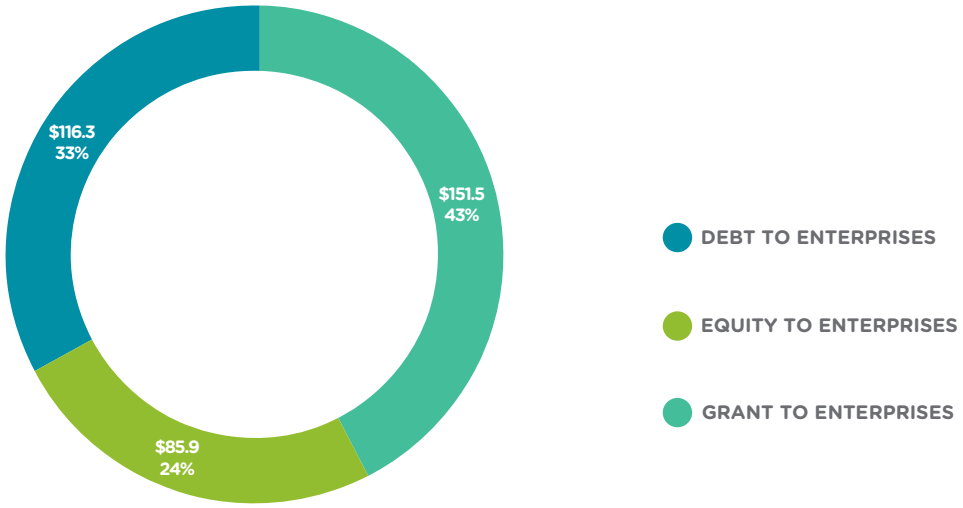
Table 1.2

Model Assumptions of Capital Blend by Mini-Grid Company Maturity

	Pilot	Validation	Scale-Up	Mature
Grant	75%	50%	40%	30%
Equity	25%	30%	30%	20%
Debt	0%	20%	30%	50%

Figure 1.5

Cumulative Financing Need for Mini-Grid Enterprises in the Philippines (Million USD)



does not preclude the development of mini-grids that are capable of delivering Tier 4 or 5 access. However, if either of these levels of service were to be considered the minimum, the overall costs of delivering energy access via mini-grid solutions would increase considerably. To achieve the 330,000 new mini-grid connections envisaged in the forecast scenario outlined above, mini-grids will have a cumulative financing need of USD 353.7 million, as seen in Figure 1.5 above. This assumes that each mini-grid will support 200 households and two large anchor clients that consume over a third of the mini-grids generated electricity and that connections will cost between USD 650-1,050 per connection, depending on the maturity of the mini-grid developer.

Mini-grid projects rely on a blend of grants and equity to finance early-stage development costs, operational costs, and leverage for the additional debt financing needed to build and maintain infrastructure, as illustrated in the diagram above. In the model, the blend of capital is directly tied to the companies' stage of growth, where pilot stage companies obtain closer to 75 percent grant funding and little to no debt, and mature companies require 30 percent grants and are much more reliant on debt.

The analysis of financing needs for mini-grid development assumes that international development agencies, local government agencies, trusts and foundations, and other investors will provide grants to cover 43 percent of enterprise financing, while venture capital, private equity, impact funders, and other equity investors will contribute 24 percent. The remaining 33 percent of enterprise financing would come from debt. Interviewees in the Philippines expressly noted that impact funding and concessional funding for energy access projects are increasingly being concentrated in Africa, which makes fundraising in Asia more difficult.[94] In addition, local commercial banks in the Philippines do not offer project-based financing for small- and medium enterprises (SMEs). As a result, the borrowing capacity of SMEs is capped by their balance sheet, which subsequently limits how much these companies can participate in government tenders.[95]

Affordability of Mini-Grids

Subsidies have played an important role in the Philippines market, thanks to the establishment of the UCME Fund, which provides subsidies in areas not interconnected to the main grids. Aside from NPC-

[94] Based on in-country interviews.
[95] Based on in-country interviews.

SPUG, NPPs and QTPs (which can be conventional or renewable energy developers) are eligible to tap the UCME.[96] As of 2015, only 1 QTP and 15 NPPs had been certified by the Department of Energy, thus limiting the number of private sector companies accessing the Fund.[97] After qualifying, the accredited entity must negotiate a reasonable, unsubsidized electricity tariff with the Energy Regulatory Commission (ERC). This baseline rate will be designated as the True Cost Generation Rate or "TCGR" and used as a reference point for computing the UCME subsidy. After establishing the TCGR, the ERC will then determine the appropriate Subsidized-Approved Generation Rate (SAGR) for the off-grid site being proposed for electrification. The difference between the TCGR and SAGR will constitute the UCME Subsidy that the accredited entity will be able to access.

Unfortunately, the subsidy disbursement of the UCME fund is above its replenishment rate and demand for subsidies is increasing due to the growing per capita energy demand and population size of existing SPUG Areas. Due to this burden on the UCME fund, it can no longer subsidize new missionary areas. To make the UCME sustainable, the DoE must now impose a graduation pathway for SPUG areas that no longer require a subsidy, most likely a lengthy and politically challenging process, so that new missionary areas can benefit from the fund.

Key Challenges and Opportunities Relative to Mini-Grids Delivering on SDG7 Targets

Mini-grid growth is constrained by a complex and competitive selection process with stringent oversight for small-scale projects and limited access to subsidies for off-grid electrification.[98] The Philippines has a one-size-fits-all approach to energy regulations, where regulations designed to limit the social and environmental impacts of large-scale projects are also being applied to small-scale, off-grid projects. One mini-grid developer reported having to secure 190 signatures from national and local government agencies to implement a 45-kilowatt (kW) hybrid mini-grid, adding time and cost to the development process.[99] Another noted that, at a country level, the blanket application of policies and regulations that govern multi-megawatt installations onto small, missionary electrification projects discouraged broader private sector participation. This issue extends project development timelines and costs to levels that are not financially attractive.[100] Policies will need to be streamlined and procurement rules simplified to encourage additional private sector mini-grid development and increased interest in participating in the electrification of off-grid, commercially unviable areas.[101]

In addition to overhauling the policy and procurement procedures governing mini-grid development, access to local finance will also play a critical role. This can be done by extending the NEA's rural electrification grant funding to apply to off-grid technologies in addition to grid extension efforts or by offering other government-financed de-risking mechanisms to promote local financial institutions to finance mini-grid projects.[102] Also, as outlined earlier in this chapter, the UCME fund is one of the most established sources of rural electrification subsidy in the Philippines. If the UCME is rationalized and a graduation policy is introduced for more prosperous SPUG areas, a substantial portion of the UCME can be diverted to truly missionary areas.

Finally, determining tariff levels for off-grid rural electrification is a complex and time-consuming process. The process is managed by the ERC, who evaluates every application and conducts all requisite public hearings that must be conducted to finalize tariff levels. ERC is understaffed and over-burdened to finalize tariff levels. Current tariff levels are also based on on-grid cost calculations. A distinct tariff determination process should be adopted for off-grid projects, which takes into account the higher generation and operating costs associated with mini-grids.[103]

[96] Department of Energy. 2016. "Missionary Electrification Development Plan".
[97] Department of Energy. 2016. "Missionary Electrification Development Plan".
[98] International Renewable Energy Agency. 2017. "Accelerating Renewable Mini-grid Deployment: A Study on Philippines".
[99] Ibid.
[100] Based on in-country interviews.
[101] Ibid.
[102] Ibid.
[103] Ibid.

STAND-ALONE SOLAR CONTRIBUTION TOWARD SDG7

In a BAU scenario, stand-alone solar access is expected to reach 7 percent, whereby net new household connections (gross additions minus retirements) averages 110,000 Tier 1 equivalent or higher per year through 2030 (of which 750,000 new connections would occur over the period 2020-2025). The forecast model projects that new stand-alone solar will account for 2.1 million new household connections between 2020-2025, peaking at 10.5 percent of electrified households. This represents an increase of over 300 percent in new connections from stand-alone solar compared to 2018. However, beyond 2025, the share of households with stand-alone solar systems is forecast to drop off as a notable share of them become connected to the grid and mini-grids. This is because a share of new grid and mini-grid connections will be installed in households previously relying on stand-alone solar. Thus, by 2030, stand-alone solar systems would be delivering electricity access to some 2.5 million households. While this is a relatively small increase from the BAU scenario in 2030, achieving the short-term 2025 target will require a great deal of capital and private sector capacity building.

Financing needs

To achieve the connections envisaged in the forecast scenario outlined above, stand-alone solar will have a cumulative financing need of USD 864 million as seen in Figure 1.7. The outputs depicted in this figure are based on two key assumptions:

- Stand-alone solar systems are assumed to have a lifetime of four years and, as such, households purchasing a system in a given year are projected to require a new system to maintain access fully four years later. A country with a high rate of stand-alone solar access more than four years prior to 2030 is therefore likely to have higher proportional financing needs than a country that makes rapid gains in off-grid solar access closer to 2030.

- The Philippines will require about USD 33 million in affordability gap financing to achieve universal electricity access. A more detailed explanation of consumer affordability is provided below.

The model assumes that OGS businesses are at different stages of maturity during the forecast

Figure 1.6

Stand-Alone Solar Electricity Access Forecast in the Philippines

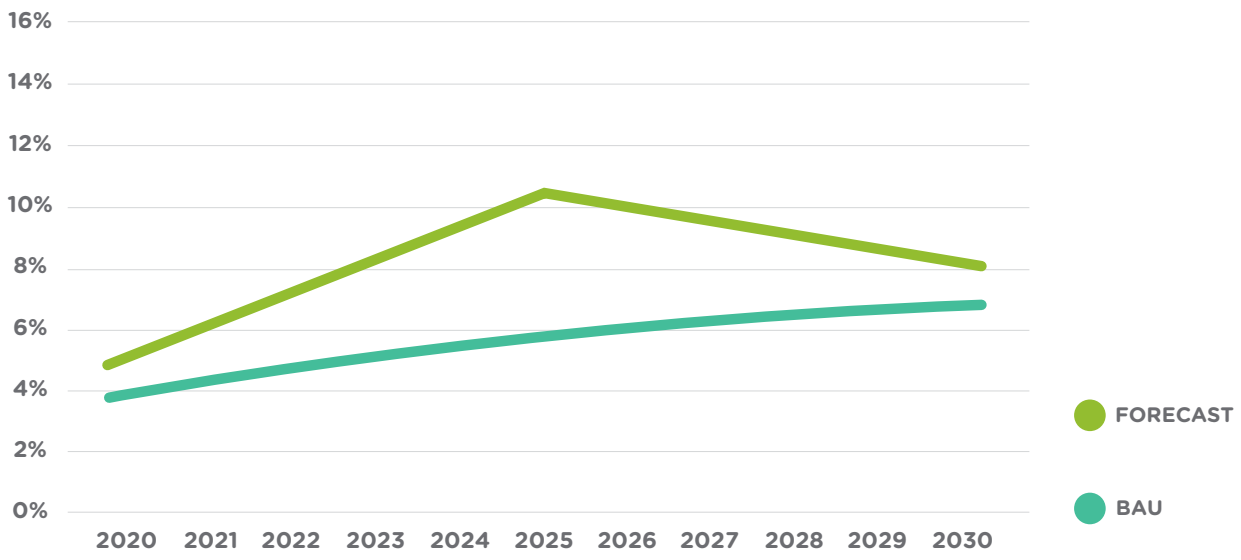
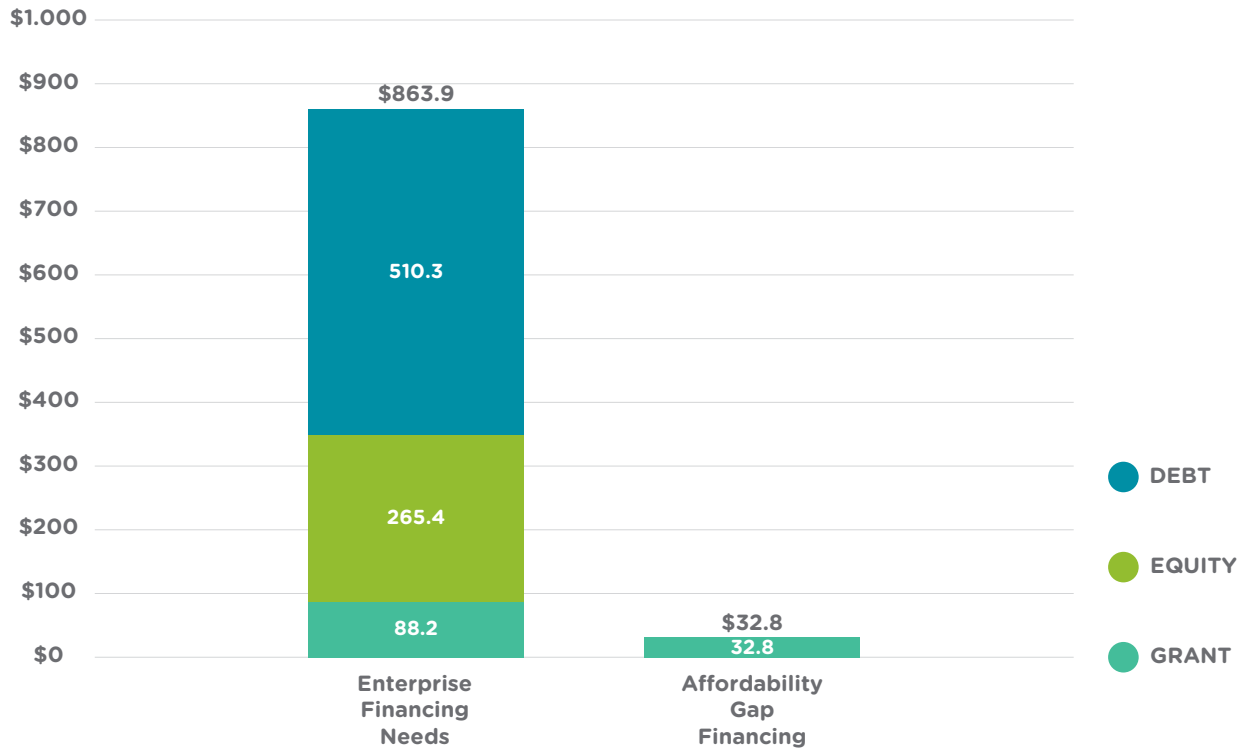


Figure 1.7

Cumulative Financing Needs to Achieve Stand-Alone Solar Targets in the Philippines (Million USD)



period (pilot, validation, scale-up, mature). The blend of capital associated with these stages varies, as summarized in Table 1.3 below. Early-stage enterprises will be more reliant on grant financing and risk tolerant early equity, while more mature businesses will seek to leverage their equity financing to secure significant debt that will finance their consumer receivables and inventory finance needs.

Through 2030, grants are expected to continue to provide 10 percent of enterprise financing, largely due to the need to incentivize companies to expand sales channels into underserved rural areas. Equity finance covering 31 percent of enterprise needs will support ongoing operational activities, while lenders will contribute the remaining 59 percent of enterprise capital needs, accounting for low-cost funds to commercialize loans to solar service providers.

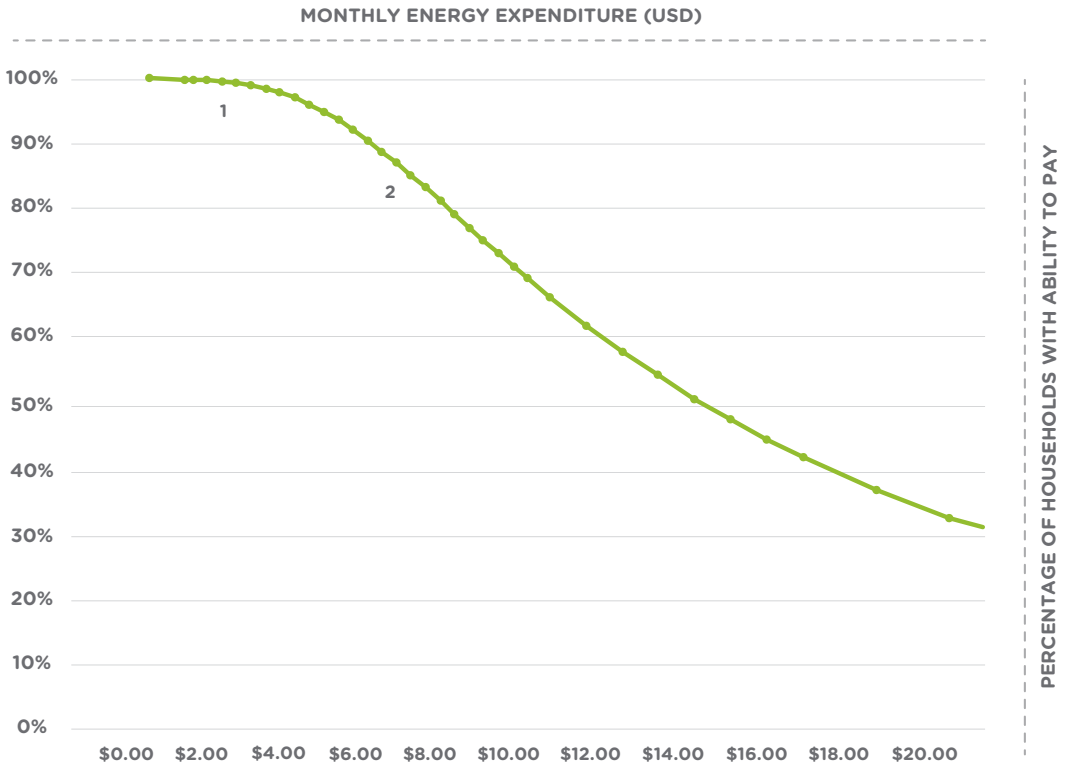
Table 1.3

Model Assumptions of Capital Blend by Stand-Alone Solar Company Maturity

	Pilot	Validation	Scale-Up	Mature
Grant	20%	30%	10%	5%
Equity	80%	55%	45%	15%
Debt	0%	15%	45%	80%

Figure 1.8

Philippines' Ability to Pay at 5% of Monthly Consumption on Electricity Access



Affordability of Solar Home Systems

In 2015, some 22 percent of Filipinos lived under the national poverty line. While this rate has been dropping, a sizable share of households is expected to have difficulty affording basic stand-alone solar products. While a relatively small share—fewer than 1 percent—of households are estimated to be unable to afford the USD 3.30 per month[104] (see label "1" on Figure 1.8) to buy a solar lantern on a pay-as-you-go (PAYG) basis, more than 15 percent of all households are unable to afford a full Tier 1 solar home system at a cost of USD 7.5 per month,[105] as illustrated in Figure 1.8 on label "2". As noted in the previous section, this is why the forecast scenario takes into account the need for affordability gap financing.

The estimated affordability constraints outlined above were determined by leveraging the World Bank poverty calculator (PovCal) to create Filipino household consumption curves, i.e., charting the percentage of households with consumption at or below specific dollar amounts.[106] Then, by assuming that households are willing to allocate no more than 5 percent of their monthly consumption on electricity access (a threshold regularly used by practitioners to define electricity affordability), the model is able to estimate the percentage of households that cannot afford either the USD 3.3 a month for a PAYG lantern (Prompt 1 in Figure 1.8) or, separately, the USD 7.5 for a Tier 1 solar home system (Prompt 2 in Figure 1.8). Compared to the other two countries (Madagascar and Uganda) that are profiled in this edition of *Taking the Pulse*, the Philippines' affordability challenge is comparatively small, with nearly all homes being able to afford a solar lantern when paid for in installments, and over 85 percent being able to afford a multi-light point system that is paid for in installments.

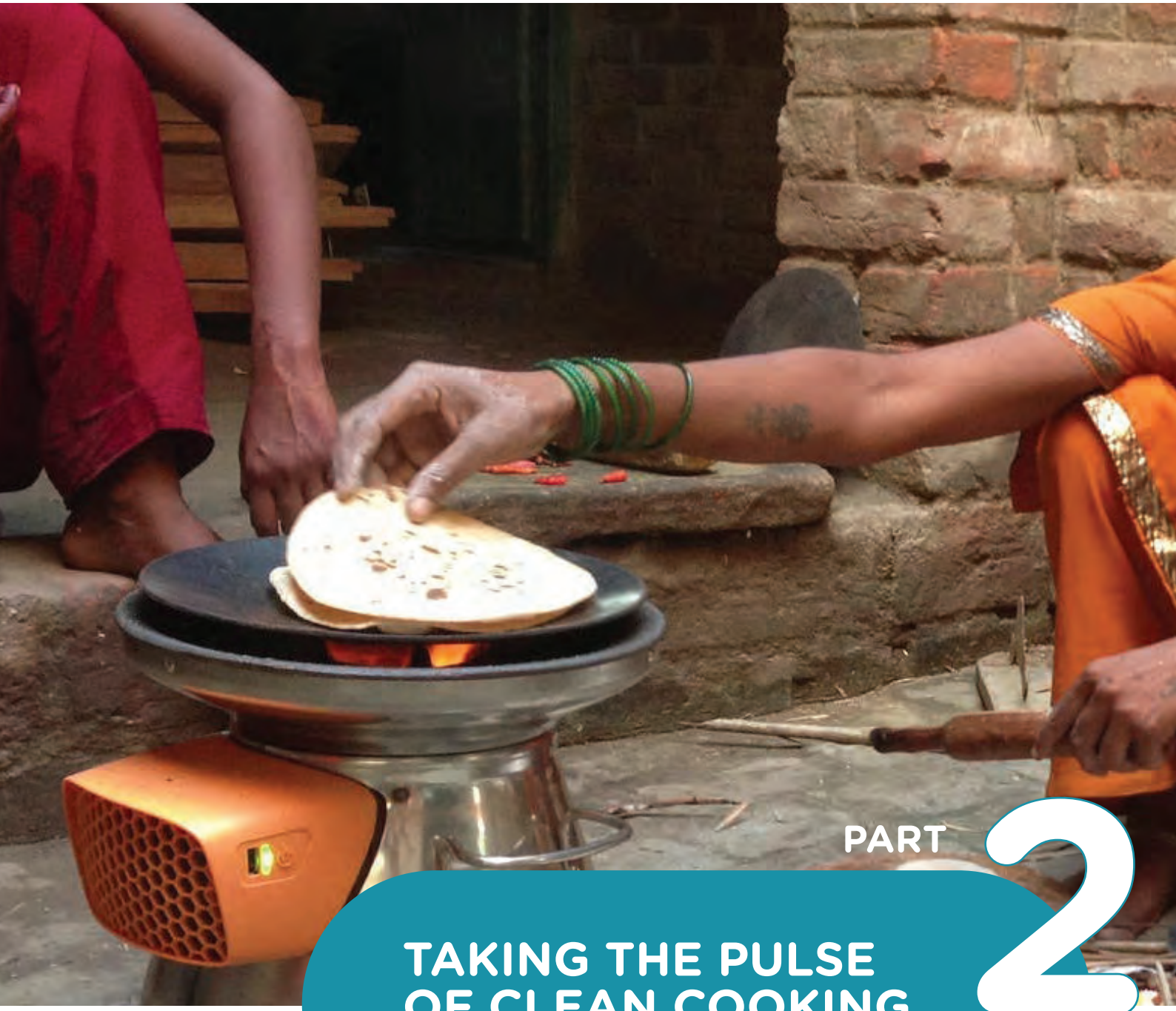
[104] The model assumes this retail price point for a household to purchase a quality verified mid-range lantern, paid for installments over 12 months.
[105] The methodology chapter discusses the approach to modeling affordability in detail.
[106] The methodology chapter discusses the approach to modeling affordability in detail.

Key Challenges and Opportunities Relative to Stand-Alone Solar Delivering on SDG7 Targets

Though mini-grids are expected to play the central role in the electrification of the Philippines, stand-alone solar can still contribute in important ways. As such, it is imperative that key challenges are addressed. First, heavy regulation of the electricity sector can discourage stand-alone solar companies from entering the market, since company certification is requisite to access government funding and, as mentioned in previous sections, is cumbersome to achieve.

Second, the Philippines lacks a comprehensive integrated electrification plan. GIS technology can be leveraged to reconcile population density and energy demand data, renewable energy potential, and the grid expansion timeline, and to identify areas that will remain off-grid for the next five to ten years because of economic or resource constraints. These areas would then become the target market for the government's rural electrification efforts. The sites that can be developed commercially could be immediately tendered to the private sector. The privatization of SPUG Areas could also be accelerated to provide additional sites where the private sector can operate. Sites that require partial subsidies can then be supported by the UCME Fund, pending the development of the graduation program recommended earlier in this chapter. Additionally, sites that require a full subsidy can be supported by a combination of public funding and donor support.

Third, given widespread access to grid and mini-grid electricity, stand-alone solar is often viewed as an inferior source of energy. Awareness raising campaigns could help raise the profile of stand-alone solar and encourage adoption. Finally, consumer affordability will be a challenge in electrifying the last mile, as those communities will be the least well off and most likely to have difficulty in paying for electrification services. For the Philippines to reach 2030 access goals, affordability gap financing from government and development agencies will be an imperative, whether through the UCME or other facilities.



PART 2

TAKING THE PULSE OF CLEAN COOKING IN THE PHILIPPINES

INTRODUCTION

Government Initiatives

Desk research undertaken during preparation of this report found nearly no existing documentation on the cooking sector in the Philippines. Furthermore, it is believed that there are no government policies that promote the use of clean cooking technologies.[107]

Numerous small-scale cookstove manufacturers do operate in the Philippines, but few have achieved operational scale due to lack of funds and limited relationships with distributors. Most stoves are produced to order and sold within a 30-kilometer (km) radius of the factory because transportation costs are high.[108] LPG, charcoal, and wood are the predominant fuel sources, with LPG most predominant in urban areas.

[107] Regulatory Indicators for Sustainable Energy. 2017. Philippines. http://rise.worldbank.org/country/philippines.

[108] StovePlus. 2015. "Exploratory Mission report".

CURRENT SECTOR ECOSYSTEM[109]

Defining Clean Cooking

Taking the Pulse uses the MTF[110] to establish the minimum definition of "improved cooking" that counts toward the SDG7 goal of universal access. The MTF measures household access to cooking based on indoor air quality, cookstove efficiency, convenience, and safety, affordability, quality and availability of the primary fuel. The report has two main ways in which it defines access to improved cooking solutions. The first, which is the primary focus of the report, centers on moving households away from traditional cooking solutions (typically using a three-stone fire or artisanal or semi-industrial cookstove) all of which do little to improve cooking efficiency and/or reduce emissions. As such, the report models out the cost of what it would take for these households to adopt improved "industrial" cookstoves, which typically entail centralized, large-scale production that uses quality components, manufactures with precision tools and employs considerable levels of automation. The focus is typically on rocket stoves, which have an insulated, L-shaped combustion chamber that improves combustion efficiency and reduces emissions. However, it is important to note that use of these stoves necessitates the continued use of either wood or charcoal as a fuel source. *Taking the Pulse* defines the minimum level of improved cooking access as ICS that meet International Workshop Agreement (IWA) minimum standards on fuel efficiency and emissions.

Related to clean fuels, the report focuses on three primary ones that are considered to have significant potential. These are a sub-set of cooking solutions that deliver high performance in terms of reducing household air pollution—often (although not always) regardless of the type of cookstove used: biogas, LPG, electricity, ethanol, natural gas, and solar cookers, collectively called "BLEENS"[111]. Given that *Taking the Pulse* only focuses on biogas, LPG, and ethanol, it adopts the term "clean fuels" in discussing them. The report forecasts the expected uptake of clean fuels over time but does not cost out the financing that would be required to achieve these forecasts. This is because it was not in the scope of this report given the complexity surrounding the costing of delivering clean fuels for cooking.[112]

Clean Cooking in the Philippines

Per our modeling, 53 percent of the Filipino households are now using clean fuels to cook at least a share of their meals. The majority of the clean cooking is accounted for by LPG, which has experienced rapid growth since the 1990s. Biogas activity is very limited for household cooking. While there is biogas generation in the livestock sector, there is no notable activity in the residential biogas market currently. Similarly, there is little sign of activity on ethanol. While there is domestic ethanol production from the local sugarcane industry, the main market for this ethanol is the transport sector, that blends it with gasoline.

LPG Market

Over 40 percent of households in the Philippines use LPG currently, and industry sources indicate that due to the competitive economics, improvements to product availability, and improved safety, LPG demand for household cooking is projected to be the primary fuel source contributing to clean, post-firewood and charcoal-based cooking in the country.

The LPG industry is concentrated mainly in urban and peri-urban regions of the country, and on the main islands, but is starting to spread more widely throughout the Philippines, driven by larger companies building out their distribution infrastructure.

The Philippines LPG industry includes a wide range of actors. The two major companies are Pascal Re-

[109] As there is no active biogas or ethanol market for cooking in the Philippines, it is not discussed in this chapter.
[110] Bhatia, M. & Angelou, N., 2015. Beyond Connections – Energy Access Redefined, Washington: Energy Sector Management Assistance Program.
[111] Bhatia, M. & Angelou, N., 2015. Beyond Connections – Energy Access Redefined, Washington: Energy Sector Management Assistance Program.
[112] In addition to the financing needs for distribution and/or installation of the cooking hardware, scaling LPG and ethanol uptake requires the build-out of large-scale distribution infrastructure, particularly related to shipping, storage, and processing of fuels.

sources Energy Inc. (PR Gaz) and Brent Gas.[113] Both companies are integrated players in the market, participating in importing and selling LPG and also refilling it. There are also other companies which specialize in the import and selling of LPG[114], LPG refilling[115] and cylinder manufacture.[116] PR Gaz, one of the main players in the LPG cooking market, has been operating in the country since 2000 and focuses specifically on reaching customers in rural areas and helping them transition to cleaner LPG fuels.[117]

PR Gaz has improved and automated the refilling process and is now in the process of expanding its supply and distribution network. For the last mile, the company is making use of sari-sari (neighborhood sundry) stores, so that the business model leverages established distribution networks and reaches customers where they currently shop. Sari-sari stores are given a stock of cylinders, and PR Gaz's initial sales package is comprised of two Gaz Lite cylinders, along with one LPG cookstove. This ensures that the client always has a spare LPG cylinder. PR Gaz provides the after-sales service, picking up the cylinders and filling them up. The company has recently built its own refilling operations and is even looking at manufacturing the cylinders itself, rather than importing them, though this is likely a few years off.

PR Gaz aims to expand to supply 1 million families through a wide range of sari-sari stores by 2020 with its Gaz Lite technology, a smaller and more affordable format for individual households. The larger cylinders (e.g., 11kg or larger) are often too expensive for households to afford upfront, especially in rural areas, and PR Gaz is now addressing this affordability barrier by offering a smaller, more compact cylinder. PR Gaz has also partnered with the Microfinance Council of the Philippines, Inc. (MCPI) to develop a loan product for households using LPG for cooking. Households availing themselves of this microloan pay USD 0.80 per week for a period of 30 weeks for a single burner stove and two LPG cylinders. As one interviewee noted, assisting consumers to purchase an entry level LPG stove, which is the major affordability challenge for low-income households, will help unlock the LPG market. The cost to refill an LPG cylinder is lower than the cost of their current fuel sources like kerosene and coal, which means households that already use kerosene and coal will be able to afford refills after their loan has been paid off.[118] As of 1 June 2019, the estimated price of household LPG in Metro Manila ranged from PHP 539.25-716.25 per 11-kilogram cylinder (USD 10.42-13.84), which works out to a per-kg price range of between USD 0.94-1.26.

The other major player in the LPG cooking market is Brent Gas, which is a fully integrated LPG company that caters to retail, commercial, and industrial market segments in the Philippines, located mainly in the region of Luzon in the north, as well as in Visayas. It has 250 stores, 13 refilling plants, 3-cylinder manufacturing and repair facilities, and over 1,000 employees. Brent Gas provides an integrated LPG service to its customers, including a range of LPG cylinder sizes ranging from 2.7kg up to 50kg.[120]

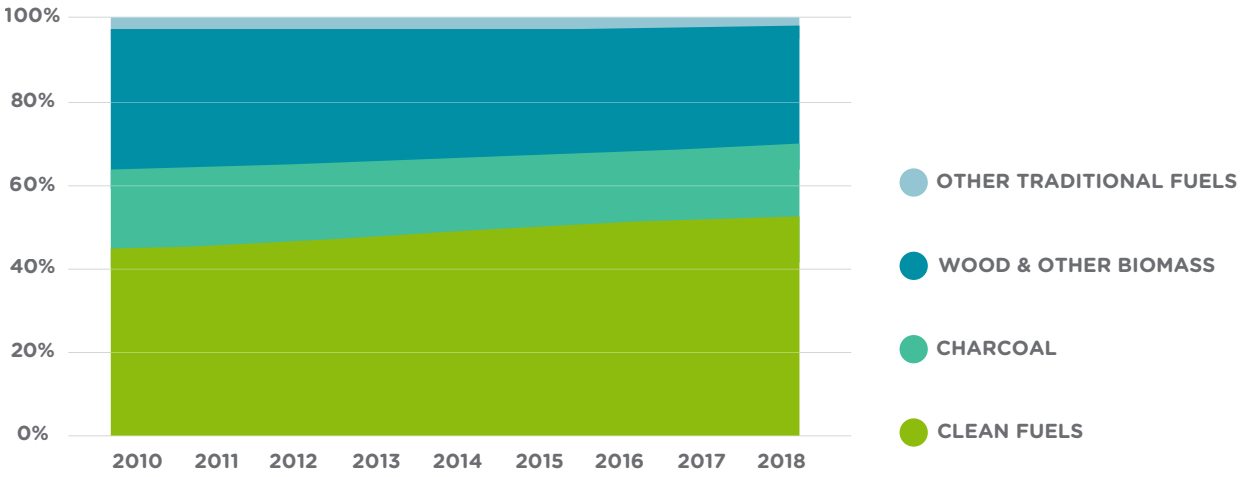
Although the LPG market is growing steadily and benefits from a wide range of players, including the fact that the Philippines has two local refineries,[121] there are still some challenges that hinder the complete success of the market. The SWOT analysis below outlines these along with the market strengths.

- **Strengths:** the LPG market is well-established and with over 40 percent of households already using the fuel, awareness is relatively high; there is a competitive market with a range of differ-

[113] Philippine Liquefied Petroleum Gas Association, Inc. 2018. http://plpga.org/members/
[114] Some of the bulk importers include Pryce Gas inc, Macro LPG Company and South Pacific Inc.
[115] Some of the major LPG refilling companies include Aral Merchandising, Caimol Marketing, Extra Ordinaire, Island Air, Masanga, Metro, Northern, Republic, Royal, Subic and World's Best Gas Inc.
[116] FSC Metal Corporation is one of the companies which entirely focuses on cylinder manufacturing.
[117] Energy for All Asia. n.d. https://energyforall.asia/projects/gaz-lite-2f65c190-2d27-4165-90ea-1a210321f4d9
[118] Based on In-country Interview.
[119] Department of Energy. 2016. "Missionary Electrification Development Plan".
[120] Brent Gas. 2018. Brent Gas. 01 04. https://www.brentgas.com.ph/pr-is-now-brent-gas/
[121] Domingo, Ronnel W. 2018. Business Inquirer. 09 24. https://business.inquirer.net/257773/petron-shell-refineries-output-14

Figure 2.1

Historical Cooking Fuel Breakdown in the Philippines



ent suppliers; and the Philippines is also home to two oil refineries, enabling LPG to be procured locally rather than imported. Income levels are also somewhat higher, and with over 50 percent of residents living in urban areas, there is a greater number of households able to afford cleaner fuels like LPG.

- **Weaknesses:** Distribution is one of the main issues for LPG: the Philippines comprises over 7,000 different islands, making the distribution network one of the biggest challenges to achieving universal access to clean cooking fuels. The geography of the archipelago, combined with all the associated logistical challenges of ensuring fuel and cylinder delivery, as well as maintaining the delivery infrastructure in place, makes it difficult to ensure that both cylinders and fuel are available in rural regions and on the smaller islands. In addition, LPG delivery infrastructure is relatively capital intensive, which means it takes time to raise financing and build-out.

- **Opportunities:** the availability of smaller cylinders, combined with rising income levels which support affordability (particularly in urban areas) make LPG an increasingly attractive option for a growing number of households in the country. Efforts are also underway to introduce tighter safety standards, including regulations on the cylinders, which should help (at least partially) address consumer concerns around their safety. Additionally, consumer finance products are emerging, notably via the MCPI, which are helping address the upfront cost barrier.

- **Threats:** There are a range of problems that continue to persist, notably with regard to the issue of safety, such as:

  - o Uneven quality of cylinders across various suppliers.

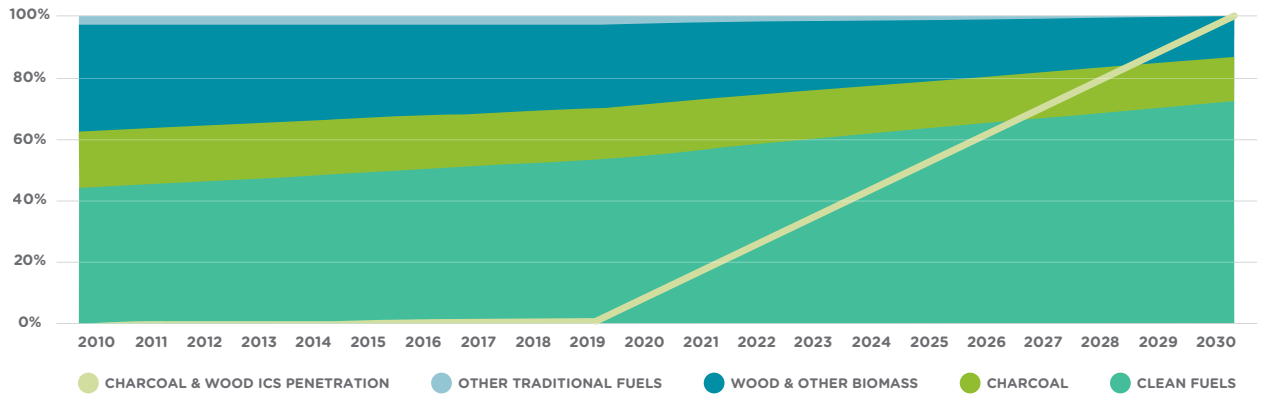
  - o Illegal re-filling of cylinders which has sometimes led to explosions, resulting in safety concerns about LPG use and therefore hindering its market adoption in certain areas.[122]

    - – This suggests that quality standards and higher quality cylinders are needed to improve customer confidence in the safety of cylinders.

[122] The Gaz Lite Project in the Philippines. 2017. "Business Development for Improved Cookstoves and Innovative Fuels".

Figure 2.2

Cooking Fuel Breakdown and ICS Penetration Forecast in the Philippines



Current State of Clean Cooking Access

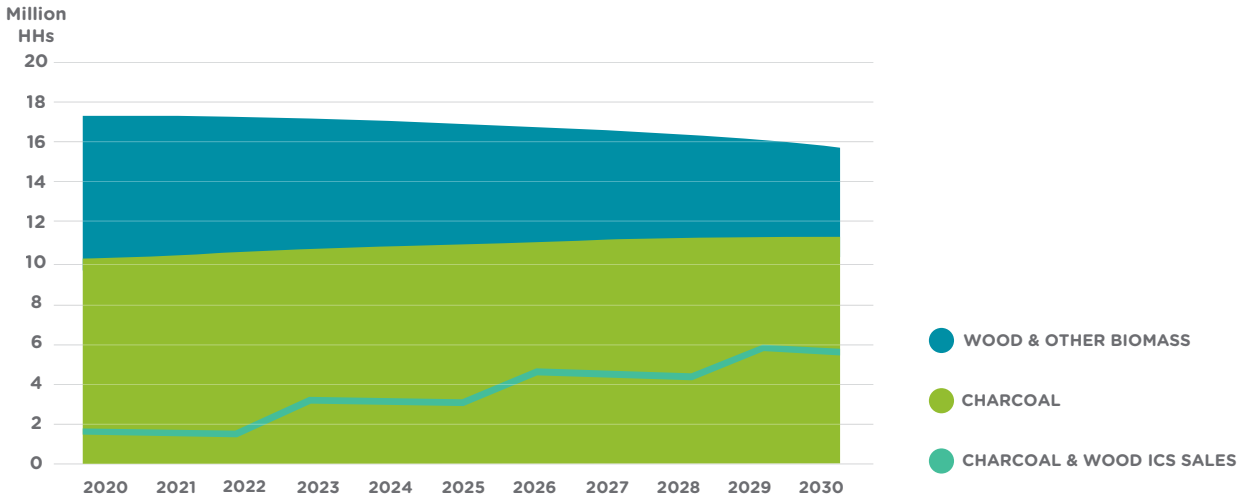
By the end of 2018, it is estimated that approximately 53 percent of Filipino households were cooking at least a share of their meals with clean fuels, particularly LPG and electricity. A very small share of households currently use biogas. Just one percent of households cooking with charcoal or wood were thought to be doing so ICS. As such, over 17 million Filipino households (72 percent) are still estimated to lack full access to clean cooking due to the prevalence of stove stacking and the limited uptake of wood and charcoal ICS.

Of the nearly 13 million households using clean fuels (53 percent of the total), some 6 million are thought to "fuel stack"[123] with charcoal, wood, or biomass residues, meaning they will require ICS for these secondary fuels. Nearly 12 million Filipino households (47 percent of the total) still cook exclusively with traditional fuels.

[123] Fuel Stacking is the phenomenon of end users retaining traditional cooking solutions for use alongside clean or improved solutions to accommodate both diverse household cooking needs and the force of tradition.

Figure 2.3

Philippines – Forecast Traditional Cooking Fuel Use and ICS Sales



CLOSING THE CLEAN COOKING ACCESS GAP IN THE PHILIPPINES

Figure 2.2 illustrates the scope of the clean cooking challenge in the Philippines. The model projects that households using clean fuels will increase significantly to a total of 73 percent (representing nearly 10 million new households cooking with modern fuels). However, a considerable share of households cooking with electricity or LPG are expected to continue fuel stacking, with charcoal remaining an important secondary or tertiary household fuel. As such, nearly 16 million households (51 percent of total households in the Philippines) are expected to continue to cook at least some of their meals with charcoal, wood or other biomass. The challenge will be to shift all of these households away from traditional cooking technologies (namely three-stone fires and lower-quality semi-industrial stoves) and onto high-quality industrial improved wood and charcoal stoves, as illustrated by the white line representing required penetration of ICS over the period 2020-2030.

Wood and Charcoal ICS Contributions Toward Achieving SDG7

The analysis now focuses on the forward-looking projections through to 2030 and modeling out what it would take for the Philippines to achieve universal clean cooking access by that time. Figure 2.3 above illustrates the model outputs through to 2030. The key considerations are as follows:

- The minimum definition of access is high-quality industrial ICS that meets international minimum standards on fuel efficiency and emissions.
- The assumed retail price is USD 25 for an industrial wood stove and USD 36 for an industrial charcoal stove.[124]
- Going forward, the greater availability of LPG, particularly in smaller, more affordable cylinders,

[124] By comparison, the retail prices for much higher quality industrial wood and charcoal stoves is assumed to be USD 25 and USD 36, respectively.

Figure 2.4

Cumulative ICS Enterprise Finance Needs in Philippines (Million USD)

is expected to drive clean fuel use. The cost of LPG itself is relatively low in the Philippines and can compete with charcoal, but distribution infrastructure and geography along with fuel availability and the upfront cost of equipment have been a barrier to entry.

- While the use of electricity and LPG is expected to reach over 70 percent by 2030, considerable fuel stacking is expected to continue, with few households relying exclusively on any one clean fuel, particularly electricity.

- Considerable sales of ICS, particularly for charcoal, will be required through 2030.

- The model assumes that the population will grow at a rate of 1.4 percent per annum.

- Stoves are assumed to be replaced at three-year intervals.

The forecast model projects that 12.2 million improved wood stoves and 26.1 million charcoal stoves will be sold during the period 2020-2030. This is driven in large part by the fact that wood and charcoal are expected to still serve 15.6 million households by 2030, roughly half of whom are also expected to be using clean fuels.

Financing Needs of ICS (charcoal and wood)

To achieve the aforementioned targets in Figure 2.3, ICS have a cumulative financing need of USD 303 million for enterprises alone, as seen in Figure 2.4 above.

Grants to enterprises represent 17 percent of the capital mix used to lower costs associated with proving out business models and displacing additional equity financing needs. Another 32 percent of financing needs will be in the form of equity investments in businesses that turn profitable at the scale-up phase, wherein they have sold about 5,000 ICS units. Debt financing accounts for 51 percent of the capital mix. This is inventory finance to enable retailers to purchase stock of stoves and then repay those loans once sales are completed. The model assumes that all stoves are sold on a cash sale basis.

Consumer Affordability

According to the forecast scenario, the Philippines will require USD 220 million in affordability gap financing to help the estimated 14.3 percent of households that cook with wood but cannot afford an industrial cookstove. The model[125] assumes that households save an amount equivalent to 2 percent of total monthly household consumption for 3 months in order to buy a basic stove. The model also assumes that if a household can afford to buy charcoal, which costs considerably more on a monthly basis than the purchase price of a semi-industrial stove, then there is no affordability gap in buying a stove. Since charcoal is expensive and industrial stoves enhance efficiency considerably, purchasing a stove should be compelling to consumers, so long as they understand this benefit. With respect to clean fuels, the relatively high upfront cost of an initial LPG kit (including the cost of the cylinder, burner, hose, and regulator) remains one of the main barriers to rapid demand-side uptake of industrial stoves. Volatile pricing for LPG (linked to the crude markets) and relatively high number of households living beneath the poverty line are also barriers.

According to the ADB, 21.6 percent of the population (21.97 million in 2015) live below the poverty line (USD 3.20 per day).[126] The proportion of the population earning less than USD 1.90 per day is estimated in 2015 at 7.8 percent (7.93 million inhabitants). However, in terms of affordability, LPG positions relatively well.

The availability of affordability gap financing can help overcome the affordability barrier, particularly for the estimated 29 percent of the population that is living on less than USD 3.20 per day.

[125] The methodology chapter provides more details on how affordability was modeled.
[126] Asian Development Bank. 2018. "Philippines Energy Sector Assessment, Strategy, and Road Map".

KEY CHALLENGES AND OPPORTUNITIES: THE PHILIPPINES SDG7 COOKING TARGETS

The Philippines market has a number of challenges to overcome to tackle the low adoption of ICS and take advantage of the existing momentum in the use of clean fuels, especially LPG. The first step will be to tackle the dearth of government support and regulation for the cooking sector. The government's energy access strategy has been dominated by its efforts to meet its universal electrification targets, which has meant that cooking has benefited from far less strategic, institutional and policy-related support than the electricity sector. However, the government has an opportunity to turn its attention to clean cooking and define targets to support the deployment of ICS technology and the adoption of clean fuels. Global cooking experts can assist it to develop policies and programs best suited to the Philippines context.

As the policy environment is being developed, the shortage of cookstove manufacturers, clean fuel producers, and cookstove distributers can also be addressed. Among the cookstove manufacturers surveyed by Geres in the Philippines, there was only one semi-industrial producer of charcoal stoves offering a patterned stove made out of aluminum and cement.[127] In the LPG space, only one sophisticated producer was identified. Targeted funds from government and development partners should encourage an increase in the number of ICS manufacturers and distributors. These funds should also increase efforts from clean fuels companies to reach beyond urban and peri-urban areas and build on the work companies like PR Gaz and Brent Gas are doing to increase affordability of their LPG solutions.

[127] StovePlus. 2015. "Exploratory Mission report".

There is also a lack of general awareness about the advantages of switching to ICS that needs to be addressed. Minimal public and donor resources have been dedicated to informing households about the potential cost savings and health benefits of switching to ICS and cleaner fuels. ICS companies are largely SMEs and do not have the resources to finance information and dissemination campaigns. For these reasons, the demand and willingness to pay for more efficient versions of existing fuelwood and charcoal stoves remain low. Consumer awareness campaigns complement the policy framework and financing mechanisms that have already been recommended will also help to address the low volume of ICS and clean fuel providers outlined above.

Finally, access to end-user financing remains a barrier to adoption. While the MCPI is working with a number of multilateral financial institutions to educate on the importance of these loan products and help members to structure them, interest has been limited, in some part due to the fact that only a few manufacturers of high quality ICS exist and also in part because of the low priority of the cooking sector. Government and development partners should be showcasing efforts like this to encourage other local financial institutions and companies to offer loan programs for cookstoves, similar to the PAYG schemes that have helped to progress stand-alone solar adoption. The government and development partners can then build out a diversity of affordability gap financing mechanisms to complement these early efforts.

Altogether, these efforts become a holistic cooking agenda that will increase supply, drive demand, and create a well-financed, supported, and regulated cooking sector.