



ENERGIZING FINANCE  
REPORT SERIES



ENERGIZING FINANCE:  
**UNDERSTANDING  
THE LANDSCAPE**

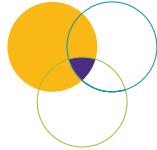
2019



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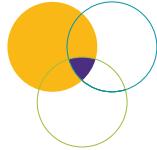




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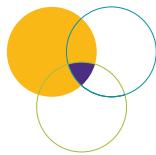
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## FOREWORD

Sustainable Development Goal 7 (SDG7) requires a massive, concerted financial commitment. Billions of dollars need to start flowing, fast, towards electricity and clean cooking solutions each year if we are to achieve access to affordable, reliable, sustainable and modern energy for all by 2030.

The amount of finance needed is not astronomical considering the amount of capital circulating the globe each day. Yet, there is a clear trend showing that, year after year, investment for electricity and clean cooking is falling short of that required for universal access.

Sustainable Energy for All (SEforALL) and Climate Policy Initiative have illuminated this trend with the *Energizing Finance* research series. Now in its third year of publication, *Energizing Finance: Understanding the Landscape 2019* identifies public and private finance commitments in 20 developing countries – known as the high-impact countries (HICs) – that together are home to nearly 80 percent of those living without access to sustainable energy.

This year's report offers a picture of sustainable energy finance from 2013 to 2017, digging deep into finance commitments for different energy solutions and the access levels they can provide. New data are also introduced this year on domestic finance and government expenditures in four countries – Uganda, the Philippines, Nigeria and Nepal – to build a clearer picture of how finance for energy access is being addressed at a national level. Combining the long-term trend analysis with country deep-dives provides policymakers and financiers with a rich body of evidence that will help them prioritize their resource allocation.

An important lesson gleaned from the report is that overall finance commitments to energy access cannot be taken at face value. While there appeared to be an overall increase in finance commitments for electricity access, a closer look shows that funds were not directed towards supporting people most in need.

Sub-Saharan Africa suffers from continued under-investment, with four countries experiencing declines in investment in 2017. Although investment in grid-connected fossil fuel plants in the tracked countries decreased by 19 percent in 2017, there was only a 10 percent increase in funding for decentralized solutions, half of which went to just three East African countries.

Of the USD 36 billion in total finance for electricity access in 2017, only USD 12.6 billion was estimated to support new access for households. Power for industrial or commercial purposes is important to a country's economic development, but household electricity access is key to building healthy, equitable communities. Sustainable energy *for all* means ensuring no one is left behind in the energy transition. We therefore have paid special attention to the energy needs of vulnerable groups – women and displaced people – in this report, assessing whether international finance is supporting their development and social equality.

We know that women and children are disproportionately affected by a reliance on unsustainable biomass for cooking. The time spent collecting fuel and exposure to indoor fumes are just two major burdens they face. This makes the 2017 data on clean

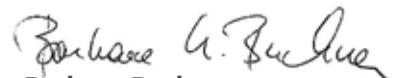
cooking finance particularly troublesome. Finance for clean cooking dropped 73 percent in 2017 compared to the 2015-2016 period. This underinvestment comes at the expense of people's health and stifles gender equality as women continue to suffer the burdens of dirty cooking.

Notwithstanding the worrisome trends, the analysis contained in this report also reveals promising signs for the coming decade. There are new financing mechanisms emerging to address specific barriers to investment in electricity and clean cooking access by domestic and international institutions. Pay-per-service models, results-based financing and crowdfunding can all help unlock vital capital, but these need to be scaled and deployed more quickly.

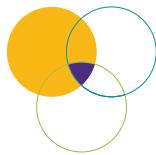
The bottom-line is that without adequate finance we cannot achieve SDG7 by 2030. The capital exists, but there is a clear need for innovation in how it is mobilized and allocated at scale. *Energizing Finance: Understanding the Landscape 2019* shows where, and for whom, energy access finance is needed most. The evidence presented here should catalyze governments, businesses and development organizations to produce new policies and investment frameworks that will deliver sustainable energy for all.



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## EXECUTIVE SUMMARY

Finance is key to achieving Sustainable Development Goal 7 (SDG7), which aims to ensure access to affordable, reliable, sustainable, and modern energy for all. However, less than one-fourth of the investment required for universal electricity access is taking place. The situation for clean cooking is even more concerning, where investment continues to lag even further behind. As progress towards each of these objectives remains underfunded, achieving SDG7 by 2030 becomes increasingly unlikely.

Without a concerted effort to increase the targeted flow of finance, it is likely that many governments' energy access goals will not be met. This is particularly true in Sub-Saharan Africa where greater investment in off-grid solutions and clean cooking is required.

This shortfall could have severe consequences for global development, as energy access is an impetus for fulfilling several of the Sustainable Development Goals (SDGs) – including those for health, education, food security, gender equality, poverty reduction, employment, and climate action. With only ten years left until 2030, the target date to meet all of the SDGs, we must act quickly.

The *Energizing Finance* series, developed by Sustainable Energy for All in partnership with Climate Policy Initiative, is the first and only in-depth attempt to capture multiple years of data on finance for the two key areas of energy access: electrification and clean cooking. This report focuses on public and private finance commitments in 20 developing countries – known as the HICs – that together are home to nearly 80 percent of those

living without access to sustainable and modern energy.<sup>1</sup>

Now in its third iteration, this report updates previous findings from 2013-14 and 2015-16 with energy access finance commitments from 2017.<sup>2</sup> For the first time, policymakers and SDG financing leaders working to achieve universal energy access can view a five-year trend analysis of where finance is flowing for energy access and where it is not. This year, the report provides a deep-dive analysis of additional data on domestic finance and government expenditures in four countries: Uganda, the Philippines, Nigeria, and Nepal.

From all angles, investment in both electricity and clean cooking continues to remain firmly below the estimated need to close the energy access gap. Investment flowing to Sub-Saharan Africa – a region home to more than half a billion people without electricity – is alarmingly low. We can no longer afford to continue current incremental increases in investment if universal access to energy by 2030 is to be achieved. We must commit to implementing all necessary actions including, but not limited to, mobilizing private finance, stronger domestic policy commitments and action, supporting innovative business models and market development activities, and scaling and replicating best practices.

<sup>1</sup> For electricity access findings, the countries are: Afghanistan, Angola, Bangladesh, Burkina Faso, Congo (DR), Ethiopia, India, Kenya, Korea (DPR), Madagascar, Malawi, Mozambique, Myanmar, Niger, Nigeria, Philippines, Sudan, Tanzania, Uganda, and Yemen. For clean cooking access findings, the countries are: Afghanistan, Bangladesh, China, Congo (DR), Ethiopia, India, Indonesia, Kenya, Korea (DPR), Madagascar, Mozambique, Myanmar, Nepal, Nigeria, Pakistan, Philippines, Sudan, Tanzania, Uganda, and Vietnam.

<sup>2</sup> All findings in the report are compared with results from the previous two reports, expressed as average annual figures for 2013-14 and 2015-16.

## ELECTRICITY ACCESS FINDINGS

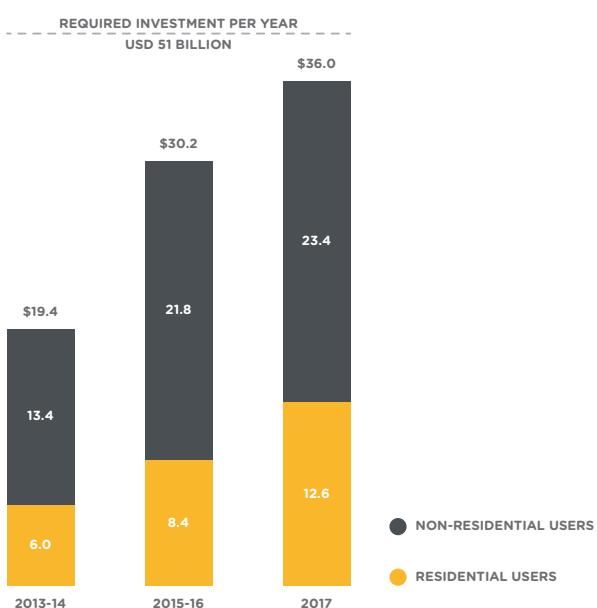
FINANCE FOR ELECTRICITY IN THE 20 HICS REACHED AN ALL-TIME HIGH OF USD 36 BILLION IN 2017, DRIVEN PRIMARILY BY INCREASED INTERNATIONAL PUBLIC FINANCE. HOWEVER, WITH ONLY ONE-THIRD OF THIS FINANCE, OR USD 12.6 BILLION, BENEFITING RESIDENTIAL CONSUMERS, FINANCE IS FALLING FAR BELOW NEEDS.



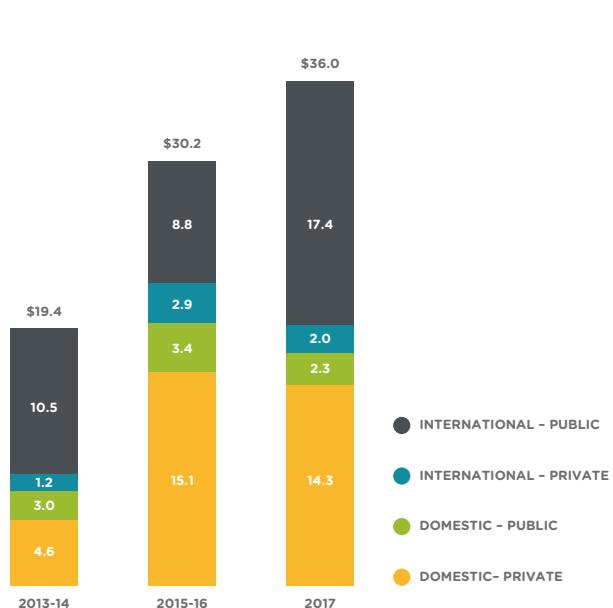
**Figure ES 1**

Snapshot of Finance for Electricity in the 20 HICs (USD Billion)

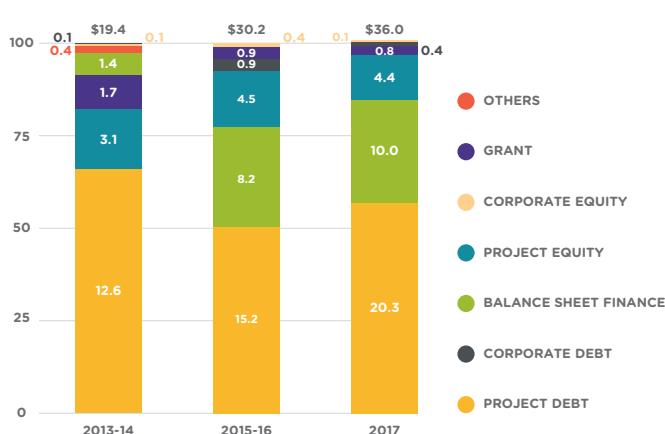
TOTAL FINANCE BETWEEN 2013-2017



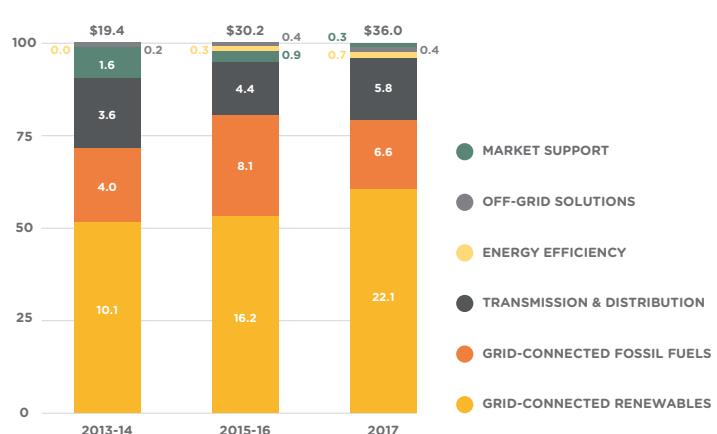
DISTRIBUTION BY SOURCE



DISTRIBUTION BY INSTRUMENT



DISTRIBUTION BY TECHNOLOGY



**Finance for electricity in the 20 HICs increased to USD 36 billion in 2017, after stagnating at USD 30 billion in 2015-16.** However, only one-third of this finance, or USD 12.6 billion, is estimated to have provided residential access. As we near the previously estimated investment requirement of USD 51 billion to bring universal electricity access to households by 2030 (IEA, 2018), it is clear that greater investment is urgently needed, especially in the off-grid sector and throughout Sub-Saharan Africa.

**Finance for electricity access from international sources increased substantially to USD 19.4 billion in 2017 after stalling from 2013 to 2016 at USD 11.7 billion per year.** This includes export credit agencies and multilateral development finance institutions (DFIs) that increased their annual expenditures for electricity projects in Sub-Saharan Africa and Asia.

**However, bilateral aid flows from most developed country donor governments declined sharply, particularly from Japan and the US, falling from USD 4.1 billion in 2015-16 to USD 2.3 billion in 2017.**

For the first time since 2013, the report tracked electricity projects funded by Indian public entities in other HICs: Afghanistan, Myanmar and Bangladesh.

**After a steady increase in 2015-16 due to the booming Indian renewable energy sector, domestic finance decreased by almost USD 2 billion to USD 16.6 billion in 2017.** This is largely attributable to a decline in financing from national public banks in India, from USD 2.5 billion in 2015-16 to USD 500 million in 2017. On the domestic private sector side, lending from commercial banks decreased tangibly, while financing from project developers and corporations increased only marginally to USD 13.5 billion in 2017, compared with USD 12.7 billion in 2015-16.

**In terms of technologies, grid-connected renewable energy plants accounted for 61 percent of all finance tracked, increasing by almost USD 6 billion compared to 2015-16.** India accounted for most of the increase in solar PV investments.

**Investment in grid-connected fossil fuel plants – mostly coal powered – decreased to USD 6.6 billion in 2017 compared to USD 8.1 billion in 2015-16.** In 2017, four coal plants were financed in two HICs, Bangladesh and the Philippines, down from 17 plants in 2015-16. 60 percent of all coal financing (USD 5.6 billion) was sourced from the Export-Import Banks of India (USD 1.6 billion) and China (USD 1.7 billion) for projects in Bangladesh. Private sector developers and banks contributed more than 30 percent of total financing for coal plants in 2017 (USD 1.5 billion), split almost equally between domestic and international sources.

**Investment in off-grid solutions and mini-grids (OGS) continues to remain a small proportion (1.2 percent) of the total finance for electricity tracked.** Standing at USD 430 million in 2017, investments in the sector only marginally increased compared to 2015-16. Kenya, Tanzania, and Uganda together accounted for 56 percent of the total.

**Investment in India and Bangladesh accounted for almost two-thirds (USD 24 billion) of the total financing tracked in 2017.** This is an increase of USD 4 billion compared to 2015-16, when the region already saw a staggering increase of USD 12.4 billion from 2013-14, mainly led by renewable energy financing in India. This investment is helping India rapidly progress towards achievement of its energy goals.

**Other than Nigeria, which attracted over USD 6 billion in 2017, investment in other Sub-Saharan African countries remained insufficient to address access needs.** Cumulatively, finance for electricity in the 13 African countries analyzed in this report increased to USD 9.6 billion in 2017 from USD 5 billion in 2015-16, but largely because of a single large hydropower plant in Nigeria worth almost USD 5 billion. Investment in four Sub-Saharan countries declined in 2017, and ten countries each received less than USD 300 million.

**As seen in previous years, most of the electricity produced by the finance tracked favors industrial and commercial customers over households.** An estimated 36 percent of all electricity finance



## ES BOX 1

### Access to Electricity in Uganda

#### HIGH AMBITIONS BACKED BY INCREASING GOVERNMENT-LED INITIATIVES

As of December 2018, only 38 percent of households in Uganda had access to a minimum level of electricity per the Multi-Tier Framework (MTF).<sup>3</sup> Uganda has ambitious goals to improve electricity access, including to achieve near universal access by 2030. There are a variety of national, publicly led efforts underway to achieve this goal, including finance facilities through the Rural Electrification Agency and Uganda Energy Credit and Capitalization Company to drive investment in electricity access projects.

Despite these efforts, finance for electricity access decreased significantly from an annual average of

USD 657 million between 2013 and 2016, to USD 269 million in 2017. While overall finance has not increased over the past half-decade, there are some positive indicators related to domestic private investment, which reached a five-year high in 2017 of USD 145 million. Similarly, investment in “last-mile” solutions, including mini grids and off-grid technologies, also reached a five-year high of USD 36 million in 2017.

Barriers remain to increasing investment in electricity access, including insufficient capital to scale up energy value chain businesses, low consumer awareness of electricity access solutions, high rates of poverty in rural communities and among displaced persons, relatively low willingness to pay for those solutions, and mistrust of both grid and off-grid solutions. Solutions discussed in the case study include application of risk pooling guarantees to drive investment, increased investment in mobile payment strategies, and commitment to product standards enforcement.

in the HICs supports new or improved access for residential electricity consumers. While investments in residential electricity have more than doubled in the last five years, following the overall growth of electricity finance, it needs to scale up even more rapidly. This is particularly the case in Sub-Saharan Africa, where achieving electrification for all would require at least USD 27 billion per year by 2030 (OECD, 2019). Considering that approximately USD 5.1 billion was estimated as committed towards access for household consumers in 2017, current financing is substantially below what is needed.

**Only 3 percent of total finance commitments for residential electricity supported lower tiers of electricity access (Tiers 1 and 2) associated with basic energy connections.** It is these basic connections, often off-grid or other decentralized solutions, that can represent an important step forward for increased electricity access to people in remote areas.

### CLEAN COOKING FINDINGS

**Finance for residential clean cooking decreased to USD 32 million in 2017 – down 73 percent from the 2015-16 estimated annual average of USD 117 million<sup>4</sup>.** The limited finance tracked for clean cooking

<sup>3</sup> 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>

<sup>4</sup> This report uses updated values for the 2013-14 and 2015-16 totals published in the previous reports.

demonstrates a continued and serious underachievement when compared to the estimated annual investment requirement of USD 4.4 billion (*Tracking SDG7: The Energy Progress Report 2019*). Such shortfalls increase annual investment levels required between now and 2030, and intensify the urgency to expand finance for clean cooking as soon as possible.

**There was a marked decrease in international public finance in 2017, in terms of both quantum and proportion, reaching a new low of USD 10.6 million.** International public finance decreased from annual averages of USD 36.3 million in 2013-14 and USD 108 million in 2015-16, respectively. From providing 92 percent of all finance tracked in 2015-2016, international public finance accounted for only 33 percent of finance tracked in 2017.

**Private finance<sup>5</sup> for clean cooking increased in quantum and proportion in 2017, accounting for 66 percent of all finance tracked, up from 14 percent in 2013-14 and 8 percent in 2015-16.** While an annual average of USD 6 million of private finance was tracked in 2013-14, 2017 saw approximately USD 21 million. This was largely driven by an uptick in corporate equity investments, from levels of USD 2 million observed in 2013-14 and USD 6 million in 2015-16, to almost USD 14 million in 2017.

**Sub-Saharan Africa received the majority of clean cooking finance in 2017, with Kenya receiving 63 percent of total commitments tracked.** Kenya's

<sup>5</sup> The Clean Cooking Alliance (CCA) tracked USD 40 million of investments into clean cooking companies in 2017 (Clean Cooking Alliance, 2019). This report only incorporates transactions benefiting companies operating in the 20 HICs, resulting in USD 22.5 million that was included in the analysis.

## ES BOX 2

### Access to Electricity in the Philippines

#### DISTRIBUTED RENEWABLES NEEDED FOR PERSISTENT POCKETS OF LOW ELECTRICITY ACCESS

The Philippines is one of the fastest growing economies in Southeast Asia and has set an ambitious target to achieve 100 percent electrification by 2020. But despite this being less than a year away, in some regions an average of 26 percent of the population still does not have access to electricity, indicating that there is much progress to be made.

Because of the country's archipelagic nature, existing grid infrastructures fail to reach the smaller and more remote islands and populations in the

Philippines. However, off-grid investments averaged only USD 2 million per year between 2013 and 2017, as overall investment declined sharply from USD 4.1 billion in 2015-16 to USD 1.4 billion in 2017. Complicating matters further, affordability of electricity is an issue, as 21.6 percent of the population lives below the national poverty line, while the average cost of electricity is amongst the highest in Asia.

Bringing solar power to the more remote areas of the Philippines has the potential to provide reliable, sustainable, and affordable electricity to those areas. This will require newer, innovative financing products and associated capacity building, while spreading and refining previously piloted mechanisms on a wider scale. Tailored debt products with longer tenors and lower interest rates may help to cover upfront costs and sustain the wider adoption of distributed solar.

reputation as a destination for energy access impact investment in the region was upheld, as the country attracted over USD 20 million of 2017's USD 32 million of clean cooking finance. Other countries with more significant needs (i.e. with more than 90 percent of the population lacking access to clean fuels and technologies) received disproportionately limited financing. It is important to note that data limitations hinder the report's ability to track domestic public financing programs, and thus the analysis underrepresents the depth of financing in HICs that have prioritized clean cooking, such as India and Indonesia.

**Improved biomass stoves continued to receive the greatest amount of finance in 2017, followed by alcohol-based cooking solutions.** While improved biomass stoves and biogas solutions have each been the leading recipients of clean cooking finance commitments for alcohol-based solutions overtook those

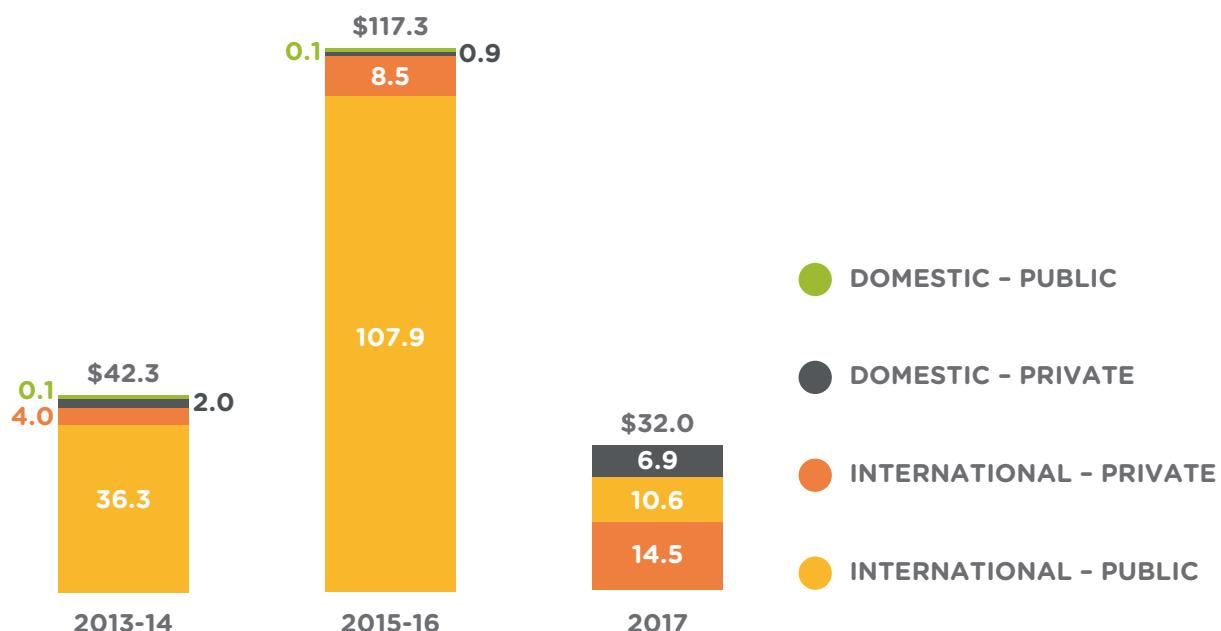
for biogas digesters in 2017, receiving over USD 6 million, with more than USD 14 million of finance allocated to improved biomass stoves.

**Methodological improvements introduced this year have improved the reliability of the analysis, historically impacted by large data gaps in the clean cooking sectors.** A welcome addition of clean cooking finance data provided by the World Bank Group allowed for the opportunity to identify nearly USD 200 million worth of additional transactions in the 2013 to 2016 period, and update the annual averages that were published in the previous editions of this report.

**However, transaction data for clean cooking finance remains challenging to consolidate.** A multi-stakeholder research effort is required to enhance the understanding of this important financing landscape.

**Figure ES 2**

Sources of Finance for Residential Clean Cooking (USD Million)



### ES BOX 3

#### Access to Clean Cooking in Nigeria

##### A LARGE CLEAN COOKING MARKET WAITING TO BE TAPPED

Nigeria is the largest and most populous economy in Africa. 95 percent of households, or approximately 190 million people, do not have access to clean cooking fuels and technologies, leading to 23,000 child deaths per year due to lower respiratory infections caused by the use of solid cooking fuels. The country's size presents a residential clean cooking market opportunity of about 40 million households.

Nigeria tested the subsidization of kerosene as a cooking fuel. Costing the government approximately USD 1 billion in 2015, this program was found to be ineffective in ensuring access to affordable cooking fuels. Despite the subsidy having been lifted in

2016, kerosene remains a preferred fuel among urban households.

Although Nigeria is one of the world's largest producers and exporters of LPG, its households consume far less than those in neighboring oil-producing countries, and indeed, less than the average seen across all Sub-Saharan African households. This shortfall in per capita LPG consumption has been attributed to the country's underdeveloped regulatory environment for LPG cooking gas, which has precluded the commercial investment in the sector that is needed to enable greater adoption.

With limited investments tracked in Nigeria's clean cooking sector over the years, dramatically strengthening the investment environment is crucial. This will require: 1) the development of catalytic smart subsidy programs, such as those drawing on the experience of results-based financing schemes (RBF) in other markets; 2) the exploration and preparation of modern clean cooking fuels investment opportunities; and 3) the adoption of international best practices in LPG market transformation.

#### REACHING THE MOST VULNERABLE

For the first time in the *Energizing Finance* series this iteration highlights the challenges faced by highly vulnerable groups in accessing energy. It focuses specifically on women and girls, who are disproportionately responsible for fuel collection and biomass-fueled cooking. As a result, they are at risk of both violence during collection and of negative health outcomes associated with indoor biomass burning. This report also draws attention to the risks facing displaced persons, who are likewise highly reliant on biomass fuels

and among whom fuel collection can drive political conflict over limited resources (SAFE, 2015).

**In 2017, only 7 percent of the USD 14 billion annual official development assistance (ODA) for energy activities in developing countries was specifically targeted to benefit women.** Flows of ODA to the energy sector with gender equality as an explicit policy objective have increased ten-fold since 2002, but the proportion of total energy flows has remained almost unchanged. Energy access projects aimed at women and the dis-

## ES BOX 4

### Access to Clean Cooking in Nepal

#### A TRADITIONAL CLEAN COOKING MARKET PRIMED FOR BOLD APPROACHES

Nepal has prioritized the dissemination of artisanal mud and metallic cookstoves, rocket stoves, and gradual concentric chambers (GCC) biogas digesters for decades. Yet, despite these actions and the country's small size and population of 30 million, only 28 percent of households have access to clean cooking fuels and technologies. Rural households predominantly rely on traditional, solid biomass fuels, while urban households increasingly favor the use of imported LPG cooking gas.

The Government of Nepal has set a target of achieving clean cooking for all by 2022. Through a series

of policies, programs, and strategies coordinated by the Alternative Energy Promotion Centre, clean cooking investors and enterprises can enjoy a welcoming investment environment that is bolstered by capital subsidies available for certain technologies and communities.

Unfortunately, public and private investment in clean cooking remains limited, with less than USD 1 million of transactions tracked over the past five years. In order to transform clean cooking in Nepal, it is recommended that the government consider: 1) expanding the range of clean cooking fuels and technologies supported by the Renewable Energy Subsidy Policy; 2) building on Nepal's history of public-private partnerships in energy, i.e. to access new sources of climate finance; 3) expanding national storage capacity for LPG, to reduce seasonal supply chain limitations; and 4) exploring new and modern clean cooking opportunities.

placed include "pay-as-you-go" (PAYG) financing, support for entrepreneurship in the energy sector, and specialized finance programs aimed at supporting access for the most vulnerable. There has been progress in implementing energy access projects to benefit women and displaced persons, but additional scale and acceleration of investment is needed to achieve energy access goals.

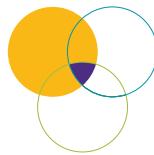
### INNOVATIVE FINANCING MECHANISMS TO INCREASE ENERGY ACCESS

New to this year's report is an analysis of how innovative financing mechanisms can increase energy access. Factors such as credit risk, liquidity and currency risk, small investment ticket size, and political instability that, especially when applied to challeng-

ing, underdeveloped energy markets, prevent investors from entering those markets at scale. However, a number of existing business models and financing mechanisms, when applied to different sectors, technologies and geographies, can unlock additional private capital for energy access projects using structuring to meet the specific needs of different investors.

It is encouraging that a number of such financing mechanisms are being developed and implemented in the distributed renewable energy and clean cooking space. These include: guarantees, RBF, pay-per-service models, securitization, currency risk management instruments, crowdfunding, and project preparation facilities. Such models now need to be replicated at scale to fill the investment gap.

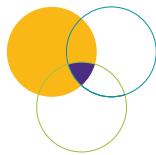




## ABBREVIATIONS

<b>CCGT</b>	Combined-cycle gas turbine
<b>CRS</b>	Creditor Reporting System (of the OECD)
<b>DAC</b>	Development Assistance Committee (of the OECD)
<b>DFIs</b>	Development finance institutions
<b>EE</b>	Energy efficiency
<b>FF</b>	Fossil fuels
<b>GLPGP</b>	Global LPG Partnership
<b>GW</b>	Gigawatts
<b>HFO</b>	Heavy fuel oil
<b>HICs</b>	High-impact countries
<b>IAP</b>	Indoor air pollution
<b>IT</b>	Information technology
<b>ICS</b>	Improved cookstoves
<b>kWh</b>	Kilowatt-hours
<b>LCOE</b>	Levelized cost of electricity
<b>LNG</b>	Liquefied natural gas
<b>LPG</b>	Liquefied petroleum gas
<b>MFI<is></is></b> s	Multilateral financial institutions

<b>MTF</b>	Multi-Tier Framework
<b>MW</b>	Megawatts
<b>ODA</b>	Overseas development assistance
<b>OGS</b>	Off-grid solutions (includes mini-grids)
<b>PAYG</b>	Pay-as-you-go
<b>PE</b>	Private equity
<b>RE</b>	Renewable energy
<b>SDGs</b>	Sustainable Development Goals
<b>SDG7</b>	Sustainable Development Goal 7
<b>SHS</b>	Solar home systems
<b>SMEs</b>	Small and medium enterprises
<b>SOE</b>	State-owned enterprise
<b>Solar PV</b>	Solar photovoltaic
<b>T&amp;D</b>	Transmission and distribution
<b>USD</b>	United States Dollars
<b>Wp/kWp</b>	Watt-peak/kilowatt-peak
<b>VC</b>	Venture capital



## GLOSSARY OF TERMS

**Asset:** a resource with economic value owned by an individual, company, or country; for example, an on-shore wind farm.

**Centralized electricity solutions:** extensions of a country's electricity grid and/or power sources connected to an existing electricity grid.

**Clean and improved fuels and technologies for cooking:** the report tracks financial commitments for: advanced biomass stoves and fuel infrastructure, alcohol stoves and fuel infrastructure, biogas digesters, electric stoves, improved biomass stoves, LPG stoves and fuel infrastructure, natural gas stoves and fuel infrastructure, and solar cookers. These are referred to as "clean cooking solutions" or "clean fuels and technologies for cooking" throughout the report.

**Export Import (EXIM) Banks / Export Promotion Agencies / Export Credit Agencies (ECAs):** public agencies and entities that provide government-backed loans, guarantees, and insurance to corporations from their home country that seek to do business overseas in developing countries and emerging markets.

**Finance for residential clean cooking access:** the estimated portion of finance for clean cooking for which the residential sector is the ultimate end user; that is, finance that can be considered as increasing residential access to clean and improved fuels and technologies for cooking.

**Commitments:** a firm pledge to provide funds to a specific investment project with the expectation that the project will go ahead.

**Concessional finance:** finance where the investing or lending party provides financing at rates and/or terms better than or below standard market rates/terms. Often concessional finance is provided in exchange for non-financial goals such as promoting low-carbon investment.

**Domestic finance:** finance where the funding institution (either publicly or privately owned) is primarily based in the country where the project is being developed or constructed.

**Disbursements:** funds that are actually transferred to a project after a commitment is made. For example, when a funder commits to invest in a project in 2017, but the project can only commence construction in 2018, funds transferred to the projects' builders and consultants in 2018 are classed as disbursements.

**Energy access:** the ability of the end user to utilize energy supplies; used here to cover both access to electricity and to clean fuels and technologies for cooking.

**Finance for energy:** investment commitments for specific technologies, assets and market support activities within the energy sector, regardless of the ultimate end user of the energy supply.

**Energy infrastructure:** any assets used in the generation or transmission of electricity, transportation of clean cooking fuels or cooking itself.

**Finance for electricity:** the portion of energy finance commitments supporting all grid-connected generation plants, electricity transmission and distribution infrastructure, and mini-grid and off-grid solutions.

**Financial value:** the value of something in US dollars at the time of measurement.

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

**Finance for residential clean cooking access:** the estimated portion of finance for clean cooking for which the residential sector is the ultimate end user, that is, finance that can be considered as increasing residential access to clean and improved fuels and technologies for cooking.

**Finance for residential electricity access:** the estimated portion of finance for electricity where the residential sector is the ultimate end user. For example, finance that can be considered as increasing residential access to electricity.

**International finance:** finance where the funding institution is primarily based outside the country where the project is being developed or constructed.

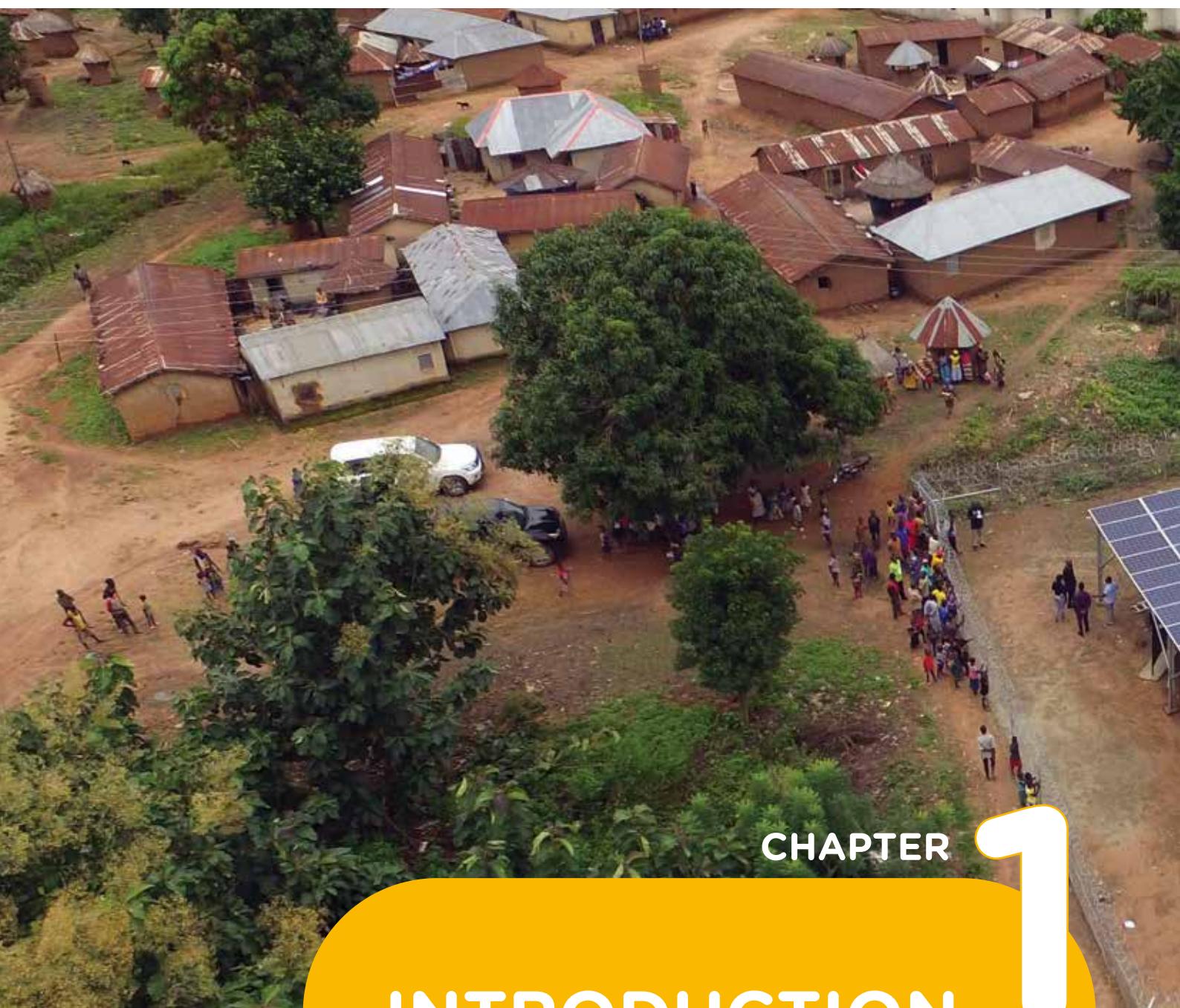
**Multi-Tier Framework (MTF):** measures the level of energy access provided by energy finance to residential consumers. Rather than using binary measures of energy access (having or not having a household electrical connection) that do not consider the quality, regularity, or affordability of service, the MTF instead recognizes that access to electricity is a continuum. Finance is therefore allocated to five "Tiers," from Tier 0 (no access) to Tier 5 (very high level of access), based on the MTF developed by the World Bank (Bhatia and Angelou, 2015) and supported by SEforALL. The MTF is explained in more detail in Chapter 1 and Methodology.

**Non-concessional finance:** finance provided on market terms and rates.

**Off-grid solutions:** provision of electricity that does not take place through a country's centralized grid. Examples of off-grid solutions include off-grid solar home systems and local mini-grids not connected to the main electricity grid.

**Public finance/private finance:** whether a finance flow is classed as public or private is determined by who is undertaking a project. In alignment with OECD definitions, finance qualifies as public if carried out by central, state, or local governments and their agencies at their own risk and responsibility.

**Residential consumers:** all consumers in a country, aside from business or government consumers. The intention is to broadly capture residential consumption, discounting business consumption where businesses are run from households, where possible.



# INTRODUCTION

CHAPTER



## CHALLENGES TO SUSTAINABLE ENERGY ACCESS

Despite recent progress in several countries, the number of people living globally without access to electricity and modern clean cooking solutions is still enormous. Electricity is a prerequisite for development that 840 million people currently lack, while almost 3 billion people lack access to clean

fuels and technologies for cooking (*Tracking SDG7: The Energy Progress Report 2019*).

Universal access to affordable, reliable, sustainable, and modern energy by 2030 is key to fulfilling the other SDGs, including those for health, education, food security, gender equality, poverty reduction, employment, and climate change. This report an-

**Table 1**

## Energy Access in the HICs

	<b>Electricity</b>	<b>Clean Cooking</b>
Total population without access (million)	840	2,900
Population without access in the HICs (million)	584	2,532
Population without access in the HICs as a share of total population without access (%)	70%	87%

**Note:** Population and access levels in 2017 using data based on World Bank Indicators.

alyzes finance flows directed towards the 20 HICs with the largest energy access deficits around the world, collectively representing 70 percent and 87 percent of the global electricity and clean cooking access shortfall, respectively (see Table 1).<sup>6</sup>

In 2018, the International Energy Agency estimated that achieving universal energy access by 2030 requires an additional USD 51 billion per year of investment in electricity and USD 4.4 billion per year for access to modern clean cooking solutions (IEA, 2018).<sup>7</sup>

SEforALL's *Energizing Finance* reports have highlighted that annual investments for both electricity and clean cooking remained significantly below these levels during the 2013-2017 period.

Years of unmet infrastructure needs, plus projected population growth, industrialization and urbanization, will further intensify energy demand in developing countries, increasing the investment gap and jeopardizing the likelihood of meeting SDG7, as well as the other SDGs.

## SUMMARY OF METHODOLOGY

This report examines finance for energy access by capturing data on financial commitments for 20

HICs from several publicly and privately accessible international databases, as well as through surveys with relevant stakeholders. Results are reported on an aggregate level for this group of countries, and are especially influenced by flows to larger economies, such as India and Bangladesh.

This exercise allows us to paint a broad picture of the global situation and is particularly effective at capturing international public finance for large-scale projects. The main disadvantage of this method is limited coverage of domestic finance, which is a significant share of overall financing flows to the sector<sup>8</sup>. While data on domestic private finance is available in some cases (generally large-scale electricity generation and transmission projects), it is limited in the cases of government-level spending and energy budgets. Accessing this level of data requires conducting complex surveys in each country.

To address these methodological limitations and to present a more comprehensive overview of finance for energy access, this year the report provides additional data on domestic finance and government expenditures in four countries: Uganda, the Philippines, Nigeria, and Nepal.<sup>9</sup>

<sup>6</sup> These countries were taken from the 2015 Global Tracking Framework (IEA and the World Bank, 2015) that was the most up to date list at the time the 2017 Energizing Finance report was commissioned, and maintained in 2018 and 2019 reports to ensure comparison across years.

<sup>7</sup> On top of this, another USD 660 billion for renewable energy is needed to substantially accelerate the share of renewable energy, and USD 600 billion for energy efficient technologies is required to double the rate of energy intensity improvements (IEA, World Bank, IRENA, 2019).

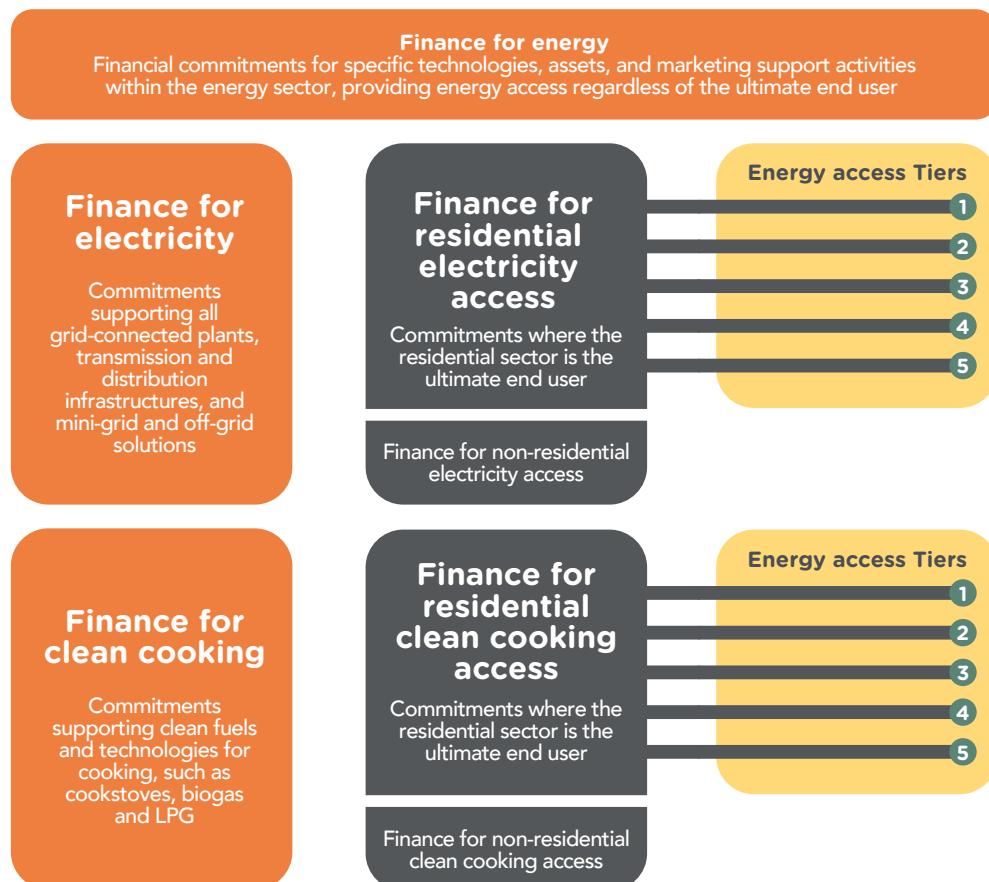
<sup>8</sup> It could amount to 20-40 percent of the total, based on complementary, case study analysis for specific countries.

<sup>9</sup> These countries were chosen based on several factors including but not limited to, recent improvement in energy access, high percentage of population without energy access, innovative solutions undertaken in the country, and presence of SEforALL operations to better understand ground level issues.

**Figure 1.1**

Methodology Summary

**Finance commitments are broken down as follows:**



At a more detailed level, the report takes the following approach for specific allocations:

- 1. Time horizon:** This report tracks finance committed to clean cooking and electricity access in the 20 HICs in the year 2017. The findings are compared with the results of the previous two reports, expressed as average annual figures for 2013-14 and 2015-16. The annual average figure enables meaningful comparisons of estimates both within the report and with investment estimates from external sources.
- 2. Financial commitments:** Financial commitments do not automatically translate to electricity gen-

eration or cooking assets. Because of lags in disbursements, fluctuating currency values, and changing project costs, commitments are unlikely to equate directly to realized asset values (*Missing the Mark*, SEforALL and AfDB, 2017). This means that a financial commitment of USD 1 billion is highly unlikely to correspond to USD 1 billion in energy infrastructure on the ground. By examining commitments, it is possible to identify:

- o The main sources and actors involved in financing increased energy access, the instruments they use, and the technologies and geographies in which they invest.

- o How different technologies are increasing and extending energy access.
- o Finance gaps in certain sectors, technologies, instruments, and geographies.

**3. Residential allocations:** A large power plant financed by a tracked commitment is likely to produce electricity consumed by both residential and non-residential consumers (such as businesses, industries, grid exports, and government institutions). Therefore, having identified total finance commitments relevant to clean cooking and electricity access in the HICs, a share of those commitments is allocated to residential consumption using assumptions about the relative shares of power consumption in the country in question, as detailed in the Methodology chapter.

**4. Tier allocations:** The previous steps yield the total finance commitments relevant for residential electricity and clean cooking access. As the final step, the residential element of the finance commitment is allocated to the appropriate energy access Tier, using the World Bank's MTF, quantifying the level of electricity or clean cooking service provided.

The detailed methodology is available in Annex 2.

## STRUCTURE OF THE REPORT

This report provides an overview of finance committed for access to electricity and clean cooking solutions in 20 HICs with the largest populations without access to electricity and clean cooking solutions in the world.<sup>10</sup>

Chapters 2 and 5 analyze financial commitments for 2017 in the 20 HICs for electricity and clean cooking access, respectively, highlighting the main trends in the preceding five years. For comparability with the previous reports, historical figures are expressed as biennial averages (2013-14 and 2015-16).

Data from several public and private sources were used to analyze almost 2,100 financial commitment transactions in 2017, focusing on international commitments and capturing all available information on domestic commitments. The chapter also includes estimates of the portion of finance flowing to residential energy access, as well as the Tier of access provided.

Chapters 3 and 4 provide key insights of barriers and solutions to scale-up domestic finance for electrification in Uganda and the Philippines, while Chapters 6 and 7 analyze the clean cooking finance situation in Nigeria and Nepal. These case studies aim to complement the global finance figures tracked in Chapters 2 and 5 with a more tangible perspective, providing tailored recommendations for policymakers.

Finally, Chapter 8 analyzes the intersectionality between energy access and outcomes for the most vulnerable populations, including girls and women, while Chapter 9 focuses on the role of financial innovation in progressing access to electricity and clean cooking.

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<sup>10</sup> To enhance comparability across years, countries analyzed in the report are the same as those in the previous editions of the report. These were identified in the 2015 edition of the Global Tracking Framework (IEA and the World Bank, 2015), which was the latest available when the 2017 report was commissioned. The GTF reports (now called Tracking for SDG 7) track the global energy access status and annually update the list of HICs, therefore resulting in a minor misalignment with the HICs analyzed in this report. See the Methodology for details.





CHAPTER

2

FINANCE FOR  
ELECTRICITY ACCESS

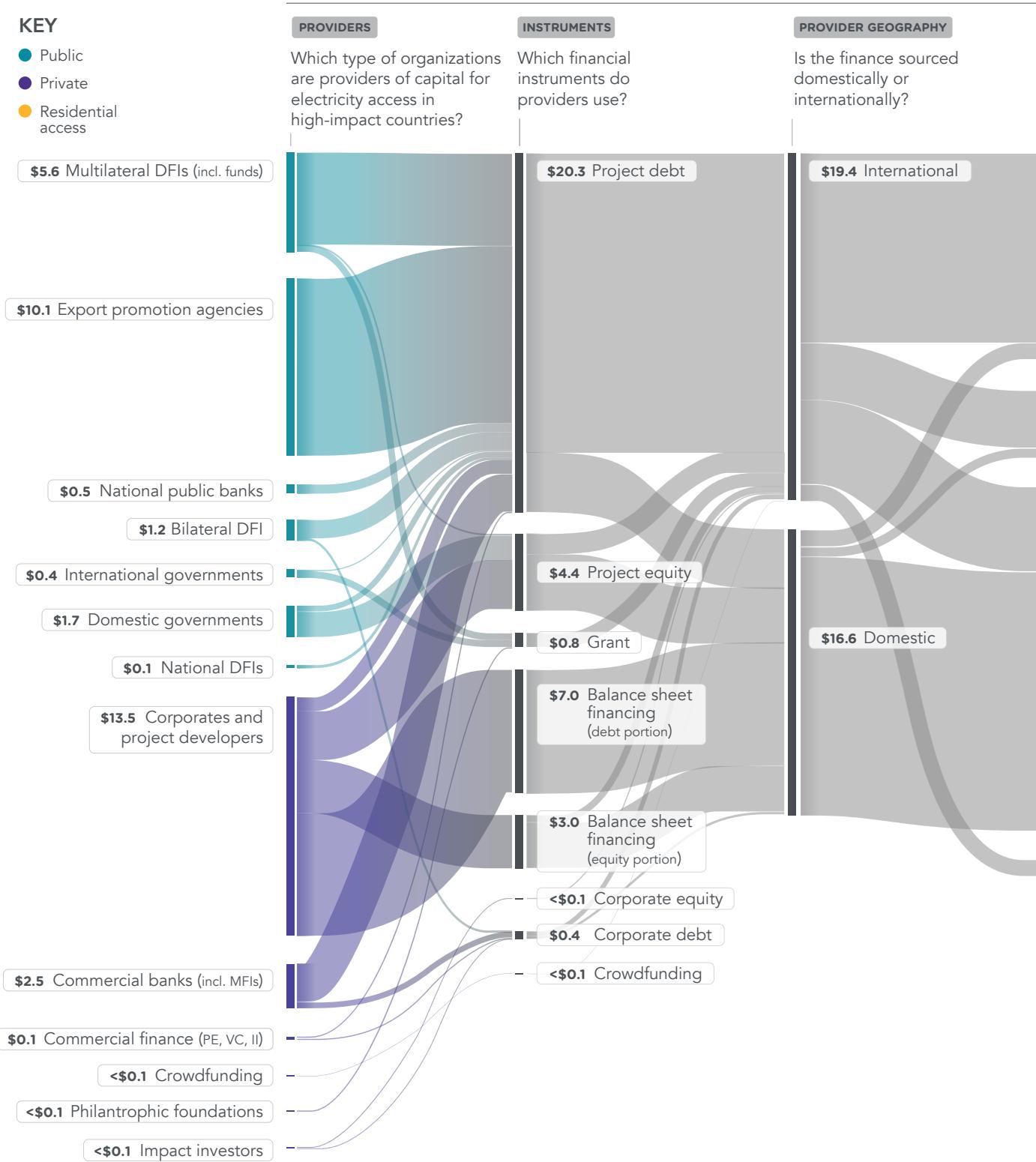


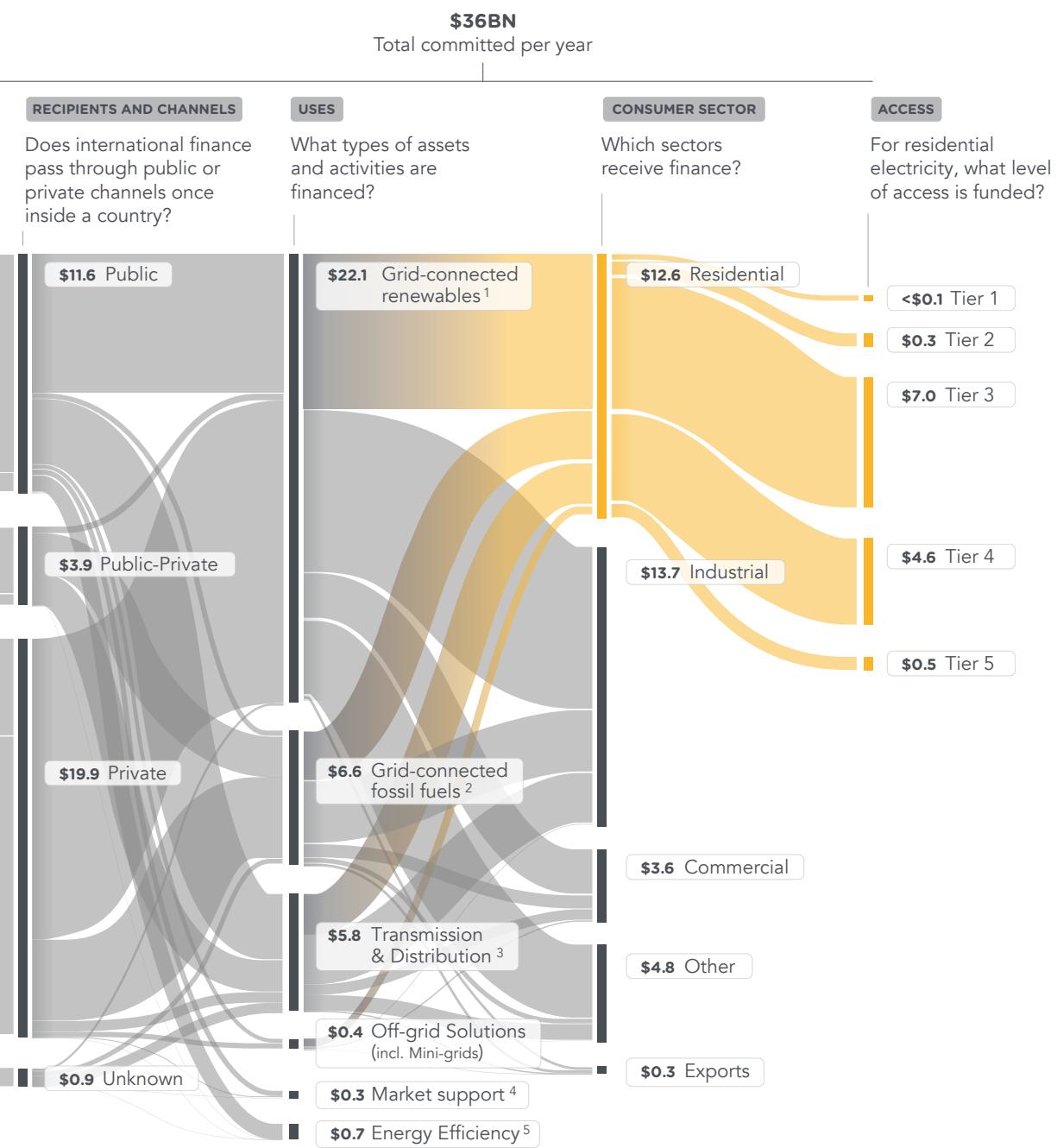
**Finance for electricity in the 20 HICs increased to USD 36 billion in 2017 compared to USD 30 billion in 2015-16.** However, only USD 12.6 billion, or one-third of the total finance commitments for electricity, was estimated to benefit residential consumers. This continues to fall drastically short

of the required annual investment of USD 51 billion to attain universal electricity access by 2030 (IEA, 2018). More investment is urgently needed, especially in distributed generation technologies, to successfully bring connections to remote and rural communities.

**Figure 2.1**

Finance for Electricity Access in 2017  
Committed in 2017 in High-Impact Countries (USD Billion)





NB: Values may not add up due to rounding specific tier

<sup>1</sup> Grid-connected renewables includes: Wind, Solar PV, Large hydro, Geothermal, Biomass and waste, Small hydro, Other / unidentified, Biofuels.

<sup>2</sup> Grid-connected fossil fuels includes: Coal, Gas, Oil, Unspecified.

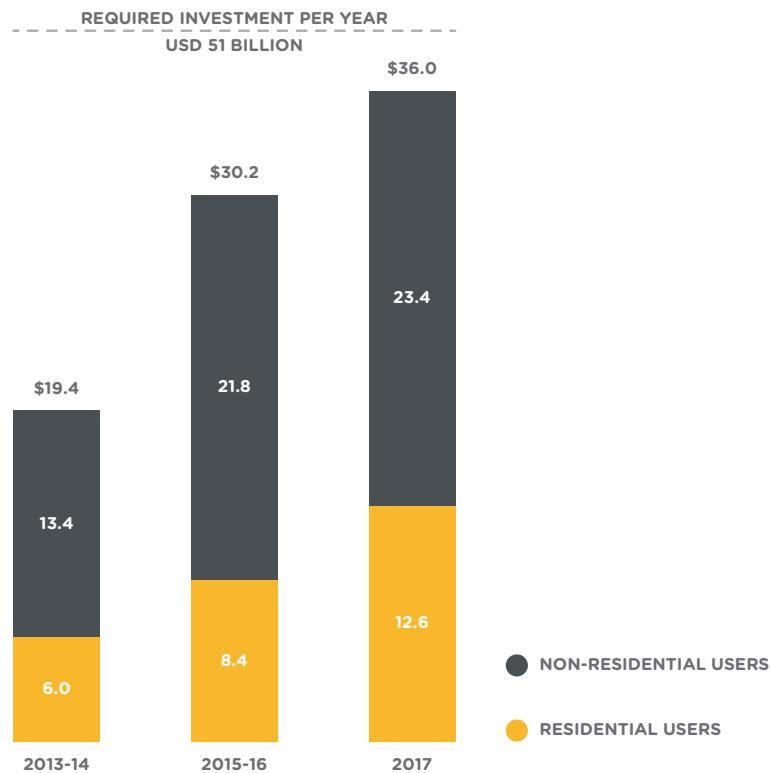
<sup>3</sup> Transmission and distribution includes: Transmission, Distribution, Unspecified T&D.

<sup>4</sup> Market support flows were not assigned to any specific consumer sector.

<sup>5</sup> Energy efficiency flows were not assigned to any specific consumer sector.

**Figure 2.2**

Total Finance for Electricity Across the 20 HICs (USD Billion)<sup>11</sup>



**FINANCE FOR ELECTRICITY IN THE 20 HICS REACHED AN ALL-TIME HIGH OF USD 36 BILLION IN 2017, DRIVEN PRIMARILY BY INCREASED INTERNATIONAL PUBLIC FINANCE. HOWEVER, APPROXIMATELY ONLY ONE-THIRD OF THIS FINANCE, OR USD 12.6 BILLION, IS ESTIMATED TO REACH HOUSEHOLD CONSUMERS, HIGHLIGHTING AN INVESTMENT GAP THAT HAD BEEN ALREADY OBSERVED FOR YEARS.**

### PROVIDERS

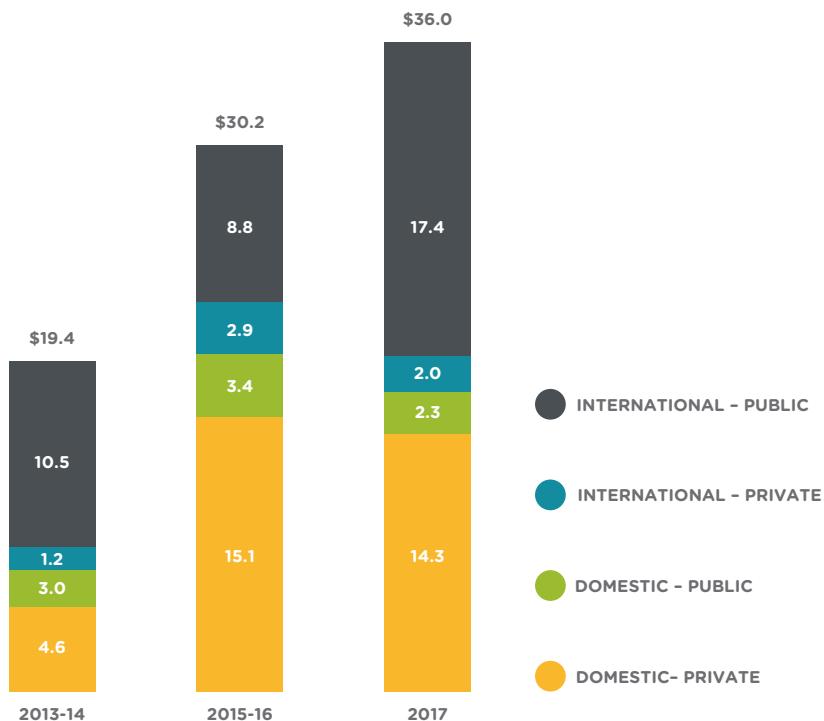
International finance represented about 54 percent of finance tracked in 2017, with a cumulative USD 19.4 billion from public and private providers (Figure 2.3), primarily led by increased financing from export credit agencies and multilateral DFIs. This is a significant increase from previous years, as international flows stalled at an average of USD 11.7 billion in both 2013-14 and 2015-16.

On the other hand, domestic finance decreased to USD 16.6 billion in 2017, after a clear increase recorded in 2015-16 that was due to the booming Indian renewable energy sector.

<sup>11</sup> All data reported are in current/nominal prices for each year.

**Figure 2.3**

Sources of Finance for Electricity Across the 20 HICs (USD Billion)



**Note:** Findings from 2017 are compared with the results of the previous two reports, expressed as average annual figures for 2013-14 and 2015-16.

**Export-credit agencies from China and India replaced multilateral DFIs as the single largest provider of public finance for international electrification projects.** This was mainly due to China's Ex-Im Bank financing a large hydro power plant in Nigeria (USD 4.9 billion) and a coal plant in Bangladesh (USD 1.7 billion). The Ex-Im Bank of India also financed two projects in Bangladesh, a coal plant (USD 1.6 billion) and a power transmission and distribution project (USD 900 million). Export-credit agencies are becoming an increasingly important source of international finance, especially for large projects, by either providing debt themselves and/or covering another lender's exposure (FS-UNEP, 2018).

**The energy access portfolio of multilateral DFIs continued to be dominated by transmission and**

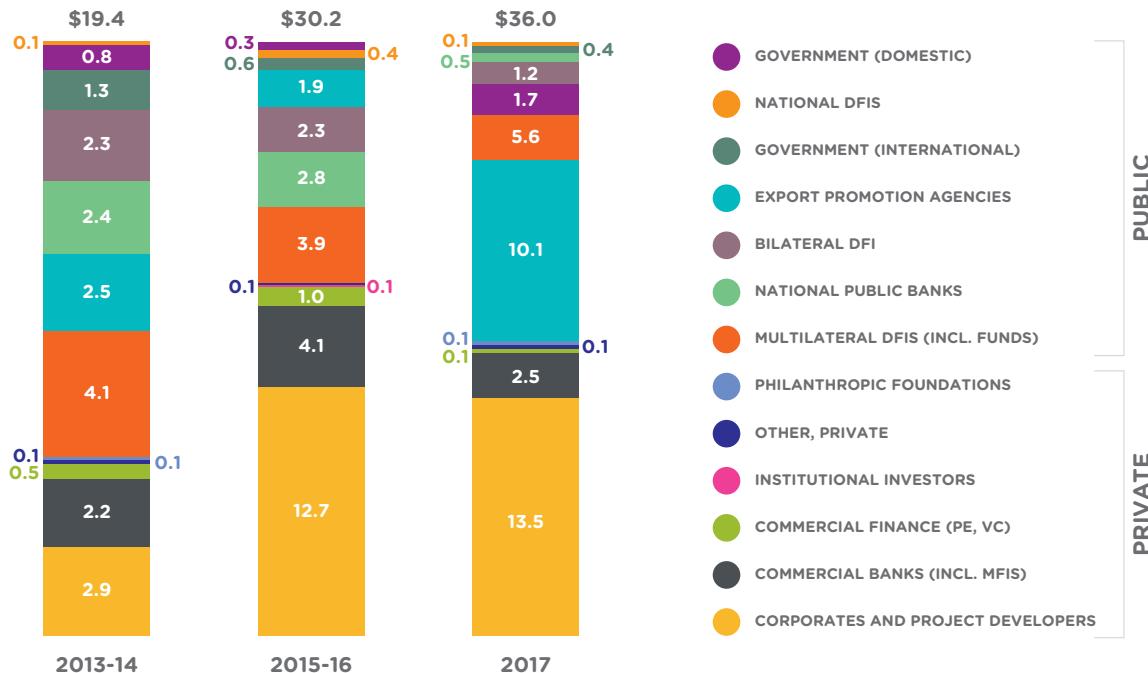
**distribution and on-grid electrification projects as off-grid investments remained lackluster.** After stagnating at an average of USD 4 billion between 2013 and 2016, financing from multilateral DFIs increased to USD 5.6 billion in 2017. However, 57 percent of total finance committed (or USD 3.2 billion) in 2017 was in transmission and distribution projects<sup>12</sup> followed by investments in grid-connected renewables (19 percent or USD 1.1 billion) and energy efficiency (9 percent or USD 500 million). DFIs' investment in fossil fuel projects continued – marginally increasing from USD 350 million in 2015-16 to USD 400 million<sup>13</sup> in 2017. Further, off-grid and mini-grid financing by multilateral DFIs, key to solving rural energy access issues, remained lackluster accounting for only 2 percent of their total financing.

<sup>12</sup> Including network upgrades, new connections, or extension of distribution lines.

<sup>13</sup> These projects were in Bangladesh, Burkina Faso, Myanmar and Sudan.

**Figure 2.4**

Sources of Finance for Electricity Across the 20 HICs (USD Billion)



**BILATERAL AID FLOWS FROM MOST DEVELOPED COUNTRY DONOR GOVERNMENTS DECLINED SHARPLY, PARTICULARLY FROM JAPAN AND THE US.**

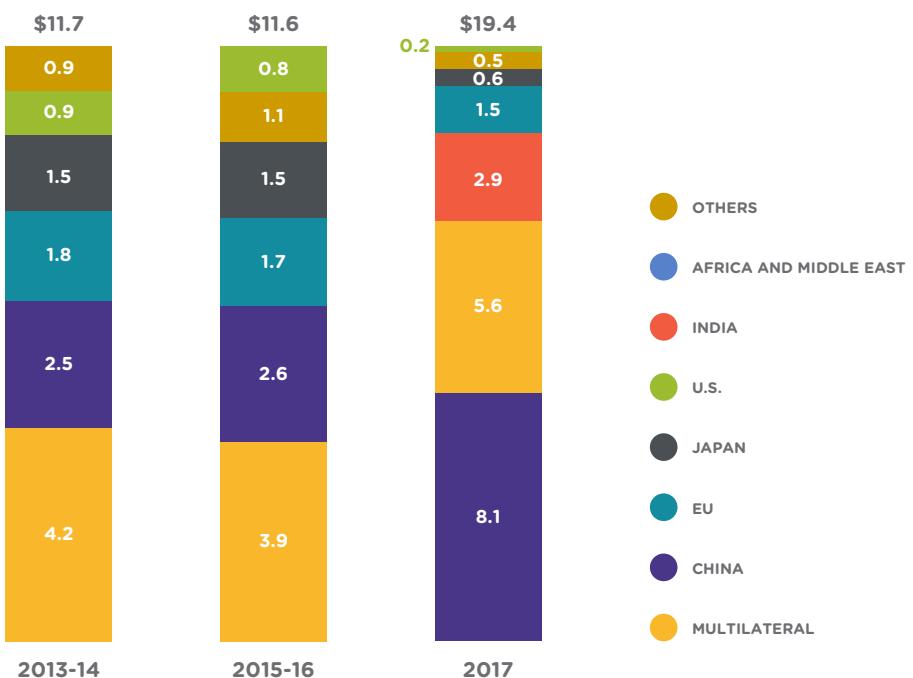
**Total commitments for electrification in the 20 HICs from developed country donor governments fell to USD 2.3 billion in 2017, almost half of the amount tracked in 2015-16 (USD 4.1 billion annually).** In Japan, funding fell from USD 1.5 billion to USD 600 million, while in the US it fell from USD 800 million to USD 200 million. Investment from the European Union also declined marginally from USD 1.7 billion in 2015-16 to USD 1.5 billion in 2017, mainly due to France halving its annual financing commitments.

**China<sup>14</sup> continues to be a major provider of bilateral finance.** China increased its annual international commitments to electricity threefold, reaching USD 8.1 billion in 2017, of which more than half (USD 4.9 billion) financed the development of a single hydro-power project in Nigeria. China's financing of overseas coal plants in the HICs also increased from USD 1.6 billion in 2015-16 to USD 2.2 billion in 2017 for projects in Bangladesh and the Philippines – a concerning trend under China's Belt and Road Initiative (BRI), launched in 2013. Chinese equity investment has contributed to finance almost 13 gigawatts (GW) of new wind and solar and almost 68 GW of new coal capacity since 2014, mostly in South and Southeast Asia (Greenpeace, 2019).

<sup>14</sup> It is important to note that Chinese commitments may be underreported, as China is not required to officially report its international financing to institutions like OECD, and data from other private databases often lack details and accuracy.

**Figure 2.5**

Sources of Public and Private International Finance Commitments for Electricity to the 20 HICs (USD Billion)



For the first time in this series, we tracked USD 2.9 billion of India public financing to international electricity projects in other HICs (Afghanistan, Bangladesh, and Myanmar). More than two-thirds of this amount supported a single coal-fired power plant in Bangladesh.

**Total domestic public finance<sup>15</sup> decreased from USD 3.4 billion in 2015-16 to USD 2.3 billion in 2017, largely due to lower investment from public banks.** Financing from national public banks in India, accounting for 89 percent of the USD 2.5 billion in total financing in 2015-16, sharply declined to USD 500 million in 2017. This decrease in lending can be largely attributed to escalating non-performing assets of public sector banks in India, which increased from less than 3 percent in 2012-13 to 9.3 percent in 2017.

To address this issue, several stressed assets resolution mechanisms including the Prompt Corrective Action<sup>16</sup> were put on banks, reducing their ability to lend freely (MoF, 2018).

Financing from national governments through domestic budgets and government agencies in 2017 was six times higher than in 2015-16 (USD 1.7 billion against USD 275 million). However, government co-financing for large projects in Bangladesh and Nigeria made up most of this increase, rather than an increase across all the HICs. It is important to note that the coverage of government budgets and other public domestic flows is limited, and these reported figures (USD 2.3 billion<sup>17</sup>) are likely to be higher. (See Box 2 for more details.)

<sup>15</sup> Domestic public finance mainly includes financing from national government and public agencies, national public banks and national DFIs.

<sup>16</sup> A framework under which banks with poor financial metrics – capital ratios, asset quality and profitability – are put under watch by the Reserve Bank of India.

<sup>17</sup> This is mainly reported from only five HICs: Bangladesh, Ethiopia, India, Nigeria and Philippines.

**Project developers and corporations, which account for the majority of domestic<sup>18</sup> private finance, marginally increased their financing to USD 13.5 billion in 2017 (from USD 12.7 billion in 2015-16).** This was primarily due to steady renewable energy investment from the private sector (USD 11.2 billion in 2017 from USD 10.2 billion in 2015-16) in India. However, the Philippines witnessed a significant decline in financing for utility scale projects in 2017 (USD 512 million) compared to 2015-16 (USD 1.6 billion). (See Chapter 4 for more details.) Around 90 percent of the investment from project developers and corporations was in utility scale renewable energy projects, funded through balance sheet financing.

**Financing from commercial banks decreased from USD 4.1 billion in 2015-16 to USD 2.5 billion in 2017.** This was primarily due to reduced lending from international commercial banks – mainly in China – which only loaned USD 530 million in 2017, compared to USD 1.9 billion in 2015-16. This can be attributed, in part, to an overall slowdown in lending by China's commercial bank to address the issue of high non-performing loans in 2017 (CNBC, 2017). With the exception of India, where domestic commercial banks' financing increased to USD 1.7 billion in 2017 (from USD 1.3 billion in 2015-16), all other HICs including Kenya, Nigeria, and Tanzania reported a decline. Banks' financing in the Philippines also halved to roughly USD 700 million in 2017, in line with the overall decrease in financing for energy access in the Philippines.

**Philanthropic foundations and impact investors committed USD 60<sup>19</sup> million in 2017, more than doubling the USD 25 million committed in 2015-16.** Funding from philanthropic foundations and impact investors continues to be increasingly important in achieving universal energy access. To understand the financing landscape of these actors, data were again collected from the Shine Campaign, GOGLA,

**FINANCING FROM PHILANTHROPIC FOUNDATIONS AND IMPACT INVESTORS MORE THAN DOUBLED IN 2017, AS THEY INCREASINGLY COLLABORATED WITH INNOVATIVE SOLUTION PROVIDERS TO CREATE NEW FINANCING STRUCTURES TO CLOSE THE ENERGY ACCESS GAP.**

OECD, and the Clean Cooking Alliance (see Box 3 for details), supplemented by dedicated surveys. The majority (USD 48 million) of the finance identified flowed in the form of grants to support innovative off-grid solutions and market development activities.

## INSTRUMENTS

Project financing remains the predominant mode of finance for electricity access, accounting for 56 percent of total financing. Project debt, which is debt provided directly to projects rather than to the companies developing projects, increased by 34 percent to reach USD 20.3 billion in 2017, compared to USD 15.1 billion in 2015-16.

By comparison, balance sheet financing increased from USD 8.2 billion to USD 10 billion in 2017, accounting for 27 percent of total finance for electricity access<sup>20</sup>. A likely driver of this trend is that several corporates and developers, who marginally increased financing commitment to USD 13.5 billion in 2017, are opting to finance initially on balance sheet with a view to bringing in institutional investors at a later stage (FS-UNEP, 2018).

<sup>18</sup> Domestic finance refers to finance flows committed from institutions that are primarily based in the country where the project is being developed or constructed.

<sup>19</sup> Most likely, contributions from these organizations remain underrepresented, as transactions are often not disclosed publicly.

<sup>20</sup> Assumptions of realistic debt to equity ratios were applied to balance sheet financing, which is a default classification used by data providers when information on financing details is missing. Structures of 70:30 are common for financing large scale wind and solar PV projects in India, for example.

**CONCESSIONAL  
DEVELOPMENT FINANCE  
FLOWING TO SUB-  
SAHARAN AFRICAN  
COUNTRIES STAGNATED,  
WHILE IT DECREASED  
IN SOUTHEAST ASIAN  
COUNTRIES AS THEY  
SHOW SIGNIFICANT  
PROGRESS IN EXPANDING  
ELECTRICITY ACCESS.**

Grants from DFIs and donor governments remained consistent at USD 840 million in 2017, compared to USD 895 million in 2015-16.

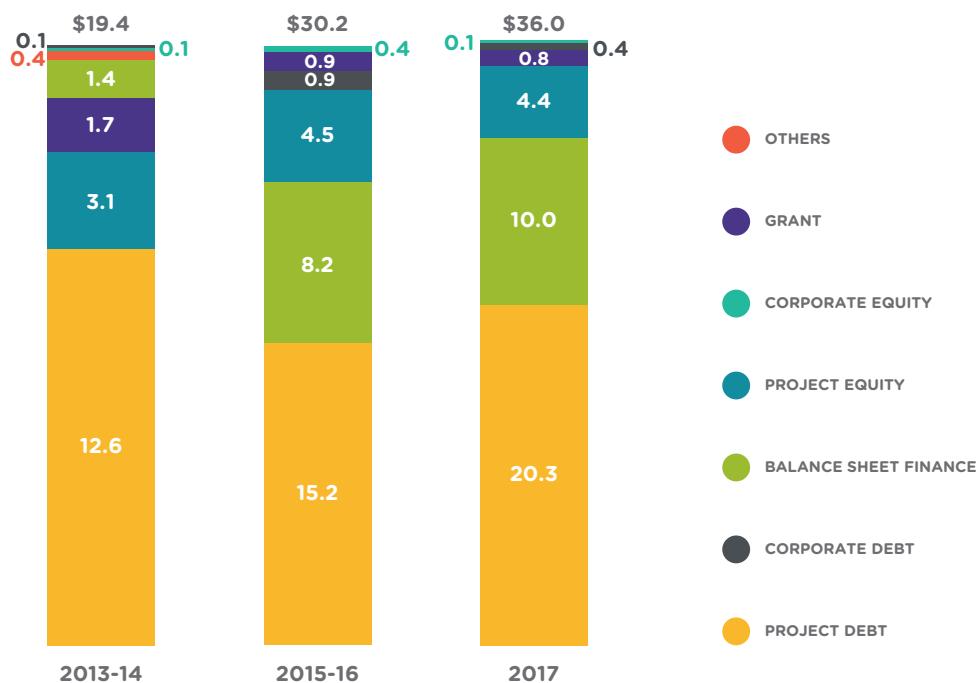
Concessional development finance<sup>21</sup> for electricity access from DFIs and donors (excluding ECAs) de-

creased by 20 percent in 2017 to USD 3.8 billion, compared to USD 4.8 billion in 2015-16. Grants made up 21 percent of concessional finance in 2017 (USD 800 million), with the remainder provided in the form of concessional loans (USD 3 billion). Concessional finance to the South Asia region continued to decrease from USD 3.4 billion in 2013-14 to USD 2.3 billion and USD 1.3 billion in 2015-16 and 2017, respectively. India and Bangladesh, two of the three HICs in Asia, are gradually phasing out concessional finance as they close their electricity access gap rapidly, and receive financing from alternative sources, such as export-credit agencies. A similar trend was also observed in East Asian countries, where concessional finance decreased by more than half – to USD 250 million in 2017. In Sub-Saharan African countries concessional finance stagnated at USD 1.8 billion in 2017. The sole exception to the trend was Yemen, where concessional finance doubled (USD 480 million).

<sup>21</sup> This figure is mostly derived from information contained in the OECD CRS database. A portion of international financing, especially South-South commitments, is likely to happen on concessional terms, but there are few disclosed details to confirm this. Also, this excludes finance from export credit agencies like the China Ex-Im Bank and the Export-Import Bank of India.

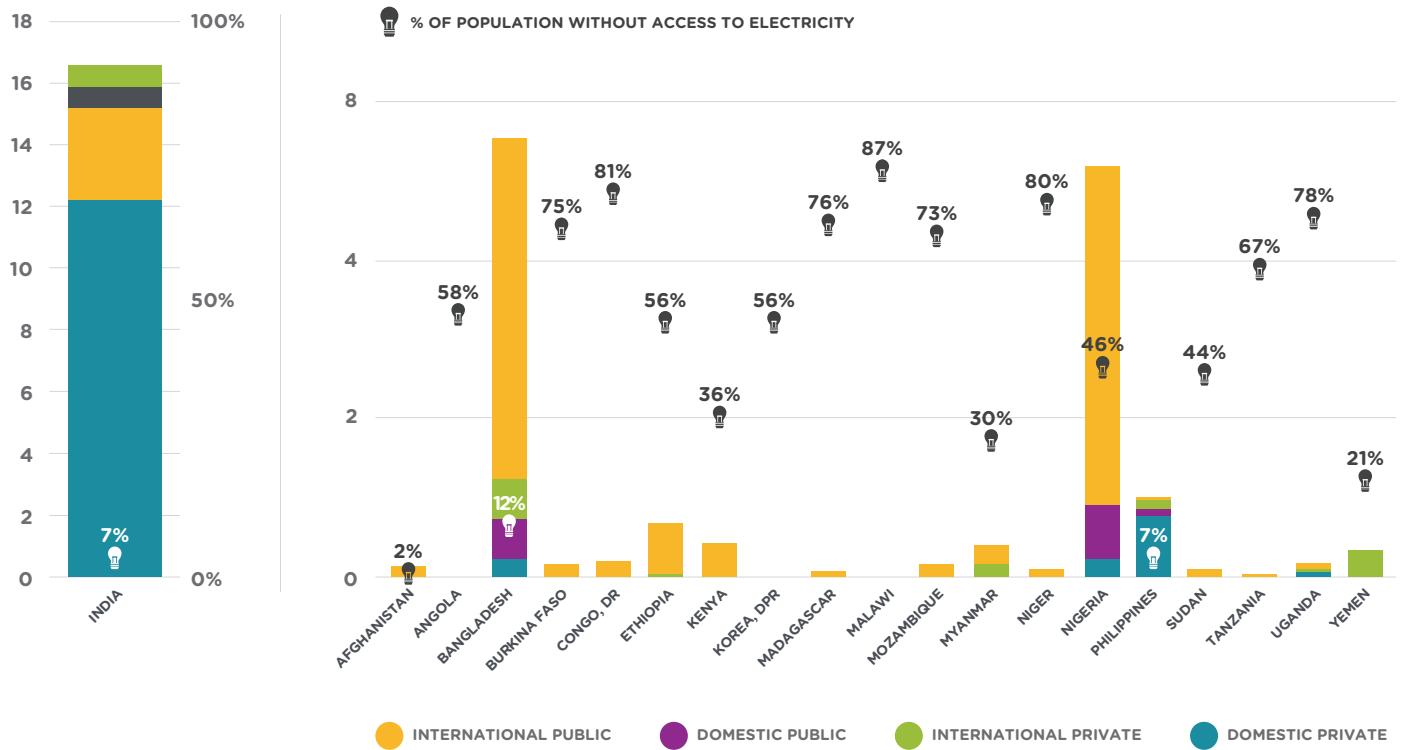
**Figure 2.6**

Finance for Electricity by Instrument Type (USD Billion)



**Figure 2.7**

Distribution of Finance for Electricity Across the HICs (USD Billion)<sup>22</sup>



On top of this, we also tracked USD 7.6 billion of debt financing from export credit agencies that had close to concessional characters. However, private finance at the domestic level was invested almost entirely with the expectation of earning commercial returns, particularly through project finance (debt and equity) for grid-connected electricity generation.

**EXCEPT FOR ONE LARGE INVESTMENT IN NIGERIA, INVESTMENT IN SUB-SAHARAN AFRICAN COUNTRIES REMAINED FLAT - 10 OUT OF 13 COUNTRIES RECEIVED FEWER THAN USD 300 MILLION FOR ELECTRIFICATION IN 2017.**

## RECIPIENTS

**Investment in India and Bangladesh accounted for almost two-thirds (USD 24 billion) of the total financing (domestic and international) in the electricity sector in 2017.** This is an increase of USD 4 billion compared to 2015-16, when the region reported a massive increase of USD 12.4 billion over 2013-14, mainly led by renewable energy financing in India. Bangladesh was the biggest gainer, seeing investment increase from USD 2.7 billion in 2015-16 to USD 7.1 billion in 2017, mainly finance by export-promoting agencies of India and China. Investment in India declined marginally by USD 600 million to USD 16.6 billion in 2017, while in the Philippines it decreased from USD 4 billion in 2015-16 to USD 1.4 billion in 2017.

<sup>22</sup> Latin American and the Caribbean are closing in on universal access with an access rate of 98 percent in 2017 – less than 12 million people still require electricity connections.

**Other than Nigeria, which attracted over USD 6 billion in 2017, investment in other Sub-Saharan African countries remained abysmally low. Four out of the 13 Sub-Saharan African countries reported an absolute decline in electricity investments, and ten countries received less than USD 300 million in 2017.** This is a discouraging trend given that these countries together are home to more than 570 million people without electricity (IEA, IRENA, UNSD, WB, WHO, 2019). Nigeria was the only bright spot, as investment reached USD 6.3 billion in 2017 compared to a mere USD 612 million in 2015-16, mainly due to a single 3 GW hydro-power plant<sup>23</sup> financed by the China Ex-Im Bank for USD 5 billion.

**The analysis found domestic private finance for electricity only in five countries: Bangladesh, India, Nigeria, the Philippines, and Uganda.** The ability of these countries to mobilize private sector investments can be partly attributed to a more enabling policy and regulatory environment than those of the other HICs (GSMA, 2017). Although information available on domestic finance is not comprehensive (in particular for government budgets), domestic financing is crucial to close the energy access investment gap in all HICs.

Focusing on international public finance (Figure 2.8)<sup>24</sup> only, Bangladesh received the majority of development finance for electrification in absolute terms, followed by Nigeria and India.

When finance is weighted for the proportion of countries' populations without access to electricity, the report's analysis shows that Sub-Saharan African countries received a much lower level of financing than most Asian countries. **Bangladesh, for example, which has the same number of people without electricity as Kenya and Madagascar, received the highest amount across all 20 HICs on a per capita basis**— almost nine times higher than Kenya and 78 times higher than Madagascar.

<sup>23</sup> Mambila Hydropower Plant.

<sup>24</sup> Financing from multilateral and bilateral development finance institutions, government and export credit agencies.

## SECTORS

**Grid-connected renewable energy projects<sup>25</sup> accounted for 61 percent (USD 22.1 billion) of the total amount of electricity finance, an increase of around USD 6 billion compared to 2015-16** (Figure 2.9). Within renewables, solar PV attracted more than USD 9.8 billion a year (compared to USD 8 billion in 2015-16). This aligns with the global renewable energy investment trends wherein solar installations accounted for 38 percent of all the new capacity addition, which is more than coal, gas, and nuclear plants<sup>26</sup> (FS-UNEP, 2018).

This trend was due primarily to improved manufacturing processes, more competitive supply chains, and the continuous decline in cost<sup>27</sup> of electricity from solar PV driven by technological improvements including higher solar PV module efficiencies (IRENA, 2018). In addition, competitive procurement processes, including auctions, tenders, and power purchase agreements (PPA), have increased transparency and lowered risk for investors, attracting more investment.

The majority of the increase in solar PV investments was due to investments in India. However, several African countries also reported an increase in solar PV investments compared to 2015-16 (see Figure 2.9).

There was a steep increase in investments in large hydro plants – from USD 500 million in 2015-16 to USD 6.1 billion in 2017 – mainly due to a single hydro-power project in Nigeria which cost USD 5.8 billion. Meanwhile, investment in wind projects decreased to USD 5.4 billion in 2017 from USD 6.2 billion in 2015-16. This decrease can be attributed to policy uncertainty around the tariff-determination mechanism and generation-based incentives (GBI) scheme in India's wind energy sector (Quartz, 2017).

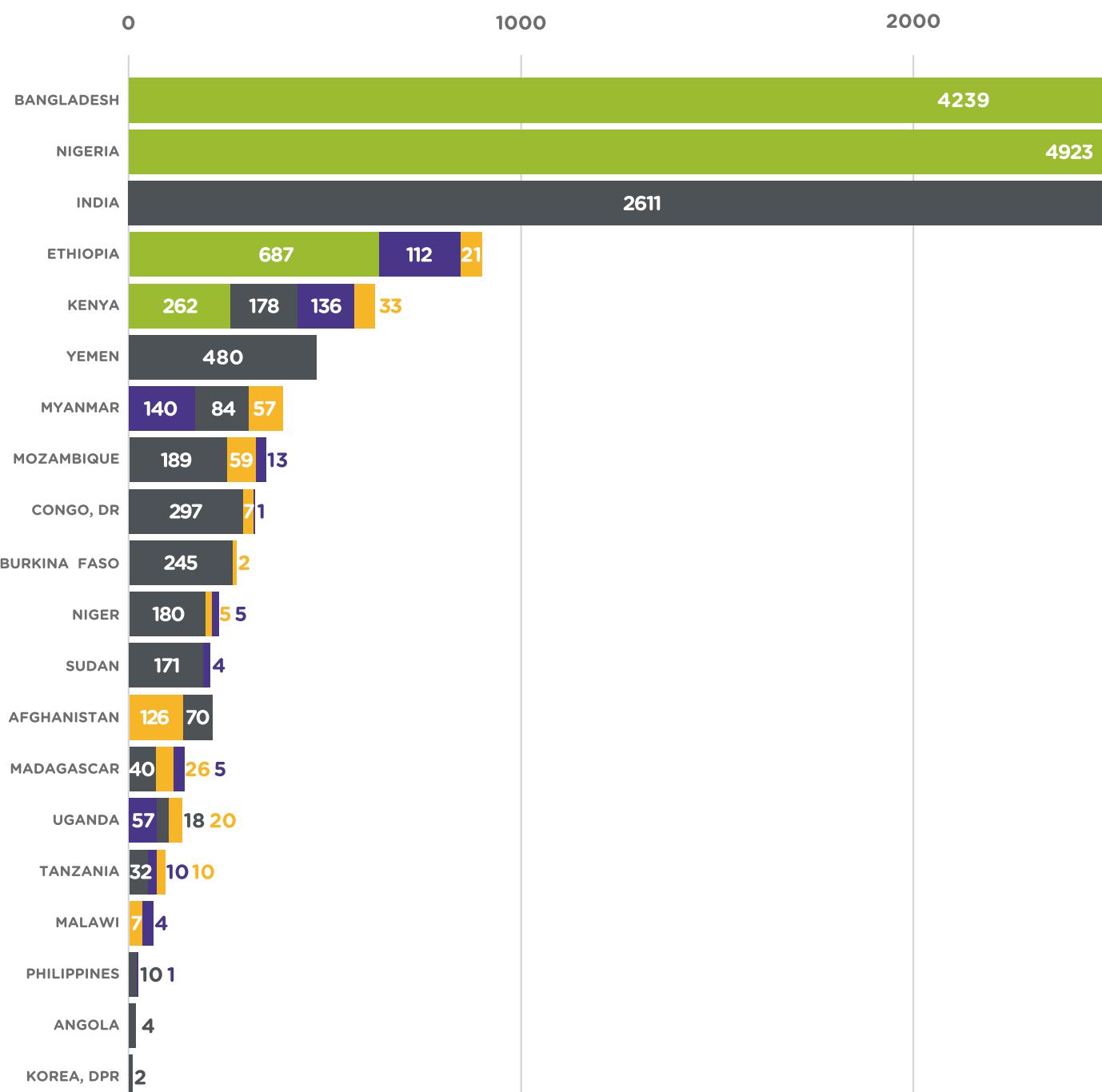
<sup>25</sup> Including large hydro.

<sup>26</sup> Grid-connected nuclear investments are excluded, as no investments were identified in 2017. National Thermal Power Corporation (NTPC), an Indian state-owned power utility provider raised rupee-denominated bonds in overseas markets but only limited information was available about it proceeds for the nuclear projects and is hence excluded from the analysis. Projects on training related to applications of radioisotopes and radiation technologies, amounting to USD 0.3 million, are allocated to 'market support – non-renewables'.

<sup>27</sup> The global weighted average levelized cost of electricity (LCOE) of utility scale solar PV has fallen 73 percent since 2010, to USD 0.10/kWh for new projects commissioned in 2017 (IRENA, 2018).

**Figure 2.8**

Recipients of International Public Finance In 2015-16 and 2017, by Provider Type (USD Million)

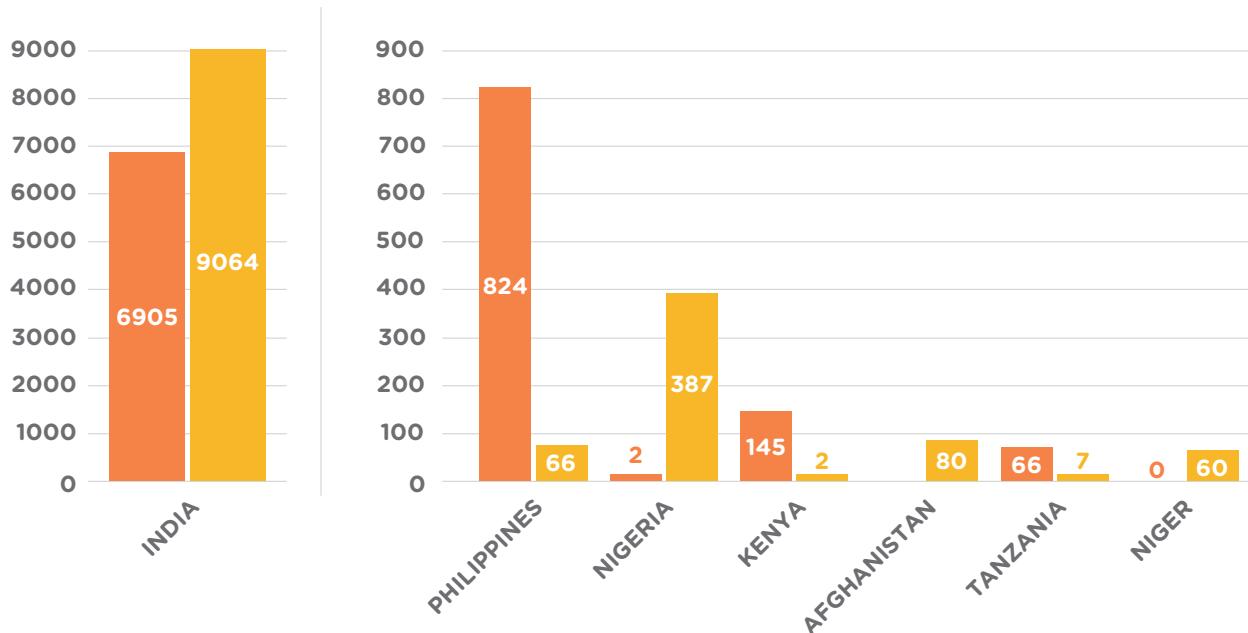


● GOVERNMENT (INTERNATIONAL) ● BILATERAL DFI ● MULTILATERAL DFIS (INCL. FUNDS) ● EXPORT PROMOTION AGENCIES



**Figure 2.9**

Breakdown of Grid-Connected Solar PV Investments by Recipient Country (USD Million)



**Transmission and distribution projects continue to attract increasing investment**, reaching USD 5.8 billion in 2017 compared to USD 4.4 billion in 2015-16. This trend is likely to continue as these projects support the integration of variable renewable energy (VRE) into the grid and promote more efficient energy use (IRENA, 2018a). Much of the financing (55 percent or USD 3.2 billion) was from multilateral DFIs, followed by export credit agencies (24 percent or USD 1.4 billion).

**Investments in grid-connected fossil fuel plants declined in 2017 after doubling between 2015-16 and 2013-14.** Financing for fossil fuel plants decreased to USD 6.6 billion in 2017, compared to USD 8.1 billion in 2015-16.

In 2017, only four coal plants<sup>28</sup> were financed in two HICs, Bangladesh and the Philippines, totalling USD 5.6 billion in new investment. This is a significant decline compared to 2015-16, when 17 coal plants were financed in India, Philippines, Bangladesh and Kenya.

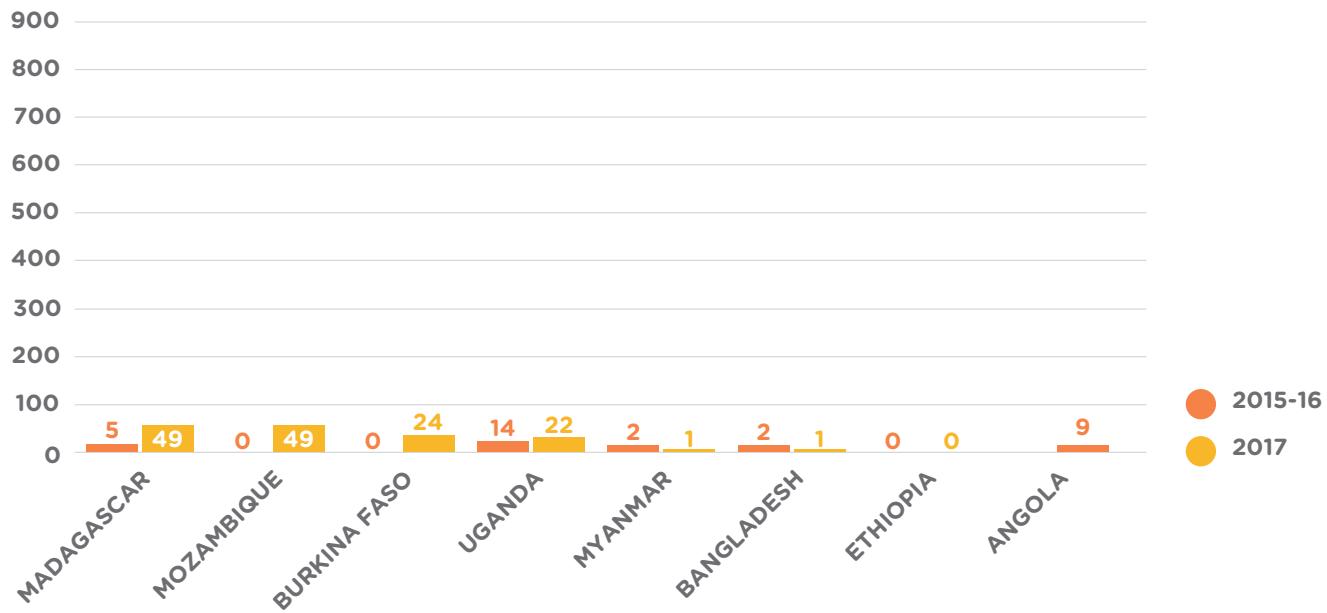
Investment for new coal plants was not identified in India in 2017, a symptom that an increasing number of coal power projects in the country are reporting financial stress. In 2017-18 in fact, 34 coal-fired thermal power plants in India, totalling 40 GW in capacity, were categorized as financially 'stressed' due to several issues, including non-availability of regular fuel supply arrangements, lack of Power Purchase Agreements (PPAs), and inability of the promoters to provide equity and working capital (Ministry of Power, 2018).

However, the Ex-Im Bank of India has jointly financed coal projects in Bangladesh with the China Ex-Im Bank, for USD 1.6 billion and USD 1.7 billion respectively. This joint financing represents nearly sixty percent of the total financing for coal projects tracked in 2017.

As domestic climate policies and public outcry continue to drive a transition towards low-carbon economies, coal plants will increasingly turn into stressed or stranded assets.<sup>29</sup> The stalling of the Lamu coal plant in Kenya, whose financing was highlighted in last year's report, is one such example.

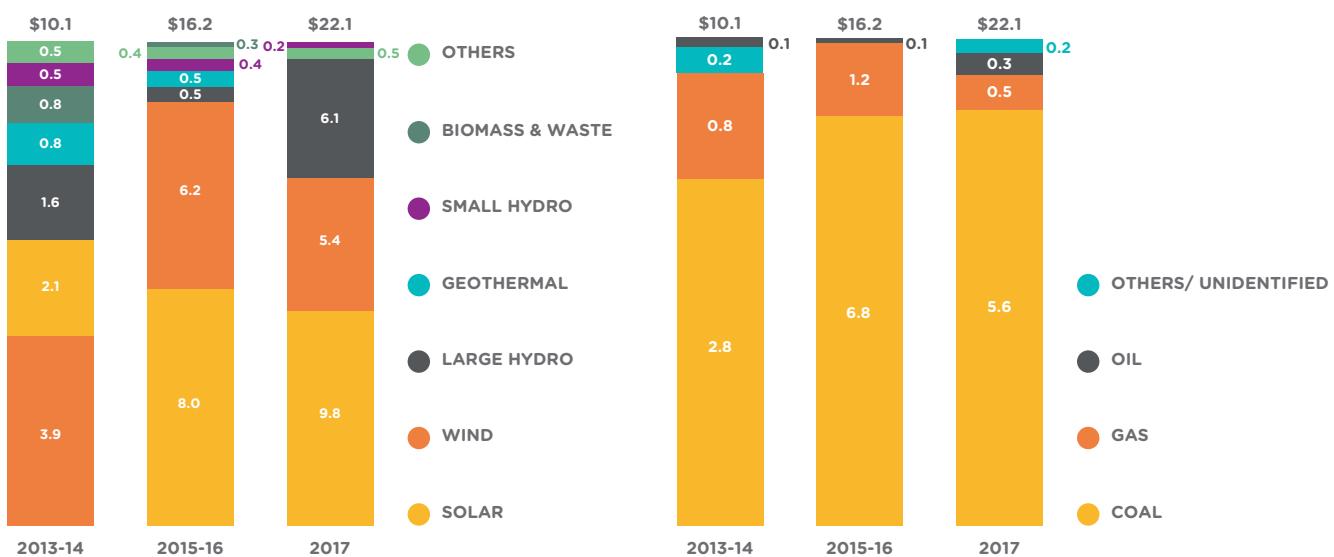
<sup>28</sup> Excludes investments expected from the National Thermal Power Corporation (NTPC), an Indian state-owned power utility provider, raised rupee-denominated bonds raised in overseas markets. Only limited information was available about how proceeds raised through the facility will be allocated to coal plant projects in India.

<sup>29</sup> Since 2018, 34 financial institutions globally have taken policy positions to divest and/or no longer fund coal investments (IEFA, 2019).



**Figure 2.10**

Breakdown of Grid-Connected Investments by Renewable and Fossil Fuel Sub-Technology (USD Billion)



**Figure 2.11**

Total Coal Financing Tracked in the 20 HICs

	2015-16		2017	
	Total financing (USD billion)	Number of plants	Total financing (USD billion)	Number of plants
Philippines	2.8	5	1.1	1
India	4	8	–	–
Bangladesh	2.1	3	4.5	3
Kenya	2	1	–	–

**INVESTMENT IN OFF-GRID  
SOLUTIONS CONTINUES  
TO STAGNATE; THERE  
IS AN URGENT NEED TO  
MAINSTREAM MINI-GRIDS  
IN NATIONAL ELECTRICITY  
ACCESS STRATEGIES.**

**Investment in off-grid solutions, including mini-grids, stood at USD 430 million in 2017, a marginal 12 percent increase of USD 46 million compared to 2015-16.** Most of these investments were in companies delivering stand-alone solar home systems, mainly enabling basic household energy access. Kenya, Tanzania, and Uganda alone accounted for 56 percent of total off-grid investment. Almost all financing for off-grid solutions was obtained from international sources – mainly DFIs (bilateral and multilateral), private equities, and venture capitalists. Philanthropic foundations and impact investors more than doubled their off-grid investments in the 20 HICs to USD 42 million in 2017 compared to USD 18 million in 2015-16.

It is estimated that between 2016 and 2030, renewable energy sources will account for 60 percent of new energy access connections, of which 40 percent will be through mini-grids (IRENA, 2018b). However, tracked investment in mini-grids is negligible despite their unique positioning between grid-based solutions and stand-alone systems. Several actions must be taken to meet the targeted projection, including, but not limited to: mainstreaming mini-grids in national electricity access strategies, dedicated regulations and financial and fiscal support mechanisms, and clarity on the future of mini-grids once the project service area is connected to the centralized grid (SEforALL and CPI, 2018).

**Investment in energy efficiency almost tripled in 2017.<sup>30</sup>** Energy efficiency investment amounted to about USD 740 million in 2017 (compared to USD 260 million in 2015-16), or 2.1 percent of all tracked electricity finance, provided mainly by multilateral and bilateral DFIs. These investments include projects that support energy conservation and demand reduction, including building and industry upgrades, smart grids, metering,

<sup>30</sup> Energy efficiency refers to SDG7.3 which calls for doubling the global rate of improvements in energy efficiency by 2030. On average, energy intensity – the ratio of energy used per unit of GDP – has declined globally to 2.2 percent per year over 2010-2015, but progress still falls short of the 2.6 percent yearly decline needed to achieve the target. Without intensifying efforts and increased investment, the pace of improvement is not expected to exceed 2.4 percent during 2016-2030 (IEA, 2018b).

tariffs, and improvements in lighting, appliances and equipment that increase the quality of electricity grids and infrastructure, and consequently improve the Tier of energy access. It is important to note that the energy efficiency figure captured in this report is only partial, as a lack of sufficient details from various data sources makes it difficult to identify and separate energy efficiency financing from overall investment figures. (See Box 2 for more details).

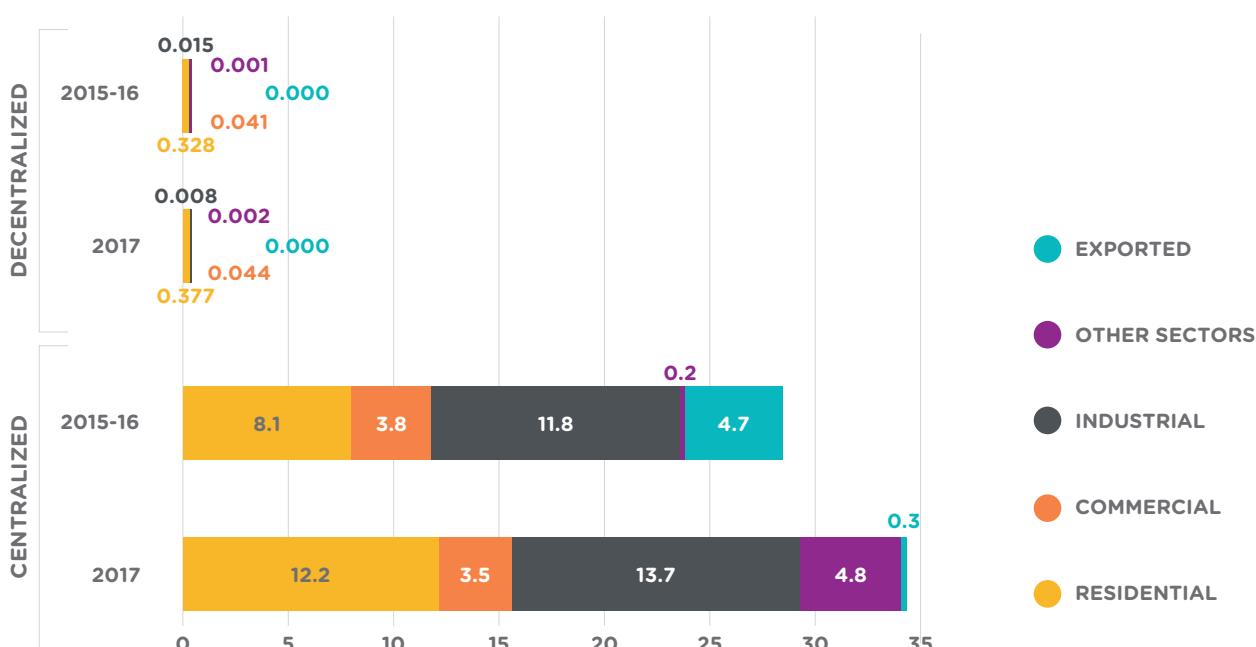
Households' investment into energy efficiency is critical to avoid costly lock-ins of inefficient buildings and appliances as residential demand and service levels grow, for both developed and emerging economies. However, at the same time, a behavioral consideration needs to be considered: the rebound effect, wherein improvements in energy efficiency from better equipment may result in greater use of energy and consequently less than expected reductions in electricity requirements (SEforALL, 2018).

Another 1 percent of the total finance tracked (or USD 350 million, all from public sector sources) was for market support activities, including capacity building, technical assistance, and institutional support for energy reforms, amongst other activities. This represents a substantial decrease compared to 2015-16, when USD 870 million was reported in market support activities, split almost equally between project debt and grants.

As the renewable energy sector continues to mature and utility-like infrastructure investment become more common (WEF, 2016) the need for market support activities slows down. However, foreign-supported market development activities are still needed, especially in areas like integrated electrification planning, policies and regulations, or where proof of concepts are needed to pilot new technological approaches and delivery models in the off-grid space (SEforALL, 2019).

**Figure 2.12**

Estimated Finance for Electricity Commitments by End User Across the 20 HICs (USD Billion)



## USES

While the majority of financing for electricity was allocated to grid-connected generation, transmission and distribution technologies, the contribution of these areas to increasing residential electricity access may still be lower per unit of capital invested when compared to off-grid technologies.

To identify the share of commitment flowing to residential users, the report applies relative shares of power consumption<sup>31</sup> in the HICs to the total finance tracked for electricity. (See Methodology section for details). The report finds that USD 12.6 billion (Figure 2.12) has been allocated to residential access to electricity across the 20 HICs, for both centralized and decentralized technologies. This accounts for 35 percent of the total financing for centralized technologies – a 7 percent (or USD 8.1 billion) increase over the 2015-16 numbers.

Commercial and industrial players are estimated to consume half of the grid-sourced electricity in the countries observed (corresponding to USD 17.2 billion), while 14 percent is used by other community and economic activities, such as street lighting, hospitals, schools, and the military, or is exported.

For off-grid solutions, the majority of electricity consumed (87 percent) is by residential users, with the rest, as in previous years, going to mostly commercial uses. However, the ability of off-grid solutions to positively impact residential access is limited as it only accounts for 1.2 percent of the total finance tracked across the 20 HICs.

After identifying the proportion of finance committed to electricity that targets residential consumers, these financial commitments were allocated to Tiers of electricity access based on the technology and the reliability of the country's

grid (World Bank, ESMAP, SREP, SEforALL, 2018 updating Bhatia and Angelou, 2015). It is estimated that the majority of finance for residential electricity access (56 percent, or USD 7 billion) is to support Tier 3 access, as observed in previous years (Figure 2.13). This level of energy service supports medium-power appliances and guarantees a minimum of eight hours of electricity supply a day. Tiers 4 and 5 entail greater availability of electricity services; Tier 5, for example, requires electricity access of at least 23 hours a day with no more than three disruptions a week. These Tiers (4 and 5) accounted for an average financial commitment of USD 4.6 billion and USD 0.5 billion, respectively. Tiers 3, 4, and 5 are usually – though not exclusively – associated with a connection to a central grid, which in most but not all countries ensures higher availability, reliability, and quality of electricity. However, grid connections often fail to reach rural populations living without access to electricity, and those without access to electricity in the HICs live disproportionately in rural areas.

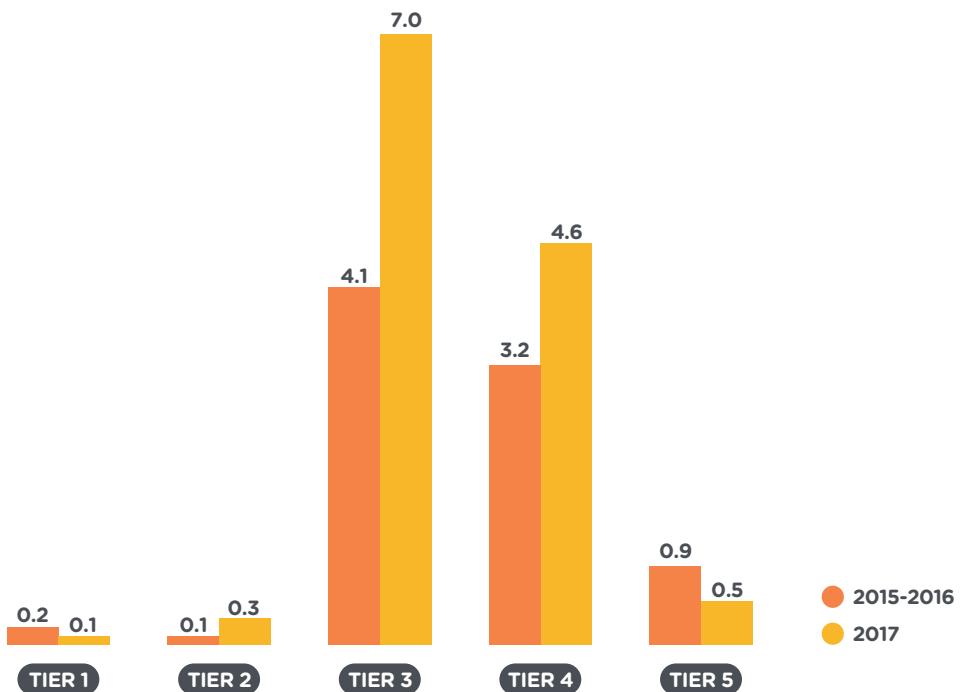
Due to data limitations, it is not possible to ascertain whether financing commitments provide new connections and/or improved electricity access for consumers who already have some access to electricity; if for example, commitments bring a residential consumer from Tier 2 to Tier 3, and/or provide entirely new access to electricity to a residential consumer. Nor is it possible to estimate the number of people affected by the financial commitments tracked, given the quality of data available.

Only 4 percent of the total finance flowing to residential access (or USD 405 million) targeted Tier 1 and 2 access, the same as in the previous years. Tiers 1 and 2 provide solar lanterns and solar home systems, as well as other, generally off-grid solutions, which are critical to allow the expansion of residential electricity access for rural populations whose locations make grid extension difficult.

<sup>31</sup> Estimates of electricity consumption by sector across the HICs are based on analysis including, but not limited to, country-specific grid supply and demand and technology-specific considerations for off-grid technologies (see more details in the Methodology).

**Figure 2.13**

Tiers of Energy Access in 2017 (as % of Finance for Residential Electricity Access)



## BOX 1

### ACCESS TO FINANCE FOR ELECTRICITY IN SUB-SAHARAN AFRICA

With nearly 570 million people still lacking access to electricity, Sub-Saharan Africa needs urgent action to close the access gap by 2030. Of the 13 countries analyzed in this report, eight have electricity access rates dramatically below 30 percent.

Achieving electrification for all in Sub-Saharan Africa will require at least USD 27 billion per year by 2030 (OECD, 2019), with USD 31-33 billion that needs to be invested in off-grid solutions alone over the same time frame (Shell Foundation, 2018).

From all angles, these figures are significantly far from the USD 9.6 billion of finance for electricity access that was tracked in 2017 across the 13 Sub-Saharan Africa HICs. Approximately USD 5.1 billion was estimated targeting household consumers, further widening the investment gap for residential energy access.

**SUB-SAHARAN AFRICA HAS  
CONTINUED TO FALL FURTHER  
BEHIND WITH EACH PASSING YEAR.  
THERE IS AN URGENT NEED TO  
CONTINUE SCALING UP INVESTMENTS  
IN THE OFF-GRID SECTOR**

Four of the 13 countries experienced a decline in electricity investments in 2017 (as shown in Figure 2.14), and ten countries received less than USD 300 million in 2017.

Financial support for large-scale, grid-connected renewable energy plants increased exponentially across the Sub-Saharan Africa HICs, from USD 1.5 billion in 2015-16 to USD 7.6 billion in 2017. The increase was largely due to the USD 5.8 billion financing of the 3GW Mambila Hydropower Plant in Nigeria, of which USD 5 billion was provided by the China Ex-Im Bank.

On the other hand, investment in grid-connected fossil fuel plants in the region declined from USD 1.6 billion in 2015-16 to USD 278 million in 2017. This investment was for projects in Burkina Faso and Sudan.

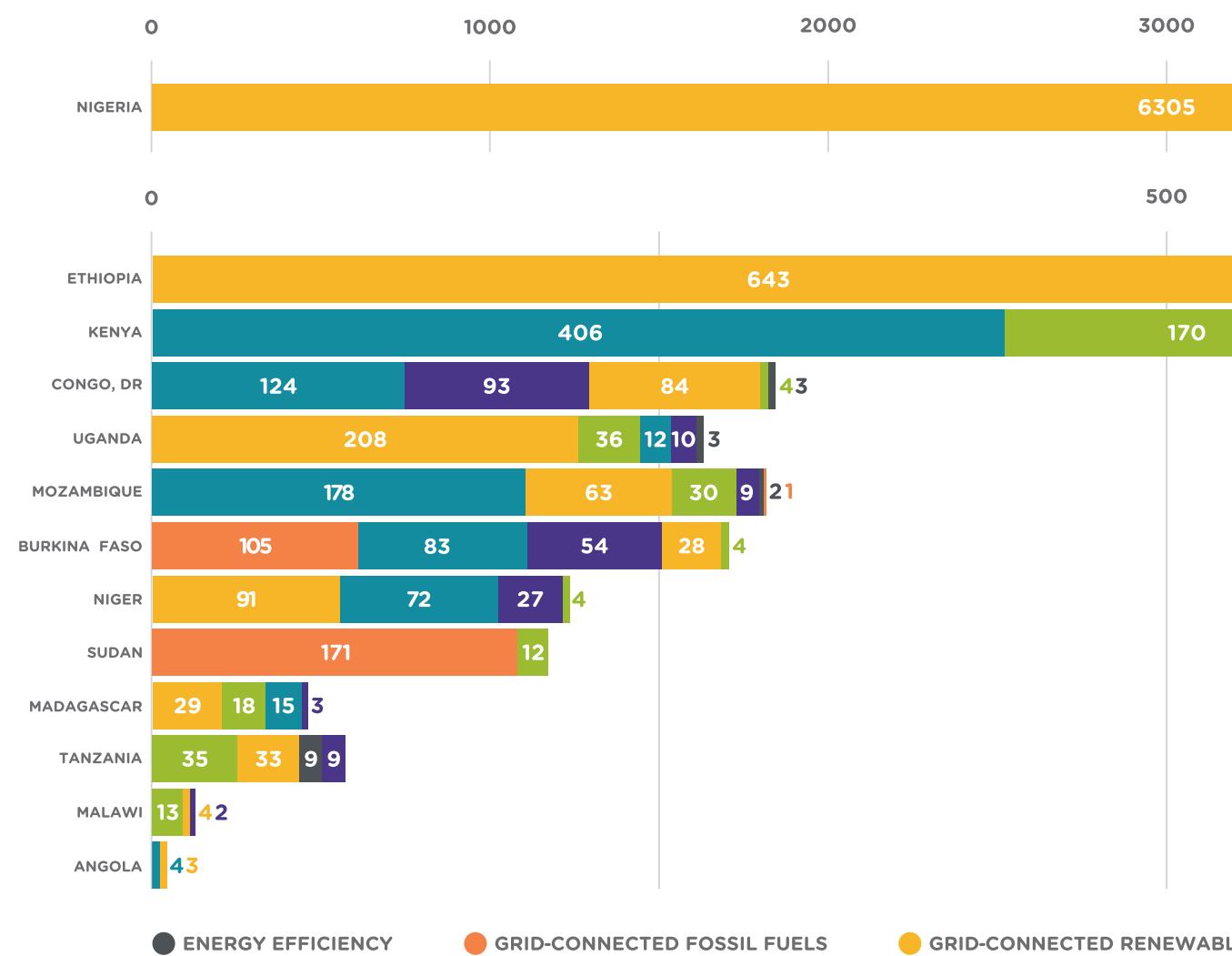
Investment in transmission and distribution (T&D) also declined by USD 400 million to reach USD 1.1 billion in 2017. This is in contrast with the trend witnessed in Asian HICs, where T&D investment increased from USD 2.8 billion in 2015-16 to USD 4.6 billion in 2017.

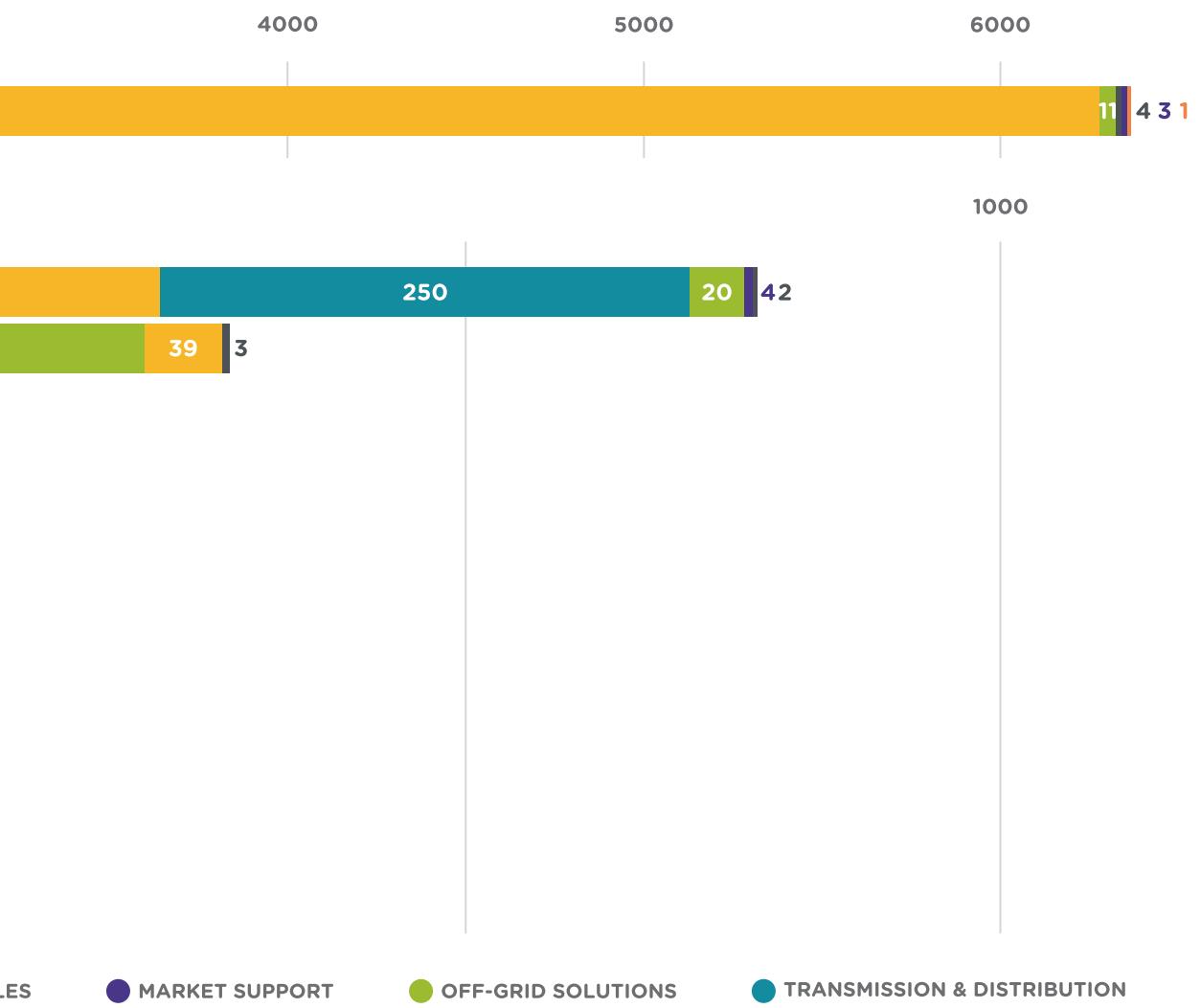
Sub-Saharan African HICs received more than 87 percent of the total investment for off-grid solutions tracked in 2017 (USD 380 million), almost doubling the 2015-16 figure of USD 210 million. This was driven by solar off-grid companies providing pay-as-you-go (PAYG) services linked to mobile money in several countries.



**Figure 2.14**

Electricity Sectors Financed in Sub-Saharan Africa in 2017 (USD Million)





## BOX 2

### DATA COVERAGE

The *Energizing Finance* series examined several existing data sources<sup>32</sup> to provide the most comprehensive analysis of finance for energy access. However, several important data gaps were identified that can have substantial implications on this report's findings and need to be addressed to provide a more detailed assessment of finance for energy access. Figure 2.15 provides a visual representation of the data captured in this Chapter and its quality.

In order to continue increasing the data coverage of the report, this year several improvements have been introduced, including:

**Dedicated Surveys:** Philanthropic foundations, family offices, and impact investors are emerging as funders of energy access activities, but their impact is under-reported due to a lack of centralized and comparable

<sup>32</sup> Data sources are described in detail in the Methodology.

data. Foundations, in particular, are characterized by the private nature of their operations, which they finance mainly through grants that are not reported through development aid databases.

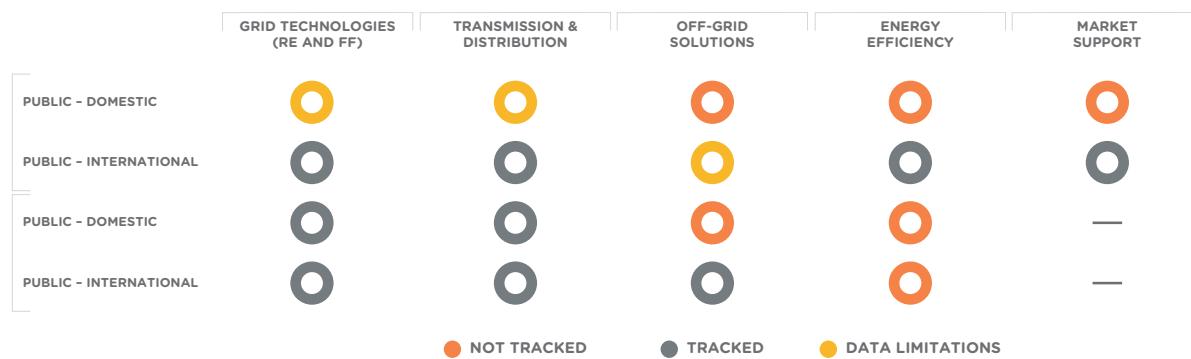
To address this issue, surveys were distributed to 20 philanthropic foundations and impact investors that actively finance off-grid electricity solutions and clean cooking activities in Africa and Asia.<sup>33</sup> Surveys were complemented with project-level data gathered from the websites and annual reports of other organizations, where available.

**Shine Campaign:** Complementing the surveys, this report has benefited substantially from a recent collaboration with the Shine Campaign, an investment campaign that brings together a community of philanthropic, development and faith-based partners to

<sup>33</sup> Of the surveyed companies, only five responded: Acumen, DOEN Foundation, IKEA, Rockefeller Foundation and Shell Foundation. Surveys were complemented with project level data from other organizations gathered from websites/annual reports, where available.

**Figure 2.15**

#### Electricity Finance Tracked in the Report



mobilize new forms of capital, scale resources, and generate momentum for achieving SDG7. As part of this collaborative effort, Shine has provided data on its members' financing for energy access activities.

**GOGLA**<sup>34</sup>: Since 2017, GOGLA has contributed information on the financial transactions of pico-solar and solar home system companies. This dataset provides information only on publicly disclosed deals, anonymizing any confidential information. As such, it represents a conservative view of overall financing activity for solar off-grid solutions.

**Domestic Public Finance:** Data tracking domestic public finance for energy access, mainly from national budget and expenditure systems, remain poor, and this is a limitation of this report. These data typically include federal and ministry-level expenditures (occurring within the national budget), transfers from national government to local government, to SOEs and to financial institutions, as well as the expenditures and investments of those entities (Falconer and Oliver, 2019). Collecting such information is challenging due to a lack of consistent methodologies and guidelines across countries, difficulty in distinguishing between different budget items (operational and investment), and insufficient institutional capacity at the country level.

**South-South Financing:** Significant uncertainty exists regarding projects solely financed with overseas capital from non-OECD countries (so called "South-South" financing), as these projects are not system-

atically tracked by official international systems like the OECD DAC Creditor Reporting System (CRS); they are only tracked by countries that report development assistance voluntarily to the OECD CRS. Partial information on South-South finance is available from Bloomberg New Energy Finance (BNEF), IJ Global, and Boston University's 'China's Global Energy Finance' and is reflected in the analysis.

**Detailed Information on Private-Sector Transactions:** International and domestic private sector investment for grid-connected generation, transmission, and distribution are well covered through various data sources, including BNEF and IJ Global. However, these transactions are usually confidential and detailed information on debt and equity provider, split of investment by debt and equity amongst different lenders, total investment amount, and other transaction details is often lacking.

**Granular Information from Public Data Sources:** Detailed information on international development cooperation is available from the OECD DAC CRS. However, the database, in its current form, is unable to adequately capture the exact financing for energy access between technologies, particularly in the areas of decentralized electricity and clean cooking solutions.

For instance, the Electric Power Transmission and Distribution classification contains very large transmission projects, but also vil-

<sup>34</sup> GOGLA, established in 2012, is the leading association of the off-grid solar energy industry – representing over 135 members globally. GOGLA has been aggregating data on product sales, consumer impact, and investment trends from its member companies since 2014.

large-scale isolated mini-grids. Isolated mini-grids are often also reported under other codes, such as hydro or solar, depending on the energy source powering the infrastructure. Similarly, in clean cooking, Energy Conservation and Demand-Side Efficiency includes a wide variety of activities in industries from metering to air conditioning to efficient stoves. The manufacturing of clean cook-stoves, biogas production, and the refurbishment of industrial complexes are different activities that should be more carefully categorized.

SEforALL and CPI have been collaborating with the OECD Secretariat since 2017, proposing amendments to the CRS sector classification to improve the tracking of development co-operation activities in support of SDG7. Approval of these amendments to the codes has been presented to the Working Party of Development Finance Sta-

tistics of the OECD-DAC and, if approved, they are expected to enter into force in 2020 (personal communication with OECD, May 2019).

**Private-Sector Investment in Energy Efficiency and Diesel Generators:** This report attempts to track energy efficiency investment in the private sector, but there are significant data gaps that are difficult to overcome. Filling these gaps would entail tracking finance directed toward specific activities or components within a project-level investment, such as the installation of more efficient lighting in buildings (CPI, 2018). Such approaches are often resource-intensive and may lack the required level of detail. Also, limited data on private-sector expenditures for diesel generators, used in areas with grid limitations, make it inherently difficult to quantify the finance committed to the sector.





CHAPTER

3

## ACCESS TO FINANCE FOR ELECTRICITY IN UGANDA



## COUNTRY CONTEXT

Uganda is a land-locked country in East-Central Africa with a population of about 38 million as of 2018. By the end of 2018, 38 percent of households in Uganda had Tier 1 level access to electricity, the minimum level to be considered to have access to electricity or clean cooking per the MTF (*Taking the Pulse*, 2019). With almost 26 million people lacking

access to electricity, Uganda has ambitious targets to improve electricity access, including an aim to reach 98 percent access by 2030 (MEMD, 2015), and to achieve 2500-megawatts of total generation capacity by 2020<sup>35</sup>, mainly through hydro-pow-

<sup>35</sup> As of May 2019, total installed capacity amounted to 1,182 MW (Source: Electricity Regulatory Authority).

er and geothermal development (Government of Uganda, 2015).

The Government of Uganda engaged with SEforALL in 2012, and subsequently developed an Action Agenda, a SEforALL Secretariat within the Ugandan Ministry of Energy and Mineral Development, and a task force<sup>36</sup> to guide implementation of the Action Agenda. The Action Agenda – developed and approved to be implemented by the task force – proposes a focus on off-grid solutions, including solar home systems and distributed mini- and micro-grids focused on increasing agriculture, water supply and mobile telecommunications capacity in rural areas.

The government also developed Uganda Vision 2040, a wide-ranging national development plan, which conveys goals to improve access and availability of electricity through new transmission line construction, to accelerate rural electrification programs,

and to increase government incentives in order to lower costs associated with electricity infrastructure, facilities, and equipment. Uganda Vision 2040 indicates an aim to develop Uganda's hydropower sector, which at present accounts for 68 percent of total installed generation capacity in the country (USAID, 2018).

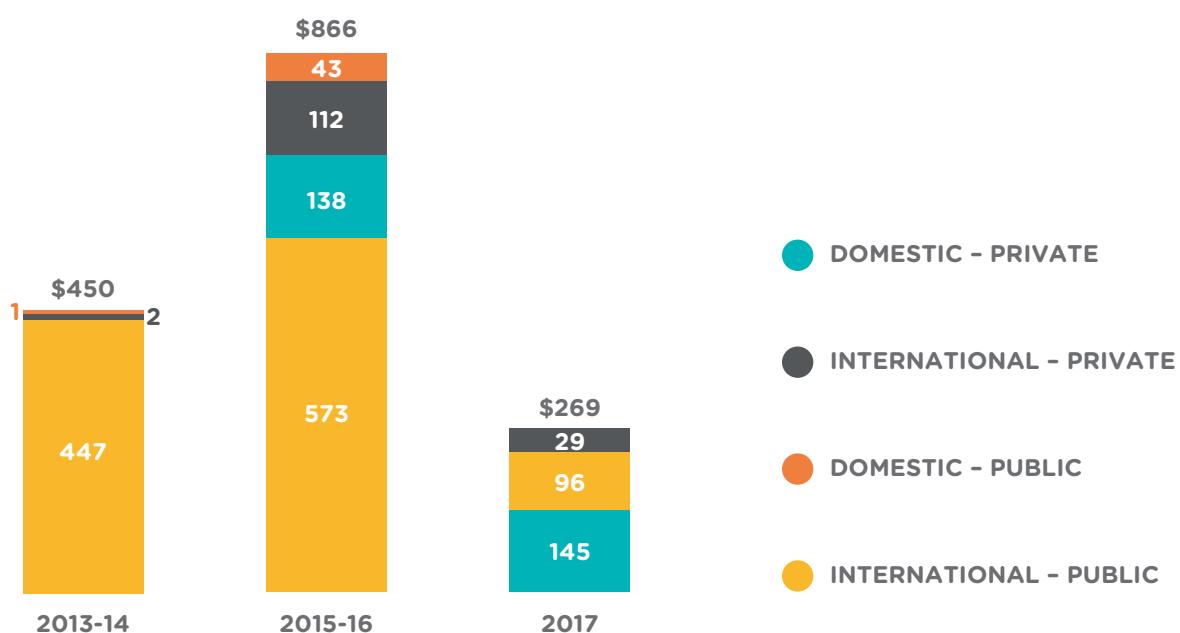
Uganda has several other government-led initiatives to improve electricity access, including the Uganda Rural Electrification Agency and the Uganda Energy Credit and Capitalization Company:

- **The Uganda Rural Electrification Agency (REA)** was established in 2001 to drive progress in on- and off-grid connections to electricity through private sector engagement. REA is funded by a variety of partners including the World Bank, the Swedish International Development Agency, the Japanese International Cooperation Agency, the Norwegian Agency for Development, the Islamic Development Bank, and the Saudi Fund for Development.

<sup>36</sup> The task force includes an European Union delegation, UNDP, KfW, and the Ugandan Ministry of Energy and Mineral Development.

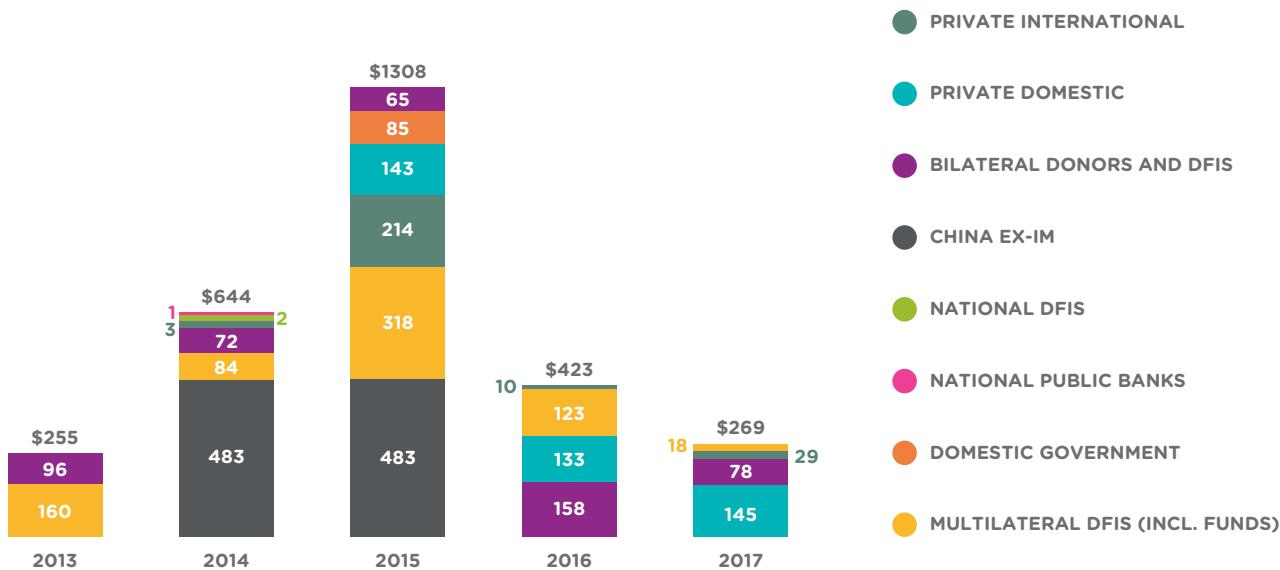
**Figure 3.1**

Sources of Finance for Electricity in Uganda, 2013-2017 (USD Million)



**Figure 3.2**

Sources of Finance for Electricity in Uganda, Highlighting China Ex-Im and Other Public Sources, 2013-2017 (USD Million)



**Note:** some finance from National DFIs and national public banks was also tracked in 2014, but not represented in the chart because it was a negligible portion of total finance (cumulatively, USD 3 million in 2014 only).

- **The Uganda Energy Credit Capitalisation Company (UECCC)** was established in 2009 to coordinate renewable energy infrastructure funding from the Ugandan government, the private sector, and development partners and to promote private sector participation in renewable energy development (UECCC, 2017). The UECCC's products and services include solar refinancing, a power connection loan facility, technical assistance for independent power producers, a working capital facility, partial risk guarantees for solar companies, and a biomass refinance facility.

## FINANCING AND POLICY LANDSCAPE

In 2017, USD 269 million was invested in Uganda for electricity projects and energy sector development, marking a decrease from the prior four-year period (Figure 3.1), when averages of USD 450 million and USD 866 million per year were captured in 2013-14 and 2015-16 respectively.

While investment from the Ugandan domestic private sector reached an all-time high of USD 145 million

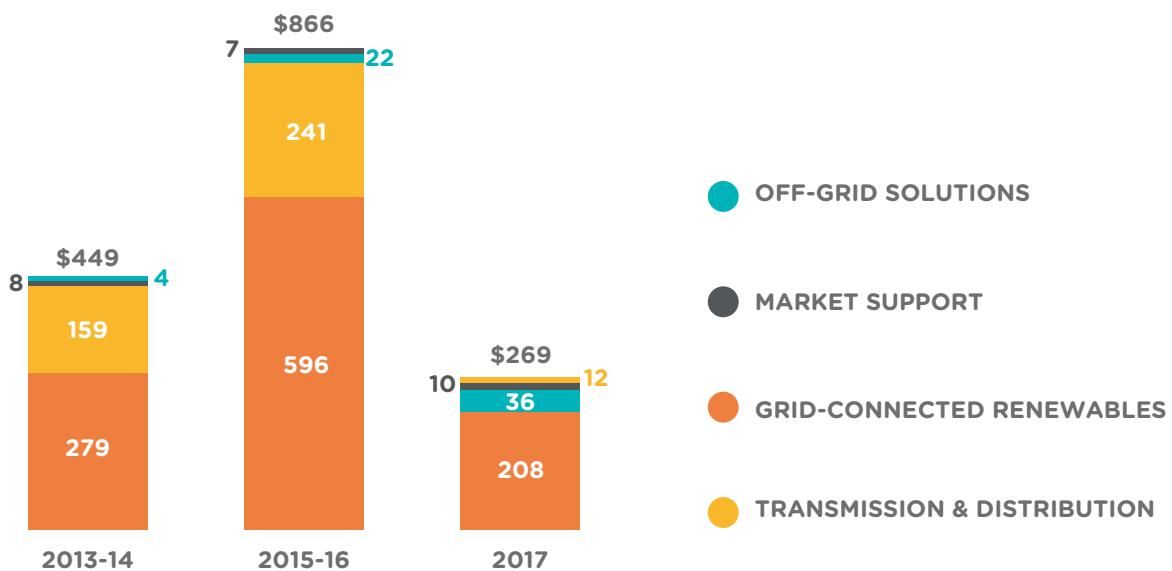
in 2017, largely driven by the growing local off-grid solar market, international public and private finance flows decreased substantially in 2017 compared to the previous four years. This decline is largely attributable to lower finance flows from international public sources and a lack of large-scale grid-connected and transmission projects in 2017. The Chinese Export Import Bank issued a USD 482 million concessional loan in 2015 for construction of the 183 MW Isimba Hydropower Plant<sup>37</sup> in central Uganda (Xinhua, 2019), which alone accounted for 37 percent of total finance tracked in Uganda in 2015. The lack of any similar large-scale international public finance in 2017 differentiates it from the 2013-16 period.

Investment in the off-grid stand-alone solar market has shown a steady increase since 2013, (Figure 3.3), in alignment with the emphasis on these technologies in the Action Agenda, Uganda Vision 2040, the mission of REA and the overall solar sector

<sup>37</sup> The Isimba hydropower project was commissioned on the Nile River in March 2019 (Ingram, 2019).

**Figure 3.3**

Finance for Electricity in Uganda by Technology Type, 2013-2017 (USD Million)<sup>38</sup>



expansion in Eastern Africa. Increased investment in mini-grid and off-grid solutions reflects a growing understanding in Uganda that such technologies represent a critical element of the expansion of electricity access, especially to last-mile communities.

An analysis of solar home systems and units sold in the private sector in Uganda indicates that all operators assessed are PAYG enabled, that operators have a wide range of system availability, and that the market has a high capacity for growth (UOMA, 2019). Solar home systems are a vital element of achieving universal energy access by 2030. *Taking the Pulse* 2019 estimates that stand-alone solar will need to reach 52 percent of Ugandan households by 2030 (with on-grid and mini-grids reaching the remainder) for Uganda to achieve SDG7 by 2030.

While off-grid investment increased in 2017 as compared to the prior four-year period, distribution and transmission investment declined dramatically, from USD 241 million on average annually in 2015 and 2016 to USD 12 million in 2017. On-grid solutions

play a key role in electricity access expansion, particularly due to Uganda's plentiful hydropower resources.

On-grid access expansion is currently supported by organizations including the World Bank, the Ugandan Ministry of Energy and Mineral Development, and REA. The World Bank funded Energy for Rural Transformation Programme III has a core scope focused on grid expansion and is being implemented by REA and the Ministry. REA is implementing a project to subsidize household electricity connections after independent verification of installation of a working connection and proof of use of service through billing records (REA, 2019). Continued investment in distribution and transmission is critical in order to have outlets for planned generation, so a decline in investment in this sector could pose significant challenges for on-grid electricity supply.

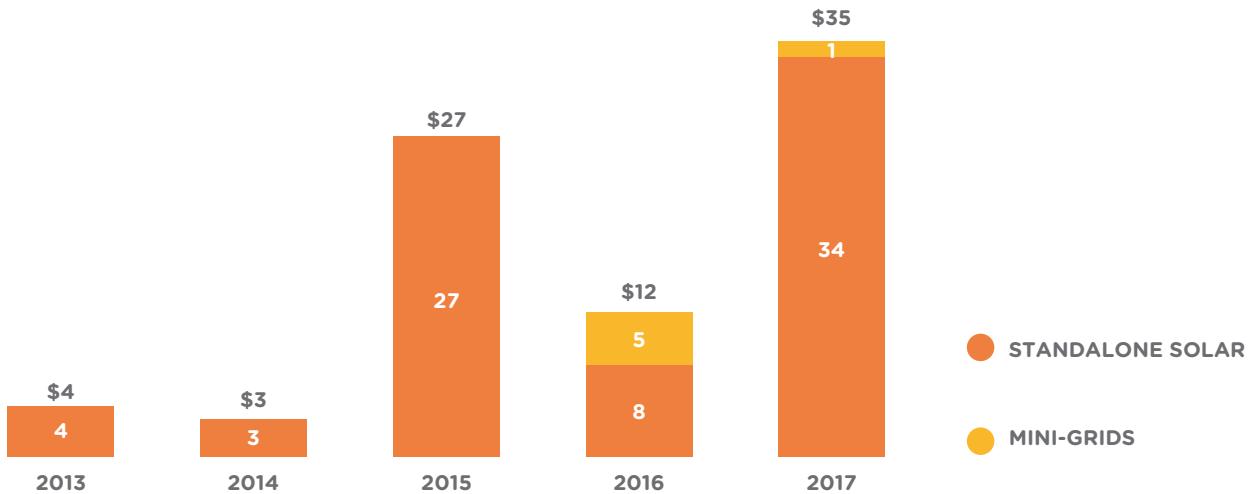
## KEY CHALLENGES

As is the case across HICs, a range of financial and social barriers exist that limit electricity access in Uganda. For on-grid electricity access solutions, barriers are related to reliability of the grid, limitation of capital to achieve scale, and declines in international investment.

<sup>38</sup> Finance towards energy efficiency and mini-grids is included in this analysis but not represented here because it was a negligible portion of total finance.

**Figure 3.4**

Finance for Off-Grid Solutions in Uganda, 2013-2017 (USD Million)



Additional information on each of these barriers follows:

1. **Systematic grid load shedding and unreliability affect energy consumers across sub-Saharan Africa.** In Uganda, as across the region, these challenges lead to a mistrust of grid reliability. Over 30 percent of Ugandan respondents to a survey on grid connectivity said that the grid as a source of energy was “extremely unreliable” or “not so reliable” (Enclude, 2014).
2. **Limitations exist in mobilizing enough capital to scale up energy value chain businesses.** In the private sector, entrepreneurs struggle to raise necessary capital to grow electrification businesses, particularly due to investor perception of risks associated with investing in small emerging-technology businesses and barriers to accessing international markets.
3. **A significant decline occurred in transmission and distribution investment in 2017.** This decline in investment intersects with the possibility of an oversupply of electricity and existing agreements where the country will have to pay for the electricity even if distribution or demand is not enough. This would lead to higher costs per kW of electricity and have a deteriorative impact on the sustainability of the sector (World Bank, 2019).

There is also an array of barriers that affect finance towards off-grid solutions, primarily centered on poverty and a significant population of displaced people, low affordability, and skepticism regarding quality of products. Six key barriers to delivering off-grid solutions are:

1. **High rates of poverty, especially in off-grid rural regions and in refugee communities.** In Uganda, almost 30 percent of households live below the poverty line, including 34 percent in rural areas and 11 percent in urban areas (MEMD, 2015). High poverty levels contribute to repayment capacity barriers, limited consumer awareness of available energy access products, and restricted negotiating capacity to improve consumer protections.
2. **Uganda has a refugee population of more than 1.3 million people who face unique energy access challenges.** Uganda hosts the largest refugee population of any country in Africa and the third largest in the world (World Bank, 2017). Uganda has relatively progressive refugee laws – refugees are able to work and access social services and have freedom of movement yet despite these factors, refugees face energy access barriers related to high rates of poverty, limited access to credit, and language barriers.

**3. There is relatively low willingness to pay for electricity access solutions compared to the price point of these solutions.** There is a relatively high level of access to mobile money in Uganda; 43 percent of the population has access to mobile money and 26 percent of the population currently uses it (Scott, 2016). Despite this access, a willingness-to-pay analysis found that Ugandan customers are only willing to pay an average of USD 2.50 per month for energy. In high-poverty Northern Uganda, this value is even lower at just USD 1.04 per month<sup>39</sup>. Based on the price point of the lowest PAYG solar home system at present, the market penetration given those willingness-to-pay averages would be just 15 percent (UOMA, 2019).

**4. There is an inconsistent application of VAT and tariff policy.** Solar products and mini-grids are VAT and tariff exempted, but product parts and spare parts are charged tariffs, so establishing an enterprise to assemble and then distribute products within Uganda is difficult (OCA, 2018).

**5. Low consumer awareness of and trust in decentralized electricity access solutions.** Less than 50 percent of rural Ugandans surveyed reported knowing where to buy an off-grid solar product and those that are aware of off-grid products often mistrust the quality of these products (ODI, GOGLA, Practical Action, Solar Aid, 2016).

**6. Lack of consumer protection.** One source estimated that 60 percent of portable solar lanterns in Uganda are low quality, only 15 percent of retailers offer warranties for off-grid products, and only 6 percent offer after sale services including maintenance and training<sup>40</sup> (ODI, GOGLA, Practical Action, Solar Aid, 2016). Current willingness to pay may be influenced by low trust in quality of products sold.

## PATHWAYS TO INCREASE ACCESS

Despite significant ambition on the part of the Ugandan government, and considerable promise for electricity access growth due to government commitments, relatively widespread access to mobile money, and a diverse range of private sector actors engaged in the space, there is more progress to be made to scale up electricity access in Uganda. Increased investment is needed in stand-alone solar home systems, mini-grid technologies, and in transmission and distribution construction to expand on-grid access in accessible regions.

*Taking the Pulse 2019* projects that in an SDG7 scenario, grid access will reach approximately 47 percent of households, stand-alone solar 52 percent, and mini-grids less than 1 percent. In this scenario, stand-alone solar would require cumulative financing of USD 1.5 billion, in addition to affordability gap financing of USD 330 million. Mini-grids would require USD 50 million of financing.

As shown in Figure 3.5, the total estimated financing need towards stand-alone solar is USD 166 million annually between 2019 and 2030, compared to the USD 33.7 million in finance that flowed to solar home systems in 2017. Total mini-grid financing required by 2030 as estimated in the report is USD 51 million, or USD 4.6 million annually, compared with USD 1.4 million in mini-grid finance that flowed to Uganda in 2017. Achieving universal electricity access by 2030 will require considerable commitment from the Ugandan government, public international partners, and the private sector.

In order to improve the efficacy of electricity finance, four components of change driven by government policy and shifts to the regulatory environment are recommended:

- Structure credit that could allow additional customers to take on loans in structures including lay-away payments with trusted community groups to finance both off-grid solutions and grid connectivity and utility payment when applicable.

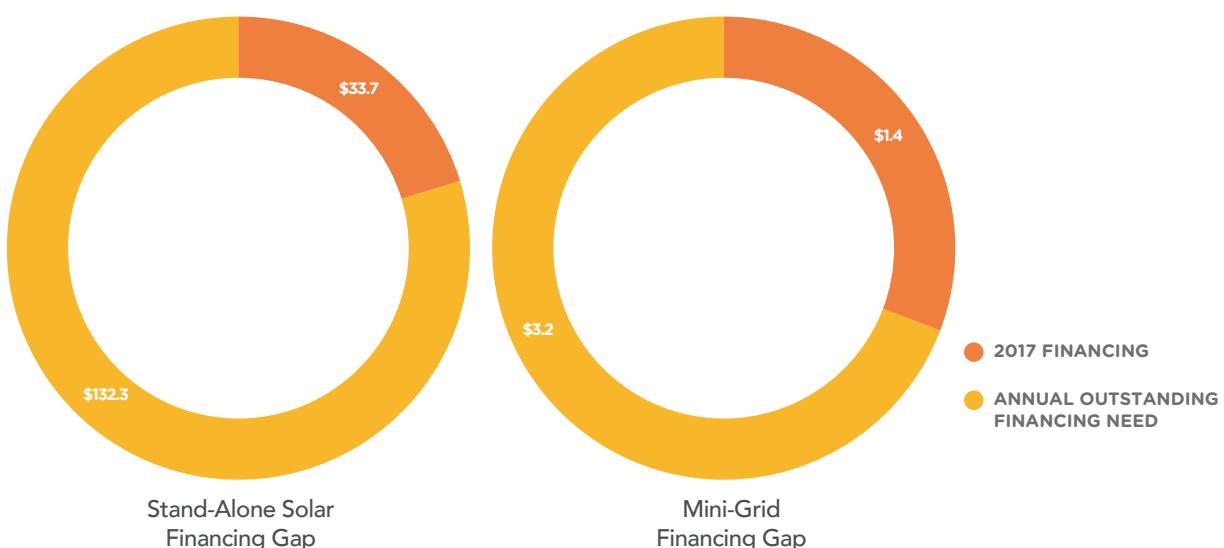
<sup>39</sup> Adjusted annual net national income per capita is USD 427.9 or USD 35.7/month, so a willingness-to-pay USD 2.50/month represents 7 percent of monthly income (World Bank DataBank, 2019).

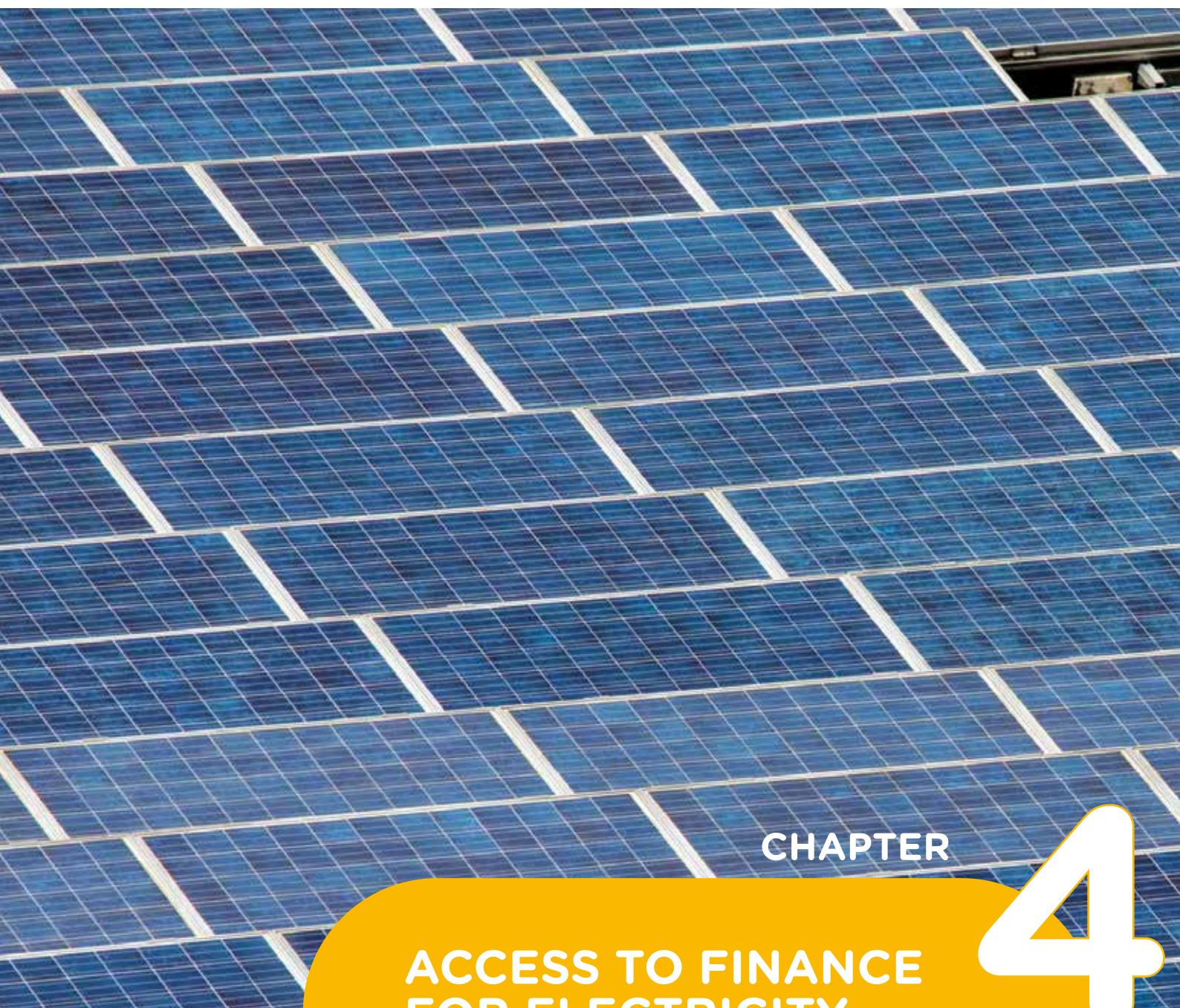
<sup>40</sup> The market has expanded rapidly in recent years, so the current figure may be higher in 2019 than when this analysis was completed in 2016.

- Support an enabling environment for microfinance and rural financing bodies to drive increased access to finance while maintaining financial stability and consumer protection.
  - Promote PAYG solutions and explore reduction of government taxation on mobile money transactions to allow the solution to reach full potential and drive increased uptake by retailers and financial institutions.
  - Ensure that the VAT and tariff regime in Uganda is incentivizing solar product and mini-grid assembly.
  - Evaluate additional funding to UECCC, which could enhance the power connection loan facility, technical assistance for power producers, the working capital facility, and risk guarantees for solar companies to drive both grid connectivity and off-grid solutions.
- To further improve electricity access finance in Uganda, the following recommendations aim to drive private sector engagement in solutions:
- Establish additional downstream finance, in particular trade finance and working capital, to help ensure that retailers can pay for sufficient stocks of solar home systems and mini-grid components to drive demand and meet distribution needs.
  - Continue to drive the mini-grid policy framework to guide the regulatory treatment of mini-grids, establish best practices for mini-grid technical requirements, and develop business models for connection to the national grid (UOMA, 2019).
  - Increase familiarity among banks with PAYG payment mechanisms and the use of cases of the business model which could increase use of mobile payments in electricity access financing and facilitate off-grid and mini-grid solutions when the cost of upfront systems is prohibitive for many customers.
  - Improve quality testing of private sector solutions to Lighting Global Quality Standards across elements of advertising, durability, and commitment to warranty to increase consumer confidence in electricity access products in the market and shift willingness-to-pay for such products.

**Figure 3.5**

Annual Financing Gaps for Stand-Alone Solar and Mini-Grid Solutions in Uganda (USD Million)





CHAPTER

4

**ACCESS TO FINANCE  
FOR ELECTRICITY  
IN THE PHILIPPINES**



## COUNTRY CONTEXT

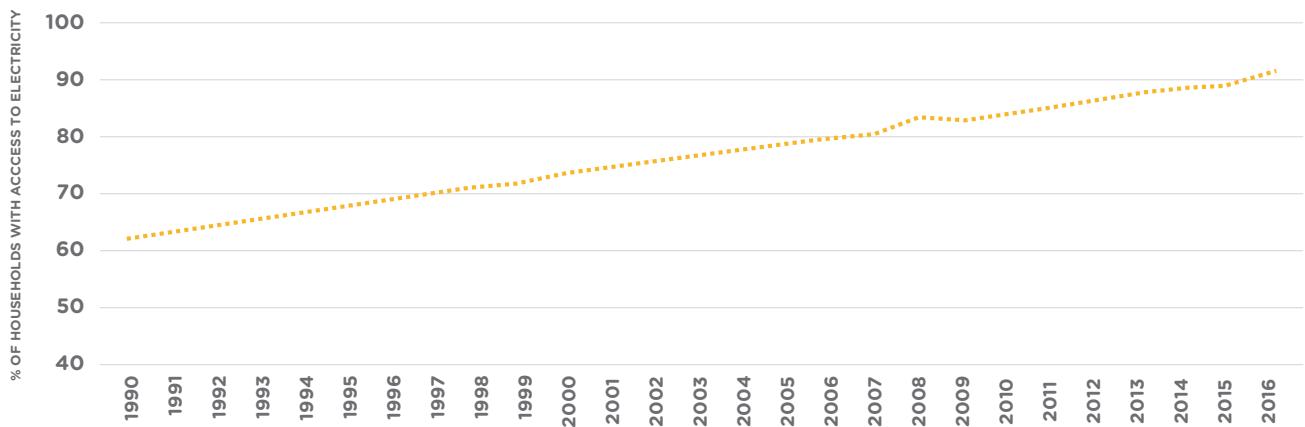
The archipelagic country of the Philippines consists of over 7,600 islands with a population of about 107 million people as of 2018. The island nation is one of the fastest-growing economies in Southeast Asia and is the third largest economy in the region after Indonesia and Thailand.

Despite 6 percent annual economic growth over the past five years, the country is still only ranked 94th globally for “quality of electricity supply” and 98th for “electrification rate” (WB, 2017).

The Philippines can be divided into two regions – the “high electrified regions” with an electrification

**Figure 4.1**

### Access to Electricity in the Philippines



rate above the national average of 90 percent (the island grouping of Luzon and Visayas) and the “low electrified region” with an average of 74 percent electrification (the islands of Mindanao). The Government of the Philippines has set an ambitious target of achieving 100 percent electrification by 2020 under its 2016 – 2030 energy plan (DOE 2016).

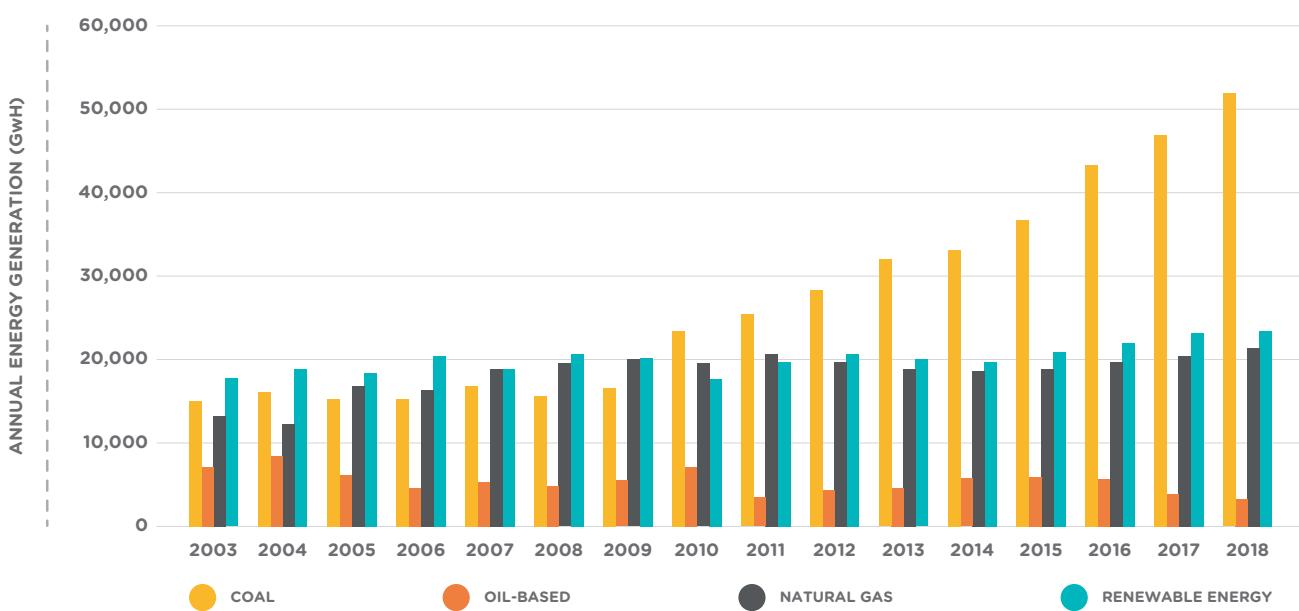
76 percent of the electricity generated in the Philippines in 2018 came from fossil fuels: 52 percent

from coal, 21 percent from natural gas, and 3 percent from oil. Coal fired generation has more than tripled since 2003, with almost 5MW of new coal projects committed in 2019 alone (IEFA, 2019).

On the other hand, renewable energy generation has remained stagnant for the last 15 years, accounting for only 23 percent of the total energy supply mix, primarily driven by geothermal (10 percent) and hydroelectric (9 percent) energy.

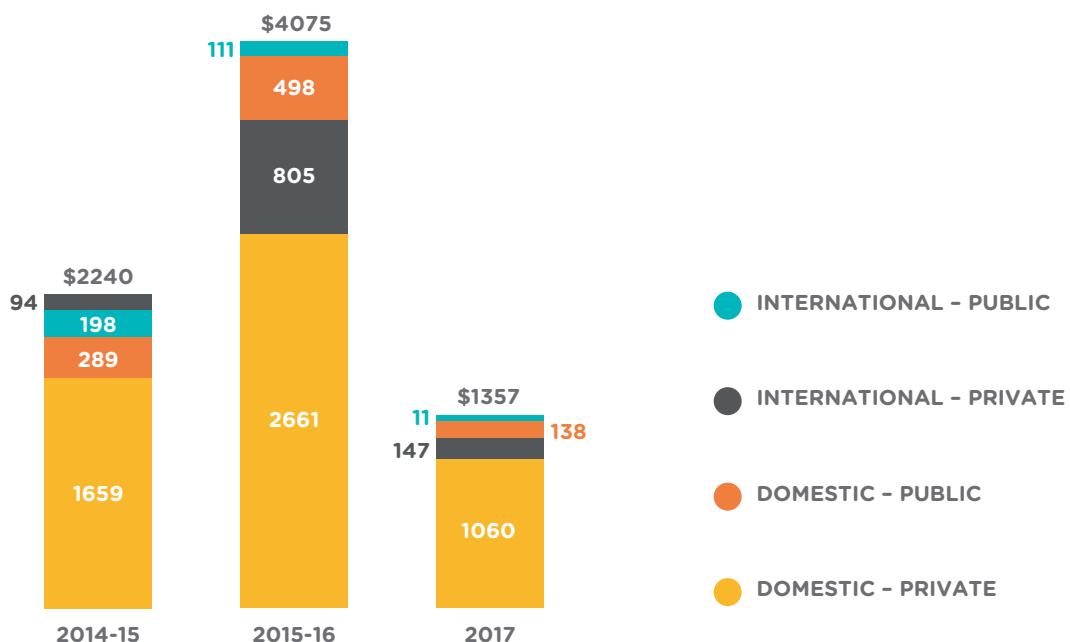
**Figure 4.2**

### Annual Electricity Generation from Different Sources (GWh)



**Figure 4.3**

Sources of Finance for Electricity in the Philippines, 2013-2017 (USD Million)



## FINANCING AND POLICY LANDSCAPE

Financing for electricity projects in Philippines has suffered a significant setback in 2017, falling from USD 4.1 billion in 2015-16 to USD 1.4 billion in 2017. This decrease in financing was seen across all sources of finance but especially from domestic actors and the private sector, which have previously been the main sources of finance for electricity projects (Figure 4.3). For instance, financing from domestic corporations, project developers and commercial banks fell by more than half to USD 1.1 billion compared to USD 2.4 billion in 2015-16.

Most of the finance tracked in the Philippines since 2013 has supported grid-connected, fossil fuel projects (see Fig. 4.4). But the Philippines' historically high dependence on fossil fuels witnessed a significant slowdown in 2017 as investments in coal plants declined by 60 percent – from USD 2.8 billion in 2015-16 to USD 1.1 billion in 2017. However, this was not accompanied by a corresponding increase in renewable energy investments, which also declined from USD 1.2 billion in 2015-16 to 0.2 billion in 2017. In particular, the market of utility-scale solar PV was thriving in 2015-16, with

more than USD 800 million per year tracked, largely from domestic private sector companies, became almost non-existent in 2017 (see figure 2.9).

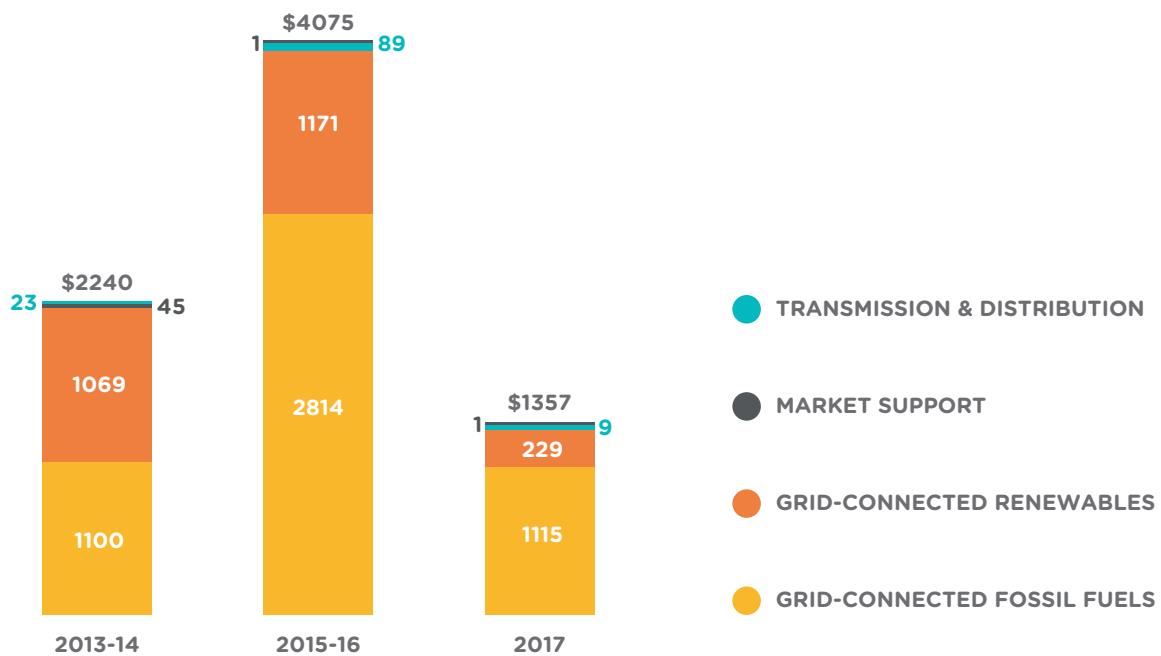
Further, existing grid infrastructure failed to reach populations of the smaller and more remote islands, offering a window of opportunity for off-grid solar solutions. But investment in off-grid solutions has also remained lackluster, with USD 3 million in stand-alone home systems and no investment tracked for mini-grids in 2017.

Several programs and policies from the Department of Energy (DOE) were instrumental in increasing electricity access from 60 percent to 90 percent in the regions of Luzon and Visayas over the 1990-2017 period, and focused primarily on five key areas:

**Phased extension of the grid:** Extension efforts started from the unelectrified barangays (a Filipino term for village or district) and expanded to the sitios (typically a rural location far from the center of the barangay).

**Figure 4.4**

Finance for Electricity in the Philippines by Technology Type, 2013-2017 (USD Million)



A negligible amount of finance for mini and off-grid solutions (~0.001%) was tracked, but it is not shown in the graph.

- Between 2011 and 2017, The Barangay Line Enhancement Program (BLEP) brought grid connection to around 900 barangays that were previously energized by unsustainable off-grid solutions such as diesel generators or solar home systems, at a total cost of USD 62 million (PHP 3.2 billion) (DOE, 2018).
- The Sitio Electrification Program helped to energize more than 32,600 sitios, corresponding to half a million consumers from 2011 to 2016 with a total project cost of USD 390 million (PHP 20 billion) (DOE, 2018).

**Electricity distribution to the remaining households:** After the successful extension of the grid to unserved areas, the DOE shifted its focus toward distribution to individual unelectrified households. The National Intensification of Household Electrification (NIHE) program promoted the installation of house wiring by providing grants and technical assistance to approximately 300,000 households (DOE, 2016b).

**Decentralized electricity generation:** In areas where grid extension was not feasible, the DOE introduced policies and programs to allow decentralized generation using diesel-based generators or small hydro. At the time of writing, the focus has moved to deploying off-grid solar solutions to electrify households.

An example of programming to address this priority is the Access to Sustainable Energy program (ASEP) which will run from 2016 to 2020 and cost USD 94 million (PHP 4.9 Billion). This aims to provide basic electricity services to poor and remote households through solar mainstreaming and deploying mini-grids using pre-paid meters, and has a target electrification rate of at least 100,000 households using solar home systems.

**Policy reforms:** Despite achieving only modest results in directly increasing renewable energy adoption, the Renewable Energy Policy Act of 2008 paved the way for the introduction of renewable energy technologies such as wind and solar, which in 2018 corresponded to 2 percent and 4 percent

of new annual installations respectively, growing from 0.2 percent cumulatively in 2013.

To support the commercialization of renewable energy technologies and the removal of market barriers, the USD 43 million program Development of Renewable Energy Applications Mainstreaming and Market Sustainability (DREAMS) was launched in 2016. Funded by the GEF, UNDP, DOE and other local public and private actors, DREAMS is comprised of three components: i) technical assistance to the DOE to implement sector reforms; ii) an investment fund supporting the Philippines' renewable energy programs; and iii) co-financing of innovative solutions and business models to promote electricity access in remote areas (GIZ, 2017).

**Private sector and foreign entities:** A number of reforms have been enacted to modernize the electricity sector and stimulate private sector participation. These include unbundling electricity monopolies (i.e. dividing generation, transmission and distribution services firms into separate entities) and creating electricity exchanges. In addition, the Qualified Third Party (QTP) scheme allows private sector electricity companies to service remote areas with mini-grids, wherever the franchised utility is unable to connect local households to the grid.

## KEY CHALLENGES

Despite the stated goal to increase electricity access to 100 percent by 2020, progress in certain regions (for example Mindanao, 26 percent unelectrified) remains insufficient. Several major barriers in these regions continue to frustrate progress toward full electrification:

**Geography and grid inaccessibility in the smaller islands:** As an archipelago of over 7,600 islands, the Philippines has not been able to service its smaller and more remote islands and populations through existing grid infrastructure.

**Affordability:** Because 21.6 percent of the population lives below the national poverty line, affect-

ing more than 35 percent in the Mindanao region (ADB, 2018a/b), and because the average cost of electricity in the region is amongst the highest in Asia, affordability is a crucial issue.

### Bureaucratic procedures and slow implementation:

Weak implementation and slow regulatory clearances for rooftop solar projects have discouraged companies and investors from entering the segment. For example, the application process for net metering connections can take up to nine months in some distribution areas. Further, the requirement for arguably unnecessary distribution studies<sup>41</sup>, adds time and cost to the connection process, rendering some projects unviable (IEEFA, 2018).

**Lack of financing options for solar rooftop:** Compared with other countries in the region, the Philippines' financial sector is less equipped to finance small, distributed rooftop solar projects. As banks in the Philippines tend to focus on larger projects (1-50 MW), homeowners have instead borrowed using high-interest home equity loans (backed by their real property as collateral) to finance the installation of solar home systems. However, the combination of minimum loan values is often too high relative to installation and system costs, and loan tenors are often too short, making these instruments inappropriate (IEEFA, 2018).

## PATHWAYS TO INCREASE ACCESS

**Bringing solar power to the more remote areas:** The Philippines relies heavily on imported and subsidized diesel for electricity generation. But distributed solar, with and without storage, has now reached parity with, or is even cheaper than, electricity from diesel gensets (IEEFA, 2019).

Adopting solar with storage/hybrid generation has the potential to provide reliable, sustainable and affordable electricity to remote areas. This requires

<sup>41</sup> A Distribution Impact Study (DIS) is required to assess impacts of systems up to 100 KWp being connected. A Distribution Asset Study (DAS) determines the distribution assets required and their associated costs to accommodate a net metering connection. Such studies can be replaced by predefined standards.

innovative financial products and associated capacity building, while refining and scaling successfully piloted mechanisms such as PAYG. Tailored debt products with longer tenors and lower interest rates may help cover upfront costs and sustain wider adoption of distributed solar.

**Phase out diesel subsidies:** Progressive hybridization of existing generation plants with renewable energy and the subsequent reduction of imported diesel could avoid USD 200 million per year in diesel subsidies (IEEFA, 2019).

**Islamic finance:** In some areas such as the Muslim majority region of Mindanao, Islamic finance can become an additional avenue for financing distributed solar products. One example of an Islamic investment modality that could be utilized is the *Al-Ijarah Muntahia Bittamleek*, a form of asset finance whereby a property is leased by a bank to its client and at the end of the lease period, the lessee becomes the property owner. This could be tested for the financing of standardized solar systems,

but there is currently only one bank<sup>42</sup> authorized to issue this product in the Philippines, although a pending senate bill may soon open Islamic financing opportunities to other banks (UNDP, 2019).

**Improved policy support:** The Philippines needs stronger policy support for distributed solar and hybrid systems. Introducing guidelines and standards for approving new installations and establishing a dedicated agency to fast-track approval processes could facilitate increased deployment.

**Adjust electricity tariffs:** The existing electricity tariff structure allows utilities to pass through the fluctuating costs of imported fossil fuels and foreign exchange rates directly to ratepayers. This creates an uneven playing field among competing energy providers and reduces risk for utilities, disincentivizing them from transitioning to cheaper renewable energy technologies (IEEFA, 2019).

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<sup>42</sup> Al-Amanah Islamic Bank, owned by the Development Bank of the Philippines.





**FINANCE FOR  
CLEAN COOKING  
ACCESS**

CHAPTER

5



**Finance for residential clean cooking access decreased to USD 32 million in 2017 – down 73 percent from the 2015-16 estimated annual average of USD 117 million<sup>43</sup>.** Considering the historically low levels of clean cooking finance, these decreases

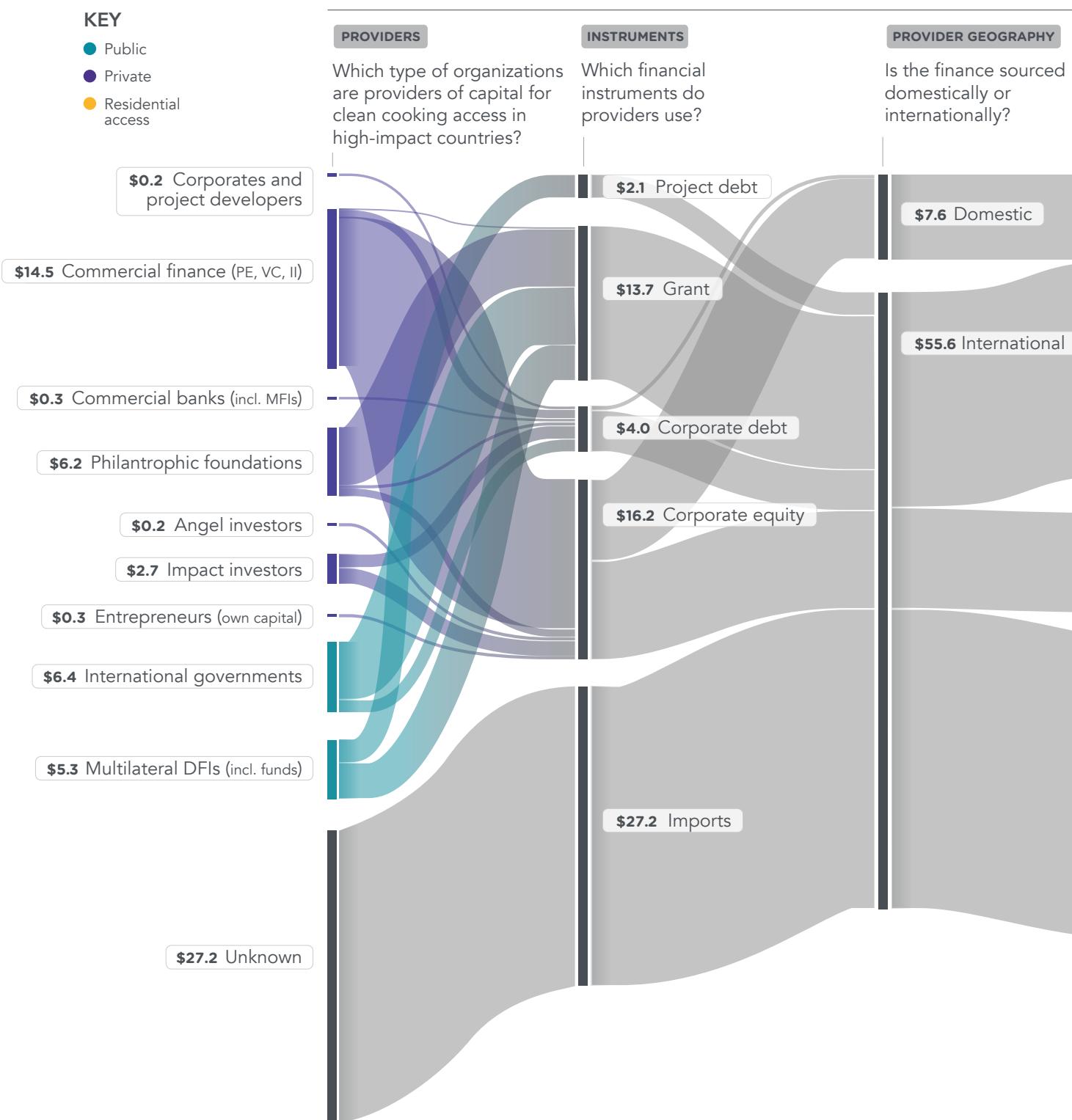
of approximately 24 percent and 73 percent from the annual average commitments tracked in 2013-14 (USD 42 million) and 2015-16 (USD 117 million) respectively are alarming.

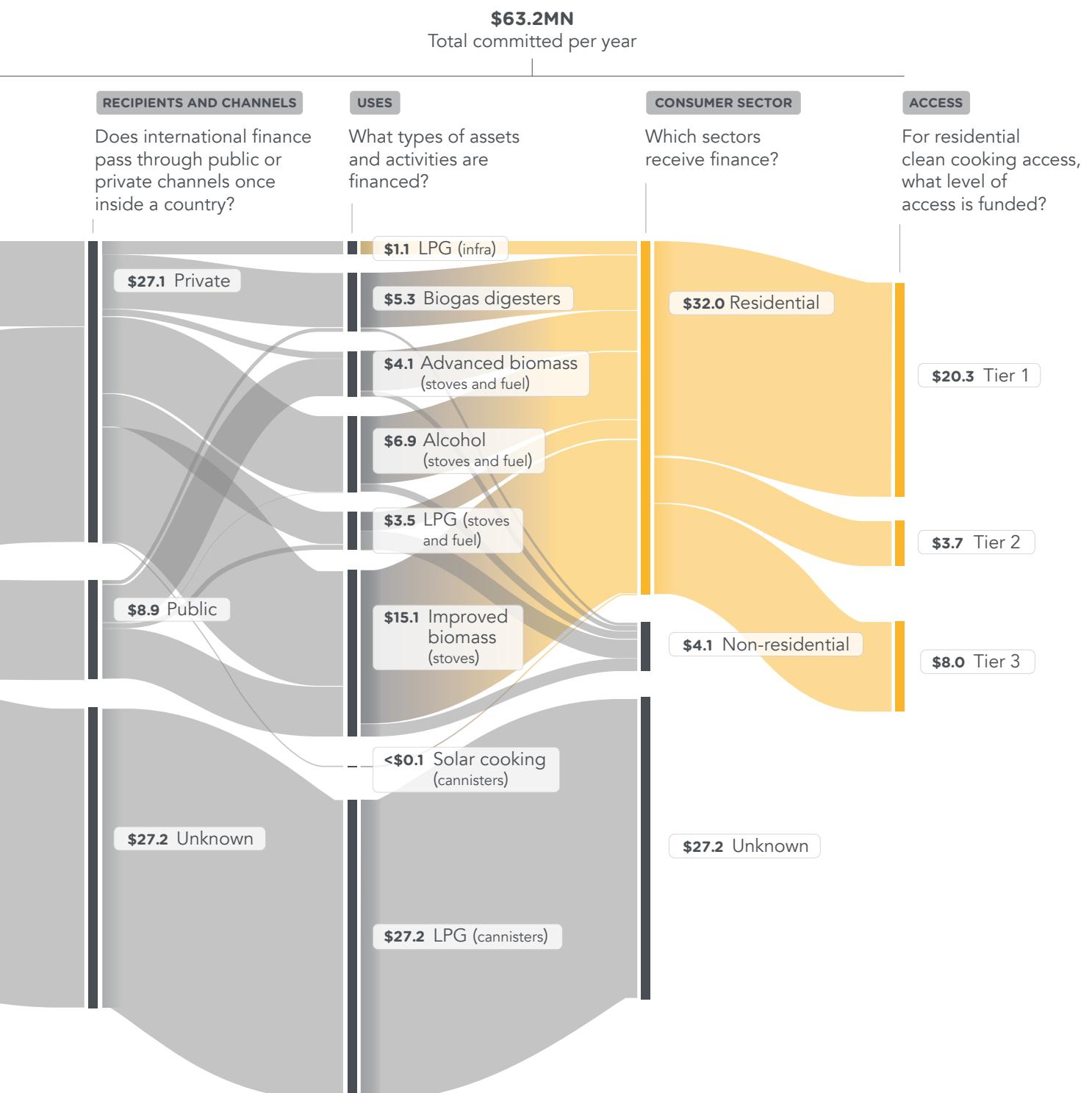
After several years of negligible financing efforts, the USD 4.4 billion in annual investment estimated in 2014 as required to achieve universal access to clean

<sup>43</sup> A welcome addition of clean cooking finance data provided by the World Bank Group allowed for an update of annual average figures for 2013-14 and 2015-16. As such, the annual average figures for the years 2013-2016 in this report differ from those previously published.

**Figure 5.1**

Finance for Clean Cooking Access in 2017  
Committed in 2017 in High-Impact Countries (USD Million)

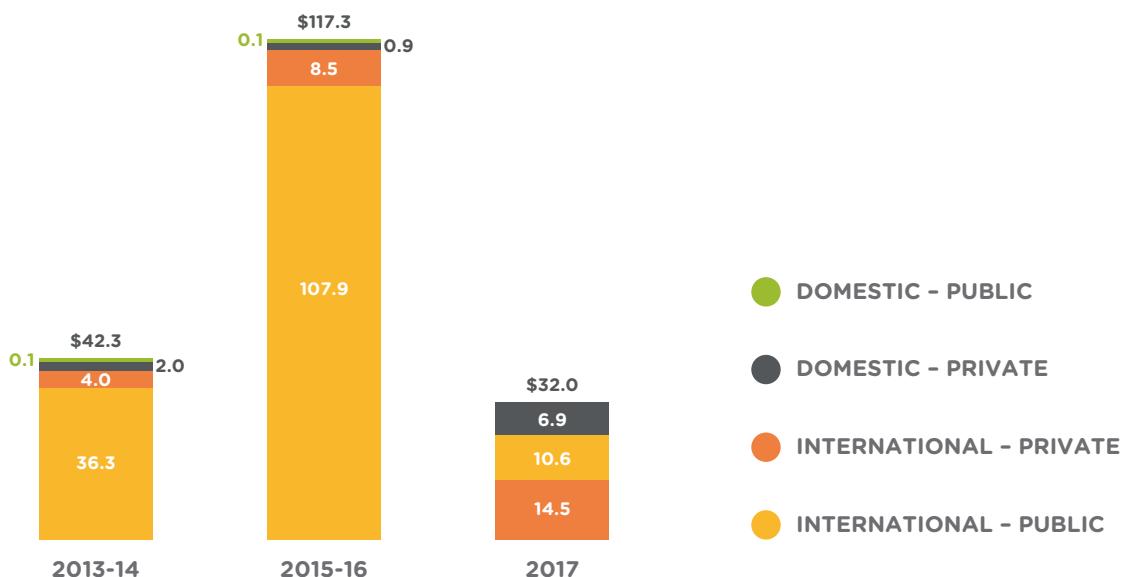




NB: Values may not add up due to rounding

**Figure 5.2**

Sources of Finance for Residential Clean Cooking (USD Million)



**Note:** Averages over 2013-2014 and 2015-2016 periods.

**FINANCE TRACKED  
FOR CLEAN COOKING  
SOLUTIONS IN THE  
20 HICS DECREASED  
FROM PRECEDING  
YEARS, REMAINING  
DRAMATICALLY BELOW  
ANNUAL INVESTMENT  
REQUIREMENTS TO  
DELIVER CLEAN COOKING  
SOLUTIONS TO 3 BILLION  
PEOPLE AND HINDERING  
THE INTERNATIONAL  
COMMUNITY'S CHANCES  
OF MEETING SDG7.**

cooking solutions worldwide by 2030 is now substantially higher and the level of financing tracked in the HICs demonstrates a continued and serious gap in financing for this important development sector.<sup>44</sup> These major shortfalls in annual finance intensify the urgency to expand funding for clean cooking as soon as possible.

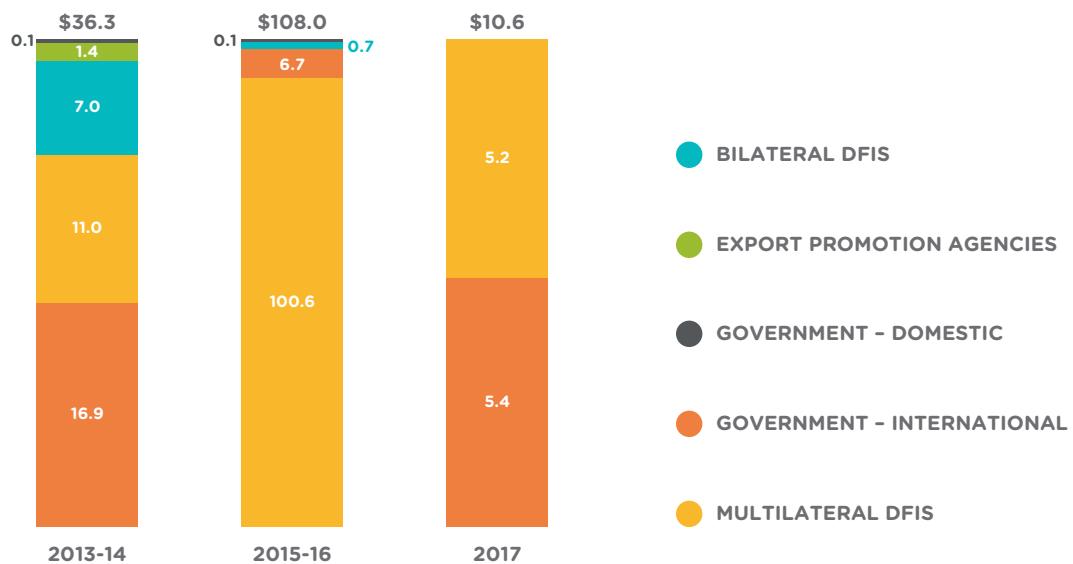
It is important to highlight **four methodological considerations** related to the figures reported in this year's analysis.

First, significant and recent work from the World Bank Group has provided new transaction data illuminating the Bank's commitments to clean cooking finance since 2010. This new compilation of data is warmly welcomed and has allowed for an **update of figures previously published for the 2013-14 and 2015-16 reporting periods**. As such, the historical figures referenced in this year's analysis differ from those published in previous editions of this

<sup>44</sup> See the *Understanding the Landscape 2017* report for a more detailed analysis of the varying estimates of investment needs for energy access.

**Figure 5.3**

### Public Finance Providers for Residential Clean Cooking



**Note:** Public finance provided by domestic governments was not included as it amounted to less than 1 percent for all years.

report. The addition of this new data has increased the annual averages of financing tracked for clean cooking in the previous periods, as follows:

- 2013-14: USD 42 million per year (up from the previously published USD 32 million).
- 2015-16: USD 117 million per year (up from the previously published USD 30 million).

Second, the tracking methodology has been modified to expand data coverage for commitments in LPG-based cooking solutions. This allowed the report to identify an additional USD 27 million of finance for LPG, potentially raising identified commitments to USD 59 million for the year. However, while this situation is portrayed visually in the opening summary diagram (Figure 5.1), this financing is excluded from the topline figure of USD 32 million and the rest of the chapter, due to limitations in data granularity (more details are provided in Box 5).

Third, a notable development in this year's analysis is the inclusion of carbon finance transactions for

certain clean cooking projects. For methodological reasons, carbon finance flows were not previously included. However, the transactions included in this year's analysis were part of publicly funded programs that provided a sufficient amount of detail to be included in the analysis (see Box 6 for a discussion of the role of carbon finance for clean cooking projects).

Fourth, the analysis of clean cooking finance continues to be challenged by data and methodological complexities. These limitations are indicated throughout the analysis, so as to ensure the integrity of insights from this year's report. More information is presented in Boxes 3-8.

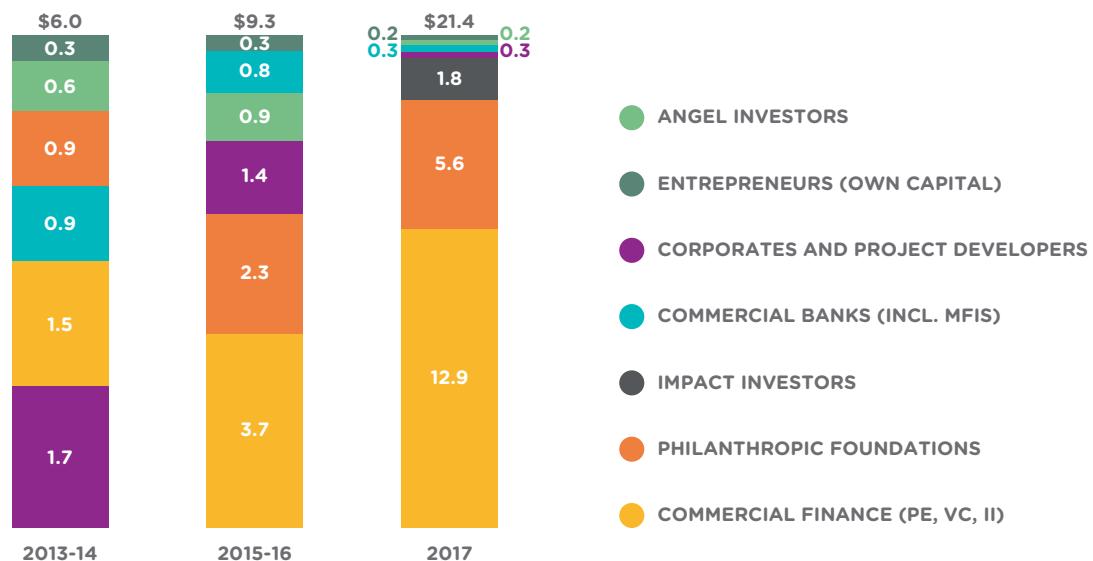
### PROVIDERS

**2017 was marked by a tremendous decline in international public finance, both in terms of quantum and proportion, reaching a new low of USD 10.6 million.**

It is alarming to observe this scale of a reduction in public finance, particularly within an energy access sector that presents multiple and intersectional benefits for global development, which

**Figure 5.4**

### Private Finance Providers for Residential Clean Cooking



relies on both concessional and catalytic funding, and for which the global community has been deepening its call for urgent action. Given the multiplicity of challenges that the clean cooking sector faces, and the potential value of public benefit that may be harnessed through its development, the key providers of public finance – including multilaterals, international donors, development agencies, and climate funds – must re-consider their clean cooking strategies.

**Multilateral finance in clean cooking decreased by nearly 100 percent, to approximately USD 5 million, as compared to an annual average of USD 101 million in 2015-16.** This decrease of USD 96 million was due to the existence of two large World Bank-financed projects in China's Hebei province: a USD 80 million commitment for the distribution of clean cookstoves as part of a wider air quality plan in 2015, and a USD 64 million commitment for the development of sustainable biogas production as part of a wider rural renewable energy project in 2016. Even excluding these two major transactions, a steep decrease in multilateral financing for clean cooking over the five years exists: from an average annual investment estimated at USD 11 million in 2013-14, to USD 29

million in 2015-16 (excluding the two investments in China), to just USD 5 million in 2017.

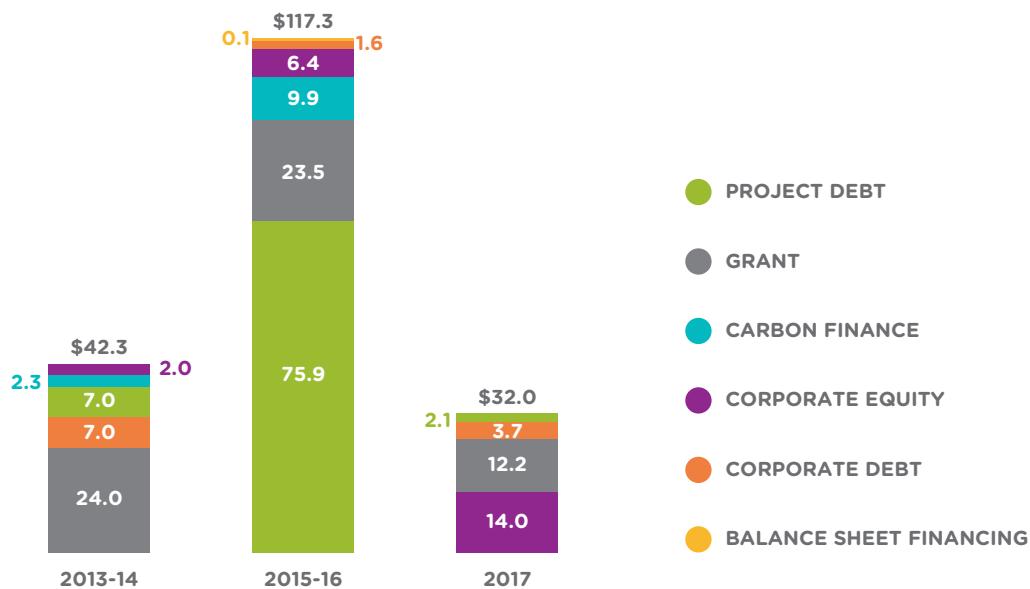
**Private finance<sup>45</sup> for clean cooking increased in 2017, accounting for 66 percent of all finance tracked, up from 14 percent in 2013-14 and 8 percent in 2015-16.** While an annual average of USD 6 million of private finance was tracked in 2013-14, 2017 saw approximately USD 21 million<sup>46</sup>. This was largely driven by an uptick in corporate equity investments, from levels of USD 2 million observed in 2013-14 and USD 6 million in 2015-16, to over USD 13 million in 2017. This trend indicates that, although public finance commitments decreased in 2017, impact-oriented private foundations and investors continue to demonstrate an appetite for clean cooking business models and technologies with high potential for scale, sustainability and impact.

<sup>45</sup> The Clean Cooking Alliance (CCA) tracked USD 40 million of investments into clean cooking companies in 2017 (Clean Cooking Alliance, 2019). This report only incorporates transactions benefiting companies operating in the 20 HICs, resulting in USD 22.5 million that was included in the analysis.

<sup>46</sup> The difference between this figure and the number tracked by the Clean Cooking Alliance's survey of 40 companies – an important source of data for this report – is due to the report's adjusting for HICs only.

**Figure 5.5**

Finance Instruments for Residential Clean Cooking (USD Million)



**Domestic private finance rose to 21 percent of all tracked commitments, compared with 5 percent and 1 percent of all commitments tracked in 2013-14 and 2015-16, respectively.** While the majority of private commitments (68 percent) in 2017 originated with international providers, funds sourced from domestic providers increased from annual averages of under USD 2 million in the previous periods, to USD 6.9 million in 2017. This increase was mostly driven by a domestic corporate equity investment in Kenya. As in other areas of the analysis, it is anticipated that domestic private investments in the marketplace have not been fully captured due to methodological and data limitations. These are addressed in both Box 5 on LPG tracking, and in Box 7 on domestic government-led initiatives.

**60 percent of total private finance committed was provided by commercial financiers, which includes private equity and venture capital firms, as well as other investors.** This is up from 25 percent of total private finance tracked in 2013-14. Interestingly, the share of total commitments provided by angel investors decreased from 10 percent in 2013-14 to 1 percent in 2017, while

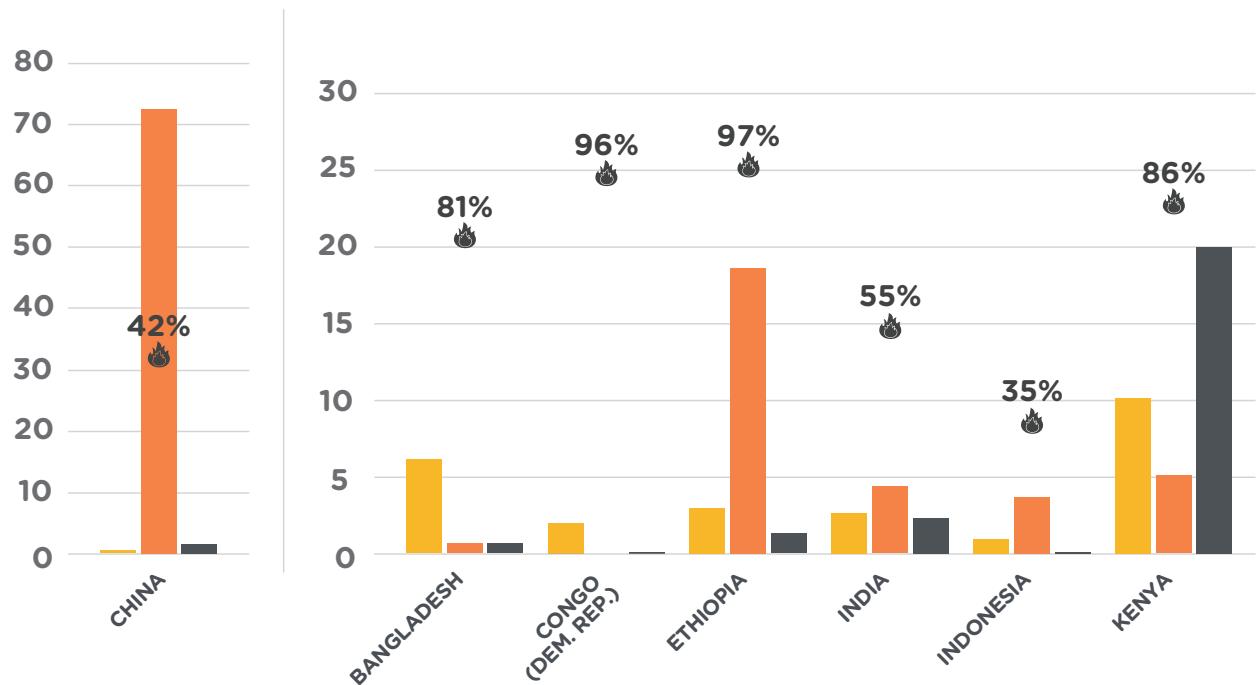
that provided by founders and entrepreneurs decreased from 5 percent to 1 percent over the same period. One explanation may be that there were fewer seed stage clean cooking startups founded in 2017, and thus angel and sweat equity investments decreased. Another may be that, given the increased participation of private equity and venture capital firms, larger rounds of later stage equity or growth capital investments reduced the proportion of finance provided by angel and founder investments.

## INSTRUMENTS

**The level of equity investments in clean cooking enterprises doubled.** Compared to previous years, financial commitments were more evenly distributed across instrument types, which include grants, corporate debt or equity, balance sheet financing, and concessional or non-concessional project debt. Private investment in the form of corporate equity doubled between the 2015-16 average and 2017, and was the largest contributor to finance in 2017, providing 44 percent of tracked commitments. While most private transactions were sized under USD 1 million, there were at least two equity in-

**Figure 5.6**

Recipients of Finance for Residential Clean Cooking (USD Million)



**Note:** Averages over 2013-14 and 2015-16 periods. No data were found in 2017 for Afghanistan, Korea DPR, Myanmar, Korea or Philippines.

vestments sized at more than USD 5 million, and at least two debt investments sized at more than USD 1 million.

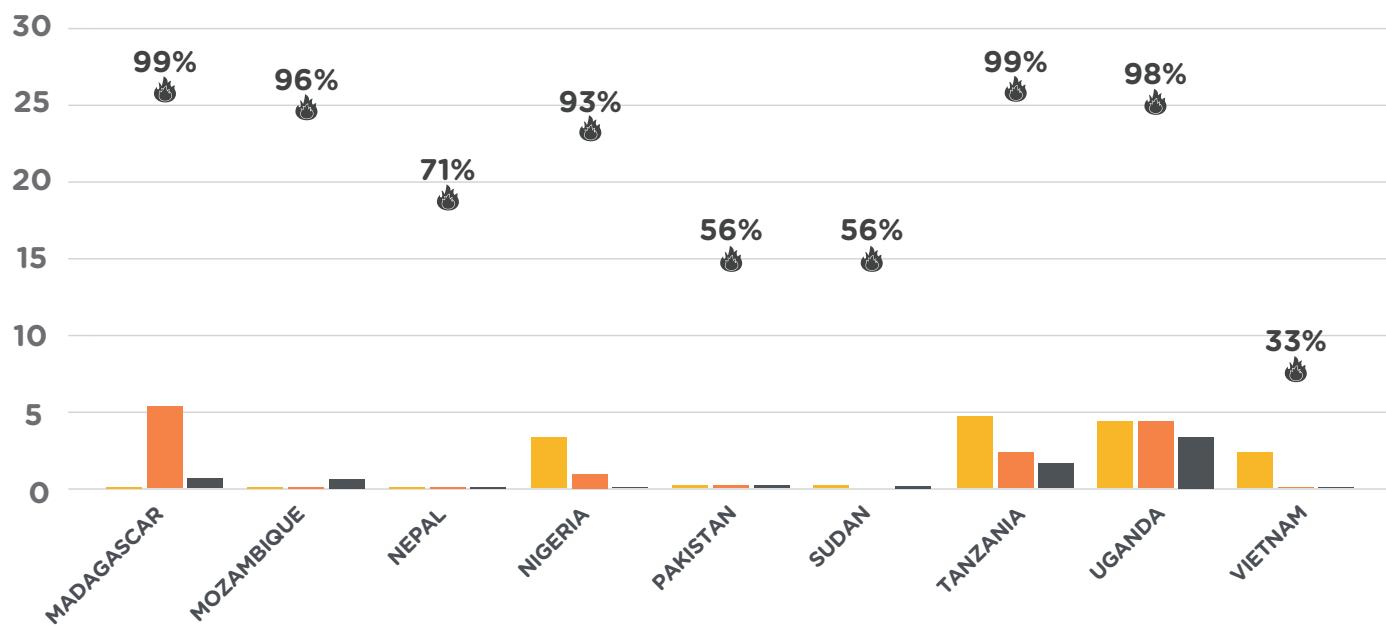
**Grants for clean cooking projects continue to diminish, continuing a trend first observed in 2015-16.** While a larger number of grants was tracked compared to other instrument types (71 grant transactions versus 12 for corporate equity), they were typically of much smaller size, averaging USD 0.17 million as opposed to USD 1.16 million for corporate equity. This suggests that, along with a decrease in public finance to the sector, there was also less appetite from philanthropic sources of funding to provide grants to clean cooking activities. While it is promising to see greater private investment in clean cooking, for a sector that clearly requires new approaches, technologies, and business models to be de-risked, the report would anticipate a much greater volume of grant-based innovation funding to be deployed.

## RECIPIENTS

**Sub-Saharan Africa received the majority of clean cooking finance in 2017, with Kenya receiving 63 percent of total commitments tracked.** The region received 86 percent of total finance tracked in 2017, up from 31 percent of total commitments during the 2015-16 period. Kenya's reputation as a destination for energy access impact investment in the region was upheld, as the country attracted over USD 20 million of the USD 32 million of clean cooking finance tracked in 2017. Other countries with more significant needs (i.e. with more than 90 percent of the population lacking access to clean fuels and technologies) received disproportionately limited financing. It is critical to note that domestic public financing programs, such as the large scale initiatives underway in India and Indonesia, were excluded from this analysis. The analysis thus underrepresents the depth of financing available within HICs that have prioritized and made government funding available for national transitions to clean cooking.

2013-14 2015-16 2017

🔥 % OF POPULATION WITHOUT ACCESS TO CLEAN FUELS AND TECHNOLOGIES FOR COOKING



At the country level, international financiers showed considerable interest in Kenya, as shown by a USD 2.7 million grant provided to a biomass briquettes project and a USD 2 million concessional loan from the World Bank to support the distribution and use of improved cookstoves (ICS) for displaced persons. Due to these and a handful of other USD 1 million transactions, 67 percent of the finance for Kenya in 2017 was committed by international actors. It is interesting to note, however, that the largest investment in the country, of USD 6.7 million, was provided by domestic investors.

**India and Indonesia, with approximately 700 million and 100 million people without access to clean cooking, respectively, received 7 percent (USD 2.2 million) and 0.3 percent (USD 0.09 million) of tracked financial commitments.** As this analysis excludes domestic government allocations for clean cooking, commitments tracked globally and especially in these two HICs, are dra-

matically underrepresented. In India, the PAHAL LPG subsidy scheme is the largest direct benefit transfer program in the world, having transferred nearly USD 10 billion of cash subsidies to over 175 million subscribers in India between 2013 and 2017 inclusive (Mittal, Mukherjee, and Gelb, 2017). Similarly, the Pradhan Mantri Ujjwala Yojna (PMUY) scheme was launched in 2016 with a domestic budget of over USD 1 billion allocated for providing free LPG connections to Below Poverty Line (BPL) households in India (Business Standard, 2017). Each of these schemes are outside of the scope of this analysis.

Similarly, as discussed in last year's edition of this report, the Government of Indonesia in 2007 initiated the largest household cooking energy transition initiative at the time. By 2015, it had subsidized over 57 million LPG starter kits at a reported total cost of over USD 1 billion (Thoday et. al., 2018). See Box 7 for more details about domestic government-led clean cooking

**Figure 5.7**

Finance for Residential Clean Cooking According to Asset Type



**Note 1:** LPG infrastructure and fuel are excluded in these percentages due to data gaps (see boxes 3 and 5). Assets that represent 3 percent or less of total finance are included as “Others”. The complete list of assets is: advanced biomass (stoves and fuel), alcohol (stoves and fuel), biogas digesters, electric (stoves), improved biomass (stoves), LPG stoves (and fuel), market support, natural gas (infra), and solar cooking (stoves).

**Note 2:** It should be noted that many of the clean cooking transactions tracked include a market support component, such as but not limited to: research and development of the technology, development of the supply and distribution chains of stoves and fuel, and assistance to local entrepreneurs. While these are important elements that seek to improve the enabling environment of these technologies, the report is limited in granularity of reported data. Its analysis tries – when possible – to identify these market support activities specifically; otherwise, these activities are classified according to technology type.

initiatives and the *Understanding the Landscape 2018* report for a more comprehensive analysis of Indonesia’s clean cooking experience.

### SECTORS AND USES

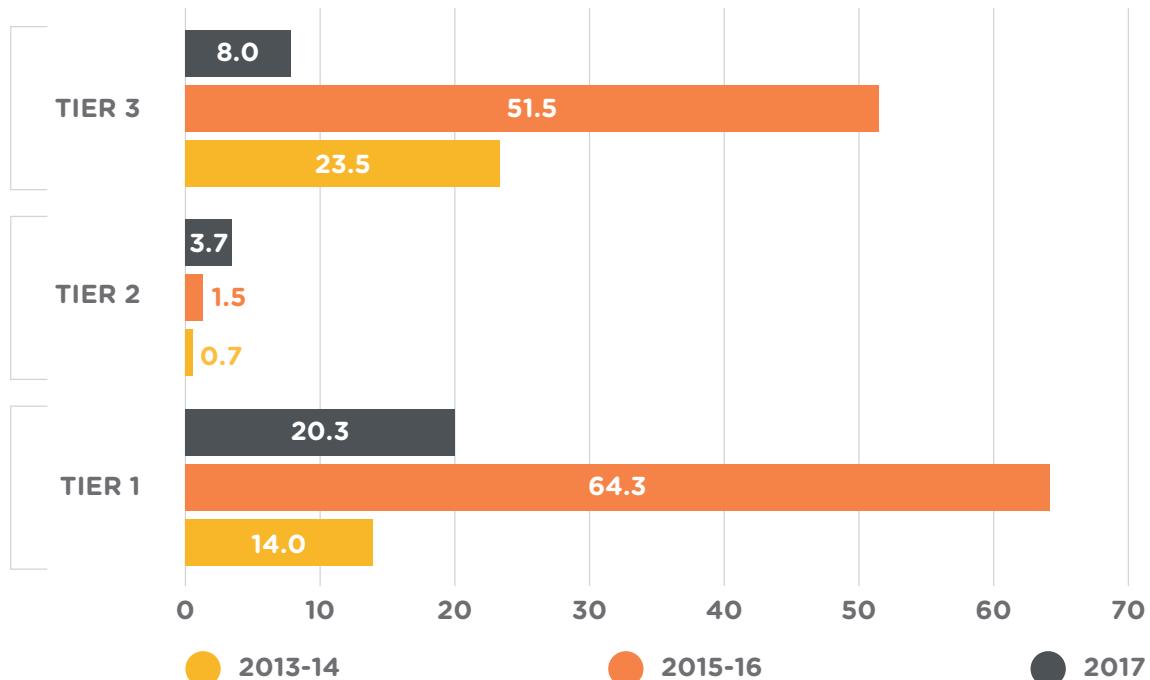
**In line with a trend observed in 2015-16, most finance commitments tracked in 2017 were allocated to improved biomass cookstoves, representing 46 percent or USD 14 million worth of finance.** While improved biomass stoves and biogas solutions have each been the leading recipients of clean cooking finance in previous editions of this report, alcohol-based solutions eclipsed biogas digesters in 2017 to receive the second-largest amount of funding, at over USD 6 million received in 2017. This follows more than USD

14 million allocated to improved biomass stoves. According to IEA projections, LPG and biogas solutions have the potential to provide clean cooking access to 1 billion people by 2030, mostly in urban areas (IEA, 2017). Analysis of the past five years of financing flows suggests otherwise; namely, that improved biomass cookstoves will remain an important part of future cooking energy mixes.

The increase in investment for improved biomass stoves relative to biogas is likely due to the limited commitments made by public financiers in 2017. While biogas digesters represented 16 percent of total finance committed for clean cooking in 2017, the USD 5 million that was committed is a sharp decrease

**Figure 5.8**

Finance for Residential Clean Cooking According to Tiers of Access (USD Million)



from the annual average of USD 50 million committed to the technology in 2015-16, which was largely due to the World's Bank USD 64 million loan to China, and USD 19 million in 2013-14. As such, the overall decrease in commitments for biogas digesters is in line with the decreases observed in commitments from multilateral institutions. Still, private philanthropic investors contributed 34 percent of finance for biogas digesters in donations, and impact investors committed 21 percent in the form of corporate debt. This shift towards a greater participation of private funding in biogas solutions suggests that new innovations may be increasing the viability of biogas solutions, and potentially allowing the technology to emerge from being largely publicly-financed.

**Funders and clean cooking companies themselves are indicating greater interest in supporting fuel- or energy carrier-based business models.** When outlier biogas data are excluded, the proportions of finance tracked for fuel- or energy carrier-based clean cook-

ing solutions increases from 12 percent in 2013-14, to 38 percent in 2017. These solutions include LPG-, advanced biomass-, electric-, and alcohol-based solutions. The beginning of this shift towards fuel- or carrier-based business models may be due to investors aiming to capture the deeper commercial opportunities provided by recurring fuel revenue streams, as opposed to product margins on discrete stove sales. Such targeting may be an outcome of the reduced amount of both public and concessional financing in the sector, and the increased participation of private funds.

One striking takeaway from the allocations of both public and private financing in clean cooking is the limited amount of funding that has been made available for technological and commercial R&D. While a range of solutions in off-grid electricity have flourished as a result of innovation grants, challenge funds, and accelerators financed by both public and philanthropic capital, much less of this type of funding has been availed for innovation in clean cooking.

## BOX 3

### DATA COVERAGE AND GAPS

**Data sources.** The report's analysis of the financial landscape for clean cooking relies on a number of data sources including: OECD DAC CRS, Clean Cooking Alliance (CCA), IJ Global, and philanthropic and impact investors surveys. Apart from the additional survey data received from new impact investor contributions, the same data sources were used for the 2013-14 and 2015-16 analyses.

**OECD DAC CRS data:** This database continues to be an important but incomplete source of information on financing transactions in clean cooking. Project descriptions in the OECD DAC CRS database are limited, requiring inferences to be made with minimal project information. Assumptions were used to determine the eligibility of the listed projects, the technological categorization of identified projects, and the portion of finance that enabled residential (as opposed to non-residential) clean cooking. Certain transactions, most often publicly financed development initiatives, seek to achieve multiple programmatic objectives in addition to clean cooking – such as increasing access to electricity, raising awareness of climate change, and increasing entrepreneurial skills. This characteristic of clean cooking programming increases the difficulty of identifying, classifying, and reporting on clean cooking activities, as well as parsing transaction data. Entries with a clear clean cooking component but no clear cost breakdown between components were adjusted by

a factor of 2 or more, depending on the number of project components.

**Data gaps.** Significant data gaps remain, preventing the report from presenting a comprehensive analysis of financial flows in clean cooking initiatives worldwide.

**Country coverage:** No data points were found in the OECD CRS database for activities in Afghanistan, China, Korea DPR, Myanmar, Nigeria or Philippines.

**Market shares and market structure:** Country-level data which disaggregate residential and non-residential uses of clean cooking are limited. As mentioned above, assumptions to the report's data set were applied based on limited information. These assumptions are further explained in the Methodology chapter.

**Piped natural gas data:** No transaction data were available to capture finance flows for natural gas infrastructure. It is anticipated that these transactions will make up a significant amount of financing for the sector in coming years, particularly as cities in India and other emerging markets continue to build out piped natural gas (PNG) infrastructure for household cooking.

**LPG data:** Comprehensive data on LPG investments and finance continue to be challenging to capture, and the approach to identifying financial commitments in this sub-sector continues to be updated (see Box 5 for more information).

## BOX 4

### FOCUS ON CLEAN COOKING ALLIANCE TRACKING EFFORTS

Since 2010, the Clean Cooking Alliance (formerly, the Global Alliance for Clean Cookstoves) has worked with its member organizations to collect data about their annual sales, distribution numbers, and financing raised. These self-reported data are compiled to help track and measure progress toward increasing access to and adoption of cleaner, more efficient cookstoves and fuels. For the devel-

opment of this report and previous editions, CCA has contributed its data on financing raised from cookstove and fuel companies, which represent a fundamental part of the global clean cooking financing landscape.

In the *Clean Cooking Industry Snapshot*, CCA tracked USD 40 million of financing into clean cooking companies in 2017, a 36 percent increase over the total in 2016 and greater than any of the previous five years (CCA, 2019). In this analysis, only those transactions benefiting companies located or operating in the 20 HIC have been incorporated, thus including USD 22.5 million out of the total USD 40 million tracked by CCA in 2017.

## BOX 5

### TRACKING FINANCE FOR LPG SUPPLY CHAINS

Capturing investments made in LPG supply chains remains difficult. Comprehensive data coverage would require in-depth country studies that are outside of the scope of this analysis. Tracking of financial commitments in this sub-sector has been incrementally improved with publicly available international trade data.

This year's report features the addition of a data inquiry which focused efforts on the imported volumes of LPG cylinders used for domestic households. According to the Global LPG Partnership (GLPGP), this data point might reasonably represent 40-60 percent of total capital expenditure within the LPG sector of a given market for one year; however, it is important to keep in mind that this range represents a broad generalization, and that the figure can vary significantly from country to country, and from year to year. For example, investments made in new terminals or other major components of supply chain infrastructure within one particular year may potentially dwarf the costs of LPG cylinders imported in that same year. However, when considering aggregate investments made in LPG market development throughout low- and middle-income countries and across multiple year timeframes, as a rule, investments in LPG cylinders for residential use make up the largest share of LPG asset investment.

Using the International Trade Centre (ITC)'s data, the monetary value of imported goods was tracked using Harmonized System (HS) code 7311: "Containers of iron or steel, for compressed or liquefied gas (excluding containers specifically constructed or equipped for one or more types of transport)" for all of the HICs. HS 7311 provides an overall category in which both residential and non-residential equipment is included. A sub-category, 73110010, was available for China and India, and specifically indicates LPG cylinders imported for domestic use.

Thus, for all other HICs, an approximation was used to identify the amount of finance flowing to the residential sector. In order to disaggregate the figures provided by HS 7311, data were applied from the IEA, which provides the share of total oil product consumption attributed to the residential sector. This percentage was then used as a proxy to be applied to the value of imported LPG goods and equipment. This allowed for an estimation of financial commitments made for LPG-based cooking in the residential sector.

While this approach is an improvement upon previous years' analysis of finance in the LPG sub-sector, it has its limitations:

- Relying on import data ignores locally produced or manufactured LPG goods and equipment.
- The methodology assumes that the percentage of oil products going to the residential sector at a national level applies to the consumption of LPG, which is unlikely to be true.

- Where there were no available IEA data to disaggregate residential final consumption – i.e. for Afghanistan, Madagascar, and Uganda – the percentage of Chinese imports that were residential is used as a proxy and multiplied by the trade import value of total LPG cylinders. This is likely not representative of the LPG consumption profile of these countries.

Including LPG using this method doubles the tracked committed finance in 2017 to a total of USD 59 million. Despite the limited scope of this new approach, the increase in identified commitments suggests that a considerable share of clean cooking finance in the LPG sector continues to be omitted due to data limitations. Implementing these opportunities requires a combination of refining, bulk fuel storage, bulk fuel transport, and distribution, refilling, and consumer appliance development. It also requires substantial investment from the local government, as well as general market development support. This analysis is currently unable to capture finance procured through domestic budget expenditures, and therefore lacks an important piece of the clean cooking finance puzzle.

As mentioned previously, a predominant issue in tracking finance for the clean cooking sector is the variety of technologies offering clean solutions, and the capital required to fund them. Most of the activities tracked in this chapter have a smaller-scale, community impact; other solutions, such as LPG, piped natural gas, biogas, and ethanol, require developers and financiers to adopt long-term, “industry build-

ing” perspectives. These technology solutions require considerable infrastructure investments as well as fully functioning enabling environments that can absorb multi-million or billion-dollar investments. The financial and professional services providers and organizations supporting these industries, as well as the sectoral regulatory regimes, are materially different from those in the rest of the sector, as is the contribution to countries’ clean cooking access. According to IEA projections, LPG and biogas solutions have the potential to provide clean cooking access to 1 billion people by 2030, mostly in urban areas (IEA, 2017).

SEforALL will continue to work with the Global LPG Partnership (GLPGP) and the World LPG Association (WLPGA) to further improve the tracking methodology for LPG solutions for clean cooking access and provide a more comprehensive overview of the market for future iterations of this research.

## BOX 6

### CARBON FINANCE

Carbon finance has historically been an important source of financing for clean cooking projects around the world. Both the official regime, under the UNFCCC's Clean Development Mechanism (CDM), as well as voluntary carbon market schemes, have played critical roles in providing startup funds to clean cooking projects, as well as raising awareness of clean cooking as a global issue impacting health, gender, environment, and poverty. The basic mechanics of a carbon financed clean cooking project dictate that, because the project will create emissions reductions vis-à-vis a baseline carbon intensive scenario, a project developer may sell verified Emission Reductions (i.e. carbon credits) to buyers over a set time period, and at agreed prices. The number of credits generated and sold per project depends on the technical, operational, and commercial details of the project design, including variables such as what cooking solution is being used, what volume of the solution is being distributed, and what the baseline emissions profile for the project area is. Using approved carbon accounting methodologies, project developers develop Emissions Reductions Purchase Agreements (ERPAs) which specify the sale of carbon credits to buyers, the terms for monitoring, disbursements, and payments, and so forth.

Unfortunately for this research, a majority of executed ERPAs are commercially sensitive documents.

These are commodity sales agreements negotiated and legally executed by two or more parties, whose terms are typically not made open to the public. This makes carbon finance a promising yet opaque source of data for clean cooking transactions; however, it is one which may be developed to enhance future data coverage. In future editions of this report, it may be possible to secure anonymized data from the main carbon finance project registries.

In the meantime, applying estimations of carbon pricing based on reported volumes of emission reductions was considered. This approach provides a wide and potentially unhelpful range of financing flows. For example, a project registered in 2017 to increase the production of biogas from dairy buffaloes in India was predicted to avoid the emission of 138,796 tons of CO<sub>2</sub> per year. With the price of CO<sub>2</sub> varying between USD 5 to USD 100 per ton, the implied financial value would be in the range of USD 0.7-14 million in 2017 per year, and of USD 4 million if using the EU-ETS current price of approximately USD 30 per ton of CO<sub>2</sub>. Having identified four similar projects from the UNFCCC, and using publicly available data only, including these projects would increase the amount of financing tracked for clean cooking in 2017 by USD 2.5-51 million, depending on the assumed price of carbon contained in the ERPA. Moreover, ERPAs can contain any number of additional commercial terms that would make attempts to accurately estimate actual carbon finance commitments, with incomplete information, somewhat ambitious.

## BOX 7

### DOMESTIC GOVERNMENT-LED INITIATIVES

Initiatives led and financed by domestic governments are not captured in the report's data sources, representing a key gap in the tracking of finance committed to improving access to clean cooking stoves and fuels. In consideration of large subsidy programs in countries like China, India, and Indonesia, this omission creates a large underestimation of total investment. In an effort to create insight into the potential scale of domestic investment, this edition of the report includes a deeper look into the policies and budgets of each of the HICs.

While assembling these deep dives is challenging, particularly when dealing with data unavailability and opacity, three types of government-led initiatives were identified:

1. **Domestic development programs** to provide or encourage the use of clean cooking solutions.
2. Trade and market-based instruments: **reduction of import duties or of value added tax (VAT)** on clean cookstoves.
3. Market-based instruments: **LPG subsidies and kerosene subsidy phaseouts.**

While national governments today still finance **domestic development programs to encourage the use of ICS**, these programs were more prevalent in previous decades. China's National Improved Stove program in the 1980s was one of the largest of its kind, with approximately 200 million ICS distributed throughout the decade (World Bank Group, 2013). International initiatives have now taken over the distribution of cookstoves.<sup>47</sup> These programs often increase affordability by distributing ICS either for free or for a small fee. An example of a more recent program is Nepal's initiative to install 60,555 ICS in 2016, led by the Ministry of Energy, Water Resources and Irrigation's Alternative Energy Promotion Centre (AEPC).

Considering the limited success of these programs – acceptability of a new cookstove is often stated to be a problem (IRENA, 2018) – governments seem to be increasingly turning to **market-based price signals** in an attempt to drive end-user incentives away from traditional cooking methods toward cleaner technologies. **Market-based tools** have been successfully applied to encourage the adoption of cleaner cookstoves; Bangladesh reduced import duty on ICS by 10 percent in 2016, while Kenya's import duty the same year decreased from 25 percent to 10 percent (Clean Cooking Alliance, 2018). While, to avoid double counting, the report's landscape numbers do not include out-of-market transfers such as subsidies, these policies are relevant.

<sup>47</sup> 97 percent of investment for improved biomass stoves committed on average per year between 2013 and 2017 came from international providers, in our landscape tracking.

vant to understand domestic governments' efforts in providing citizens access to clean cooking.

A recurrent domestic initiative is to **subsidize LPG**, consistent with the IEA's claim that LPG will be the primary vehicle – primarily for urban populations – through which hundreds of millions of people will access clean cooking technologies and fuels by 2030 (IEA, 2017). India's LPG subsidy, led by the Ministry of Petroleum and Natural Gas since 2012, amounts to an average expenditure of USD 2.8 billion per year between 2015 and 2018 (India Union Budget, 2019). Other countries have opted for tax cuts, as in the case of Kenya in 2016 with the removal of 16 percent VAT on LPG (Clean Cooking Alliance, 2018a/b).

Simultaneously, a general push exists to **phase out the use of kerosene**, as 52 percent of its global supply is estimated to benefit from subsidies (Mills, 2017). Many of the countries tracked in this report, including Ethiopia, India, Kenya, and Nigeria have recently worked towards decreasing these subsidies to replace the fuel. As described in last year's edition of this report, Indonesia's kerosene-to-LPG conversion program explicitly aimed to replace the use of kerosene with LPG, reflected in the policy's combination of an LPG subsidy with the phase out of a kerosene subsidy. This program is an example of a substantial government expenditure to improve access to clean cooking; the LPG subsidy cost an average of USD 1.8 billion annually over 2015-16 (SEforALL & CPI, 2018)<sup>48</sup>. The country is now seeking to increase the adoption of electric stoves.

The total numbers tracked during this year's exploration of domestic government programs indicate that **up to USD 4.4 billion** was spent in redirecting finance towards clean cooking in 2017<sup>49</sup>. Other types of initiatives such as China's 13th Five-Year Plan for Biomass Energy Development, which is part of a long-term and broad program but includes a clear intention to improve access to clean cooking, were more difficult to include due to lack of data clarity (ESCAP, 2016). Challenges exist in both avoiding the risk of double counting and asserting that these investments will fully contribute to providing access to clean cooking. Isolating the clean cooking component of a budget is a challenge – for example, one of India's LPG subsidy programs includes an income distribution mechanism, the Direct Benefit Transfer – and there is no excluding the possibility that these government-led initiatives are ultimately financed by external donors or international programs.<sup>50</sup> For these reasons, this additional sum was not included in the landscape, although it is of interest to understand the tools and policies favored by domestic governments, as well as the full scale of finance being committed towards clean cooking.

<sup>48</sup> While the report characterizes this program as an example of a government expenditure on clean cooking, the kerosene subsidy was, in reality, far greater than the LPG subsidy, indicating a net government savings.

<sup>49</sup> This number is the sum of finance tracked in our landscape and of LPG subsidies in India and Indonesia, using data obtained from government budgets. As the methodology does not include subsidies, this number is not considered as a potential upper bound of financial commitment for clean cooking access, but is included to indicate the scale of these government-led measures.

<sup>50</sup> For example, Tanzania's Biomass Energy Strategy (BEST) is funded by the European Union (EUEI PDF, 2012).

## BOX 8

### RECOMMENDATIONS FOR IMPROVING DATA COVERAGE IN CLEAN COOKING

Following three editions of creating the *Understanding the Landscape* report, in which gaps in data coverage and methodological complexities have limited the ability to track financial flows in clean cooking, the following recommendations were compiled for future editions of the report:

1. **Organize a coordinated, intensive, and multi-stakeholder data collection effort.** Such an effort should focus on identifying, organizing, and updating the definitive dataset of financial flows in clean cooking.

This effort would require buy-in from key institutions concerned with clean cooking, including SEforALL, the Clean Cooking Alliance, industry associations, private partners, development finance institutions, commercial financiers, and the relevant line ministries in HICs. Ideally, such a coordinated effort would result in an open access database that could be efficiently updated on an annual or semi-annual basis, and help to preclude duplicative data collection and analysis efforts throughout the sector.

2. **Expand the sources of data and methodologies used to inform the analysis.** The research team recommends expanding data collection activities to include carbon and climate finance initiatives, domestic government-led initiatives, greater investor and entrepreneur outreach, and enhanced coverage of LPG and piped natural gas sectors.



CHAPTER

6

## ACCESS TO FINANCE FOR CLEAN COOKING IN NIGERIA



## COUNTRY CONTEXT

With a population of 201 million people<sup>51</sup>, Nigeria is the most populous country in Africa. Just over half of its citizens – approximately 105 million people – live in urban areas, making the country one of the most densely populated on the continent, with an average of 217

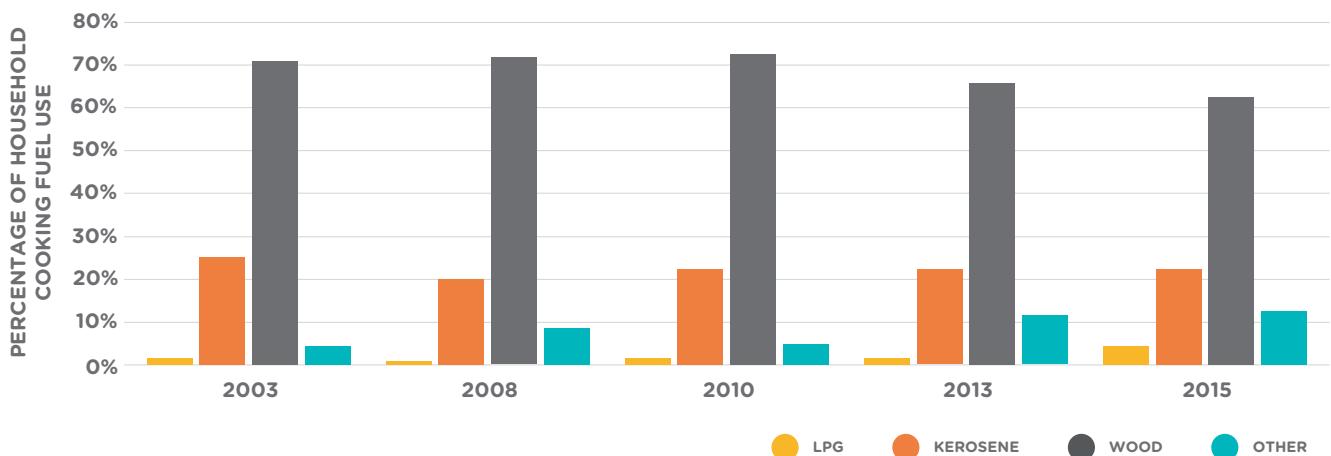
inhabitants per square kilometer. This is set to increase, as Nigeria's population is growing at an annual rate of 2.6 percent and is urbanizing at a rate of 4.2 percent.

In 2012, Nigeria's gross domestic product (GDP) surpassed that of South Africa's to make it the largest economy in Africa. With a GDP of USD 397 billion and gross national income (GNI) per capita of USD

<sup>51</sup> Statistics in this section are from WPR, 2018 and WB, 2018.

**Figure 6.1**

### Trends in Cooking Fuel Use in Nigeria



**Source:** Megbowon et al., 2018

1,960, Nigeria is considered a lower middle-income economy (World Bank, 2018).

Nigeria's economic growth has been accompanied by increases in greenhouse gas (GHG) emissions, with national emissions increasing 25 percent from 1990 to 2014 (Climate Scorecard, 2019). The majority of emissions originate within the land-use and forestry sector (67 percent) and the energy sector (28 percent) (UNFCCC, 2019). At 3.5 percent, the annual deforestation rate is among the highest in the world (FAO, 2019) and is a key driver of climate vulnerability for rural populations, causing losses in soil fertility, soil structure, and agricultural yields. Black carbon emitted by the country's oil and gas industry, as well as the use of traditional cooking energy solutions, accelerates warming effects while increasing the incidence of respiratory illness due to indoor air pollution (IAP) and poor air quality. The total number of deaths attributable to IAP in Nigerian households is the highest in Africa and the seventh highest in the world. More than 23,000 children in Nigeria die each year as a result of respiratory infections caused by the use of solid fuels for cooking (Clean Cooking Alliance, 2019).

In this context, the Government of Nigeria views the expansion of renewable energy and modern

clean cooking solutions as critical to its sustainable economic development agenda. This ambition is demonstrated in Nigeria's Nationally Determined Contribution (UNFCCC, 2019), which presents an increase in clean cooking as a key solution to the challenges of short-lived climate pollutants, social and gender inclusion, and deforestation. Nigeria's 2015 SEforALL Action Agenda targets a transition of 80 percent of the population to modern cooking facilities by 2030, while the Government of Nigeria's Economic Recovery & Growth Plan (2017-2020), per the Ministry of Budget & National Planning (2017), includes an interim target to "increase the number of households transitioning from kerosene to cooking gas (LPG) to 20 percent by 2020" (Federal Republic of Nigeria, 2017). As of 2015, 6.41 percent of Nigerian households depended on LPG as a main cooking fuel (National Bureau of Statistics, 2015).

### FINANCING AND POLICY LANDSCAPE

Only approximately 5 percent of Nigeria's population has access to clean fuels and technologies for cooking (World Bank, 2018), leaving approximately 190 million people without access to clean cooking solutions. Given the country's large and growing population, aggressive deforestation rate, and national concerns for sustainable development and public

**Table 6.1**

## Challenges in Nigeria's LPG Supply Chain

<b>Production and Supply</b>	<ul style="list-style-type: none"> <li>Sub-standard products from some supply sources</li> <li>Product quality specification compliance and monitoring issues</li> </ul>
<b>Shipping</b>	<ul style="list-style-type: none"> <li>Inadequate supply of low-draft vessels</li> <li>Inefficiencies in shipping operations leading to high unit freight cost</li> <li>Channel draft restrictions</li> <li>Maritime security</li> <li>Jetty occupancy, availability and turnaround times</li> </ul>
<b>Receiving Facilities</b>	<ul style="list-style-type: none"> <li>Inadequate and unevenly spread receiving terminals</li> <li>Limited jetty availability – few jetties &amp; low priorities for LPG in terminals</li> <li>Restricted access</li> <li>Inefficient/unsafe operations</li> </ul>
<b>Inland Transportation and Distribution</b>	<ul style="list-style-type: none"> <li>Inadequate transportation infrastructure, including road network, pipelines, and rail network</li> <li>Few and mostly sub-standard trucks – limited truck specification and monitoring for safety in operations</li> <li>Inadequate size and availability of bulk storage facilities</li> <li>Limited geographic coverage of bottling plants – approximately 300 nationwide, mainly in the south, with many operating at below breakeven capacity</li> </ul>
<b>Cylinders and Accessories</b>	<ul style="list-style-type: none"> <li>Major issues around cylinder availability, ownership, property rights, and safety responsibilities</li> <li>No functioning cylinder manufacturing plant in country</li> <li>Lack of cylinder standardization</li> <li>High start-up/switching cost for consumers</li> <li>Cylinder availability and ownership Issues</li> <li>Significant use of second-hand, smuggled, and unsafe cylinders</li> </ul>
<b>Retail Outlets &amp; End Users</b>	<ul style="list-style-type: none"> <li>Fragmentation and lack of control</li> <li>Unethical, sub-standard and unsafe operations</li> </ul>

**Source:** Adapted from Nigeria LNG Limited.

health, there is a need to substantially increase the penetration of clean cooking fuels and technologies.

The domestic cooking landscape in Nigeria is broadly similar to that of other countries throughout Sub-Saharan Africa, with some key differences. Approximately 75 percent of household cooking energy is sourced from solid fuels comprising of firewood, charcoal, and crop/animal waste (SEforALL, 2016). A breakdown of the country's cooking energy mix over the years 2003 to 2015 is provided in Figure 6.1.

Rural households overwhelmingly rely on solid biomass fuels and the use of traditional stoves. However, several other technologies have made inroads

into the Nigerian market, including biogas digesters, solar cookers, ethanol gel stoves, biomass gasifiers, and other clean and improved cooking solutions. These technologies have been piloted in the context of carbon finance projects, government initiatives, social enterprises, and international co-operation programs.

Kerosene has played an important role as a cooking fuel among urban households, which have largely been transitioning away from biomass-based solutions (Ozoh, O. et. al., 2018). This transition was initially catalyzed by a national kerosene subsidy, estimated at a cost of approximately USD 1 billion in the year 2015 alone (Vanguard, 2016). The sub-

sidy was assessed as having created limited benefits for low-income households (IISD, 2019) and was ultimately ended in 2016. Despite the removal of the subsidy and the corresponding increase in retail prices of kerosene, the fuel persists as a cooking fuel of choice among low- and middle-income urban households. A 2018 study of urban households in one administrative area of Lagos confirmed the prevalence of fuel-stacking<sup>52</sup> and further found the use of kerosene to be more common than that of either charcoal or LPG. Kerosene usage was found to be correlated with age, and its prevalence was suggested to be the result of years of subsidy and promotion as a clean cooking fuel for low- and middle-income households (Megbowon et al. 2018).

A second defining characteristic of the Nigerian clean cooking market is the substantial domestic production of LPG that could become a major clean cooking solution, if made widely available and accessible on a safe, affordable, and commercially sustainable basis. Nigeria is one of the largest producers of LPG on the continent, yet 85 percent of Nigeria's annual LPG production is exported, while domestic per capita consumption of LPG is exceedingly low. While Ghana and Senegal have respective levels of residential LPG consumption per capita at approximately 4.7 kg and 12 kg<sup>53</sup>, per capita consumption in Nigeria averages approximately 1 kg (Nigeria LNG, 2019).

Further, Nigeria's LPG cooking sector faces unique challenges in terms of regulation, enforcement of regulation, and safety. LPG cooking gas stakeholders cite the application of VAT on domestically produced LPG as a main reason limiting the affordability of LPG cooking solutions for domestic households. Applying VAT to domestic LPG places local production on an uneven playing field, as imported LPG is both import duty and VAT exempt (AllAfrica, 2018). Table 6.1 presents an overview of key LPG challenges in Nigeria.

<sup>52</sup> Often households do not transition directly to cleaner cooking alternatives, but instead they diversify the number of energy sources used without necessarily abandoning completely the old ones.

<sup>53</sup> Approximately 50 percent of Ghana's LPG consumption per capita figure may be attributed to vehicular consumption. Still, this leaves a per capita consumption roughly double that of Nigeria.

While the sector is deregulated and allows the participation of private enterprise, several aspects of a safe and functioning market that protects consumer interests remain overlooked. One critical regulatory gap concerns the cross-filling of LPG cylinders and a related lack of cylinder inspection and safety. In markets that have undergone large cooking gas transitions to LPG – e.g. Brazil, India, Indonesia – strong regulation reflecting global best practices has ensured consumer safety through tight regulation governing the branding, distribution, recirculation, refilling, inspection, safety, and maintenance of cylinders. In such markets, a customer exchanges a branded, empty cylinder for a filled cylinder that has been inspected and filled by the corresponding branded LPG marketer<sup>54</sup>. Each branded marketer has responsibility and liability for this set of functions and obtains the commercial benefits from performing them well.

In Nigeria, cylinder ownership and the marketers' functions, responsibilities, liabilities, and commercial benefits, are decoupled and fragmented. This has resulted in customers owning and refilling LPG cylinders at independent marketers, and has additionally allowed for the importation of sub-standard second-hand cylinders (Compcom, 2017). This lack of regulation governing the retailing of gas, and the safe and accountable re-circulation of cylinders, poses outsize consumer risk and is a significant barrier to commercial investment.

Recent years have seen an increase in the diversity of cooking solutions available to Nigerian households, as well as a gradual increase in the penetration of modern solutions. From 2013-2016, at least USD 8 million was transacted to support clean cooking initiatives in the country (CPI analysis). Of these financing flows, approximately 99 percent and 14 percent were provided by international public financiers in 2013-14 and 2015-16, respectively. 71 percent of financing in the sector in 2015-16 was provided by international private financiers. A selection of initiatives in Nigeria's clean cooking landscape is provided in Table 6.2.

<sup>54</sup> Note: Retailers are a distinct entity type in the supply chain from marketers; they do not perform inspection and filling functions.

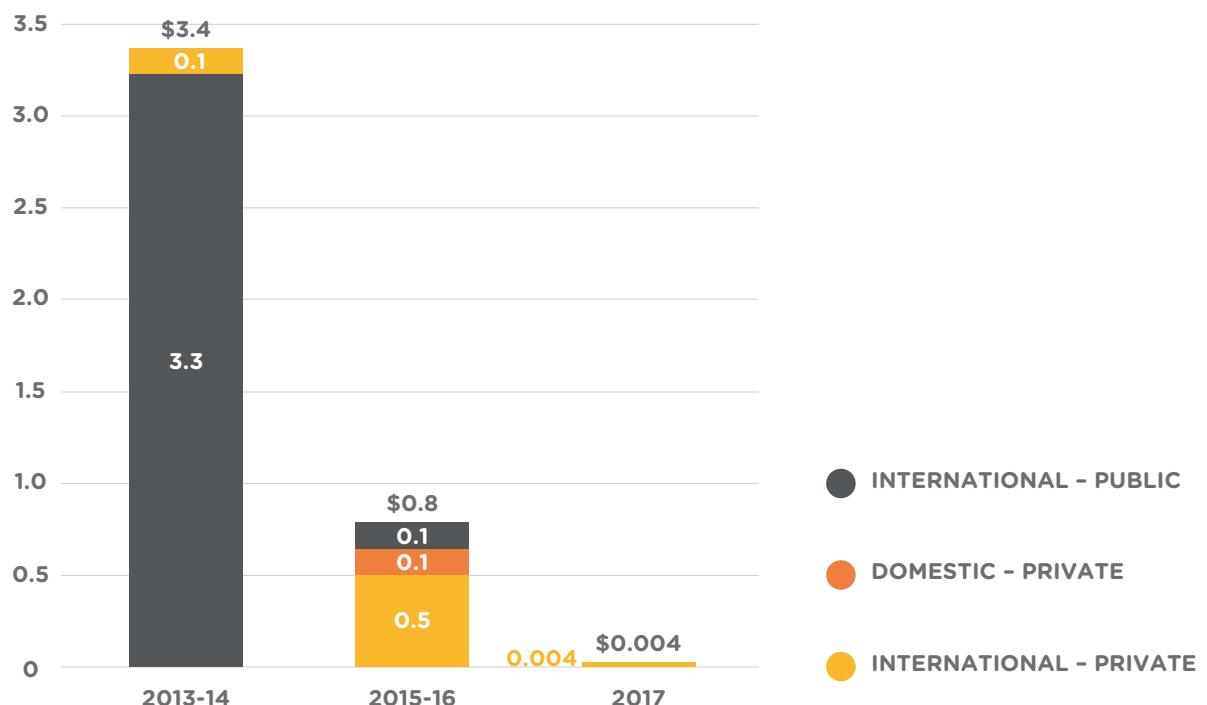
**Table 6.2**

## Selection of Private and Public Clean Cooking Initiatives in Nigeria

Private Sector-Driven Activities	
<b>Carbon project activities (various)</b>	Several carbon finance cookstove projects have been developed in Nigeria, including three CDM projects and five programs of activity (PoAs) registered with the UNFCCC.
<b>Clean Cooking Alliance</b>	The Clean Cooking Alliance (formerly Global Alliance for Clean Cookstoves) has funded several pilot and research projects in Nigeria (CCA, 2019). The country chapter, the Nigeria Alliance for Clean Cooking, is housed at the International Centre for Energy, Environment & Development (ICEED, 2019).
<b>Envirofit</b>	Envirofit is a leading manufacturer of clean cookstoves. The company has been distributing its products in Nigeria since 2012 and operates a stoves production facility in Lagos (Envirofit, 2017).
<b>Green Energy Biofuels (GEB)</b>	Green Energy Biofuels manufactures and distributes an innovative, smoke-free cookstove that utilizes an environmentally-friendly fuel gel. GEB has sold more than 400,000 ethanol gel-based stoves.
<b>NLPGA</b>	The Nigeria LP Gas Association (NLPGA) is the umbrella body for LPG stakeholders in the country. It organizes events, shares industry information and resources, and advocates for the adoption of LPG as a cooking fuel.
<b>Project Gaia</b>	Project Gaia is a non-profit dedicated to the deployment of liquid alcohol-based cooking fuels. It has been researching the health benefits of alcohol-based cooking solutions in Nigeria since 2003 and has piloted both ethanol- and methanol-based solutions in the country (Project Gaia, 2019).
Public Sector-Driven Activities	
<b>National Energy Sector Support Programme (GIZ)</b>	Through two phases of the National Energy Support Programme (NESP I: 2013 to 2017; NESP II: 2017 to 2021) GIZ has supported training, development of enabling environments, and technology pilots in the clean cooking sector.
<b>National Clean Cooking Scheme</b>	The Federal Ministry of Environment's National Clean Cooking Scheme was launched to support the production and distribution of clean cooking solutions (GIZ, 2015). However, the scheme has been met with some controversy (Channels, 2015).
<b>UN World Food Programme</b>	In 2018, WFP deployed more than 7,000 fuel-efficient stoves to displaced families in Borneo state and has advocated the Nigerian Armed Forces to ensure the safety of women collecting fuelwood.
<b>National Kerosene Subsidy</b>	In 2015, the Government of Nigeria spent approximately USD 1 billion on kerosene subsidies (Vanguard, 2016). The benefit of the subsidies for low-income households has been questioned.

**Figure 6.2**

Providers of Finance for Clean Cooking in Nigeria (USD Million)



A majority of finance for clean cooking solutions over the years 2013 to 2017 inclusive was provided by international public financiers. One transaction in particular, an approximately USD 6 million investment made in LPG in 2013, has carried the majority of clean cooking financing in the country since. As mentioned above, in the years 2015-16, the majority of finance in Nigeria's clean cooking sector was provided by private, international financiers; at least three transactions sized at over USD 200,000 each were executed to support the deployment of alcohol- and advanced biomass-based solutions.

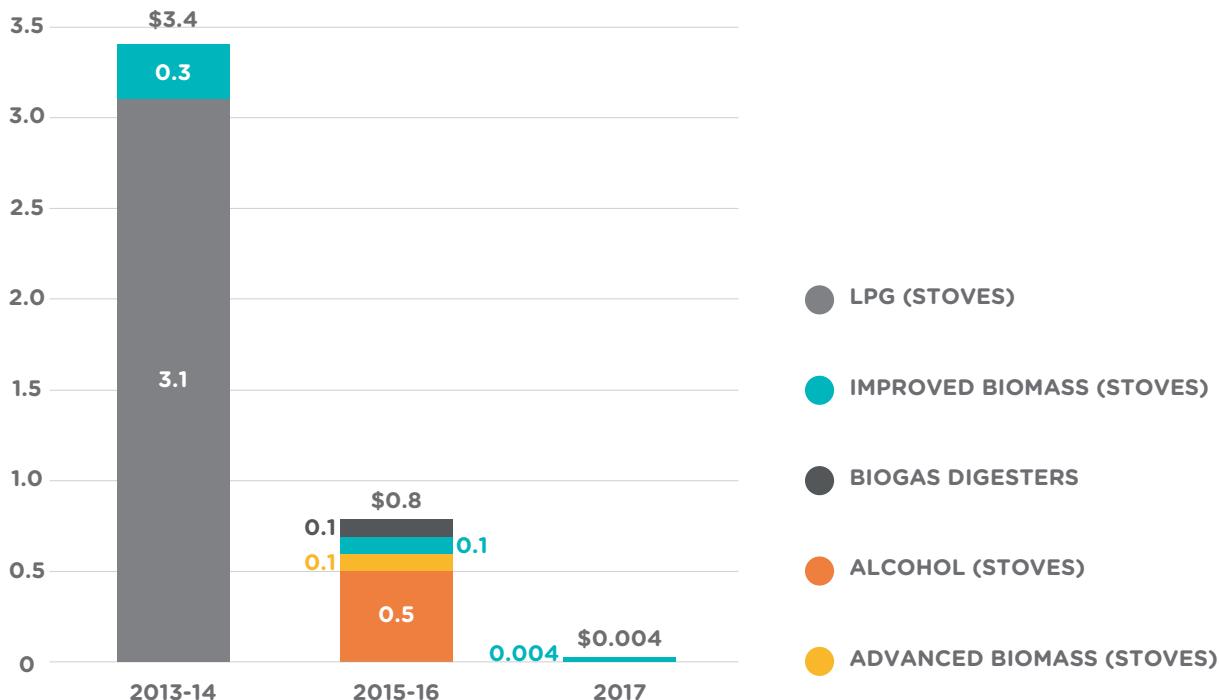
Financial flows tracked for inclusion in the 2017 database are all but non-existent, with the exception of two small, grant-funded R&D projects. It is likely that such a sharp reduction in funding is indicative of a gap in transaction data – particularly with regards to the amount of domestic and private LPG investment that is likely ongoing in the country.

### KEY FINANCING CHALLENGES

Despite the unique nature of the Nigerian urban clean cooking environment, the country shares multiple challenges to increasing clean cooking investments with other markets in Sub-Saharan Africa, particularly in regard to the use of kerosene and the technical potential of LPG. The business models and commercial viability of clean and advanced cooking stoves, absent subsidies or the adoption of new cooking fuels, remain questionable. This is particularly the case in rural areas, where solid biomass fuels are often free and households have limited ability and willingness to pay for clean or cleaner cooking solutions. Retail distribution and consumer adoption of modern solutions in rural and remote areas is thus challenging on a commercially sustainable basis, and presents a key financing challenge for commercial and private investors. In contrast, as discussed previously, the potential for the proliferation of clean cooking solutions on a commercial basis may be

**Figure 6.3**

Finance for Clean Cooking in Nigeria, by Sectors (USD Million)



much higher in urban markets, given existing fuel expenditures, increasing population sizes, and serviceable population densities.

Specific to LPG, the market, regulatory, and enabling environments are not sufficiently developed to attract commercial investment. The sector faces key challenges around public perceptions of safety and hazard, affordability (i.e. LPG as a “rich man’s fuel”), and supply reliability (Clean Cooking Alliance, 2011). Importers and distributors of LPG have voiced concerns related to the complexity and costs of importation for both fuel and equipment, an uneven playing field for domestically produced LPG, and an under-supported market environment that may be better supported through targeted government intervention. Specifically, the imposition of VAT on domestic LPG limits the affordability of LPG cooking solutions, as does a lack of public support for consumers to finance the purchase of LPG kits.

### PATHWAYS TO INCREASE ACCESS

Investments in clean cooking in Nigeria could be significantly advanced through publicly financed market transformation initiatives. Ensuring the existence of policy targets which support a range of solutions, a strengthened enabling environment including comprehensive regulation and appropriate fiscal incentives, increased availability of finance for enterprises and consumers, targeted subsidy programs, and an enhanced consumer awareness campaign are key components of such a transformation. Considering the lack of both international and domestic public finance in Nigeria, a holistic market transformation package appears to be a needed solution for catalyzing both investment and action. Specific opportunities to increase financing for clean cooking in Nigeria include:

**Implement market transformation programs including catalytic, smart subsidy programs for**

**clean and cleaner cooking to achieve government ambitions.** While the Government of Nigeria has clearly articulated clean cooking policy targets, apart from its support of the kerosene subsidy, it has yet to procure sufficient domestic resources to achieve these targets. Considering the rate of deforestation in Nigeria, development partners and the Government of Nigeria might consider holistic market transformation programs to accelerate market activity. A key component of such a program would be smart subsidies that could incentivize the dissemination of fuel-efficient cooking solutions among urban and rural communities. Similarly, a demand-side consumer financing subsidy, such as that seen in India's LPG sector, could ease the financial burden precluding low-income households from adopting modern cooking solutions. An RBF mechanism is one way that hard-to-reach segments can be served on a commercial basis, and can also be applied more broadly as a general market acceleration instrument. For disadvantaged and climate vulnerable communities – i.e. those in highly remote and acutely poverty-stricken areas – government and international partners might consider fully or majority subsidized approaches.

**Explore and prepare a modern clean cooking fuels investment opportunity.** Given the potential to develop local supply chains for sustainable and advanced bioenergy-based cooking fuels – i.e. biomass pellets, alcohol-based fuels, and others – the development of an actionable, modern, and clean cooking fuels roadmap should be considered. Such a strategy exercise might include elements of landscape assessment, enabling environment reform, and the visible piloting of novel technologies and models. As an example, in the case of liquid alco-

hol-based cooking, a study of the large-scale commercial implementation by KOKO Networks and Vivo Energy in Kenya could inform the implementation of similar approaches in Nigeria, as well as highlight the policy and regulatory reforms that would be required to catalyze private investment in this modern fuel opportunity. In Tanzania, UNIDO is implementing a liquid ethanol-based clean cooking market acceleration initiative targeting the development of a sustainable supply chain and the dissemination of 500,000 stoves over the next five years.

**Adopt best practices in the LPG cooking market transformation, level the playing field for domestic LPG, and urgently tighten regulations for cylinder recirculation, cylinder branding and ownership, and safety responsibility.** Within the context of accelerating LPG-based cooking in households, the Government of Nigeria should seek to adopt, implement, and enforce global best practices in market transformation. Key issues to be addressed in Nigeria include changing consumer perceptions of safety and affordability, ensuring stability and reliability of supply, and ensuring the implementation of a safe and sustainable model for cylinder recirculation. Market accelerants, drawing from experiences in India and Indonesia, might include the provision of direct cash transfers for the purchase of LPG kits (i.e. cylinders, hosing, and stoves) as well as the subsidization of lower-income households to use LPG as a cooking fuel. Reform of LPG market rules, including the removal of VAT for domestic LPG, as well as fiscal incentives along the supply chain, enhanced storage and transport infrastructure, and streamlined importation procedures for private enterprises, would additionally encourage investment and the proliferation of LPG solutions.





CHAPTER

7

## ACCESS TO FINANCE FOR CLEAN COOKING IN NEPAL



## COUNTRY CONTEXT

Nepal is one of the least developed nations in the world, with more than 81 percent of the population living in rural areas, and 25.2 percent living below the national poverty line (World Bank 2018; ADB 2018). Nepal ranks 109th in the world in terms of CO<sub>2</sub> emissions, however, its per capita emissions are growing at the fastest rate in South Asia, increasing

5.8 percent per annum between 1990 and 2017 compared to a global annual average of 0.9 percent over the same period (Global Carbon Atlas, 2018).

The majority of Nepal's emissions originate from the agricultural sector (50.1 percent), followed by energy (30 percent), and then land-use change and forestry (15 percent) (USAID, 2019). Approximately

77 percent of Nepal's energy is supplied by traditional biomass, including fuelwood, animal dung, and residues, largely to meet residential demands for cooking energy (Government of Nepal, 2017). This reliance on traditional biomass for cooking contributes to an estimated 8,700 deaths per year, as a result of exposure to IAP (WHO, 2016).

The Government of Nepal is committed to increasing renewable energy production and moving to a low-carbon development pathway. In October 2018, Nepal announced 2018–2028 as the "Energy Decade," emphasizing the development and expansion of renewable energy. The Government's energy ambitions include clear targets for a range of solutions to achieve universal access to clean cooking.

As part of Nepal's participation in the SEforALL partnership, the Government of Nepal has committed to achieving the goal of Clean Cooking Solutions for All (CCS4All) by 2022. This includes replacing all traditional biomass cookstoves with clean cooking solutions (CCS) rated as Tier 3 and above<sup>55</sup> by 2030 (AEPC, 2018a). Among other clean energy targets, the National Rural and Renewable Energy Programme (NRREP) has set targets to install 475,000 ICS and 131,200 biogas digesters, while Nepal's first Nationally Determined Contribution (NDC) indicates a target to "equip every household in rural areas with smokeless (improved) cooking stoves (ICS) by 2030" (UNFCCC, 2016).

The Ministry of Population and Environment's 2017 Biomass Energy Strategy is similarly aligned, and provides additional detail, pledging to make Nepal free from IAP by 2022, and to ensure the availability of modern clean energy in all households using solid biomass energy by 2030 (Government of Nepal, 2017). The Biomass Energy Strategy further specifies targets of promoting 3 million ICS, installing 600,000 biogas digesters, and increasing the annual production of biomass briquettes and pellets to 20,000 metric tons.

<sup>55</sup> As per the MTF.

## FINANCING AND POLICY LANDSCAPE

Nepal's positioning in the Himalayas provides a difficult physical context for ensuring universal access to modern energy services. It is estimated that only 28 percent of the population has access to clean fuels and technologies for cooking (World Bank, 2018).

As seen in other developing regions, Nepal's cooking energy mix is largely defined along urban, peri-urban, and rural domains. Urban and peri-urban areas have a greater penetration of LPG solutions (78 percent), while rural areas are predominantly dependent on the use of traditional biomass (63 percent) (World Bank, 2017).

Nepal has a long history with clean cooking initiatives, dating back to the 1950s. A majority of cookstove interventions in the country have focused on improved mud and metallic stoves, as well as biogas digesters, produced and installed domestically. There has been comparatively less experience with mass manufactured and branded clean cookstoves. However, the national government is well versed in the range of clean cooking solutions available for households, which is likely the result of strong cooperation and implementation efforts in the clean cooking sector over the past three decades, as evidenced by specific targets for clean cooking in various national strategies, plans, and initiatives that detail a variety of technological approaches for clean cooking.

The Alternative Energy Promotion Centre (AEPC)<sup>56</sup>, under the Ministry of Energy, Water Resources and Irrigation, is a key actor in clean energy market development throughout the country. Clean cooking has been a critical component of vital policies, programs, and strategies informing the work of the AEPC over the years, such as: the Rural Energy Policy (2006), the NRREP, the Renewable Energy for Rural Areas program, the Biomass Energy Strategy. Since its inception in 1996, the AEPC has been successful in supporting the dissemination of more than 1.3 million ICS, 400,000 biogas plants, and around 600 solar cookers.

<sup>56</sup> The AEPC is a nodal agency created in 1996 to promote alternative and renewable energy in Nepal and has prioritized the dissemination of clean cooking solutions over its lifetime.

Importantly, the AEPC is the implementing agency of the Government of Nepal's Renewable Energy Subsidy Policy<sup>57</sup>. The subsidy policy provides details on specific levels of capital subsidy for a variety of renewable energy technologies and has been designed to further incentivize both private equity investment as well as lending into the renewable energy sector. The subsidy is financed through both domestic government and

development partner contributions to the Central Renewable Energy Fund (CREF) which has the mandate to provide both subsidies and loans (i.e. through qualified partner financial institutions) for eligible activities.

Table 7.1 presents a range of subsidy levels available for clean cooking fuels and technologies, as stipulated by the policy.

**Table 7.1**

#### National Subsidies for Clean Cooking per the Renewable Energy Subsidy Policy (Illustrative)

Technology	Range of Subsidy (in Rupees)	Range of Subsidy (USD-eq)
<b>Domestic biogas plants</b>	10,000 – 35,000	90 – 318
<b>Domestic 3-pot hole metallic ICS</b>	3,000 – 6,000	27 – 54
<b>Institutional metallic ICS</b>	Up to 20,000	181
<b>Domestic 2-pot hole gasifier</b>	Up to 4,000	36

**Note:** This table is included for illustrative purposes only; keen readers are encouraged to review additional details in the policy.

Over the years, AEPC has been directly involved in coordinating projects and programs focused on ac-

celerating clean cooking adoption in Nepal. Two of these are listed in Table 7.2.

**Table 7.2**

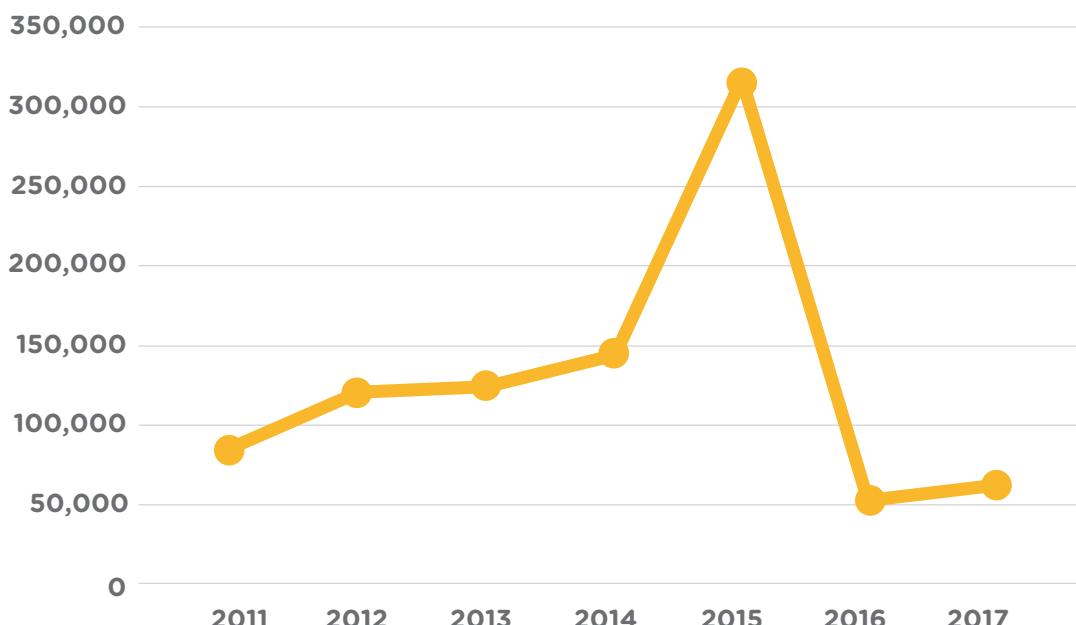
#### Selected AEPC Projects and Programs Supported by Development Partners

Project/Program	Period	Development Partners Involved	Project size	Clean Cooking Component
<b>Rural Energy Development Programme (REDP) – Phases I, II, III</b>	1996-2011	UNDP, World Bank	USD 33 million	Financial and technical assistance enabling the installation of biogas plants and ICS
<b>Biogas Support Programme (BSP) – Phases III, IV, V</b>	1997-2012	KfW, SNV	USD 21 million	National market development program enabling enterprise development and domestic biogas digester installations

<sup>57</sup> Under this policy, the AEPC is "responsible for providing technical assistance, evaluating subsidy applications forms or documents of different renewable energy systems and projects, selecting RETs companies for manufacturing, supply and installation of RE related material and equipment, monitoring installed systems and standardizing equipment and materials related to RETs."

**Figure 7.1**

Annual Installations of ICS



Source: AEPC

As a result of AEPC's support to the sector over the years, the total number of installations of ICS had been increasing steadily through 2015, before falling in 2016, as shown in Figure 7.1. The massive earthquake that hit Nepal in April 2015 dramatically impacted intervention efforts as resources were dedicated to rehabilitation and recuperation. According to Safe Access to Fuel and Energy (SAFE)<sup>58</sup>, "more than 75,000 households saw their cooking technology damaged or destroyed" (SAFE, 2018). The 2015 earthquake disrupted public investment flows into the clean cooking sector, as large sums were diverted to humanitarian efforts.

Until 2014, 100 percent (USD 250,000) of clean cooking financing was internationally driven by public organizations. This amount decreased by half in 2015 as large transfers were made for post-earthquake re-

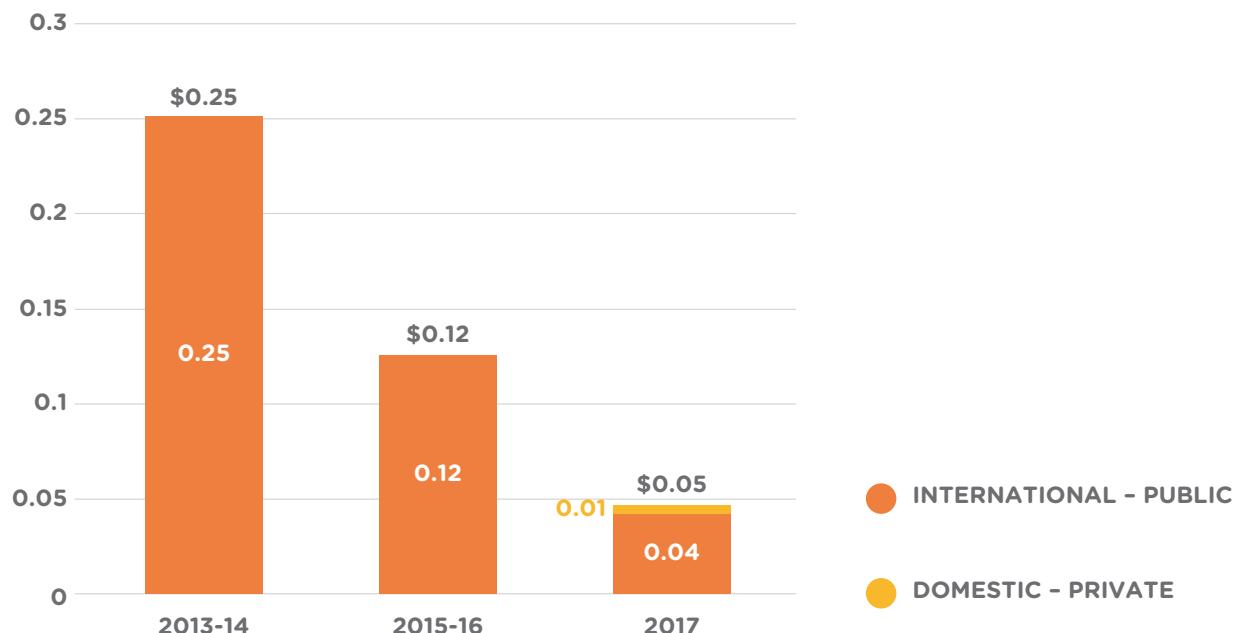
habilitation. By 2017, the domestic private sector had started making inroads into Nepal's clean cooking market; however, overall investment in the sector has fallen significantly over the past three to four years.

The Biogas Support Programme (BSP) is one of the most recognizable features of clean cooking market development in Nepal. The program installed over 200,000 digesters in Nepal between 1992 and 2009, with a total budget of approximately USD 50 million. Key to the program's success was a combination of policy and regulations, technical and entrepreneurial support, a clearly defined subsidy policy, quality control, and ongoing program monitoring. The program demonstrated the success of a multi-stakeholder approach to market development which was then replicated in several countries throughout Southeast Asia and Africa, championed by the Dutch development organization SNV. From a financing perspective, one of the most interesting aspects of BSP is its use of carbon financing. BSP

<sup>58</sup> SAFE is led by the SAFE Humanitarian Working Group, which is a consortium of international partners and organizations including FAO, the Clean Cooking Alliance (formerly, the Global Alliance for Clean Cookstoves), UN-HCR, UNICEF, WFP, and the Women's Refugee Commission, among others.

**Figure 7.2**

Sources of Finance for Clean Cooking in Nepal, 2013-2017 (USD Million)



registered the first CDM projects in Nepal in 2005 (SNV, 2010). The AEPC now coordinates eight CDM projects in biogas and micro-hydro sectors which generated an annual average of USD 2 million in carbon revenues between 2014 and 2017 (AEPCb, 2018).

### KEY FINANCING CHALLENGES

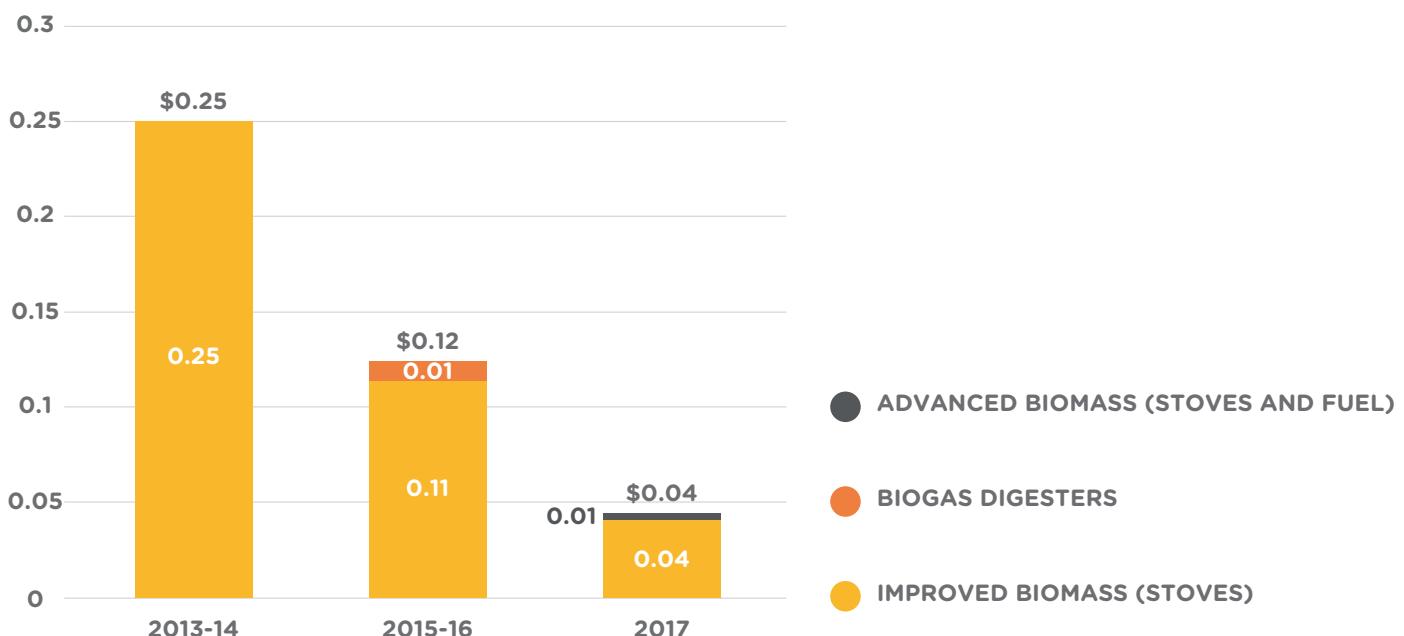
Some of the key challenges to financing clean cooking in Nepal include the country's highly dispersed and remote populations; limited abilities to pay; reliance on traditional bioenergy solutions; and a rugged landscape, which makes clean cooking operations challenging to implement. As a result, to date, Nepal has been prioritizing the promotion of mud and metal improved cookstoves that can be manufactured by decentralized local artisans. However, these solutions only meet the criteria for Tier 1 and 2 cooking solutions (i.e. as per the ESMAP MTF), and are challenging to scale as well as to quality control.

As domestic biogas digesters have been previously promoted in Nepal, these have been widely installed and remain a central focus of clean cooking planning. However, with many rural families losing young and productive family members to urban and foreign employment, livestock rearing has declined, leading to decreased feedstock for biogas plants and consequent abandonment of biogas plants in many areas. This potential lack of promising market precedents may reduce investor confidence in biogas as a solution.

LPG is imported, contributing to the drain of Nepal's foreign currency reserve and resulting in acute shortages when the import supply is curtailed due to contractual disputes or politically motivated disruptions. Thus, while an important clean cooking solution globally, LPG will not be considered a sustainable, long-term option for a clean cooking transition in Nepal without systemic changes addressing supply challenges.

**Figure 7.3**

Finance for Clean Cooking in Nepal by Technology Type, 2013-2017 (USD Million)



Finally, although electric-based solutions are acknowledged as having the potential to become a main cooking solution in urban areas of Nepal, the huge investment required to strengthen electricity generation, transmission and distribution systems means this will take many years to be a reality. In some communities, grid-based electricity may never arrive, due to the country's physical landscape and low rural population densities. In these communities, off-grid solar electric cookers may be a technical option, but one which would likely face affordability challenges.

Tier 3 and above biomass-based ICS, which also require processed fuel (pellets and briquettes) have, until now, mainly been promoted for demonstration purposes. However, it is likely that they will form a key component of the country's strategy going forward. These stoves and processed fuels are mostly imported from neighboring countries; in order to ensure the widespread and long-term adoption of

pellet- and other fuel-based solutions (alcohol), local fuel value chains would need to be developed.

The promotion of Tier 3 (and higher) cookstoves and clean cooking fuel-based solutions, including electric-based solutions, is seen as a transitional strategy to achieve universal clean cooking. However, deploying these solutions in rural areas will require a mix of market support mechanisms to overcome the generic challenges of clean cooking marketplaces, and those that are unique to the Nepali environment, its landscape, dependence on imports, and limited commercial precedents.

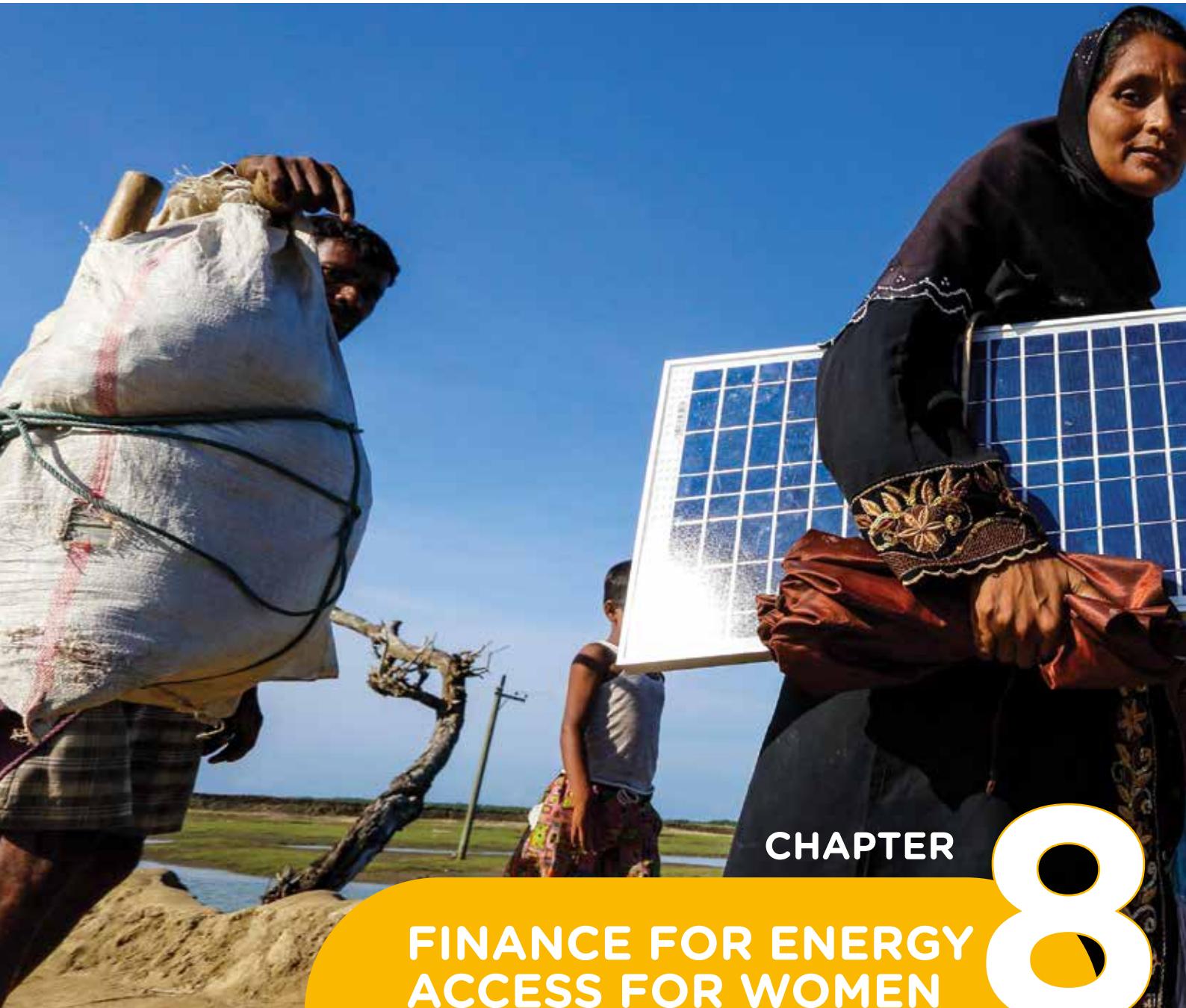
### PATHWAYS TO INCREASE ACCESS

Given the demonstrated political will to achieve universal access to clean cooking in Nepal, investments in this sector could be dramatically increased through key enabling actions. These include expanding and raising awareness of Nepal's developed subsidy regime, creating new programs that build on Nepal's

history of public-private partnerships, and promoting the use of modern clean cooking technologies to serve densifying urban centers.

Specific opportunities to increase financing for clean cooking in Nepal include:

- **Expand subsidies available for clean cooking technologies and fuels, and raise international awareness of existing subsidy levels.** The Renewable Energy Subsidy Policy with support from the CREF, is a leading market support initiative that indicates the Government of Nepal's strong commitment to clean cooking. Expanding the list of clean cooking technologies that are covered by the subsidy policy would broaden the range of actors that may invest in Nepal's clean cooking sector, and diversify solutions available in the market. Moreover, increasing international awareness of Nepal's well-developed subsidy instrument may likely mobilize greater foreign direct investment, as commercial developers and investors learn of the investment de-risking that may be provided through domestic government support. As an example, Nigeria's international campaign raising awareness of its minimum subsidy tender (MST) to catalyze mini-grid investment was well-received, resulting in international bids from leading global mini-grid technology and services providers.
- **Build on the history of public-private partnerships (PPPs) to access new and innovative sources of international finance for market development programs.** Nepal's experience with the Netherlands-sponsored biogas support program, as well as the current institutional design of the CREF, demonstrates an extended track record of PPPs to achieve clean cooking objectives. One opportunity to increase investment flows into the domestic clean cooking sector would be to design new PPPs, harnessing the latest clean cooking technologies and business models, as well as novel sources and models of energy access financing which leverage the strength of Nepal's institutional environment for renewable energy dissemination. Like BSP – which was able to catalyze approximately USD 2 million of international carbon finance into Nepal's energy sector – new partnerships and financing modalities may be developed (e.g. under the NAMA facility or as Green Climate Fund-backed program) to achieve universal access to clean cooking.
- **Expand national storage capacity for bulk storage of LPG.** To reduce the effects of seasonal transportation limitations, the Government of Nepal may consider exploring an expansion of bulk LPG storage facilities. Such strategic reserves would help to reduce disruptions to local markets and additionally mitigate against international price volatility.
- **Explore and prepare the modern clean cooking fuels investment opportunity as well as the adoption of electric induction stoves.** As is the case in Nigeria (Chapter 6), Nepal could better prepare its marketplace for the introduction of the latest technological and business model innovations in clean cooking. While Nepal's clean cooking sector has experience with artisanal and domestically produced stoves, it has had comparatively less experience with advanced clean cooking solutions and, particularly, modern fuels-based opportunities. Nepal has an annual domestic ethanol production potential of 18 million liters, which could serve approximately 60,000 households, based on sugarcane feedstock alone (Silveira and Khatiwada, 2010), and with approximately 2 GW of hydroelectric projects that are planned, proposed, or under construction, large-scale urban adoption of induction-based cookers may present a cost-effective complement to the subsidization of imported LPG fuel and cylinders. Targeted support for the introduction and piloting of these solutions – as well as other modern cooking innovations including the low-cost retail and distribution of advanced stoves, the use of PAYG models, and the retailing of advanced biomass pellet-based stoves – would diversify commercial activity in the sector and potentially enhance private investment flows.



CHAPTER

# 8

**FINANCE FOR ENERGY  
ACCESS FOR WOMEN  
AT THE LAST MILE AND  
FOR THE DISPLACED**



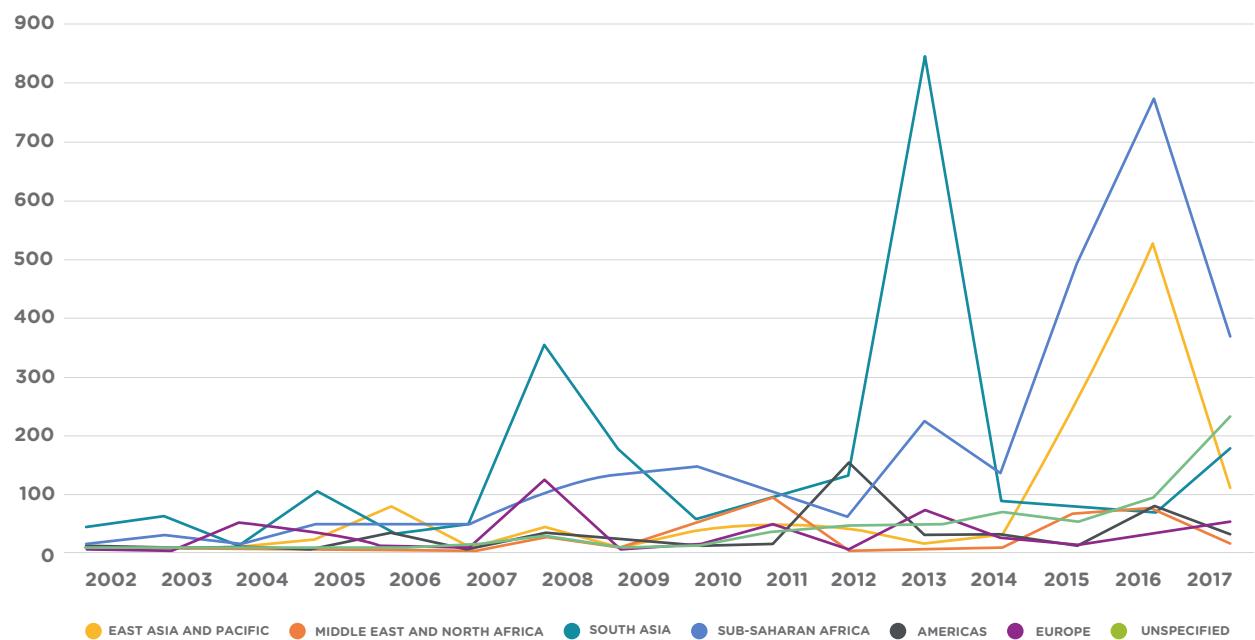
Women and girls currently bear disproportionate health, productivity, and employment burdens associated with poor energy access and fuel collection in the developing world. A lack of access to clean energy sources has severe health consequences—approximately 3.8 million people globally, mostly women and girls, die each year from biomass burned indoors (World Health Organization, 2016). Further-

more, women and girls who spend long periods of time collecting fuel are exposed to risks of gender-based violence during collection (SAFE, 2019).

Investment in increased access for women and girls to clean sources of energy can have transformative benefits for their health and safety and can reduce drudgery and allow more time for income-generat-

**Figure 8.1**

### Regional Evolution of Energy Development Aid with a Gender-Equality Objective 2002-2017 (USD Million)



Source: OECD 2019.

ing activities, including those that support sustainable energy access solutions for communities (O'Dell et al., 2015). Investment and policymaking to support women's engagement in the energy sector as business owners and entrepreneurs can also have a transformative impact on those entrepreneurs and their communities. Support for women engaged in the energy sector can generate improved returns on investment as women are more likely to repay loans than men. Women entrepreneurs also often outperform men in selling energy products due to their broad networks and a better understanding of energy needs in their communities so they can improve reach to rural areas (SEforALL, UKaid, ENERGIA, 2018).

#### FINANCIAL AND SOCIAL BARRIERS FOR WOMEN TO ACCESS ENERGY SERVICES

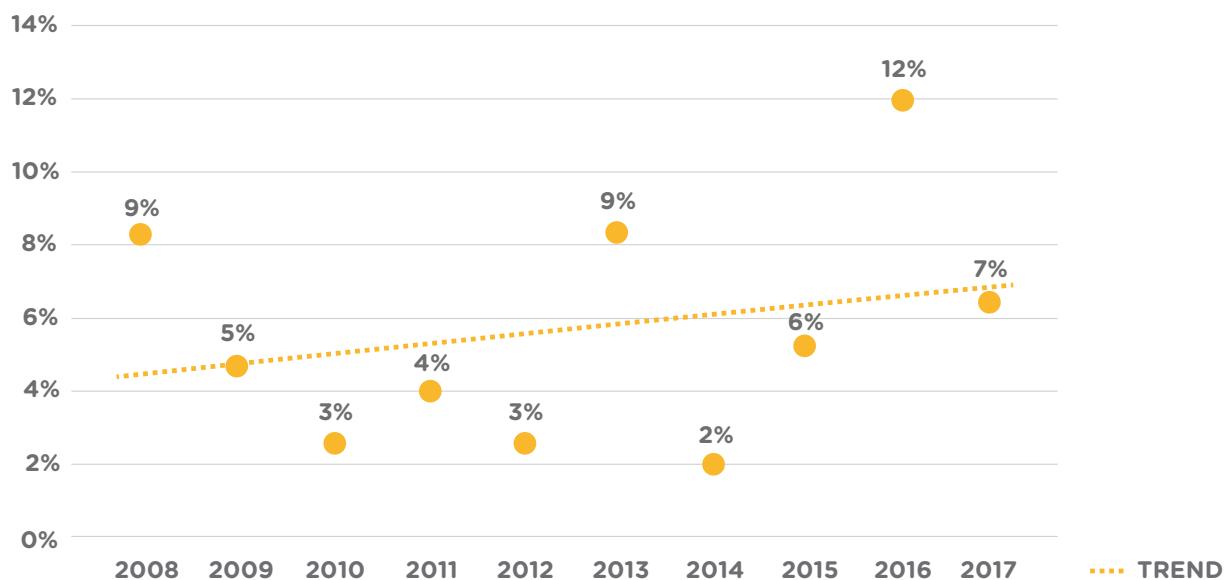
Women face a host of financial and social barriers to energy access, including: (i) lack of access to formal financial institutions; (ii) a lack of credit history or collateral; (iii) limited engagement and consideration of

their needs in the development phase of energy access projects; (iv) low engagement as entrepreneurs in the energy value chain; and (v) limited education and discriminatory social norms and laws.

When women entrepreneurs seek to develop business in solar home systems, mini-grid development, or energy distribution to financially engage with energy access solutions, they face higher interest rates, expectations of collateral for a higher proportion of a loan, and shorter loan periods than their male counterparts (SEforALL, UKaid, ENERGIA, 2018). Women entrepreneurs are also likely to face additional barriers due to the legal and regulatory constraints they typically face, such as national restrictions on opening a bank account without a male family member, restrictions on ownership of resources under a woman's name, and limited access to capital (women are nearly 20 percent less likely to have borrowed from a formal financial institution) (Dutta, 2017).

**Figure 8.2**

Evolution of Development Aid with Gender Outcomes as a Percentage of Total Energy Aid  
2008-2017 (%)



Source: OECD 2019.

### FINANCING FOR GENDER-FOCUSED ENERGY ACCESS

In 2017, OECD reported USD 974 million in global official development assistance (ODA) finance in the energy sector with gender equality as a policy objective, a more than ten-fold increase from 2002 when these activities totaled USD 73 million. As seen in Figure 8.1, the geographic targets of the finance have shifted over the 15-year period, and in the last five years, 38 percent of finance to energy access with a gender equality objective has flowed to Sub-Saharan Africa, while 24 percent has gone to South Asia, and 18 percent has been directed to East Asia and the Pacific.

Energy sector finance with a gender-quality objective represents only a fraction of the total development aid directed to the energy sector in the past ten years. While the total value of gender-related energy sector development aid flows has increased in this time, the proportion on total energy sector aid has almost remained unchanged, averaging 6 percent.

However, the small proportion identified in the energy sector (6 percent) is quite distant from the proportion of development finance targeting gender equality across all sectors which stood at 38 percent in 2016-17, the highest level ever recorded (OECD 2019a). This indicates that significant challenges still persist in defining and measuring precisely the magnitude of development finance for energy access that has specific outcomes for women.

Gender-focused activities differ widely depending on the energy sub-sector, and there are instances where an activity is marked as gender-related but does not include project documentation of gender outcomes. Many of the projects with the clearest connection to gender outcomes have been financed at concessional conditions through grants or donations. These projects included an electric generator for a women's center in Ethiopia, a project promoting women in energy-related enterprises in India, and a project in Burkina Faso to establish an Institute for Training in Applied Solar Technology which

supports the training of advanced technicians and engineers, with a minimum threshold of 20 percent female trainees.

## WOMEN AS ENTREPRENEURS IN THE ENERGY VALUE CHAIN

Because women's entrepreneurship is a straightforward gender intervention, a large portion of gender and energy access efforts include support for women's energy enterprises as a key component. Although there are certainly other dimensions of the gender-energy nexus, women's energy entrepreneurship is among the most prominent – and best documented. Supporting women engaged in the energy sector can generate improved returns on investment, can increase reach to rural areas, and can increase reinvestment in communities. The following are two such efforts that aim to equip female entrepreneurs with the capacity to develop clean energy businesses and to access necessary capital to achieve scale:

- In Senegal, Energy for Impact has run a women's economic empowerment program called Energy Opportunities for Women in Senegal (EOWS), which develops enterprises run by individual women and groups of women, including groups currently selling solar lamps and ICS. EOWS implementers have established a credit program and provide concessionary finance on a leasehold basis for initial capital for equipment purchases, and implementation partners guarantee the value of energy products through a loan guarantee fund (ENERGIA, 2017).
- In Nigeria and Tanzania, Solar Sister works with over 3,000 women entrepreneurs to provide training to build technology-driven clean energy businesses. The organization provides business and technical training, access to products and services, marketing support, and ongoing coaching to help women entrepreneurs in off-grid communities meet the needs of their customers. Solar Sister entrepreneurs have reached more than 1 million people selling solar lanterns, solar home systems, and cookstoves from regional distribution hubs (IEA, 2019).

## THE WAY FORWARD

Most of the energy access projects highlighted in this chapter are relatively limited in scope and target only portions of women's need for energy access finance. Women are disproportionately impacted by poor access to energy services yet have significant capacity to be involved in improving access and driving the energy value chain in high-impact regions. Involving women throughout energy access project implementation, tying finance to demonstrable improvements in access for women, and supporting women's entrepreneurial activities are all ways to improve gender equitable energy access.

Targeted finance to improve energy access for women will require concerted effort from the international community to ensure that investments in energy access overcome barriers including lack of access to formal financial institutions, a lack of credit history or collateral, and discriminatory social norms and laws. Various financing approaches can be employed to improve women's ability to access energy including targeted credit and subsidy solutions (including social assistance mechanisms), loan guarantees to enable financial providers to mitigate any greater perceived risk associated with female customers, and use of mobile payments to overcome finance access barriers. Social assistance mechanisms targeting increased energy access for women can shift public funding support to finance the initial capital cost of a connection to clean energy or subsidize ongoing electricity or fuel use.

The following are examples of programs that help provide a blueprint for targeted finance to improve energy access for women:

- In India, the Self-Employed Women's Association, with backing from IFC, provides loans to members to purchase clean energy products and offers payment guarantees to diminish perceived risk of lending to borrowers with limited formal credit history or collateral (FAO, 2018).
- In Nepal, national policies adopted in 2013 have targeted women and socially excluded groups

with subsidies for clean cookstoves and credit services to increase investment in biogas (World Bank, 2017).

- The global 2X Challenge, launched by the major economies' DFIs, aims to mobilize USD 3 billion towards women's economic empowerment in developing countries.

Alongside targeted financing approaches to enable women's access to energy solutions, gender audits – with a focus on development of outcome metrics related to gender-focused energy access finance – are critical to ensure equity. These audits serve to ensure that project implementers have a common understanding of gender equity goals and knowledge of the relationship between gender, access to energy, access to finance, and poverty. With support from ENERGIA, the Kenyan government performed a gender audit to assess the gender equality implications of its energy policy and development goals. This audit contributed to planning for Kenya's SEforALL Action Agenda as

well as efforts which resulted in funding from the European Union and Hivos for improved household cookstove programs in Kenya (Prebble et al., 2017).

Policymakers, non-governmental organizations, and private sector actors can also drive investment in energy access targeting women through increased support for women's entrepreneurship. This support can include policymaking to ensure base pay alongside commission payments for women entrepreneurs and to ensure employers commit to flexible working conditions and child care options. The private sector can engage in this space through co-design of equipment with female customers and field testing to ensure that systems meet the energy access needs of women in practice. Public sector actors can also engage in targeted partnerships with the private sector including with mini-, micro-, and off-grid product manufacturers and with concessionary finance providers including national development banks to facilitate capacity building, entrepreneurial development, and access to financing for women entrepreneurs (Clean Cooking Alliance, 2019).

## BOX 9

### FINANCE FOR ENERGY ACCESS FOR DISPLACED PERSONS

Conflict, economic insecurity, and natural and climate-related disasters have led to the highest-ever level of human displacement. As of 2019, there are more than 70.8 million forcibly displaced people globally (UNHCR, 2019a/b). Just under 90 percent of individuals in refugee camps have Tier 0 (no access) to energy and have a high dependence on traditional biomass for cooking (Grafham et al., 2015).

Biomass fuels and cookstoves are relatively rarely provided to individuals in camps, so residents must forage for fuelwood or other traditional biomass options (SAFE, 2015).

As is true for other vulnerable groups, a lack of access to modern energy sources has significant consequences for displaced individuals, including poor health outcomes, risks to physical safety, and decreased work and study productivity. The journey to collect fuel is especially dangerous for women and girls in refugee camps, where fuel collection is consistently shown to increase incidence of gender-based violence. In Farchana refugee camp in Chad, 90 percent of confirmed rapes occurred

when women left the camps in search of firewood (Clean Cooking Alliance, 2019). Reliance on a limited supply of fuel can also drive political conflict.

Displaced people within and outside of camps can encounter significant challenges in financing energy costs. Financial barriers for displaced people include limited access to financial institutions, lack of collateral, and limited legal rights to settle, work, and own land (UNHCR, 2019a/b).

The Moving Energy Initiative estimates that approximately 5 percent of humanitarian agency spending is directed to diesel, petrol, and associated maintenance costs, equivalent to USD 1.2 billion in 2017 (Graham et al., 2018). In the Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement, the UN Institute for Training and Research (UNITAR) and partners identify three core challenges from a funder perspective in financing energy access targeting the displaced: there is limited planning for long-term investment in energy access projects; there is a lack of data on the market and business models in displacement settings; and there is a lack of planning for follow-up funding or scale-up of financing for one-time energy access projects (UNITAR, 2019). Adopting best practices and more efficient technologies in the humanitarian sector (such as replacing diesel with renewable energy generation in refugee camps), could generate savings of nearly USD 520 million a year (Graham et al., 2018).

Energy access finance targeting the displaced is often challenging to track as many displaced people are in host communities or urban centers, and thus blend in with the local population. This dispersal makes it difficult to track their energy expenditures or to disaggregate the components of wider interventions in energy access targeting displaced people. Despite significant challenges in financing energy access for the displaced and in tracking that finance, projects in this space do exist and these efforts can be instructive for the success of future ventures. These efforts include finance for a large-scale solar facility, PAYG finance of solar home systems, and biomass cookstove distribution supported by employees within a refugee camp, all described in greater detail below:

- **A solar facility at Za'atari camp costing EUR 15 million provides electricity and marketable skills to refugees employed in construction.** The solar facility was finished in 2017 through funding from the German Government through the KfW Development Bank and will provide electricity to 80,000 refugees in the camp. The 12.9-megawatt peak plant was built by Jordanians and 75 Syrian refugees living in the camp who developed or honed solar construction skills (Hashem, 2017). This type of project can provide large scale access, but will not be relevant in many contexts, including rural camps, where grid-based energy is not feasible.

- **A social enterprise, BrightLife, operating in Kiryandongo Refugee Settlement in Uganda, offers solar home systems to residents via PAYG financing.** BrightLife received concessional funding from USAID program Power Africa to de-risk the PAYG financing of solar home systems and will use it to ensure maintenance standards and offer employment opportunities to settlement residents (FINCA, 2019). This project shows how concessional finance can be employed to de-risk initial investments and drive in market-rate private sector capital to increase total finance flowing to energy access for the displaced (UNITAR, 2019).
- **A biomass fuel pellet manufacturer, Inyenyeri, opened a shop in Kigeme refugee camp in Rwanda in 2016 and offers employment for residents.** The shop opened with support from the Government of Belgium and the UNHCR which jointly finance a cash-based assistance program. Inyenyeri leases cookstoves, sells fuel pellets, and offers repair and replacement services to Kigeme residents, has generated 30 jobs with

benefits for Kigeme residents as service representatives and technicians, and has served 15,000 customers (Refugee Investment Network, 2019). Engaging refugee camp residents in energy access decisions can improve uptake of the solution and improve outcomes.

At present, energy access finance for the displaced is predominantly dependent on short-term donor funding, and solutions like those listed above are relatively rare. Organizations are beginning to explore innovative models for financing energy interventions and more work is needed to research financial instruments, including guarantees; subordinated debt instruments; climate finance mechanisms, including carbon credits and Renewable Energy Credits; and energy cooperative business models (UNITAR, 2019). Further engagement will be required on the part of public entities and the private sector to engage with these instruments and drive finance towards this critical population group.



CHAPTER

**9**

**INNOVATIVE FINANCING  
MECHANISMS FOR  
INCREASING ENERGY  
ACCESS**



The progress that India has achieved in recent years<sup>59</sup> has shown how private markets, when supported by policies and ambitious targets, are key to closing the energy access investment gap that traditional concessional or development finance is unable to fill.

However, not all countries benefit from similar enabling environments, with factors like credit risk,

liquidity and currency risk, small investment ticket size, due diligence challenges, and political instability preventing investors from entering into underdeveloped energy access markets at scale.

A number of existing business models and financing mechanisms, when applied to different sectors, technologies and geographies, have the potential to unlock additional private capital for the sector to create

<sup>59</sup> Analyzed in last year's edition of the report.

outsized impact. A few such financial solutions, successfully piloted or implemented at scale in the off-grid electricity and clean cooking space, are discussed below:

**Result Based Financing (RBF)** is a form of grants, subsidies and incentives that are provided upon the achievement of pre-defined results. This mechanism allows public sector actors to act as a facilitator, providing financial incentives and policy support while the private sector delivers the expected results (World Bank, 2018b).

While several examples of RBF have been identified in the electricity sector, application for clean cooking projects is still relatively new. For example, the World Bank, under its Clean Stove Initiative (CSI), piloted a RBF program to promote clean cookstoves in Indonesia in 2015 and later extended it to other countries (Bangladesh, China, Kenya, Lao PDR, Mongolia, and Uganda). Under this program, the provision of incentives was linked to the number of certified stoves delivered by the supplier, along with the verification of their use and performance. Another example is the Kenya Off-Grid Solar Access Project (KOSAP), a USD 15 million<sup>60</sup> RBF facility funded by the World Bank, that provides incentives to private sector companies to sell solar energy and clean cooking solutions.

**Pay-per-service models** allow customers to pay for a specific service, provided by technologies and infrastructure that are owned and maintained by the service providers. While such PAYG financing models with digital payments are common in the electricity access domain, the concept is now increasingly being applied to clean cooking. Companies like KopaGas, Envirofit and PayGo Energy allow consumers to purchase LPG on a ‘pay-as-you-cook’ basis with mobile money through their GPS-enabled smart LPG cylinder meters and gas valves.

In Nairobi, KOKO Networks, co-financed by KfW (KfW, 2018), partners with around 700 shops called ‘KOKOpoints,’ a network of physical, cloud-connected e-commerce kiosks. KOKOpoints function like fuel ATMs, allowing consumers to buy a modern ethanol stove and reusable smart cylinders that can be docked and refilled at participating kiosks. These innovative models can help demonstrate the commercial viability and scalability potential of new technologies and business models.

**Crowdfunding and peer to peer (P2P) platforms** have increasingly been adopted to provide capital for energy access projects. Philanthropic micro-donations platforms (e.g. GlobalGiving, GoFundMe), reward crowdfunding (GravityLight, WakaWaka), and equity crowdfunding offer different avenues for investors with different risk appetites. A new variant of crowdfunding is the Initial Coin Offering (ICO) where individual or institutional investors purchase tokens (or crypto assets) issued by a company that typically invests with cryptocurrencies (e.g. Bitcoin) along with fiat currencies. The ICO landscape is relatively new, but with better regulations it could offer an alternative financing method (Crowd Power, 2018).

Peer to peer (P2P) business lending platforms like TRINE, Lendahand, and Energise Africa, – focused on the off-grid energy market – also offer increasing potential in securing funding outside of traditional financiers. In fact, P2P has witnessed remarkable growth, increasing from USD 1.2 million in 2016 to USD 28 million in 2018 (Crowd Power, 2018).

**Securitization** allows companies to sell future receivables from customer contracts to different investors, and use the proceeds to finance the purchase of equipment from the manufacturers. By bundling a large number of small contracts together into one structured investment, securitization creates large ticket investments to attract private, particularly institutional, investors. It allows investors with different risk-return profiles to diversify the perceived risks of new business models, technologies or developers with limited or no credit history.

<sup>60</sup>This is a credit line of USD 47 million consisting of a debt fund (USD 30 million) for installation of solar mini-grids, and RBF (USD 17 million) for suppliers of solar mini-grids and clean cooking solutions.

SolarNow's Structured Asset Financed Instrument (SAFI), arranged by SunFunder, is the first syndicated receivables financing facility in Uganda – extending credit on solar home systems through a PAYG system. Since its launch in 2015, it has secured investment amounting to USD 19 million under three SAFI transactions. There is now a need to explore and expand similar mechanisms in other geographies to increase energy access.

Another example is the Solar Securitization for Rwanda facility being developed by the Development Bank of Rwanda, which pools solar home system loans into a tradable asset-backed security. It addresses a key barrier of providing lack of adequate collateral by providing energy developers and households with access to lower-cost, long-term, off-balance sheet finance while enabling institutional investors to access the local solar loan market. (The Lab, 2019).

**Currency Risk Management Instrument:** Currency swaps and hedging instruments enable companies and investors to lock in long-term finance in local currencies, making projects more financially attractive by lowering the cost of capital. Such mechanisms can be useful for entrepreneurs and investors operating in countries like Nepal and Uganda, where instability of domestic currency leads to uncertainty in costs and revenues.

The Currency Exchange Fund (TCX<sup>61</sup>) along with MFX Solutions (MFX) support loans indexed in Ugandan shillings and Kenyan shillings for off-grid solar companies like M-Kopa and BBOXX. In early 2019, the UK Department for International Development (DFID) invested GBP 31 million in TCX<sup>62</sup> to provide currency hedges for loans and bonds. The African Guarantee Fund<sup>63</sup>, funded by governments and DFIs, provides guarantees to mobilize infrastructure investment in local currency and develop financial markets in African

economies. As development banks and other investors increase their lending in local currencies, such currency risk management strategies need to be evolved and made cost effective.

**Technical Assistance Facilities:** The off-grid sector is characterized by limited information on creditworthiness and attractiveness of investment opportunities, hindering private investment. Technical assistance facilities can help create an enabling environment to scale private investment by providing tailored technical and management expertise, technology transfer, monitoring and verification, implementation of new practices, and so on.

The Uganda Off-Grid Energy Market Accelerator<sup>64</sup> (UOMA), piloted in 2017, helps scaling of off-grid energy access in Uganda by reducing market barriers. It includes activities such as market opportunity and credit risk training to Ugandan banks, and support and guidance to non-bank lenders, and for technology pilots and business models. Such market acceleration models are now being adopted in other African nations including Ethiopia, Nigeria, and Rwanda (UOMA, 2018). A similar initiative in the clean cooking sector is the CCA's Spark+<sup>65</sup>, a funding and capacity building program providing operational, strategic and investment related advisory support to clean cooking companies.

Most of these instruments rely on some form of concessional capital. However, in 2017, concessional development finance flowing to the electricity sector of HICs in Sub-Saharan Africa stagnated, while in South-East Asian countries it decreased (see Chapter 2). Given, these challenging settings, it is important that these innovative mechanisms are structured in a way to ensure: (i) minimum concessionality (ii) a focus mainly on areas that are underinvested (iii) that they pioneer and test new business models to establish their commercial viability and (iv) that they are scalable, replicable, and can eventually phase out the need for concessional capital.

<sup>61</sup> TCX, founded in 2007 by a group of development finance and microfinance institutions, provides currency swaps and forwards with no tenor limitations in 80+ financial markets where such products are not available or poorly accessible to facilitate local currency financing.

<sup>62</sup> This investment is expected to allow TCX to hedge high-impact investments of more than USD 1.5 billion until 2045 (The Lab 2019b).

<sup>63</sup> African Guarantee Fund (AGF) is owned by the Government of Denmark, Government of Spain and the African Development Bank (AfDB).

<sup>64</sup> It is implemented by Open Capital Advisors in partnership with the Shell Foundation, USAID, Power Africa and DFID.

<sup>65</sup> Spark+ has evolved from the CCA's Spark Fund, an investment-focused program, which has supported 15 enterprises with USD 4 million in catalytic grants since 2012.



## METHODOLOGY



## LIST OF HICs

This section describes the HICs that were considered for the report. The list of HICs, both for access to electricity and access to clean cooking, is taken from the 2015 Global Tracking Framework (IEA and the World Bank, 2015) which was the most up to date list at the time the 2017 Energizing Finance report was commissioned, and maintained in

the 2018 and 2019 reports to ensure comparison across years.

The recently published *Tracking SDG7: The Energy Progress Report 2019* (IEA, World Bank, IRENA, 2019) has a slightly updated list reflecting countries' progress in energy access. The list includes Chad, Mali, and Zambia, and no longer includes Afghanistan, Philip-

**Figure A.1**

HICs Analyzed in the Report

Country	Electricity	Cooking	Region	Income level	Population (million)	Percent of population without access to electricity	Percent of population without access to clean cooking solutions
Afghanistan	+	+	South Asia	Low	36	2%	66%
Angola	+		Sub-Saharan Africa	Lower-middle	30	58%	51%
Bangladesh	+	+	South Asia	Lower-middle	160	12%	81%
Burkina Faso	+		Sub-Saharan Africa	Low	19	75%	90%
China		+	East Asia and Pacific	Upper-middle	1386	100%	42%
Congo, DR	+	+	Sub-Saharan Africa	Low	81	81%	96%
Ethiopia	+	+	Sub-Saharan Africa	Low	106	56%	97%
India	+	+	South Asia	Lower-middle	1339	7%	55%
Indonesia		+	East Asia and Pacific	Lower-middle	265	98%	35%
Kenya	+	+	Sub-Saharan Africa	Lower-middle	50	36%	86%
Korea, DPR	+	+	East Asia and Pacific	Low	51	56%	89%
Madagascar	+	+	Sub-Saharan Africa	Low	26	76%	99%
Malawi	+		Sub-Saharan Africa	Low	18	87%	100%
Mozambique	+	+	Sub-Saharan Africa	Low	29	73%	96%
Myanmar	+	+	East Asia and Pacific	Lower-middle	53	30%	80%
Nepal		+	South Asia	Low	28	96%	71%
Niger	+		Sub-Saharan Africa	Low	22	80%	98%
Nigeria	+	+	Sub-Saharan Africa	Lower-middle	191	46%	93%
Pakistan		+	South Asia	Lower-middle	208	71%	56%
Philippines	+	+	East Asia and Pacific	Lower-middle	106	7%	56%
Sudan	+	+	Sub-Saharan Africa	Lower-middle	41	44%	56%
Tanzania	+	+	Sub-Saharan Africa	Low	55	67%	99%
Uganda	+	+	Sub-Saharan Africa	Low	38	68%	98%
Vietnam		+	East Asia and Pacific	Lower-middle	95	100%	33%
Yemen	+		Middle East and North Africa	Low	28	21%	37%

**Note:** Region and income level are based on World Bank country and lending groups. Population and access levels refer to 2017, based on World Bank Indicators, except for Uganda which is taken from the *Taking the Pulse 2019* report.

pines, and Yemen for electricity access. For clean cooking, Ghana has been added, and Nepal removed.

## TRACKING METHODOLOGY

This section explains the three-step approach taken to map commitments intended to increase access to electricity and to clean cooking solutions across the 20 HICs. The three-step approach (summarized by Figure A.2) is as follows:

- 1) Tracking finance for electricity and clean cooking, with a focus on commitments<sup>66</sup>.
- 2) Estimating the portion of finance for residential energy access.
- 3) Applying the MTF to identify the type of energy access provided.

### STEP 1: TRACKING FINANCE FOR ENERGY ACCESS FOR ELECTRICITY AND CLEAN COOKING

Building on the methodology developed by SE-forALL, CPI and the World Bank in the first edition of the report, and CPI's Global Landscape of Climate Finance methodology (CPI, 2017), this mapping exercise tracks public and private finance commitments to any project that enhances energy access, including investments in electricity and clean fuels and technologies for cooking. These commitments include support for capacity-building measures as well as for the development and implementation of policies.

In Chapters 2 and 5 of the report more than 2,100 primary financial transactions are tracked, in addition to public framework expenditures,<sup>67</sup> such as the development of national energy strategies or capacity-building, committed in the calendar year 2017.<sup>68</sup>

<sup>66</sup> Commitments represent a firm obligation by the means of Board decisions on investment, closure of a financing contract or similar actions, and backed by the necessary funds, to provide specified assistance/financing to a project, recipient country, or any other partner organization. Financial resources committed record the full amount of expected transfer, irrespective of the time required for the completion of disbursement. The focus on commitments rather than disbursements may affect the magnitude of flows, given that committed amounts are often disbursed over a number of years. Disbursement information would provide a more accurate picture of the actual volume of financial resources devoted to addressing climate change in a given year (which can include commitments from earlier years, as well as those due to commitments for the current year), but consistent data for disbursements are lacking.

<sup>67</sup> Precisely 2009 finance commitments for electricity and 97 for clean cooking.

This means that the report only collected information that was available at the project level, disregarding aggregate (regional or global), unverifiable figures, and top-down estimates.

The report does not track disbursements and policy-induced revenue support mechanisms such as feed-in tariffs, secondary market transactions, or other public subsidies (except in the case studies). Feed-in tariffs, for example, pay back investment costs, so including them would constitute double counting. Secondary-market transactions, such as the reselling of stakes, are only tracked if they do not constitute double counting with other areas of the data collection.

The report tracks commitments according to the following dimensions:

#### A) TECHNOLOGIES

Electricity technologies tracked in the report include electricity generation technologies and the transmission and distribution network.<sup>69</sup> Specifically, the following technologies are included, as either electricity generating or facilitating the final consumption of electricity:

- Grid-connected electricity generating assets, including renewable energy (solar PV, wind, small and large hydro, biomass and waste, biofuels, geothermal), fossil fuels (coal, oil, gas), and nuclear technologies.
- Transmission and distribution networks (including grid extensions and connections).

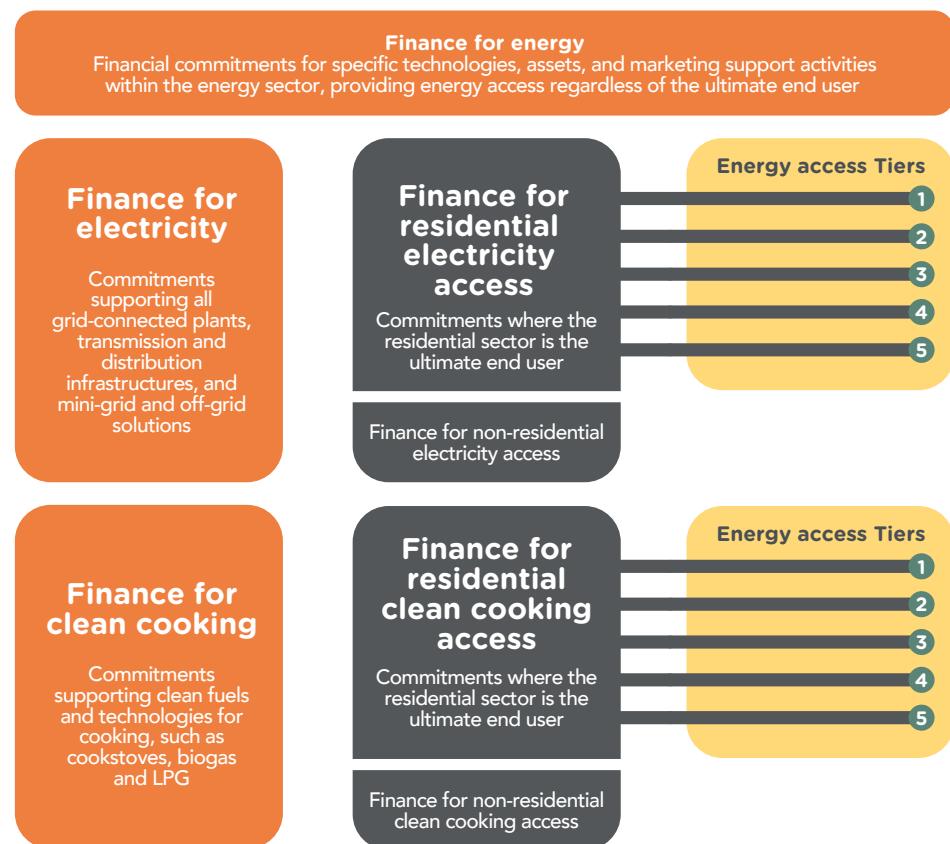
<sup>68</sup> Commitments represent a firm obligation by the means of Board decisions on investment, closure of a financing contract or similar actions, and backed by the necessary funds, to provide specified assistance/financing to a project, recipient country, or any other partner organization. Financial resources committed record the full amount of expected transfer, irrespective of the time required for the completion of disbursement. The focus on commitments rather than disbursements may affect the magnitude of flows, given that committed amounts are often disbursed over a number of years. Disbursement information would provide a more accurate picture of the actual volume of financial resources devoted to addressing climate change in a given year (which can include commitments from earlier years, as well as those due to commitments for the current year), but consistent data for disbursements are lacking.

<sup>69</sup> Infrastructure and pipelines for supplying LNG to power generation plants are excluded.

**Figure A.2**

Methodology Summary

Finance commitments are broken down as follows:



- Mini-grids including renewable energy assets, fossil fuel assets and hybrid solutions (a mix of renewable and fossil fuel energy).
- Off-grid assets including solar (solar home systems, solar lanterns) and non-solar technologies.
- Energy efficiency investments that support energy conservation and demand reduction, including building and industry upgrades, smart grids, metering, tariffs, improvements in lighting, appliances and equipment that increase the quality of electricity grids and infrastructure.
- Market support activities, including capacity building, technical assistance and institutional support for energy reforms.

Terminology in the clean and improved cooking sector is variable. This report considers the following technologies and initiatives:

- Stoves and fuels – advanced biomass, alcohol, bio-gas, improved biomass, electric, LPG, natural gas.
- Fuel infrastructure – investments in clean cooking fuel infrastructure (LPG, natural gas, and alcohol cooking technologies) that targeted no more than two distribution levels away from final end-use. This includes LPG storage facilities and cylinder bottling plants.

## B) PROVIDERS

Public sector institutions include:

- Multilateral DFIs – includes climate funds and EU institutions
- Bilateral DFIs – providers of bilateral climate-related development investors
- Export credit/promotion agencies
- National DFIs – includes public banks and local public sector providers of debt instruments
- Government domestic – government entities or departments/ministries that do not directly sell energy
- Utilities and state-owned enterprises – ministries and state-owned institutions that produce and sell energy

Private sector institutions include:

- Corporate actors and project developers designing, commissioning, operating and maintaining energy projects, such as private sector utilities, energy companies and independent power producers
- Commercial financial institutions providing private debt capital, such as commercial and investment banks and micro-financial institutions
- Commercial finance, including asset managers and early-stage investors (private equity, impact investors, venture capital and infrastructure funds)
- Philanthropic foundations
- Households, i.e. family-level economic entities, high-net-worth individuals and their intermediaries (for example, family offices investing on their behalf)
- Entrepreneurs

## C) FINANCIAL INSTRUMENTS

The report tracks:

- Grants
- Debt (both concessional and commercial)
- Equity
- Balance sheet financing (i.e. a direct debt or equity investment by a company or finance institution)
- Other instruments like crowdfunding

The report also tracks guarantees and other risk mitigation instruments but does not include them in total commitments to avoid double counting between, for example, the face value of full loan guarantees and loans. Guarantees are only exercised in particular circumstances, and there might never be any outflow from the guarantor.

## STEP 2: ESTIMATING THE FINANCE COMMITMENTS FOR RESIDENTIAL ENERGY ACCESS

Once finance commitments for energy access are identified, the portion specifically referring to residential energy access is determined. Unless project-specific information is available, assumptions are made at country/technology level, following two steps:

Firstly, adjustments to estimates and commitment values are made so that only the proportion of value relating to residential energy access is recognized. More specifically:

- If part of the capacity of a specific technology in a country is used for energy exports, the investment value is discounted by the share of exports.
- The remaining value is then discounted by the existing share of consumption going to non-residential sectors (commercial, industrial, public sector). From a methodological standpoint, it would be preferable to use the marginal con-

**Figure A.3**

The MTF for Measuring Access to Electricity

ATTRIBUTES		TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Capacity (Power Capacity ratings)		< 3 W	3 W - 49 W	50 W - 199 W	200 W - 799 W	800 W - 1999W	≥ 2 kW
Availability	Day	< 4 hrs	4 – 8 hrs	8 – 16 hrs		16 – 23 hrs	≥ 23 hrs
	Evening	< 1 hrs	1 – 2 hrs	2 – 3 hrs	3 – 4 hrs	4 hrs	
Reliability	(Frequency of disruptions per week)	> 14				4 – 14	≤ 3
	(Duration of disruptions per week)					≥ 2 hrs (if frequency is ≤ 3)	< 2 hrs
Quality (Voltage problems affect the use of desired appliances)		Yes			No		
Affordability (Cost of a standard consumption package of 365 kWh/year)		≥ 5% of household income (income)			< 5% of household income (income)		
Formality (Bill is paid to the utility, pre-paid card seller, or authorized representative)		No			Yes		
Health and Safety (Having past accidents and perception of high risk in the future)		Yes			No		

**Source:** World Bank, ESMAP, SREP, SEforALL, 2019 updating Bhatia and Angelou, 2015.

**Note:** Colors signify tier categorization.

sumption, for example, how one extra unit of electricity in a country is consumed across the various sectors. Given that these data are largely absent, existing consumption shares have been used as a proxy.

For example, a grid-connected wind farm is likely to supply electricity to residential, commercial and industrial consumers, and therefore only a proportion of the value of the wind farm should be recognized as granting residential electricity access.

Commitments towards market support activities and energy efficiency are excluded from this step as they render benefits to both residential and non-residential users, and it is difficult to isolate the impact on each category.

### STEP 3: ALLOCATING THE ESTIMATED FINANCE COMMITMENTS FOR RESIDENTIAL ENERGY ACCESS TO TIERS

Not all residential energy access is the same. In the case of electricity, for example, some systems may only be available for certain hours of the day or may produce limited power. Recognizing the reality of different energy access service levels,<sup>70</sup> the World Bank developed the MTF to measure levels of energy access for electricity and for clean cooking. The MTF considers “the ability to obtain energy that is adequate, available when needed, reliable, of good quality, affordable, legal, convenient, healthy, and safe for all required energy applications across households, productive engagements, and community facilities.” This approach allows us to rate energy access from Tier 0 (no access) to Tier 5 (very high level of access) (Bhatia and Angelou, 2015).

<sup>70</sup> Factors which determine the level of energy access could include, in the case of electricity, the wattage available, for how many hours electricity is available, and so on.

**Figure A.4**

The MTF for Measuring Access to Clean Cooking

ATTRIBUTES		TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
Cooking Exposure	ISO's voluntary performance targets (Default Ventilation) PM 2.5 (mg/MJd) CO (g/MJd) gn	> 1030 > 18.3	≤ 1030 ≤ 18.3	≤ 481 ≤ 11.5	≤ 218 ≤ 7.2	≤ 62 ≤ 4.4	≤ 5 ≤ 3.0
	High Ventilation PM 2.5 (mg/MJd) CO (g/MJd) gn	> 1489 > 26.9	≤ 1489 ≤ 26.9	≤ 733 ≤ 16.0	≤ 321 ≤ 10.3	≤ 92 ≤ 6.2	≤ 7 ≤ 4.4
	Low Ventilation PM 2.5 (mg/MJd) CO (g/MJd) gn	> 550 > 9.9	≤ 550 ≤ 9.9	≤ 252 ≤ 5.5	≤ 115 ≤ 3.7	≤ 32 ≤ 2.2	≤ 2 ≤ 1.4
Cookstove Efficiency	ISO's voluntary performance Targets	≤ 10%	> 10%	> 20%	> 30%	> 40%	> 50%
Convenience	Full acquisition and preparation time (hours per week)	≥ 7		< 7	< 3	< 1.5	< 0.5
	Stove preparation time (minutes per meal)	≥ 15		< 15	< 10	< 5	< 2
Safety		Serious accidents over the past 12 months				No serious accidents over the past 12 months	
Affordability		Fuel costs ≥ 5% of household income				Fuel costs < 5% of household income	
Fuel availability		Primary fuel available less than 80% of the year				Available 80% of the year	Readily available throughout the year

**Source:** World Bank, ESMAP, SREP, SEforALL, 2019 updating Bhatia and Angelou, 2015.

The next step is to allocate a given residential asset or flow to Tiers of energy access the associated technology will provide, proposing an initial, simplified categorization of commitments by applying the MTF approach (World Bank, ESMAP, SREP, SEforALL, 2018; IEA and the World Bank, 2015; Bhatia and Angelou, 2015) to available information at country/technology level on selected attributes within the framework.<sup>71</sup>

The report uses technology-specific ranges of attribution as an initial starting point for allocating technologies to energy access Tiers. Figure A.3 and Figure A.4 illustrate those used for electricity and cooking, respectively. Where a technology covers more than one Tier, specific attributes based on the MTF are used to determine specific allocation. For example, in the case of central grid-connected plants – ranging between Tiers 3 and 5 – country-specific data were applied on the reliability of the grid in that country to determine the final Tier of allocation.

<sup>71</sup> As the MTF relies on extensive use of surveys to determine allocation, unavailable at the global level, the framework itself suggests the use of simpler versions to facilitate its implementation on a global scale, capturing varying amounts of information. Three different levels of the framework are envisaged: (i) comprehensive framework, (ii) simplified framework, and (iii) minimalist framework (Bhatia and Angelou, 2015).

Figure A5 summarizes technology-specific assumptions used for the estimates of consumption shares across sectors and allocation to Tiers.

For this edition of the report, World Bank and ES-MAP teams have provided the results of the MTF surveys about the existing status of electricity access in five countries: Bangladesh, Cambodia, Ethiopia, Myanmar, and Rwanda. Replacing the simplified methodology (summarized in Figure A.5) with real-world information collected through household surveys ensures greater accuracy in quantifying the impact of different financing types across service

levels (energy access Tiers), and across the various consumer sectors (residential and non-residential).

However, due to unexpected complexities, only Ethiopia and Myanmar were effectively incorporated into the report's methodology<sup>72</sup>. More work and collaboration with the World Bank is needed in the future to properly integrate the MTF country results into the finance tracking methodology.

**Figure A.5**

### Approaches Used to Estimate Consumption Shares and Tier Allocation<sup>73</sup>

Technology type	Approach used to estimate technology/country specific breakdown by target sector (export, residential, commercial, industrial, other)	Estimate for Tiers linkage (incl. rural/urban split)
<b>Residential</b>		
Grid-connected fossil fuels and renewables	<p><b>Export and sector-specific breakdown</b> To allocate investment to the different sectors, the report looks at the composition of both electricity supply and demand as per country-specific electricity balances for the years 2013–14 using IEA (2017) for the majority of HICs, examining export data, as well as consumption data from the residential and non-residential sectors. For countries not covered by IEA, other sources were used.</p> <p>Sector-specific figures and export figures are then presented as a percent of domestic generation.</p> <p><b>Exception: Export and sector-specific breakdown for the distribution network</b> As investments in the distribution network do not benefit exports or large industry (taking place at higher voltages), to identify residential investments, distribution values are presented net of the share going to the commercial sector.</p>	<p><b>Tier allocation</b> Grid-connected capacity typically ranges between Tiers 3 and 5 according to IEA and World Bank (2015) and World Bank (2017). To reflect country specific circumstances, the report allocates investment to Tiers within this range, based on available aggregate country level data matching Tier attributes identified as per MTF methodology (Bhatia and Angelou, 2015). In the absence of reliable sources at country level on power capacity available for individual residences via grid-connected plants (and associated transmission investment), the report looked at country-specific “reliability” of grid electricity supply, measured with frequency of disruptions occurring in a country, using World Bank (2017) national data on “Power outages in firms in a typical month (number)”, as a conservative proxy for disruptions for the residential sector. More specifically, the report applied:</p> <ul style="list-style-type: none"> <li>• Tier 5, if disruptions per week ≤ 3</li> </ul>
Transmission and distribution (extensions and unspecified)		

<sup>72</sup> Rwanda and Cambodia are not HICs for electricity.

<sup>73</sup> This part of the methodology has remained unchanged from the previous report due to lack of time and resources, but the figures should have been updated for 2017.

Technology type	Approach used to estimate technology/country specific breakdown by target sector (export, residential, commercial, industrial, other)	Estimate for Tiers linkage (incl. rural/urban split)
		<ul style="list-style-type: none"> <li>• Tier 4, if disruptions per week &gt; 3 and <math>\leq 14</math></li> <li>• Tier 3, if disruptions per week <math>&gt; 14</math></li> </ul>
Mini-grids, fossil fuels and renewable/hybrid	<p><b>Export and sector-specific breakdown</b></p> <p>Although there are no specific geographic limits on the boundaries of a mini-grid, the report assumed that mini-grid generation would serve only a concentrated local area (village, group of villages, small island) with zero exports.</p> <p>While mini-grids would not support the same level of energy-intensive heavy industry as a national or regional grid, evidence from the literature suggests that – on top of residential and commercial use – a significant share of mini-grid generation is for industrial applications, and indeed that industrial “anchors” on mini-grids such as factories or telecom towers may in many cases be necessary to sustain the network and subsidize residential mini-grid connections. Project-specific data also confirm this finding.<sup>74</sup></p> <p>The residential share for investments in mini-grid installation reflects electricity consumption patterns for residential, commercial and industrial use observed in the grid – excluding exports from the equation – on the assumption that region-specific usage is similar to usage observed at the national level.</p>	<p><b>Tier allocation</b></p> <p>Mini-grid capacity ranges between Tiers 3 and 4 according to IEA and World Bank (2015, Figure A2.3).</p> <p>In the absence of reliable sources at country level on power capacity made available to individual residences via mini-grid plants, the report looked at country-specific availability (duration) of resources for each technology type. Due to a lack of data on storage capacity, the report looked at availability during the 24 hours only as defined in the MTF methodology (Bhatia and Angelou, 2015). The report then applied:</p> <ul style="list-style-type: none"> <li>• Tier 4, if hours of availability per day <math>\geq 16</math></li> <li>• Tier 3, if hours of availability per day <math>&lt; 16</math></li> </ul> <p>Hours of availability were estimated applying capacity factor figures to the hours of maximum continuous operation of a plant. Figures with capacity factors for renewable energy technologies in specific countries were obtained primarily from BNEF.</p>

<sup>74</sup> For example, in Nigeria, the overwhelming majority of the identified capacity additions for 2013-15 consist of mini-grid capacity for coastal refineries, presumably with little or no surplus generation available for residences.

Technology type	Approach used to estimate technology/country specific breakdown by target sector (export, residential, commercial, industrial, other)	Estimate for Tiers linkage (incl. rural/urban split)
Other off-grid	<p><b>Export and sector-specific breakdown</b></p> <p>The report assumes the larger off-grid generators (1kW – 15 MW) are used for industrial and commercial use. Smaller off-grid generators (&lt;1kW) are instead used both for residential and commercial uses in developing countries, as the latter are usually run at family level.</p> <p>The residential share for investments in off-grid installation (&lt;1kW) reflects electricity consumption patterns for residential and commercial use observed in the grid, on the assumption – in the absence of more specific data – that usage of off-grid electricity is similar to usage observed at national level.</p>	<p><b>Tier allocation</b></p> <p>Off-grid capacity ranges between Tiers 1 and 4 according to IEA and WB (2015, Figure A2.1 and Figure A2.3).</p> <p>Tier allocation is defined by technology types, following the approach suggested for mini-grid.</p> <p>The report applies:</p> <ul style="list-style-type: none"> <li>• Tier 4, if hours of availability per day <math>\geq 16</math></li> <li>• Tier 3, if hours of availability per day <math>\geq 8</math> and <math>&lt;16</math></li> <li>• Tier 2, if hours of availability per day <math>&lt; 8</math>.</li> </ul>
Off-grid: solar home systems and solar lanterns.	<p><b>Export and residential shares –</b></p> <p>GOGLA impact metrics use a conservative estimate of 10 percent as the default coefficient indicating the proportion of customers using solar for business purposes – with the balance of 90 percent of output used for residential purposes.</p>	<p><b>Tier allocation</b></p> <p>The report allocates investments to Tiers based on GOGLA (2016), estimating how sales volumes can be attributed to the different Tiers per the MTF as part of this assessment of the social, environmental impact of off-grid lanterns. The suggested approach is focusing on technology types:</p> <ul style="list-style-type: none"> <li>• Solar lanterns increase access to Tier 1,</li> <li>• SHSs increase access to Tier 1 for systems with PV panel capacity between 11 and 20 Wp, and Tier 2 for systems with PV panel capacity above 20Wp.</li> </ul>
Energy efficiency	Case by case analysis to allocate to the specific sector. When information was missing, assumed targeting the residential sector by default.	Not allocated. Further work is needed to develop an adequate methodology for the sector.
Market support (incl. technical assistance)	Not applicable	Not applicable

Technology type	Approach used to estimate technology/country specific breakdown by target sector (export, residential, commercial, industrial, other)	Estimate for Tiers linkage (incl. rural/urban split)
<b>Cooking</b>		
Advanced biomass (stoves and fuel and infrastructures)	<p><b>Determination of percent units (# individual assets) applied to residential vs. non-residential sector:</b></p> <p>Financial commitments to advanced biomass stoves were approximated at 100 percent to the residential sector based on market knowledge and in consideration of the data source.</p>	<p>The report used aggregate indoor emissions and efficiency data Tiers provided by GACC per technology type. It then mapped these to MTF indications, whereby Tier 1 efficiency requirements enable Level 1 services, and so forth. This same logic was applied for aggregate indoor air quality metrics received. The report then used a combination of secondary data and internal analysis over the remaining five MTF attributes to arrive at the maximum potential level of service that may be delivered by a particular solution. As per the MTF, the lowest level applied for any individual attribute comprises the highest potential Tier of access that may be delivered through a given solution.</p> <p>Indoor Emissions (per GACC): 2; Efficiency (per GACC): 2; Convenience (Internal Analysis): 5; Safety (Internal Analysis): 4; Affordability (World Bank, 2015a): &lt; 4; Quality of Primary Fuel (Internal Analysis): &lt; 4; Availability of Primary Fuel (Internal Analysis): &lt; 4</p> <p>Overall Tier used in databases: 2</p>
Alcohol (stoves and fuel and infrastructures)	<p><b>Determination of percent units (# individual assets) applied to residential vs. non-residential sector:</b></p> <p>Financial commitments to alcohol stoves were approximated at 100 percent to the residential sector based on market knowledge and in consideration of the data source.</p>	<p>Same approach as above.</p> <p>Indoor Emissions (per GACC): 4 or 5; Efficiency (per GACC): 1; Convenience (Internal Analysis): 5; Safety (Internal Analysis): 4; Affordability (World Bank, 2015a): &lt; 4; Quality of Primary Fuel (Internal Analysis): 4; Availability of Primary Fuel (Internal Analysis): 4</p> <p>Overall Tier used in databases: 1</p>

Technology type	Approach used to estimate technology/country specific breakdown by target sector (export, residential, commercial, industrial, other)	Estimate for Tiers linkage (incl. rural/urban split)
Biogas digesters	<p><b>Determination of percent units (# individual assets) applied to residential vs. non-residential sector:</b></p> <p>Financial commitments to biogas digesters were approximated at 100 percent to the residential sector based on a review of the specific transactions included.</p>	<p>Same approach as above.</p> <p>Indoor Emissions (per GACC): 4 or 5; Efficiency (per GACC): 3; Convenience (Internal Analysis): 3; Safety (Internal Analysis): 4; Affordability (World Bank, 2015a): &lt; 4; Quality of Primary Fuel (Internal Analysis): &lt; 4; Availability of Primary Fuel (Internal Analysis): 4</p> <p>Overall Tier used in databases: 3</p>
Electric stoves	<p><b>Determination of percent units (# individual assets) applied to residential vs. non-residential sector:</b></p> <p>Financial commitments to electric stoves were approximated at 100 percent to the residential sector based on market knowledge and in consideration of the data source.</p>	<p>Same approach as above.</p> <p>Indoor Emissions (per GACC): 4 or 5; Efficiency (per GACC): 4 or 5; Convenience (Internal Analysis): 5; Safety (Internal Analysis): 5; Affordability (World Bank, 2015a): &lt;4; Quality of Primary Fuel (Internal Analysis): &lt;4; Availability of Primary Fuel (Internal Analysis): &lt;4</p> <p>Overall Tier used in databases: 3</p>
Improved biomass (stoves)	<p><b>Determination of percent units (# individual assets) applied to residential vs. non-residential sector:</b></p> <p>Financial commitments to improved biomass stoves were allocated at either 100 percent or 70 percent to the residential sector. Allocations of 100 percent were based on a review of specific transactions. Allocations of 70 percent residential/30 percent non-residential were applied to vendors that commercialize both residential and institutional size stoves, based on a benchmark provided by the Paradigm Project Kenya (ERMC, 2016)</p>	<p>Same approach as above.</p> <p>Indoor Emissions (per GACC): 1; Efficiency (per GACC): 1; Convenience (Internal Analysis): 2; Safety (Internal Analysis): &lt; 4; Affordability (World Bank, 2015a): &lt; 4; Quality of Primary Fuel (Internal Analysis): &lt; 4; Availability of Primary Fuel (Internal Analysis): 4</p> <p>Overall Tier used in databases: 1</p>
LPG (stoves and fuel & infrastructures)	<p><b>Determination of percent units (# individual assets) applied to residential vs. non-residential sector:</b></p> <p>Financial commitments to LPG were allocated to the residential sector by reviewing the details of each project.</p> <p>When available, IEA consumption shares for LPG were used.</p>	<p>Same approach as above.</p> <p>Indoor Emissions (per GACC): 4 or 5; Efficiency (per GACC): 3; Convenience (Internal Analysis): 5; Safety (Internal Analysis): &lt; 4; Affordability (World Bank, 2015a): &lt; 4; Quality of Primary Fuel (Internal Analysis): 4; Availability of Primary Fuel (Internal Analysis): &lt;4</p> <p>Overall Tier used in databases: 3</p>

Technology type	Approach used to estimate technology/country specific breakdown by target sector (export, residential, commercial, industrial, other)	Estimate for Tiers linkage (incl. rural/urban split)
Natural gas (stoves and fuel)	<p><b>Determination of percent units (# individual assets) applied to residential vs. non-residential sector:</b></p> <p>Financial commitments were allocated to the residential sector based on a share of consumption (in TJ) as provided by IEA indicators.</p>	<p>Same approach as above.</p> <p>Indoor Emissions (per GACC): 4 or 5; Efficiency (per GACC): 3; Convenience (Internal Analysis): 5; Safety (Internal Analysis): 4; Affordability (World Bank, 2015a): &lt; 4; Quality of Primary Fuel (Internal Analysis): 4; Availability of Primary Fuel (Internal Analysis): 4</p> <p>Overall Tier used in databases: 3</p>
Natural gas (infrastructure)	<p><b>Determination of percent units (# individual assets) applied to residential vs. non-residential sector:</b></p> <p>For the one identified transaction, sector allocation was made based on IEA indicators for natural gas in India.</p>	<p>Same approach as above.</p> <p>Indoor Emissions (per GACC): 4 or 5; Efficiency (per GACC): 3; Convenience (Internal Analysis): 5; Safety (Internal Analysis): 4; Affordability (World Bank, 2015a): &lt; 4; Quality of Primary Fuel (Internal Analysis): 4; Availability of Primary Fuel (Internal Analysis): 4</p> <p>Overall Tier used in databases: 3</p>
Solar cooking (stoves)	<p><b>Determination of percent units (# individual assets) applied to residential vs. non-residential sector:</b></p> <p>Financial commitments to solar cookers were approximated at 100 percent to the residential sector based on market knowledge and in consideration of the data source.</p>	<p>Same approach as above.</p> <p>Indoor Emissions (per GACC): 4 or 5; Efficiency (per GACC): 4 or 5; Convenience (Internal Analysis): 3; Safety (Internal Analysis): 4; Affordability (World Bank, 2015a): &lt; 4; Quality of Primary Fuel (Internal Analysis): &lt; 4; Availability of Primary Fuel (Internal Analysis): &lt; 4</p> <p>Overall Tier used in databases: 3</p>
Market support	Not applicable	Not applicable

## DATA SOURCES AND TREATMENT

Figure A6 provides the list of various public and private data sources used for tracking commitments in the 20 HICs in 2017, followed by a discussion on data treatment issues.

**Figure A.6**

### List of Data Sources Used to Track Financial Commitments

Source name	Description	Sector relevance	International /Domestic	Additional comments
<b>Organization for Economic Co-Operation and Development (OECD)</b>	Data on international aid for project and market support from bilateral and multilateral donors, publicly available from the OECD DAC Creditor Reporting System (CRS)	Electricity and Cooking	International	As information was not directly available, a keywords search was performed to identify and separate off-grid, smart grid and clean cooking activities
<b>Bloomberg New Energy Finance (BNEF)</b>	Asset finance database for grid-connected renewable energy contains data on finance raised by solar companies.	Electricity – grid-connected renewable generation (excluding large hydro) and off-grid solar	International and domestic	Main reference for finance for grid-connected renewable energy  VC/PE financing deals for solar companies located in the 20 high-impact countries
<b>Climate Policy Initiative</b>	Project-level data from DFIs (MDBs and IDFC members) collected during the Global Landscape of Climate Finance	Electricity and Cooking	International	Additional data for bilateral and multilateral DFIs that includes guarantees, risk mitigation instruments and non-concessional finance not reported in OECD DAC CRS
<b>Climate Funds Update</b>	Additional data on national and multilateral Climate Funds' commitments	Electricity – grid-connected and off-grid renewable generation	International	Complements data on international and domestic public finance for electricity projects

Source name	Description	Sector relevance	International /Domestic	Additional comments
<b>Clean Cooking Alliance</b>	Venture investment database	Cooking	International and domestic	Contributes data on financing raised by clean cooking companies
<b>GOGLA</b>	Database on financing raised from GOGLA's member organizations	Electricity – off-grid solar	International and domestic	Financing raised by solar off-grid companies located or operating in HICs
<b>SEforALL surveys</b>	Surveys sent to 20 philanthropic foundations and impact investors	Electricity – off-grid solutions Cooking – all	International	Contributes data on financing raised by clean cooking companies
<b>Shine</b>	Database on investments by philanthropic foundations and impact investors	Electricity – off-grid solar	International	Complements data for philanthropies and impact investors
<b>IJGlobal</b>	Energy and infrastructure finance database	Electricity – grid-connected generation (fossil fuel, nuclear and large hydro) and transmission and distribution Cooking – LNG distribution	International and domestic	Main reference for grid-connected fossil fuel and LNG distribution projects
<b>Boston University China Global Energy Finance</b>	Tracks overseas development finance in the energy sector provided by China's two global policy banks	Electricity – grid-connected renewable and fossil fuel generation	International	Complements coal finance data
<b>International Trade Centre</b>	Tracks LPG cylinder imports by high impact countries	Cooking – LPG	International	Captures the financial value of LPG cylinder imports

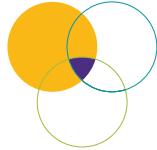
**Addressing double counting and data treatment across different databases:** aggregating data from different sources presents some challenges. To avoid double counting, some financial data from select sources and secondary market transactions were excluded. Specifically, the report excluded external resources that DFIs manage on behalf of third parties, governments' contributions to DFIs or climate funds, bilateral climate funds' commitments, and DFIs' contributions to projects reported by BNEF or IJ Global.

Combining data from the Shine Campaign, GOGLA and from the surveys to philanthropic foundations and impact investors also presented a number of issues due to the fact that several transactions were tracked, but from different angles – donor to intermediary, and intermediary from final beneficiary. For instance, Shell Foundation funding to Lendable is a finance platform that connects alternative lending companies in Africa with capital markets in the US and EU. Lendable has raised finance for several off-grid solar companies, and this information is captured by both Shine and GOGLA.

**Multi-country or regional level projects:** these projects are often marked as regional or global in the data sources, which makes it difficult to identify what portion flows to the 20 HICs. Two approaches were taken to address it:

- OECD CRS: a total of USD 580 million attributed to "Africa and Asia, regional", was not included in the analysis for conservative reasons. Similarly, energy investments marked as "global" (some of which are plausibly going to the HICs) in the OECD database were also excluded.
- Data from GOGLA, Shine and surveys: funds going to companies that operate regionally were allocated equally across the countries of operations.

**Private sector transactions:** assumptions were taken to estimate a realistic debt to equity ratio for projects with undisclosed financial information. For most renewable energy projects, a gearing ratio of 70:30 (debt to equity) was assumed, except for wind projects in China, assumed 80:20. For transactions with multiple debt and/or equity providers with limited information on financing provided by each provider, the financing amount was split equally.



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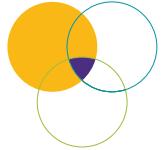
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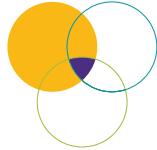
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