ENERGIZING FINANCE
RESEARCH SERIES

THE ROLE OF END-USER SUBSIDIES IN CLOSING THE AFFORDABILITY GAP

MARCH 2022

SUSTAINABLE ENERGY FOR ALL

CLIMATE POLICY INITIATIVE

ACKNOWLEDGEMENT

This brief was commissioned by Sustainable Energy for All (SEforALL). The SEforALL team was led by Tamojit Chatterjee, who worked in close collaboration with a team from Climate Policy Initiative (CPI), comprising of Morgan Richmond, Nicole Pinko, and Haysam Azhar who researched and wrote this brief.

The brief benefitted from additional review provided by colleagues from the CPI team including Chavi Meattle and Vikram Widge.

We would like to thank the following people and organizations, without whose input the report would not have been possible: Christine Eibs Singer (Catalyst Off-Grid Advisors), Johanna Christine Galan (World Bank), Wim Jonger Klunne (Household Solar Funders Group), Pauline Githugu (Africa Clean Energy TAF), Alex Cheval (Dalberg), Sjef Ketelaars (End User Subsidy Lab), and Charles Alexander Miller (End User Subsidy Lab).

We would like to thank all SEforALL staff for their support, especially Stephen Kent, Annette Aharonian, Glenn Pearce-Oroz and Tracey Crowe. We also thank Jenny Nasser (editor).

Valuable guidance and oversight were provided by Damilola Ogunbiyi, Chief Executive Officer and Special Representative of the UN Secretary-General for Sustainable Energy for All.

SEforALL acknowledges with gratitude the financial assistance provided by the Charles Stewart Mott Foundation that made this brief possible. We also acknowledge the Austrian Development Agency, the Ministry for Foreign Affairs of Iceland, the IKEA Foundation, and the Global Energy Alliance for People and Planet for their core support of our work.

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EXECUTIVE SUMMARY

Electricity access remains a significant global challenge, with only incremental progress made to date towards achieving Sustainable Development Goal 7 (SDG7) – access to affordable, reliable, sustainable and modern energy for all by 2030. The International Energy Agency (IEA) estimates that while the share of the global population with access to electricity grew to 90 percent in 2019, 759 million people still lack access to even basic levels of electricity. Of this number, 75 percent live in Sub-Saharan Africa (SSA) (IEA et al. 2021). There is growing consensus among key stakeholders that the costs of electricity products and services are unaffordable for the world's poorest and most marginalized households.

Recent literature indicates a step change in attitudes among private and public actors regarding end-user subsidies,[1] indicating favourable momentum for specific groups and products in high-impact countries (HICs).[2] An analysis by Lighting Global concluded that providing basic off-grid electricity products, such as solar home systems (SHSs) to as many as 617 million people globally would require USD 6.6 to 11 billion in financing. Of that financing, up to USD 3.4 billion would be required as public subsidies for end users to close the affordability gap (Lighting Global and Vivid Economics 2020).

Designing effective, efficient and supportive end-user subsidy programmes is a complicated process that relies on significant data and information, including an accurate understanding of the affordability gap in the targeted country or region. This brief builds on the existing literature regarding the development and implementation of end-user subsidies for SHSs. Its purpose is to: a) survey efforts to develop and advance a methodology to assess the affordability gap and the implied level of end-user subsidy required by the market, b) utilize case studies to map key attributes of subsidy design and demonstrate what these attributes look like in practice, and c) identify key data points required to accurately determine subsidy thresholds and targeting mechanisms to improve the success of subsidy programmes moving forward.

To demonstrate how the different attributes of subsidy design function for SHSs in practice, this brief considers three case studies: one from a relatively mature electricity market (Ghana) and two from emerging electricity markets (Uganda and Togo). The end-user subsidy programmes implemented in each country were also assessed on whether they directly addressed the affordability gap challenge in rural regions outside of potential grid connections. While the technologies (SHSs) and targeted populations (rural) are similar across the three programmes, the mechanisms used and ultimate results vary, as presented on the next page.

[1] End-user subsidies are direct or indirect payments to consumers that facilitate basic electricity access to households otherwise unable to afford the necessary products and services.
[2] High-impact countries for electricity access are defined in this analysis as reported in the Tracking SDG 7: The Energy Progress Report. The 20 HICs in South Asia and Africa are: Angola, Bangladesh, Burkina Faso, Chad, DRC, Ethiopia, India, Kenya, Madagascar, Malawi, Mozambique, Myanmar, Niger, Nigeria, North Korea, Pakistan, South Sudan, Sudan, Uganda, and Tanzania.

GHANA

Ghana has a reasonably well-developed electricity market with an electrification rate of 83.5 percent of the population as of 2019. The country implemented a successful end-user subsidy programme that provided SHSs to rural households. This success was likely the result of accurately calculating the subsidy thresholds for different regions in the country and targeting those populations that needed the subsidy the most.

UGANDA

In Uganda, a similar SHS subsidy for rural households had significantly less success, with a more complicated subsidy value and more stringent verification requirements that led to delayed payments. Furthermore, high prices and private companies' capacity limitations to deliver high-quality products led to consumer distrust.

TOGO

Togo is currently undertaking an end-user subsidy programme that focuses on technology to improve uptake and targeting accuracy, although programme evaluation is still underway. Early indications are that accurately calculating the affordability gap for SHS products may have been the leading factor in determining the correct subsidy threshold for increased uptake in that particular market.

Based on the conclusions from these case studies, key recommendations include:

A variety of crucial ongoing data and information issues must be addressed at the national level to effectively use existing affordability gap methodologies and to create more targeted, efficient subsidy programmes.

Researchers should advance a modified energy burden threshold for measuring the affordability gap in developing and emerging economies to ensure accuracy of subsidy targeting and a harmonization of approaches across methodologies. An accurate pricing mechanism, determined by the affordability gap methodology, is a key component of increasing subsidy uptake.

Policymakers should invest resources to improve data on several fronts: demographic data to more accurately target subsidies, technology and access-tier data to assess the potential for phased interventions of subsidies, and household-consumption data to minimize the potential for market distortion.

INTRODUCTION

End-user subsidies are direct or indirect payments to consumers that facilitate basic electricity access to households otherwise unable to afford the necessary products and services.[3] Recent literature indicates a step change in attitudes among private and public actors regarding end-user subsidies, indicating favourable momentum for uptake of the subsidies for specific groups and products. Many end-user subsidies are focused on the distribution and installation of off-grid products, such as pico solar and solar home systems (SHSs). This brief will focus on end-user subsidies for SHSs as they are a cost-effective way to provide electricity access to those off-grid, although there are also programmes outside the scope of this brief that focus on mini-grids or connections to existing electrical grids (Africa Clean Energy 2020). The structure of this brief is as follows:

Section 2 introduces end-user subsidies and contextualizes their role in increasing global energy access. This section also summarizes the two methodologies captured in this brief to assess the affordability gap and the implied level of end-user subsidy: those used in the Sustainable Energy for All (SEforALL) 2019 and 2021 Taking the Pulse reports in the Energizing Finance series and in the World Bank's Off-Grid Solar Market Trends Report in its Lighting Global programme.

Section 3 introduces a set of attributes key to end-user subsidy design and identifies the various methods available to build each component. Key attributes assessed are financing structure, delivery modality and implementers, technology targeted, market targeting mechanism, verification system, and target market. The brief contends that understanding this menu of ingredients available to policymakers, and how it is impacted by methodology choices and data availability, is critical to effectively target and verify beneficiaries while also determining the right threshold of the subsidy being provided.

In Section 4, these attributes are then mapped onto three case study examples to show how each component is developed via available mechanisms in mature (Ghana) and emerging (Uganda and Togo) electricity markets. The mapping aims to determine how each programme's design process and level of success was impacted by the affordability gap data available and calculation methodology employed.

Section 5 captures gaps in the data required to calculate the affordability gap for electricity access with the methodologies available and advances recommendations to close those gaps and improve end-user subsidy design more broadly.

[3] Households targeted by end-user subsidies are most often located in rural, hard-to-serve areas.

THE ROLE OF END-USER SUBSIDIES

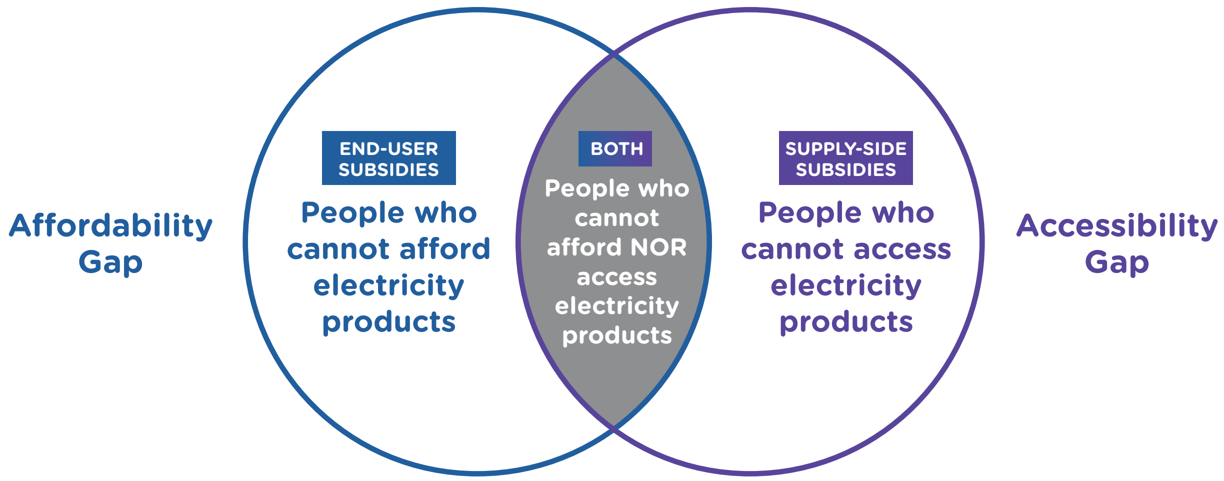
According to the Tracking SDG7 report, in a business-as-usual scenario, 940 million people will remain without access to electricity in 2030, of whom 515 million people will be in Sub Saharan Africa (SSA) (IEA et al. 2021 and IRENA 2019). Based on current access rates, it is estimated that 85 million people must gain access to electricity annually through 2030 to achieve universal access.

There is a lack of consensus around definitions of the affordability gap, accessibility gap, end-user subsidies, and supply-side subsidies. Moreover, the varied understanding of the variables used to calculate the affordability gap are not measured in a harmonized way, which may produce non-comparable results from studies being conducted in this field. To resolve these challenges, this brief provides a set of standard definitions informed by prior literature on the topic.

ELECTRICITY ACCESS TIERS: In the Sustainable Development Goal (SDG)7.1.1 target, electricity access is defined in binary terms, i.e., populations with access to electricity and populations without access to electricity. The World Bank developed the Multi-Tier Framework (MTF) that enables policymakers to devise phased interventions to help households move from lower tiers to higher tiers of electricity access. The MTF measures electricity access across five tiers. Tier 1 access represents four hours of electricity access during the day and one hour during the evening with a power capacity of a minimum of 12 kilowatt hours (kWh) daily.[4] Tier 5 represents minimum access of 23 hours per day, including four hours during the evening with a minimum power capacity of 8.2 kWh daily.[5]

AFFORDABILITY GAP: The affordability gap aims to calculate the financing required to enable access to a product for households that are unlikely to be able to afford it based on their current income. It estimates the number of households that earn too little to purchase a product and multiplies that by the average cost of such a product (ESMAP 2021). The Methodological Needs

FIGURE 1
Key Characteristics of the Affordability and Accessibility Gaps



[4] Tier 1 represents approximately sufficient power for three to four lights, charging a phone, and powering a radio.
[5] The increased capacity in tier 5 enables usage of high-load appliances such as air conditioners and washing machines.

Section presents an analysis of existing methodologies to measure the affordability gap and suggests potential improvements. The affordability gap is measured in monetary terms as it is an estimate of the total gap in finance that exists in a particular geography.

END-USER SUBSIDIES, ALSO KNOWN AS DEMAND-SIDE SUBSIDIES: End-user subsidies aim to bridge the affordability gap where consumers cannot afford products or services with their current income (Africa Clean Energy 2020). These mechanisms are structured so that the price of an electricity product or service is reduced or made available to customers for free to address the affordability challenges facing the poorest and most vulnerable potential consumers. End-user subsidies include cash transfers, voucher schemes, or results-based financing (RBF) that includes a mandatory price reduction. There are instances where it is difficult to distinguish an end-user subsidy from a supply-side subsidy, especially in the case of supply-side subsidies that may also lead to an indirect price reduction due to reduction in capital expenditure. It is important to note that end-user subsidies lead to direct price reductions of electricity products for the consumer.

ACCESSIBILITY GAP: The accessibility gap captures households that do not have a feasible way of obtaining off-grid products or services. In the context of this brief, the accessibility gap is defined solely as a supply-side issue.[6] It occurs when consumers do not have access to an electricity supply and includes consumers who could theoretically afford the products or services if the supply was improved. The accessibility gap can be attributed to a lack of feasible methods to obtain electricity products or services due to remoteness, lack of infrastructure, or lack of electricity networks. The MTF defines access as the "ability to avail electricity that is adequate, available when needed, reliable, of good quality, convenient, affordable, legal, healthy and safe for all required electricity services" (ESMAP 2015). The accessibility gap also accounts for the lack of availability of other attributes of electricity captured in the MTF.

SUPPLY-SIDE SUBSIDIES: Though not the focus of this analysis, supply-side subsidies have a role in markets with an accessibility gap (e.g., a market in a hard-to-reach rural area where products/services are not available even if customers are willing and able to pay for them) (Africa Clean Energy 2020). In these instances, supply-side subsidies aim to allow companies to charge a consistent price for their products, even when the cost of reaching a particular market is higher than average. Supply-side subsidies can take the form of RBF schemes, grants and concessional financing facilities.

BOX 1: INTERPLAY BETWEEN AFFORDABILITY AND ACCESSIBILITY

In a non-commercial market, defined as having both affordability and accessibility gaps, both supply-side and end-user subsidies must be deployed simultaneously (see Case Study 5.3 on end-user subsidies in Togo). Increased household affordability can be achieved by deploying end-user subsidies, which increase demand for products and services in areas where they are not commercially available. Alongside improved affordability, this may also reduce the accessibility gap as companies may be incentivized to operate in these markets due to higher demand for their products. Moreover, as consumer affordability improves through end-user subsidies, companies can achieve economies of scale as there is more demand for their products. This may lead to lower costs for companies and, eventually, lower prices being passed on to consumers, improving their affordability. Supply-side subsidies can also have an indirect effect on affordability by unlocking scale that brings down the price passed on to the consumer further.[7]

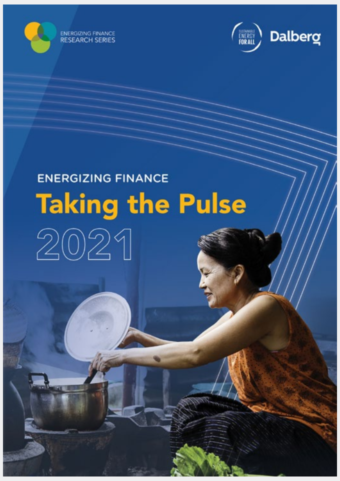
[6] For the purpose of this brief, accessibility is defined solely as a supply-side issue. An end-user subsidy is primarily designed to address the affordability gap but, in the process, also has an impact on accessibility issues. On the other hand, supply-side subsidies are primarily designed to address the accessibility gap but, in the process, also have an impact on affordability gap issues (see Box 1).
[7] Technological innovation also has a key role to play in improving household affordability by lowering the costs of developing such products/services.

MARKET DISTORTION: End-user subsidies are critical for bridging the affordability gap and reaching universal electricity access. They are usually targeted towards lower-income households for whom the challenge around affordability is much more pronounced. End-user subsidies can, as indicated below, also yield market distortion risks; this has historically led to hesitancy among policymakers in implementing them (Africa Clean Energy 2020).

The challenge around market distortion revolves around the need for an accurate calculation of subsidy thresholds in a market (how much subsidy is needed) and the effective targeting of beneficiaries (who needs the subsidy). Much of the remaining electricity access gap in many developing countries is expected to be bridged through the commercial off-grid market as many households without access are based in hard-to-reach, sparsely populated rural communities. Therefore, market distortion must be avoided to ensure the commercial market functions alongside well-structured end-user subsidies. This can be done through effective subsidy design and the use of a methodology that accurately measures the affordability gap, which helps in determining accurate subsidy thresholds for different target populations. Moreover, in many subsidy programmes, the provision of free electricity products has destabilizing effects on the price that private sector providers charge for those products. Key examples of market distortion from end-user subsidies that are of concern include:

- Erroneously signalling to consumers that the value of a product should be lower than the commercial price by not communicating the reasons for and benefits of the subsidy scheme. In these circumstances, customers who do not benefit from the scheme may delay or halt a purchase under the assumption that they are receiving an unfair price.
- Lack of clarity for commercial market players in expansion and support planning if a subsidy scheme does not have a clear exit strategy. Commercial players — including manufacturers and distributors — must clearly understand the planned timeline and scope of the end-user subsidy to plan commercial operations around the scheme.
- Arbitrage and leakage due to products given at very low prices to consumers who may sell these products at a higher price in another market if there is a lack of monitoring and evaluation regime built into the programme.

BOX 2: EXISTING AFFORDABILITY GAP METHODOLOGIES



Taking the Pulse: The 2019 and 2021 *Taking the Pulse* reports, part of SEforALL's Energizing Finance research series, advance a methodology to assess the affordability gap by country and the implied level of affordability-gap subsidy required for the population to afford basic tier 1 electricity access. The methodology focuses solely on solar home systems (SHSs) and uses the World Bank's PovCalNet tool for affordability analysis to estimate the extent of poverty at current income and consumption levels. When average household consumption is known, it is used in the model (estimated to be 8 percent for Ghana) (SEforALL 2021). When information around household consumption is not available, as in Uganda, the model assumes that households spend approximately 5 percent of consumption expenditure on electricity needs.

Affordability is determined by comparing the percentage of household consumption spent on electricity over a certain period to the cost of the most suitable system. If the share of income is below the cost of the item, the household is deemed unable to afford the product. For example, if an electricity product is USD 8 per month and a household's total monthly expenditure for all goods and services is less than USD 100 per month, the household is deemed unable to afford it.

It is important to note that the methodology also takes into account country differences in calculating the cost of products. The differences in cost are a function of varying tax regimes such as VAT and import duties on products such as SHSs. In Mozambique, the import duty on SHS products leads to a 45 percent increase in the price of the product. There are also distribution costs that have to be factored in, especially when comparing urban and rural areas.

Off-Grid Solar (OGS) Market Trends Report by the World Bank: The report's approach has some similarities to the Taking The Pulse methodology but also introduces new elements to the affordability gap calculation. As in the Taking the Pulse reports, "affordable" is defined as the OGS product costing less than 5 percent of total monthly expenditure, using the same energy burden threshold. However, the Market Trends methodology introduces a new category for analysis, "affordable at a stretch", where the OGS product costs between 5 and 10 percent of overall monthly expenditure for pico products and up to 15 percent for larger systems. Anything beyond this threshold is considered unaffordable. This methodology considers a wider variety of technologies and potential customers by using multiple tiers; a minimum threshold to calculate the affordability gap, a maximum threshold for unaffordability, and finally, evaluating a range between two thresholds.

Unlike Taking the Pulse, the Market Trends methodology is focused on calculating the affordability gap for multiple technologies such as variations of pico products: 1) single light (less than 1.5 Wp), and 2) single light + mobile charger (1.5–3 Wp), as well as variations of SHS products: 1) entry-level SHSs (11–21 Wp), 2) basic SHSs (21–50 Wp), and 3) high-capacity SHSs (100+ Wp). Moreover, the Market Trends methodology defines price points for theoretical and practical affordability, which utilize the average prices for each type of product. Theoretical affordability refers to the annualized cost of the system over its lifetime. Practical affordability refers to three months of savings to make the full (cash) payment for pico products or to make the pay-as-you-go (PAYGO)[8] deposit for larger systems.

[8] Pay-as-you-go (PAYGO) is a financing structure through which companies provide an energy product to customers for an average of 10–20 percent upfront payment of the total product cost and the remainder of the cost is paid for over a given period.

ATTRIBUTES OF END-USER SUBSIDY DESIGN

The different methodological approaches available to measure the affordability gap highlight the need for harmonization in end-user subsidy design and evaluation. Each region and market should use the methodology and approach best tailored to its goals and target communities, but the data metrics and systems of measurement should be harmonized to be more comparable across methodologies, as demonstrated by the case studies in Section 5. The use of a clear methodology in measuring the affordability gap, and the subsequent data collection and analysis, can address many of the pitfalls and data gaps identified in the Methodological Needs Section (Section 6). Defining what constitutes an end-user subsidy and what components comprise a key part of subsidy design is currently an opaque process that differs between subsidy schemes and that would benefit from a global, standardized framework to better inform progress (Africa Clean Energy 2020).

The list of attributes presented below aims to gather the main components of an end-user subsidy and identify the various methods available to build each attribute. This is, in part, to differentiate between an end-user subsidy and a supply-side subsidy and to demonstrate the variety of mechanisms employed in the development of an end-user subsidy programme. It is also to demonstrate that while affordability gap methodologies may differ across regions, the ultimate components of an end-user subsidy are largely the same. Additionally, the demographic and energy data required to complete an accurate affordability gap calculation, which are often missing, can be used across the various methodologies and in end-user subsidy design. This list of attributes of subsidy design is mapped onto the case study examples to show how each component is developed via available mechanisms in mature (Ghana) and emerging (Uganda and Togo) electricity markets.

Table 1 presents a list of the attributes of design in an end-user subsidy scheme. These attributes must function jointly to succeed in efficiently targeting the scheme and avoiding distortionary market effects. Additional details on each attribute follow.

TABLE 1
Summary of Subsidy Design Attributes

CATEGORY	TYPES
Structures	A. Discounted/free products B. Subsidized consumer finance C. Product vouchers/cash transfers
Delivery modalities & Implementers	A. Direct to household B. Through third party
Technologies	A. Solar home systems (SHSs) B. Mini-grids C. Grid-connected
Targeting mechanisms	A. Untargeted B. Implicitly targeted C. Administratively targeted D. Targeted by self-selection
Monitoring & Verification	A. Technology-enabled verification B. Manual verification
Market framework	A. Financially challenged B. Non-commercial

Structures of End-User Subsidies: End-user subsidies aim to reduce the price of an electric lighting product to address affordability challenges on the consumer end. End-user subsidy types include:

A. Discounted or free products or services provided by a third-party supplier, including results-based financing (RBF) options that include a mandatory price reduction (GOGLA 2021), which ultimately benefits consumers.[9]
B. Subsidized concessional consumer financing. In situations where the cost of financing is heavily reduced, this provides favourable finance options for equipment or services directly to the consumer, such as a pay-as-you-go (PAYGO) system.
C. Product vouchers and conditional or unconditional direct cash transfers (the most direct form of end-user subsidies).

Delivery Modalities & Implementers: Current end-user subsidy programmes generally either provide A) the subsidy directly to the household, or B) to a third party that provides the equipment and/or service (Africa Clean Energy 2020). Examples of the two modalities follow:

A. Under a subsidy provision directly to the household, vouchers or cash transfers for off-grid products are sent directly to end users. Direct financing typically comes from national- or regional-level governments or government entities and often includes direct subsidies such as cash transfers or vouchers.
B. In using a third party, subsidies are given directly to an authorized product dealer by refunding a portion of the sale price after proof of sale or verification of the product installation. This modality is common in rural areas. In areas where a single dealer owns and maintains provided equipment or acts as a small utility, subsidies are often delivered via a fee for service. Third-party implementers include: 1) electricity utilities, 2) electricity product manufacturers and distributors, and 3) international or local financial institutions. In certain instances, they can also include semi-autonomous government institutions.

Technologies: End-user subsidy programmes can provide grid-connected or off-grid access, depending on the programme, targeting mechanisms, and geographic region. Technology types are:

A. Subsidies for solar home systems (SHSs) where SHSs are estimated to be used almost exclusively (90 percent) for residential use and are considered tier 1 and 2 solutions depending on system size (Ibid). This brief focuses on SHS end-user subsidies due to cost, suitability and availability.
B. Subsidies for mini-grids are aligned with Multi-Tier Framework (MTF) tiers 3–4 (SEforALL 2021a). While an off-grid technology, mini-grids are more expensive than SHSs and therefore not featured in this brief. Moreover, delivering SHS products is much faster than implementing mini-grid projects, making them a more suitable option for the targeted end-user subsidy demographic.
C. Subsidies for grid connection or electricity for grid-connected households typically provide access to MTF tiers 3–5 depending on system reliability (Ibid).

Targeting Mechanisms: The assessed affordability gap of a target market and the methodology employed to determine that gap have a substantial impact in designing the targeting mechanisms used for an effective end-user subsidy. The Energy Safety Nets research series carried out by Sustainable Energy for All (SEforALL) identified four methods for targeting end-user subsidy beneficiaries, often used in conjunction with one another (SEforALL 2020):

A. Untargeted subsidies available to all households in a region.
B. Implicitly targeted subsidies available by default to anyone in a population group, such as a geographic area or existing on-grid area.
C. Administratively targeted subsidies refer to selecting a particular demographic using either economic, social, or cultural indicators.
D. Targeted by self-selection is defined by community or household behaviour and household demand for the subsidized product or service.

[9] Results-based financing (RBF) is most often used in supply-side subsidies, but GOGLA sees a new role for this form of financing with a strong consumer focus.

Verification Systems: Africa Clean Energy identifies two forms of verification systems to ensure that subsidized products reach the targeted demographic, that the subsidized amounts are correct, and that no leakage or arbitrage occurs (Africa Clean Energy 2020).

A. Technology-enabled verification, where verification of the reach of products is done through mobile apps or other virtual means, has lower administrative costs but may not fully cover all targeted demographics or products.
B. Manual verification is conducted inperson and is more costly and logistically challenging, but more common.

Market Framework: End-user subsidies are most appropriate for two types of markets. More details on the distinction between subsidies in these two market types are below:

A. Financially challenged markets, where consumers cannot afford to pay for grid connections and service or for off-grid products and services but are within areas that companies are able to serve. In these markets, end-user subsidies should be used with caution and an eye toward minimizing market distortion (GOGLA 2021).
B. Non-commercial markets, where consumers are neither able to afford the cost of products and services nor within the areas off-grid solar (OGS) companies or the electric grid can serve. For these markets, end-user subsidies can successfully be used together with supply-side subsidies to increase accessibility and lower cost (Ibid).

END-USER SUBSIDIES IN PRACTICE

Three case studies were evaluated for this brief, one from a relatively mature electricity market (Ghana) compared to other Sub-Saharan African (SSA) countries, and two from emerging electricity markets (Uganda and Togo). An end-user subsidy programme was developed in each country to directly address the affordability gap challenge in rural regions outside of potential grid connections. The methodology used by each programme in its measurement of the affordabilty gap had a key impact on the subsidy design, particularly subsidy pricing and targeting mechanisms. While the technologies (solar home systems)(SHSs) and targeted populations (rural) are similar across the three programmes, the mechanisms used and ultimate results vary.

Ghana has a reasonably well-developed electricity market with an electrification rate of 83.5 percent of the population as of 2019. Its case study outlines a successful end-user subsidy programme that provided SHSs to rural households (World Bank Group 2021a). In the Uganda case study, a similar SHS subsidy for rural households had significantly less success, with a more nuanced subsidy value and more stringent verification requirements that led to delayed payments. Togo is currently undertaking an end-user subsidy programme that focuses on technology to improve uptake and targeting accuracy.

Where possible, the case studies include analysis of how the assessed affordability gap of the target market and methodology used may have impacted each programme's design. Given limited availability of information — including what (if any) affordability gap data and methodology type were employed by programme implementers — the case studies do not indicate with certainty how the affordability gap or methodology factored into the design process. There are, however, clear connections between the subsidy design attributes, methodologies, and data availability. The more successful programmes appear to have had stronger data behind them, which leads to more effective subisdy design options.

CASE STUDY – GHANA

Ghana has seen a rapid increase in electricity access in the past 20 years, reaching 83.5 percent in 2019 (World Bank 2021a). This is largely due to the country's National Electrification Scheme (NES) that aims to reach "universal access" by 2025 (originally 2020) (USAID 2019). The focus of the NES is on grid expansion, and as of 2020, 81 percent of the population was able to access electricity through the main grid (Ibid). A similar project, focused on providing off-grid solutions for rural communities currently without grid access, was launched in 2019 and aims to provide decentralized electrification access to 3 million people in 1,000 communities by 2030 (Ibid). The plan prioritizes mini-grids, which provide tiers 3 and 4 access, and SHSs, which provide tiers 1 and 2 access depending on size (Ibid). As of 2020, 3 percent of the population had off-grid electricity access through SHSs. This figure is expected to increase to approximately 9 percent by 2030 (World Bank Group 2020).

The 2021 Taking the Pulse Report estimates that Ghana requires USD 22 million in finance to close the tier 1 access gap by 2030, of which USD 12 million is needed to close the consumer affordability gap (SEforALL 2021). Forty percent of the private finance need is in the form of grants to support operations in last-mile areas where distribution is costly (Ibid).

The Ghana Energy Development Access Project launched the Improving Rural Energy Access through Solar Home Systems programme in 2010. It started with USD 3.45 million in grant funding and the goal of supporting electricity access for 15,000 households in rural areas outside of potential grid connection (GPOBA 2016). By the programme's close in 2017, 8,831 SHSs of various sizes and 7,991 solar lanterns had been supplied to remote communities (Ibid). Due to Ghana's developed electricity market, accurate data for the affordability gap calculations likely played a role in the programme's success. It was considered well-targeted to the customers it was designed for, and the pricing and financing options were low enough to make it popular. Funding was supplied through multilateral development institutions, with assistance from ARB Apex Bank and its partnership with rural banks (Ibid).

ATTRIBUTES OF SUBSIDY DESIGN	GHANA – IMPROVING RURAL ENERGY ACCESS
Structures	A. Discounted products: SHSs and lanterns provided at subsidies of 50–60%
Delivery modalities & Implementers	B. Through third parties: Private equipment & service provider - SHSs via Association of Ghana Solar Industries. Implemented by Ghana Energy Development Access Project (GEDAP), Global Partnership on Results-Based Approaches (GPRBA), World Bank, ARB Apex Bank & partnership rural banks
Technologies (+ tier)	A. SHSs (10–50 Wp): Tiers 1-2
Targeting mechanism	B. Implicitly targeted: Only offered to households in off-grid areas of Ghana
Monitoring & Verification	B. Manual verification: Payments made to third-party providers upon proof of installation
Market framework	B. Non-commercial market

The programme provided discounted equipment — between 50 and 60 percent less than the traditional retail price — and offered guaranteed financing options for the remaining amount, if necessary (Bawakyillenuo 2020). While most of the funding went towards the subsidized equipment, approximately USD 1.6 million in loans were accessed through a non-subsidized finance mechanism (Ibid). Under the programme, payments were made directly to the service provider in return for verification of installation and short-term maintenance. The programme was notable for its success and showcased the benefits of working with reliable third parties; the inclusion of both the Association of Ghana Solar Industries and rural banks were programme strengths. The implicit targeting via rural communities also helped to keep administrative costs down; implicit targeting works well in countries with high electrification levels, but in countries with low access rates and high demand, moveable assets can be subject to arbitrage or leakage. While the reliance on grant funding meant this programme was only able to run for a set length of time, it is one that could be replicated elsewhere.

CASE STUDY – UGANDA

As of 2018, only 42 percent of households in Uganda had access to electricity. Efforts to expand the national grid have been slow, with grid connectivity barely doubling from 10 percent in 2010 to 19 percent in 2018 (World Bank 2019). Taking the Pulse 2019 estimates that grid connectivity will likely increase to 47 percent, yielding 4.7 million new connections between 2020 and 2030 (SEforALL 2019). The mini-grid access rate currently stands at less than 1 percent and is projected to provide access to 70,000 additional households between 2020 and 2030 (Ibid).

Given the constraints around the expansion of the grid, SHSs can play a key role in improving access rates. Taking the Pulse 2019 estimates that SHSs currently provide electricity to 19 percent of Ugandan households and can close the access deficit (Ibid). Over 7 million households would need to gain access to SHSs for Uganda to achieve universal access by 2030 as grid extension is not a financially viable option for areas sparsely populated or hard to reach (Ibid).

Additionally, 44.5 percent of households cannot afford a full tier 1 SHS at the cost of USD 7.50 per month (Ibid). Thirteen percent of households cannot afford the USD 3.30 per month necessary to buy a solar lantern on a pay-as-you-go (PAYGO) basis. The 2019 Energizing Finance series estimates the affordability gap for SHSs to be around USD 330 million, suggesting that Uganda would require an average of USD 29.9 million every year in affordability gap financing to achieve universal access by 2030 (Ibid).

The Shell Foundation conducted a fiscal policy analysis of subsidy options to close the affordability gap for SHSs in Uganda and increase electricity access. Its study included a cost-benefit analysis for SHSs and a consumer-financing guarantee, which identified direct subsidies to end consumers to be the most cost-effective way to deliver access to rural households and improve affordability. The foundation's report recommended that end-user subsidies should be applied at a regional level to account for local differences, as end-user subsidies have the potential to distort markets if beneficiaries are not targeted accurately. It also recommended that the government leverage the existing private sector players in the off-grid solar (OGS) sector in Uganda to efficiently deliver end-user subsidies (Shell Foundation 2018).

The Energy for Rural Transformation (ERT) Subsidy programme has been implemented jointly by the Ugandan Government and the World Bank since 2002. It has been the main channel for delivering subsidies to rural communities and has three phases. Phase 1 ran from 2002–2009, phase 2 from 2009–2012, and phase 3 from 2016 to the present (Energy Africa 2018). The programme has suffered from structural challenges, although the lack of transparency around it has made specific identification of these challenges difficult.

During phase 1, the programme provided subsidies to private sector actors that were passed on to the consumer as a direct 70 percent reduction in solar system price (Ibid). An ex post evaluation of the project shows that the response from the private sector was somewhat disappointing as the implementers had overestimated the capacity of the private sector to deliver the subsidies and the price of the systems was still much higher than the disposable income of rural households, leading to reduced uptake (Ibid). If an affordability gap estimate was used to determine the subsidy amount, it was likely inaccurate as the subsidy provided should have been much higher. Although the subsidy amounts varied for different SHS products, the high price of the systems was likely a key contributor to the programme's challenges. Accurate affordability gap estimates, based on more precise data, could have potentially alleviated some of the challenges faced by the project.

ATTRIBUTES OF SUBSIDY DESIGN	UGANDA - ENERGY FOR RURAL TRANSFORMATION (ERT) PHASE 2
Structures	A. Discounted products: USD 5.5 per Wp installed, if the system did not exceed 50Wp, and USD 4 per Wp for systems up to 500Wp
Delivery modalities & Implementers	A. Directly to households: Through registered financial institutions via the federal government B. Through third parties: SHS companies with a proven track record
Technologies (+ tier)	A. SHSs: 20,000 SHSs targeted (tier 1-2)
Targeting mechanism	C. Administratively targeted: Rural communities
Monitoring & Verification	B. Manual verification: Payments made to third-party providers upon proof of installation
Market framework	B. Non-commercial market

During phase 2, the design of the delivery mechanism of the subsidy was modified with the launch of the Photovoltaic Target Market Approach (PVTMA) programme. The PVTMA targeted the installation of 20,000 SHSs and saw end-user subsidies as the core strategy to achieve this (Ibid). The verification protocols for the companies delivering the subsidies were more nuanced and of a higher standard than those in the previous phase. For example, companies had to demonstrate sales in the market for at least two years. The geographic targeting of the programme also allowed for a more granular approach to segment markets, as the subsidy thresholds differed according to the size of the SHS. Specifically, the amount of consumer subsidy was equal to USD 5.5 per Wp installed, if the system did not exceed 50Wp, and USD 4 per Wp for systems up to 500Wp (Ibid).

Despite all these efforts, the programme struggled and only 14,000 SHS installations were realized against a target of 20,000, in part due to continued delays in subsidy payments that posed a liquidity challenge and the complicated monitoring processes (Ibid). There were also issues with companies adding bigger panels than were required for the systems to increase their share of the subsidy, leading to protracted legal issues. The programme is an important example of why government support is critical to implement these types of subsidies in under-developed markets.

Phase 3 of programme has been underway since 2016 with the off-grid electricity access component accounting for approximately 14 percent (USD 25 million) of total funding (USD 175 million). However, phase 3 focuses on the supply side and does not contain an end-user subsidy component (World Bank Group 2018).

CASE STUDY – TOGO

As of 2018, only 51 percent of the overall population in Togo had access to electricity and In rural populations the number was only 7 percent (SEforALL Africa Hub 2016). Over 1 million households in Togo are currently without power, translating to roughly 3 million people. Togo's government has set ambitious targets to achieve universal electricity access by 2030, and electricity access increased from 17 percent in 2000 to 51 percent in 2018 (Ibid).

The Government of Togo has adopted a National Electrification Plan (NEP) that entails the deployment of 555,000 SHSs, 300 mini-grids (55,000 connections) and 400,000 on-grid connections between 2018 and 2030 to reach universal access by 2030 (Lighting Global 2018). The focus on the off-grid sector is pragmatic since it is not cost-effective to increase grid connectivity in rural areas due to sparsely populated rural communities and lack of consumer affordability (The Borgen Project 2020). Given Togo's relatively small, low-income population and the nascency of its off-grid sector, the government launched the CIZO project to enact enabling environment supply-side and demand-side interventions at the same time (Ibid). The following case study details the end-user subsidies for SHS products being implemented through the programme.

The CIZO programme aims to deploy 555,000 SHSs to rural households by 2030, with an initial target of 300,000 SHSs deployed by 2025 (Ibid). Various multilateral institutions such as the European Union and African Development Bank have provided financing for the initiative (EUR 10 million and EUR 12 million, respectively) (Afrik 21 2019). There is a great deal of participation from the private sector with mobile carriers and authorized PAYGO solar companies implementing the initiative in tandem with the government.

ATTRIBUTES OF SUBSIDY DESIGN	TOGO – CIZO PROGRAMME
Structures	A. Discounted products: USD 144 (monthly payments of USD 4 for 36 months)
Delivery modalities & Implementers	B. Third parties: Mobile money top-up through local carriers Togo Cellulaire and Moov, systems provided by BBOXX and French energy provider EDF, Soleva, Engie Energy Access, Solergie, and Moon
Technologies (+ tier)	A. SHSs: 300,000 SHSs (tier 1-2)
Targeting mechanism	C. Administratively targeted: Rural communities[10]
Monitoring & Verification	A. Technology-enabled verification: The subsidy is delivered only if the customer is on an internal database of eligible customers
Market framework	B. Non-commercial market

[10] The selection criteria for being included in the registry are not publicly available.

The CIZO programme is innovative and the first of its kind in leveraging mobile money to provide subsidies to end users by employing a PAYGO model where:

- Customers make a monthly payment (usually USD 4) for the system through mobile money
- The mobile operator checks if the customer qualifies for the subsidy
- If the customer qualifies, their monthly payment is topped up by USD 4 from the government subsidy, and the USD 8 total payment is sent to the SHS provider.

Licenses to private sector partners are based on the quality of SHSs, machine-to-machine connectivity (M2M)[11], and their service quality (Lighting Global 2018). In terms of targeting, private service providers collect customer information digitally, focusing on low-income customers and the economically vulnerable. Customer information is aggregated into a database by telcos and the national postal service, La Poste (Ibid). This allows La Poste to establish an integrated registry for all eligible customers based on demographics.

Because the methodology for determining participation in the registry and the eligibility criteria for inclusion are not public, it is difficult to draw a connection between the targeting of beneficiaries and the affordability gap they were facing. However, an accurate affordability gap estimate for the regions within Togo would be a key part of increasing the uptake of SHSs. The already positive uptake may be an indication that the subsidy threshold was determined using accurate affordability gap estimates where the government had the required data to determine an effective level for subsidization.

Implementation of the programme has been slow despite the use of digital technology to verify installations and beneficiaries and provide the monthly subsidy payments. To date, 35,000 households have received SHSs (Ibid). However, with increasing mobile money penetration across SSA, using digital solutions to deploy subsidies has the potential to create massive government opportunities to scale up such interventions.

PROGRAMME COMPARISON

Each of the programmes in the three countries was marked by key choices that influenced individual outcomes. In creating each one, policymakers selected between the different categories available under each component of the attributes of subsidy design described in Section 3. Of the attributes, delivery modalities, technologies, and implementers were particularly impactful on programme success. Each design process was likely impacted by the affordability-gap data available and calculation methodology employed. Programme designs were likely impacted by data limitations, including a data gap in demographics and energy usage, which resulted in less accurate targeting mechanisms and pricing structures, especially in the case of Uganda.

Delivery Modalities & Implementers: In terms of the constructive impacts on the subsidy programme assessed in Ghana, a key part of the programme was the Association of Ghana Solar Industries' involvement in providing reliable products, installation and service. The Togo programme is an effective example of a public-private partnership where the government sends subsidy payments and holds the registry of eligible customers, but the delivery of subsidies is carried out by private sector partners such as digital payment and SHS providers. Moreover, the model encourages the uptake of mobile and digital payment mechanisms among rural populations to enable innovative government interventions like this one in the future. To date, 35,000 households In Togo have received solar SHSs.

In contrast, the programme in Uganda faced delays in subsidy payments to participating companies from the government and implementers, in part due to concerns suppliers were not acting in good faith, with some payment delays lasting over two years (Office of the Auditor General 2014). These delays caused significant

[11] A direct communication between devices using any communications channel, including wired and wireless.

challenges for programme performance and trust. In the end, the programme partially failed as only 14,000 of the targeted 20,000 SHS installations were realized.

Technologies: Appropriate selection of technologies has proved critical to programme success. In Togo, there are vigorous quality checks in place for the SHS products being deployed. To be eligible, the products need to meet a certain threshold (reliability, consistent supply, length of supply). In Uganda, by contrast, the programme was impacted by technology performance challenges. A group of auditors observed that the expected discharge rate of 20 hours for SHSs was not accurate as some packages only provided light for as little as two to three hours (Ibid).

Monitoring & Verification: Both the Ghana and Uganda programmes relied on manual verification provided by third-party implementers. While in Ghana this process ran well, there were logistical difficulties in Uganda. The Ugandan government first had stringent requirements for installers and required considerable evidence of proper installation. This requirement was not without reason, however, as the subsidy depended on system size and there were issues with oversized systems being installed to collect a larger amount of subsidy financing. The CIZO programme in Togo has used technology-enabled verification to much acclaim (Mobile for Development 2021). In it, the demographic data of eligible customers are collected by partners and then aggregated into a database created by telcos and the national postal service, La Poste (The Borgen Project 2020). All payments are checked against the registry for eligibility and the programme only allows SHS products that can be monitored remotely, allowing the government to verify installations via technology.

Affordability Gap Impact: The methodology used in calculating the affordability gap, which determines pricing structures, may have also varied across programmes although this information is not publicly available. The two methodologies outlined in Box 2 both assume an affordability threshold of 5 percent of monthly expenditure for electricity consumption, but the Taking the Pulse methodology allows for variation based on local data, while the World Bank's Market Trends methodology allows a larger price range as a stretch goal. Both methodologies are heavily impacted by incomplete or incorrect data. Better transparency around the subsidy design process, including data sources and methodology used, would allow for better harmonization across end-user subsidy designs.

While there is a lack of publicly available information on how each country calculated the affordability gap for their end-user subsidy programme, the more effective pricing structures in Ghana and Togo suggest more accurate demographic data were used in the calculations. The pricing mismatch in Uganda, where one of the issues was that the cost of the subsidized unit remained unaffordable for most households, suggests that the programme included inaccurate or incomplete data. The maturity of energy markets in each country — Ghana has a well-developed energy market while Togo and Uganda have only moderately-developed energy markets — likely played a role in data availability. Ongoing issues of data gaps and their impacts are discussed further in the Methodological Needs Section.

BOX 3: COMPARATIVE ANALYSIS OF END-USER SUBSIDIES ACROSS REGIONS

Experts at the World Bank note that the use of end-user subsidies to address the affordability gap for electricity varies depending on the economic and policy context of the implementing environment in question. In Latin American, for example, where electricity access rates are much higher on average than in SSA (98 percent vs. 47 percent), end-user subsidies are deployed most frequently in rural areas with significant poverty — areas that face both affordability and accessibility gaps — and are used to increase access beyond tier 1 using off-grid solar (OGS). In the Sustainable Energy for All (SEforALL) Energy Safety Nets research series, existing end-user subsidy programmes in six countries (Brazil, Ghana, India, Indonesia, Kenya and Mexico) were analyzed and the following differences and commonalities were presented:

Differences:

- In Brazil and Mexico, the government has focused on connecting rural households through OGS solutions whereas in Ghana and Kenya, previous government efforts have prioritized extending the existing grid. However, the current focus in Ghana, Kenya, and SSA is now shifting to OGS solutions to increase rural access and ensure no one is left behind.
- In countries like Togo that have high digital penetration rates, governments have been able to deploy subsidies digitally using mobile money. This also gives them the ability to verify installations of tier 1–2 products like SHSs remotely, thereby increasing the cost-effectiveness of these programmes. Over two-thirds of total global mobile money transactions were driven by users in SSA (GSMA 2019). However, compared to Latin America, digital penetration remains low (28 percent in SSA vs 68 percent in Latin America)(World Bank Group 2021b). This means that there is a difference in the potential for mobile money to solve issues such as verification and deployment of subsidy payments.

Commonalities:

- The targeting of subsidies for programmes in all six countries highlighted in the research series has been primarily geographical although Brazil's Luz para Todos programme includes elements of administrative selection.
- Grid electricity consumption has been subsidized in the form of lifeline tariffs for consumers who utilize small amounts of electricity across the six countries analyzed.
- In all six countries, there is a demonstrated link to social assistance programmes that allow for better targeting of beneficiaries using existing government databases (SEforALL 2020).

METHODOLOGICAL NEEDS

This brief identifies various data points required to calculate the affordability gap for electricity access, which may inform future studies on how to accurately calculate the affordability gap while also making use of pre-existing methodologies. Key data points, including estimated household electricity consumption, household income, and cost of electricity expenses are necessary to effectively target beneficiaries and to calculate subsidy thresholds that are adequate for intended beneficiaries, yet do not exert distortionary pressures on the market. Existing data gaps may be closed through government intervention and engagement with civil society organizations that focus on the collection and analysis of primary data. If collected and made publicly available, this type of data will benefit both government end-user subsidy programmes and those run by development institutions and other third parties (including private sector entities).

RECOMMENDATIONS FOR RESEARCHERS

A new energy burden threshold for measuring the affordability gap in developing and emerging economies is needed to ensure replicability, relevance, and accuracy.[12] In the recent past, researchers have defined households with a 6 percent electricity expenditure or higher as facing an energy burden, as explained in Box 2.[13] The percentage of household income spent on electricity forms part of the calculation of the electricity affordability gap. This means that if more than 6 percent of a household's total income is spent on electricity, an energy burden exists. In the context of the affordability gap, one would look at the percentage of household income spent on electricity over a certain period and compare that to the cost of the system. If the share of income is below the cost of the item, the household is deemed unable to afford the product.

In the Taking the Pulse methodology on affordability analysis, which is partially based on the World Bank's PovCalNet tool, this assumption is more conservative: if more than 5 percent of total household income is spent on electricity, the household has passed the energy burden threshold and therefore an affordability gap exists (SEforALL 2021).[14] If the data for the percentage of household consumption spent on energy over a certain period of time are not available for a region, a 5 or 6 percent energy burden threshold is often assumed.

The 6 percent threshold was calculated in 2003 by US-based researchers for a county-level analysis of the electricity affordability gap in the United States. This analysis was carried out for on-grid connections only. A separate threshold focused on developing countries, ideally by region and including the off-grid sector, would be more accurate in calculating the affordability gap. Moreover, the models do not factor in GDP growth that may lead to increased income and improve consumer affordability, or technological innovation that can potentially decrease costs for products like solar home systems (SHSs) in the future and increase affordability. These factors may lead to policy decisions based on false or outdated assumptions.

RECOMMENDATIONS FOR POLICYMAKERS

Demographic data are needed for more accurately targeted subsidies. Household electricity consumption data and corresponding income or wealth data are key to creating accurately targeted end-user subsidies. Currently, governments lack data on electricity consumption levels within vulnerable households. In many countries, there are a lack of up-to-date census data or an absence of any identification card system in place that would allow for effective targeting

[12] Alongside a replicable energy-burden threshold, it is important to have a harmonized affordability gap methodology to ensure comparable figures across countries inform the global conversation around energy affordability.

[13] The 6 percent affordability threshold/electricity burden threshold is based on Fisher, Sheehan, and Colton's Home Electricity Affordability Gap Analysis and is further explained in Box 2. It assumes that an affordable housing burden is less than 30 percent of income spent on electricity, and 20 percent of housing costs should be allocated to electricity bills. This leads to 6 percent of an affordable housing burden being spent on electricity costs. This analysis was done in the US in 2003 so may not be highly relevant for developing countries. For more information, see www.homeelectricityaffordabilitygap.com.

[14] The PovCalNet tool, while useful, has limited data for South Asian and Sub-Saharan African (SSA) countries.

and verification. Apart from serving as a centralized identification system, additional data collection on the specific uses of electricity within poor households and the specific electricity needs of the poor would allow policymakers to better understand the appropriate thresholds for setting well-targeted end-user subsidies.

A study conducted by the World Bank assessed the efficacy of subsidies deployed in the water supply and sanitation sector. Across the 10 developing countries examined, the research shows that, on average, 56 percent of subsidies benefit the wealthiest 20 percent, but only 6 percent of subsidies benefit the poorest 20 percent (World Bank Group 2019). Existing end-user subsidy programmes in other sectors target networked services, which are largely unavailable in poor neighborhoods. In the case of end-user subsidies for off-grid technologies such as solar home systems (SHSs), there is an opportunity for governments to mitigate this issue and target subsidies towards the poorest households using regional affordability gap estimates per technology.

Another World Bank study found that male-headed households utilized off-grid products/services much more than female-headed households. Therefore, subsidies could include a focus on the gender aspect of electricity access to stimulate female-headed household uptake. To do this, governments would need to collect household-level electricity consumption data and disaggregate them by gender. For households with a higher female ratio or those headed by a female, subsidy thresholds could be designed to be more favourable, i.e., with higher subsidy payments (Ibid). However, any differentiation between subsidy levels presents extra complications, including potential issues of leakage and arbitrage mentioned in Section 3 of this brief, where fraudulent activity may occur if proper monitoring and verification systems are not put in place. Additional monitoring systems may also need to be used to evaluate whether the higher subsidy level is having the intended impact.

Accurate household consumption data are needed to minimize the potential for market distortion. As mentioned previously, the challenge around market distortion revolves around the accurate calculation of subsidy thresholds in a market (how much subsidy is needed) and the effective targeting of beneficiaries (who needs the subsidy). The Taking the Pulse methodologies assume subsidies will cover 100 percent of the SHS price, but that may not accurately reflect the subsidy need in the target market. Rigorous economic analysis and access to regional-level data points such as household income and household consumption of electricity are required to determine the suitable thresholds of subsidies, accurately target beneficiaries, and avoid market distortion. Randomized control trials (RCTs), if affordable and possible, are a useful tool for testing the accuracy of commonly held assumptions on household electricity consumption and can improve the accuracy of the affordability gap calculation at a regional level. Moreover, as the current methodologies fail to capture the willingness of a household to spend on electricity, carefully designed RCTs can serve as a cost-effective way to collect this information.

Data around technology types and corresponding access tiers are needed to assess the potential for a phased intervention. As a best practice, it would be beneficial for governments to collect data on the affordability gap for key technologies at a regional level to determine the potential for a phased intervention. However, given the cost constraints of conducting this analysis for each high-impact technology, governments can prioritize suitable technologies that would target a tier of access that would benefit the largest volume of the target population. For example, in using the Multi-Tier Framework (MTF), governments can design subsidy programmes with long-term objectives to help people graduate from tier 1 to tier 3 electricity access, prioritizing the tier based on the volume of people impacted. It is commonly assumed that households exhibit a willingness to set aside a share of disposable income to move up the energy ladder. Moreover, occupying a higher tier such as tier 3 can help provide electricity for uses beyond basic needs such as lighting. Sound and representative affordability gap estimates are needed to predict the future trajectory of funding needs. Governments should focus on accurate and representative estimates of the affordability gap to understand where finance needs to flow. Governments can also learn from the successes of subsidy schemes applied elsewhere rather than going back to the drawing board.

CONCLUSION

End-user subsidies will be a critical tool in reducing the affordability gap, reducing electricity poverty, and achieving universal access to electricity in high-impact countries (HICs). By directly lowering the costs of technology for consumers, end-user subsidies provide electricity access while fostering a sense of ownership.

There are, however, a variety of crucial, ongoing data and information issues that must be addressed on the national level to effectively use existing affordability gap methodologies and create more targeted, efficient subsidy programmes. In Uganda, poor implementation due to high prices and private companies' capacity limitations to deliver high-quality products led to consumer distrust. Well-targeted programmes, such as Improving Rural Energy Access in Ghana, have shown how to successfully provide tier 1 electricity access to thousands of households while supporting a growing solar system industry. Togo is currently undertaking an end-user subsidy programme that focuses on technology to improve uptake and targeting accuracy, although programme evaluation is still underway.

To create the most effective end-user subsidy programmes, governments must collect accurate and thorough demographic data on electricity consumption and income levels while also encouraging civil society organizations and development finance institutions (DFIs) to support their efforts. Subsidy programmes should also be transparent about the methodologies used to calculate the affordability gap – each of the various methodologies available likely has a different impact on the subsidy design, yet a lack of transparency has made this evaluation impossible so far. While different methodologies may be more appropriate for different regions or electricity markets, a set framework is key to achieve harmonization on subsidy design to better evaluate progress and efficacy. At its heart, each programme must be designed to provide financial assistance for electricity access to the poorest households and communities, taking regional and local preferences and demographics into account.

The number of successful programmes and the growing body of academic literature give governments the opportunity to learn from experts and other countries in developing their own programmes. This brief synthesizes commonly used terms and popular methodologies, proposes a set of key attributes of the different approaches used to create an end-user subsidy, and demonstrates how three countries have created their own end-user subsidies. Finally, it highlights the ongoing data and policy needs to increase the scale and efficacy of end-user subsidies moving forward.

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