ENERGY SAFETY NETS

GHANA CASE STUDY

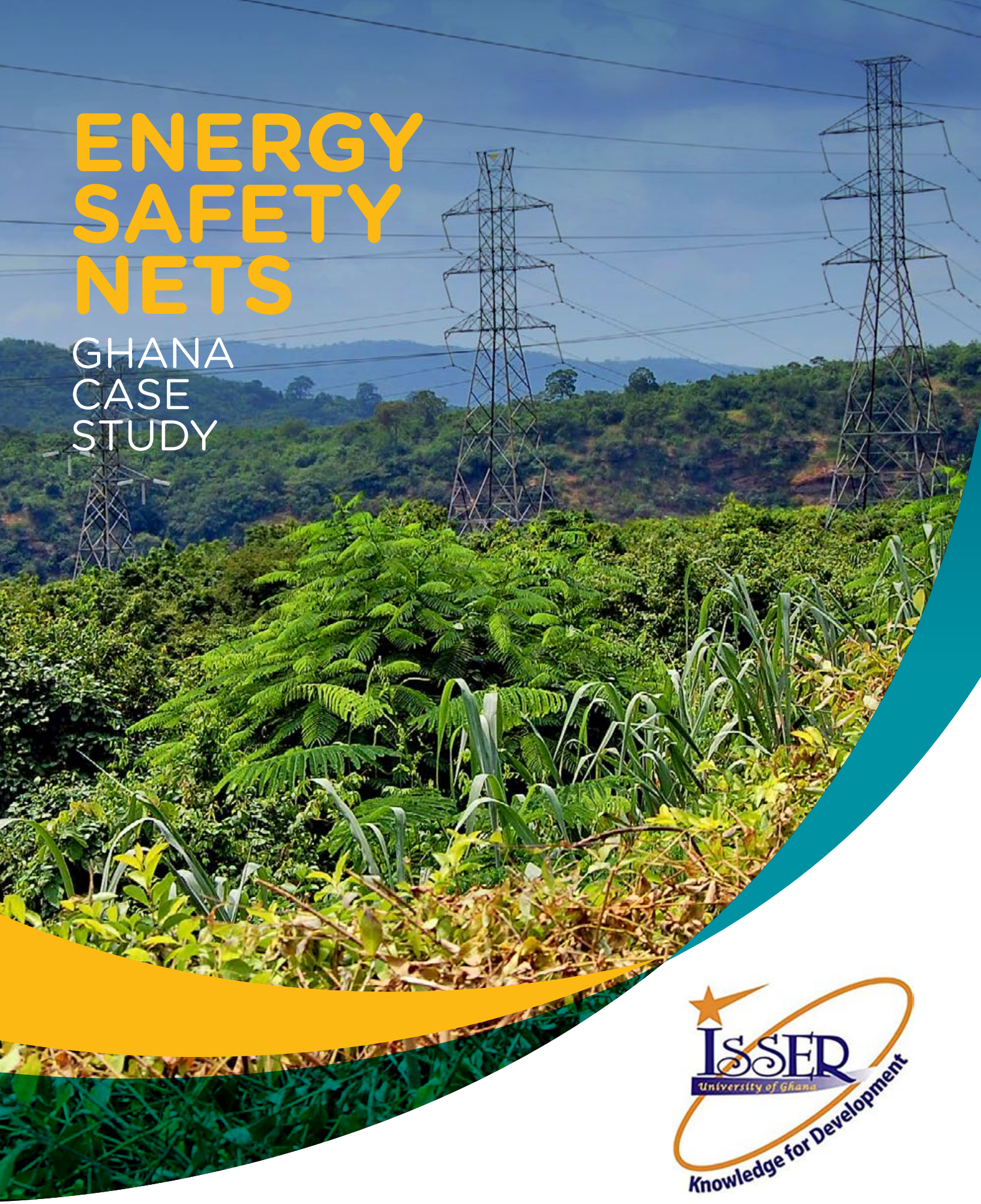

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

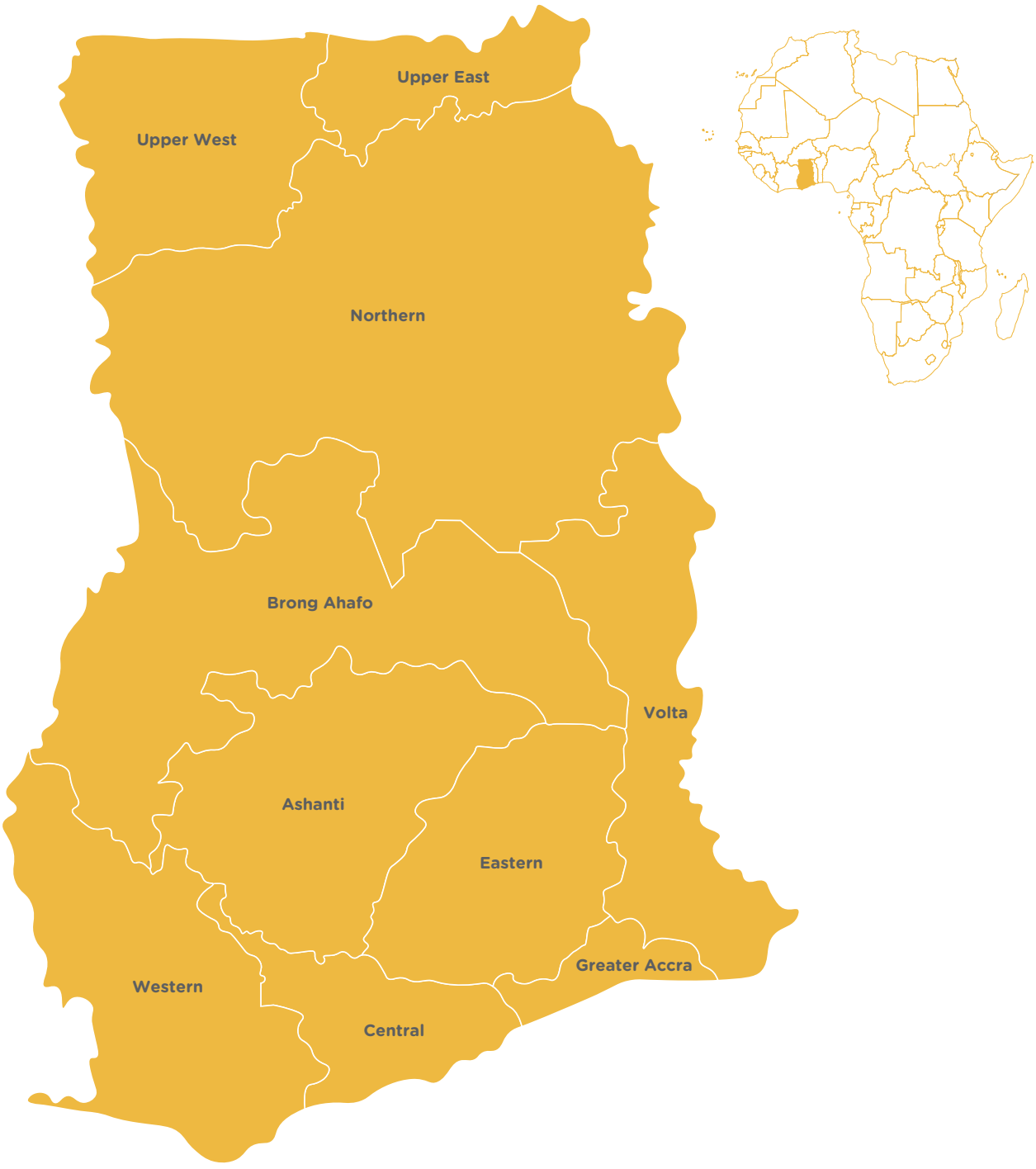
CCA	Clean Cooking Alliance
CSIR	Council for Scientific and Industrial Research
ESN	Energy Safety Net
GCMC	Ghana Cylinder Manufacturing Company Ltd
GEDAP	Ghana Energy Development and Access Project
GHACCO	Ghana Alliance for Clean Cookstoves & Fuels
GPRBA	Global Partnership on Results-Based Approaches
GPRS	Growth and Poverty Reduction Strategy
GSGDA I & II	Ghana Shared Growth and Development Agendas I & II
GSS	Ghana Statistical Service
ICBC	Industrial Commercial Bank of China
ICS	Improved Cookstoves
IEA	International Energy Agency
LEAP	Livelihoods Empowerment Against Poverty
LPG	Liquefied Petroleum Gas
MLGRD	Ministry of Local Government and Rural Development
MMDAs	Metropolitan, Municipal and District Assemblies
NEB	National Energy Board
NES	National Electrification Scheme
NHIS	National Health Insurance Scheme
NRSP	National Rooftop Solar Programme
OECD	Organisation for Economic Co-operation and Development
PDS	Power Distribution Services
PLWHIVAs	People Living with HIV/Aids
PURC	Public Utilities Regulatory Commission
PV	Photovoltaic
RLPGPP	Rural LPG Promotion Programme

SHEP	Self-Help Electrification Programme
SHS	Solar Home System
SNV	Netherlands Development Organisation
UNDP	United Nations Development Programme
UNF	United Financial Partners
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development

A note on currency

Ghana uses the Ghanaian cedi (GHS), the symbol for which is ¢. This study will use GHS. For currency conversions, the exchange rate used is an average of the relevant year(s) detailed in the text.

MAP OF GHANA



Note: In 2018, Ghana's political regions increased from 10 to 16, with some of the former regions being partitioned. This study uses 2017 data and will refer to the former 10 political regions for consistency.

EXECUTIVE SUMMARY

The provision of affordable, reliable, sustainable and modern energy continues to be a challenge in several developing countries. The adoption and implementation of efficient energy services to meet the 2030 Agenda for Sustainable Development is now imperative. While progress has been made in the provision of efficient energy in Ghana, the poor and vulnerable are increasingly likely to be excluded from business-as-usual solutions.

Energy Safety Nets (ESNs) are social assistance programs that target the poor, vulnerable and marginalized by providing them with the needed support to access and use modern energy services. As seen in other countries around the world, Ghana has implemented various interventions to increase access to electricity and clean cooking fuels. The overall aim of this case study is to identify the measures that have been put in place to enable poor and vulnerable Ghanaians to access and use modern energy services, and to explore the reasons for successes or failures in their implementation.

This case study evaluates five programs: the National Electrification Scheme (NES); Lifeline Electricity Tariffs; Solar Photovoltaic (PV) Electrification; Liquefied Petroleum Gas (LPG) Promotion; and Improved Cookstoves (ICS). Of these, only the Lifeline Tariff scheme has met the full ESN criteria used in this research project. More recently the scheme was broadened to apply universally, thereby losing the targeting component that qualified it as a safety net.

Generally, these programs have been successful in fostering access to modern energy services by the poor, although only the Lifeline Tariff scheme targeted the poor explicitly. The Global Partnership on Results-Based Approaches (GPRBA), formerly the Global Partnership on Output-Based Aid (GPOBA), Solar PV program exceeded its target of reaching 15,000 poor households and supported the purchase of almost 9,000 solar home systems (SHSs) and almost 8,000 lanterns for 16,500 poor households, eventually benefiting approximately 100,000 residents in remote, off-grid areas in the Volta Lake area. The NES has been comparatively more successful in terms of access, because it has enabled physical access to 85 percent of households across Ghana.

However, these programs have had challenges in their implementation. These include the non-existence of proper targeting of the poor and vulnerable; poor coordination among the stakeholders involved in them; politicization of implementation processes; lack of sustainability measures; and lack of education of the poor on the availability and benefits of these programs.

Despite these challenges, the programs have supported the poor, vulnerable, and disadvantaged to receive access to modern and efficient energy services and provide a platform for Ghana's energy sector to improve on in order to reach universal access.

Based on the findings of this case study regarding the design, implementation and impacts

of the selected programs, the following are recommended:

- The weak targeting that has plagued most of the programs should be addressed so their key objectives of serving the interests of the poor and vulnerable can be achieved. This could involve transitioning towards means testing to determine beneficiary eligibility.
- There should be an in-depth analysis of the different ESNs before their implementation so as to enhance their effectiveness.
- Future ESNs should be developed as complete programs with long-term perspectives to ensure sustainability over time.
- The government and other stakeholders involved in ESN programs should educate the public, especially poor and vulnerable households, on the benefits of the various ESN programs and how they can benefit from them.

INTRODUCTION

Globally, energy access remains a challenge for a significant number of people, especially in developing countries, despite some progress over the years. Sustainable Development Goal 7 (SDG7) is an urgent call for action to provide affordable, reliable, sustainable and modern energy for all. While a handful of developing countries have made strides in increasing energy access, there are still significant challenges in the provision of energy, especially to the poor and vulnerable. The total number of people without access to electricity dipped below 1 billion in 2017, but energy access trends are still not adequate to meet the global goals by 2030.

Energy Safety Nets (ESNs) are social assistance programs that target the poor, vulnerable and the economically less privileged by providing them with the necessary support to access and use modern energy services. These interventions are important tools to reduce energy poverty, or the lack of access to affordable, reliable, sustainable and modern energy services. The implementation of social assistance programs, in Ghana and elsewhere, has faced several challenges including poor targeting, faulty institutional arrangements and mechanisms, and the inability of the poor and vulnerable to take advantage of energy-focused programs (Scott and Pickard 2018). The overall aim of this study is to identify the measures that have been put in place to enable Ghana's poor and vulnerable groups to access and use modern energy services and to explore the reasons for successes and failures in their implementation.

This case study has five main sections. Following the introduction, the second section explains the contextual overview of social assistance programs in Ghana, discusses energy access and poverty, and the objectives of the study. The third section discusses the five main programs examined (the National Electrification Scheme (NES) and Self-Help Electrification Programme (SHEP); the Lifeline Tariff scheme; Solar PV Electrification; Liquefied Petroleum Gas (LPG) Promotion; and Improved Cookstoves (ICS). The final section provides conclusions and recommendations.

OBJECTIVES OF THE STUDY

The levels of poverty, inequality and consumption across Ghana suggest that some households are deprived of basic needs such as education, health, a nutritious diet and access to modern energy services (Cooke et al. 2016). Since 1990 energy access programs have directly or indirectly contributed to energy access for the poor and vulnerable. The five social assistance programs identified in this study have fostered access to energy in Ghana and are solely government-led, even though some are funded by donors.

Energy Safety Net (ESN) is an umbrella term for government-led approaches to support very poor and vulnerable people to access essential modern energy services, defined as electricity and clean fuels and technologies for cooking, by closing the affordability gap between market prices and what poor customers can afford to pay.

ESNs can make physical access (i.e. connections) to electricity or clean fuels affordable for poor and vulnerable people, or they can make the unit price of electricity or fuel affordable to consume. ESNs include some form of targeting or eligibility criteria to direct benefits to those who need them.

This country case study—like the other five, covering Brazil, India, Indonesia, Kenya and Mexico—seeks to answer four research questions:

- What policy measures have been used in Ghana to enable very poor and marginalized people to access and use modern energy services?
- How effective have these measures been in enabling the poorest social groups to access and use modern energy services?
- What links have there been/are there between these measures and wider/other social assistance programs?
- What changes could be made to enhance the effectiveness of existing policy measures in enabling very poor people to access modern energy services?

CONTEXTUAL OVERVIEW

STATE OF SOCIAL PROTECTION IN GHANA

Although *social assistance* and *social protection* appear to be similar concepts, *social protection* is broader than *social assistance*. *Social protection* is broadly classified as actions that are meant to protect the welfare of the poor and vulnerable; *social assistance* refers to non-contributory programs that support the specific needs of these groups of people. The operational processes of the two involve the use of public funds for the vulnerable and poor in society, to protect them from the negative effects of serious economic crises or difficulties (National Development Planning Commission 2015). Over the past six decades, Ghana has implemented social assistance programs that are both energy focused and non-energy focused. The non-energy focused programs have addressed health, disaster management support, emergency relief, agricultural support services, social security support services and small-scale businesses in general. These social assistance interventions have been implemented through cash transfers, labor market interventions, and social insurance (Abebrese 2011; Al-Hassan & Poulton 2009). Some specific social assistance programs that continue to operate are the Livelihoods Empowerment Against Poverty (LEAP), the School Feeding Programme, the National Health Insurance Scheme (NHIS), Capitation Grants to primary schools, and Agriculture Extension Services (Al-Hassan & Poulton 2009; National Development Planning Commission 2010, 2015). Social protection efforts in Ghana have led to the formulation of a high number of development- based policies and actions. One result is the drafting of the National Social Protection Policy (Abebrese 2011; Ministry of Gender Children and Social Protection, 2015).

ENERGY SAFETY NETS IN GHANA

Energy poverty is defined as a lack of access to affordable, reliable, sustainable and modern energy services. As government-led approaches to support very poor and vulnerable people to access essential modern energy services, ESNs strategically work to reduce energy poverty for households. Over the decades, government entitites, in addition to non-governmental and inter-governmental organizations, have introduced and implemented several energy programs that have targeted the poor and vulnerable in Ghana. While the term ESN is not frequently used in the Ghanaian context, the country has a deep history and experience with programs that support access to energy through social assistance.

There is no formal policy on social assistance programs in energy provision in Ghana, although several development documents have called for such actions. The Growth and Poverty Reduction Strategy II (GPRS II 2006–2009), for instance, called for the need to increase access to alternative forms of efficient and modern energy services that target poor and vulnerable groups (National Development Planning Commission 2005). The Ghana Shared Growth and Development Agendas I & II (GSGDA I 2010–2013 & II 2014–2017), similarly had plans that targeted the vulnerable and poor, especially women and children, in the provision of modern, efficient, and reliable forms of energy (National Development Planning Commission 2010, 2015).

This case study is restricted to energy-related government-led social assistance programs, funded either by the public sector or through donor support. Over the years, numerous government programs have been implemented to address energy service needs through electricity via the national grid, liquefied petroleum gas (LPG), the provision of solar lantern and rooftop systems for domestic use, and improved cookstoves (ICS). Examples of programs classified as social assistance programs are the Self-Help Electrification Programme (SHEP) under the National Electrification Scheme (NES), which focused on bringing the electricity grid to rural communi-

ties (Abavana 2004, 2008; Energy Commission 2012, 2017, 2018; Kemausuor and Ackom 2017) and the Lifeline Tariff scheme, which focused on providing subsidies for low levels of electricity consumption (Coulombe and Wodon 2007). LPG promotion programs have focused on the provision of highly subsidized clean cooking energy in Ghana (Energy Commission 2012; Asante et al. 2018; Ahunu 2015) while ICS efforts have focused on the provision of cheaper and clean cooking energy for households, schools and small-scale industries (Appiah 2017; Ministry of Energy 2018; Acharibasam & Apatinga 2014; UNDP 2014). The Solar PV Electrification Programme, with support from the National Rooftop Solar Programme (NRSP), the Global Partnership on Results-Based Approaches (GPRBA), formerly the Global Partnership on Output-Based Aid (GPOBA), and the Ghana Energy Development and Access Project (GEDAP), distributed subsidized solar lanterns and solar panels for the provision of domestic electricity in the very deprived areas and island communities in Ghana (Owusu & Asumadu-Sarkodie 2016; Bawakyillenuo 2009; Mas'ud et al. 2016). Table 1 provides a summary of the energy-related social assistance programs in Ghana, their focus and the periods in which they were implemented.

ENERGY ACCESS, POVERTY AND VULNERABILITY IN GHANA

Energy Use and Access

Ghana has an acute need for affordable, reliable, sustainable and modern energy. Fuelwood and charcoal from the country's forests continue to constitute a high percentage of domestic energy consumption. It is estimated that in total 40 to 50 million tonnes of fuelwood will be used in Ghana between 2006 and 2020 (Ghana Energy Commission 2006). About 67 percent of households use charcoal and fuelwood for domestic cooking (almost 34 percent use charcoal and 33 percent use fuelwood) (Ghana Statistical Service (GSS) 2018). Among Ghanaian households, roughly 18 percent consumed LPG in 2010, a figure that rose to 24 percent in 2014 (GSS 2012, 2018).

Electricity coverage among households has increased significantly in Ghana in recent years. For example, the geographical coverage of community-level electricity was about 64 percent in 2010, 80 percent in 2015 and 84 percent in 2018 (Energy Commission 2019b).[i] *Tracking SDG7: The Energy Progress Report 2019* measures a 79 percent electricity access rate in Ghana in 2017 (IEA et al. 2019). Figures 1 and 2 depict the electricity and clean cooking access rates per population over time. It is, however, important to stress that access does not connote usage. High access rates could mask low rates of household energy use, especially among the poor and vulnerable.

Poverty, Vulnerability and Energy Poor in Ghana

Poverty is multi-dimensional and encompasses a lack of access to the basic needs of life such as food, shelter, education, health and other essential components of general welfare. Within the context of Ghana, several groups of poor and vulnerable people are described in the Ministry of Gender, Children, and Social Protection's 2015 Ghana Social Protection Policy document (MOGCSP 2015). These include the chronically poor, economically at risk and socially vulnerable. The chronically poor are those who may be poor for a long time and may never come out of poverty, for example, the severely disabled, terminally ill, rural and urban unemployed and subsistence smallholder farmers. The economically at risk are those who can easily be affected by economic instability or difficulty. Examples are subsistence farmers, homeless persons, refugees and internally displaced persons, orphans, informal sector workers, widows, older persons and migrants. The socially vulnerable are those who have become poor and vulnerable due to adverse sociocultural or health factors, for example, people

Table 1

Energy Access Programs in Ghana

TYPE OF ENERGY	PROGRAM	ORGANIZATIONS AND AGENCIES INVOLVED	FOCUS	PERIOD OF IMPLEMENTATION
Electricity	National Electrification Scheme	• Ministry of Energy • Energy Commission • World Bank	To reach poor, remote and rural communities with electricity through the national grid	1990–2020
	Self-Help Electrification Programme	• Ministry of Energy • Energy Commission • World Bank	Provision of electricity to poor, remote and rural communities through a joint financial partnership between the government and communities	
	Lifeline Tariff	• Ministry of Energy • Public Utilities Regulatory Commission (PURC)	Provision of consumption subsidy to poor with respect to electricity use	Started in 1997
Liquefied Petroleum Gas	Liquefied Petroleum Gas Programs • LPG Fund • Household Energy Project	• Ministry of Energy • Energy Commission • United Nations Development Programme (UNDP) • Donor Partners	• Initial subsidy of LPG for poor and non-poor LPG users • Provision of highly subsidized gas cylinders to the poor and vulnerable	Started in 1989
Improved Cook-stoves	• CSIR Stoves • Enterprise Works • Toyola Stoves • Household Energy Project	• Ministry of Energy • Energy Commission • Council for Scientific and Industrial Research (CSIR) • Donor Partners • Enterprise Works Ghana	• Provision of cheaper and cleaner stoves through efficient cooking technology	Started in the 1980s, gained popularity in the 1990s
Solar PVs	• National Rooftop Solar Programme • Global Partnership on Results-Based Approaches (GPRBA) Solar PV Electrification Programme • Ghana Energy Development and Access Project (GEDAP)	• Ministry of Energy • Energy Commission • Energy Foundation • Donor Partners	• Distribution of solar lanterns to island and remote rural communities that have not been or cannot be connected to the national grid • Provision of solar panels	Gained government attention and support in 2011

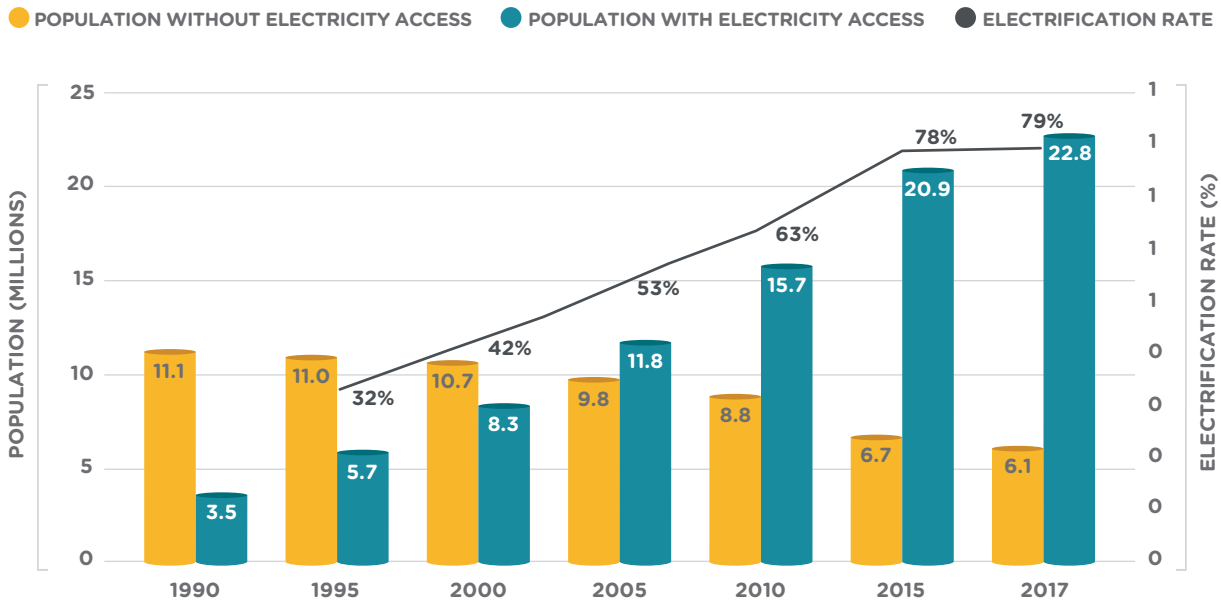
Source: Compiled by author

living with HIV/Aids (PLWHIVAs), tuberculosis sufferers, victims of domestic violence, homeless persons, internally displaced persons and female-headed households (Ministry of Gender Children and Social Protection 2015). Those living in energy poverty are unable to afford energy services for lighting and other equally important domestic activities. In addition, their quality of life and their health are deeply affected (Pachauri et al. 2012).

In 2017 almost a quarter of Ghanaians were poor and 8 percent of the population was classified as extremely poor (people living below USD 150 or GHS 792[ii] annually). Of the total poor population, 95.8 percent resided in rural areas (GSS 2019).

Figure 1

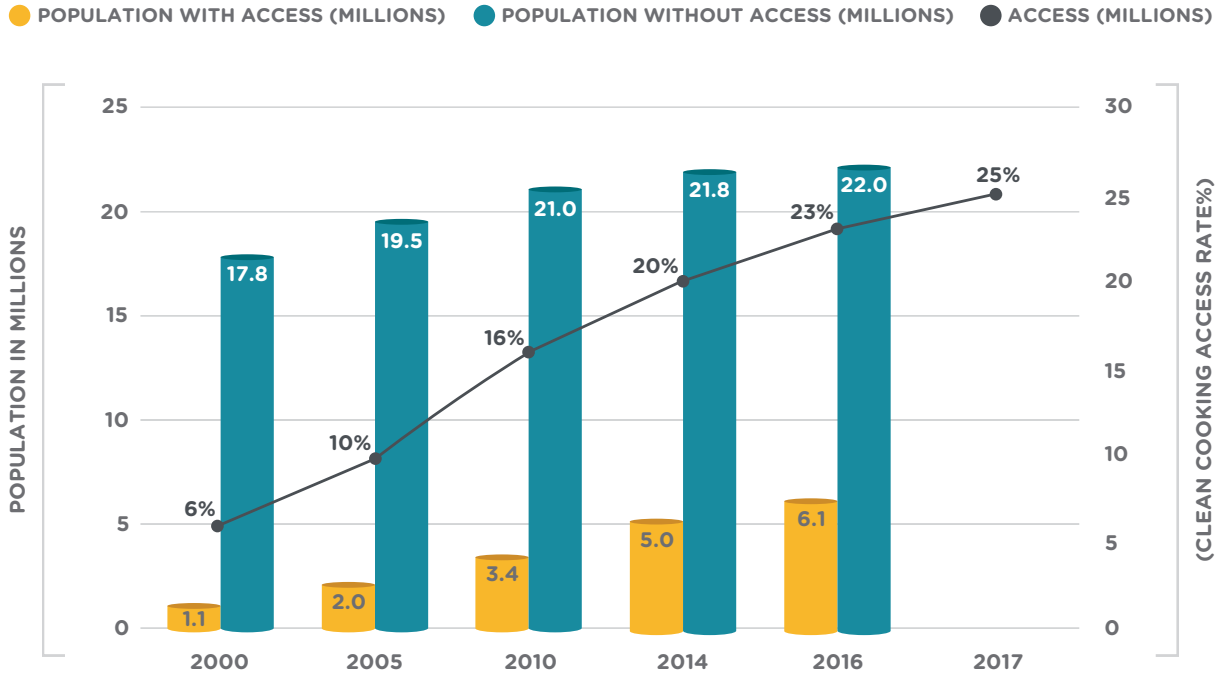
Population with access to electricity, 1990-2017



Source: IEA et al. 2019

Figure 2

Population with access to clean cooking, 2000-2017



Source: IEA et al. 2019

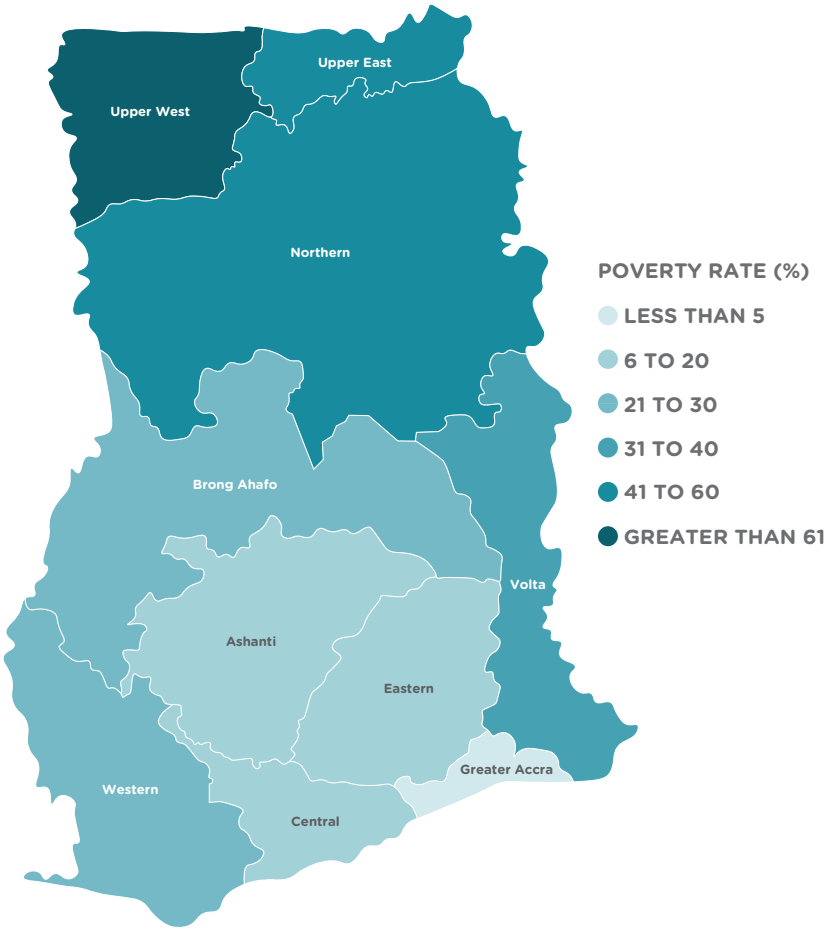
Between 2006 and 2013, urban poverty, based on income, fell by 1.8 percent and rural poverty fell by 5.8 percent (GSS 2008; 2014). In 2013, the three northern regions of Ghana (Upper East, Upper West and Northern) had the highest rates of poverty with the Greater Accra region recording the lowest poverty incidence of 5.6 percent. Figure 3 shows the geographical representation of poverty measured in Ghana.

The proportion of households using electricity increased between 2013 and 2017 in rural and urban areas across all income groups (Figure 4). However, urban households continue to enjoy higher levels of electricity access than their rural counterparts. In both urban and rural areas, households in higher income groups have higher levels of access. Figure 5 shows the relative annual household expenditure on electricity, gas and kerosene for various years in Ghana by location.

The two regions that recorded the highest and lowest inequality levels in 2013 per the Gini coefficient were the Upper West (48.1) and Greater Accra (35.1) respectively (GSS 2017). While these measures serve as indicators for where supportive energy services are needed, poorer residents in relatively wealthier regions such as Greater Accra will likely still require support for ongoing energy consumption.

Figure 3

Poverty map of former 10 regions of Ghana, 2017

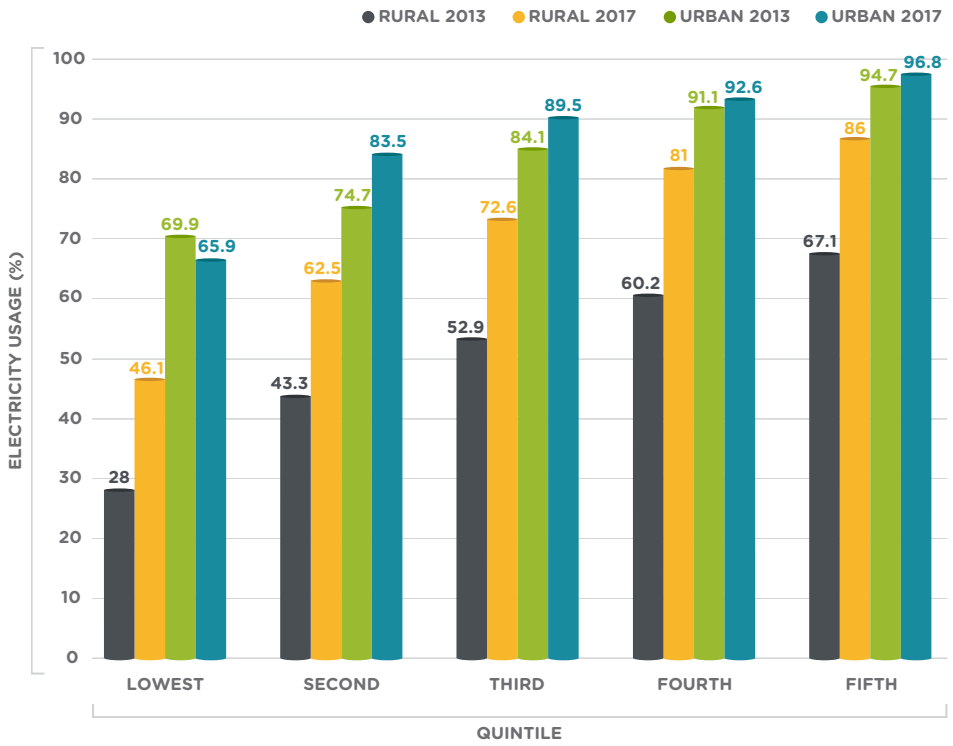


Source: Author's own construct based on GSS 2017 data.

Note: In 2018, Ghana's political regions increased from 10 to 16, with some of the former regions being partitioned. This map refers to the former 10 political regions for data consistency.

Figure 4

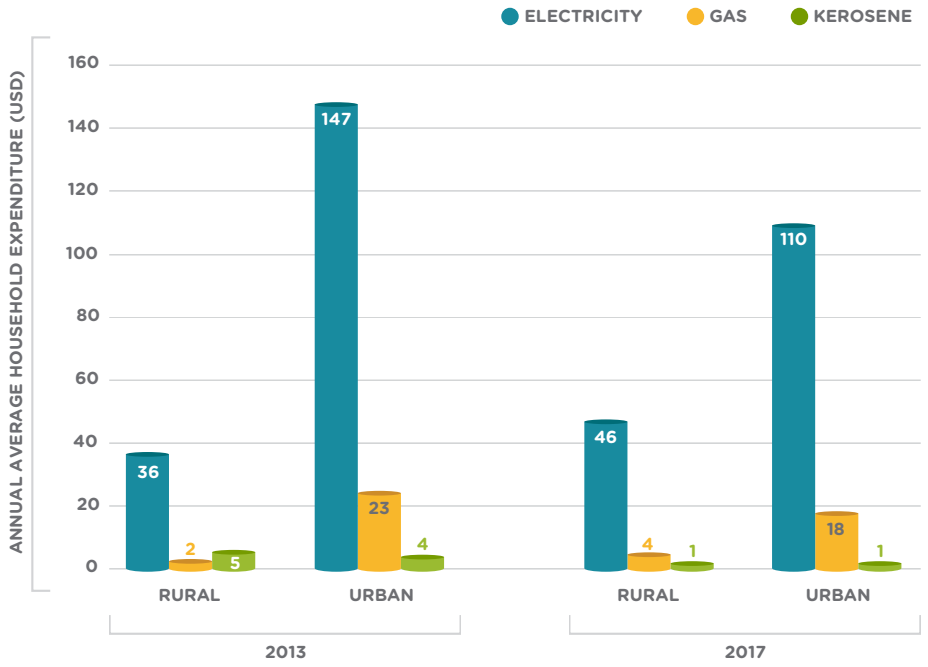
Percentage of households using electricity in Ghana, by quintile



Source: GSS 2014 and 2019

Figure 5

Annual average household expenditure in Ghana on electricity, gas and kerosene



Source: GSS 2014 and 2019

EXPERIENCE OF ENERGY SAFETY NETS IN GHANA

NATIONAL ELECTRIFICATION SCHEME (NES) AND SELF-HELP ELECTRIFICATION PROGRAMME (SHEP)

Background and Design

The Government of Ghana established the National Energy Board (NEB) in the late 1980s and initiated the 30-year (1990–2020) National Electrification Scheme (NES) in 1989. The goal of the NES is to provide universal access to electricity for all Ghanaians by 2020 through the national electricity grid and the use of off-grid solar PV (Abavana 2004). Under the NES, the government laid down a comprehensive plan to extend and provide electricity access to all settlements that have an adult population of 500 or more.

The NES was implemented in various phases. Within the first 10 years of its launch (1990–2000), 2,350 communities were electrified (Abavana 2008; Kemausuor and Ackom 2017). Under Phases 1 and 2, all district capitals and towns/villages en route to the district capitals were connected to the national grid (Kumi 2017). Communities with a population of 500 households and within a 20km radius of the national electricity grid were also to be connected under the NES (Kemausuor and Ackon 2017; Kumi 2017).

In 1993, due to inadequate funds and the need to speed up the expansion of electrification, the Self-Help Electrification Programme (SHEP) was created to complement the efforts of the NES. Unlike the NES that allocated the full cost of electrification to the government, the design of the SHEP required communities wishing to be connected to the national electricity grid to provide counterpart financing. The communities were expected to finance the purchase of low voltage poles and meters, as well as ensure that at least 30 percent of their households were wired as a key prerequisite (Kumi 2017). Some communities solicited assistance from their local governments, local elected representatives (assembly members), thought leaders, relatives living abroad and non-governmental organizations to meet the cost of the counterpart funding.

The NES also identified a goal of enhancing electricity access to vulnerable areas of the country, particularly rural communities (Abavana 2008; Kemausuor and Ackom 2017). With less than a year remaining to meet the country's 2020 target of extending electricity to all communities, the Energy Commission measures electricity access at nearly 85 percent based on the number of communities with a connection (2019b). In line with its goal of universal access by 2020, the government has made efforts to continue implementing the NES and SHEP, with emphasis placed on solar PV mini-grid systems within island communities (Kumi 2017). Figure 6 depicts the locations of some of these island communities in the Volta and Eastern regions of Ghana.

Implementation

The implementation processes of the NES and SHEP have been broad-based and have not specifically targeted any particular segment of the population. Electricity is being extended to various communities but individual households are required to secure the necessary financial resources to connect their homes to the grid. Connection costs differ depending on how far the house is from the low voltage pole. These programs have broadly targeted the general population with the sole objective of expanding electricity access to citizens in all parts of the country. Key stakeholders interviewed agreed that the NES and SHEP employed a 'universal target' nationwide, and did not make a conscious effort to put mechanisms in place to enhance the efforts of poor and vulnerable households to access electricity. Figure 7 depicts the relationship between regional poverty rates and regional electricity access rates in Ghana. While poverty rates

Figure 6

Island Communities prioritized for solar mini-grid systems

Source: Author's own construction

Note: In 2018, Ghana's political regions increased from 10 to 16, with some of the former regions being partitioned. This map refers to the former 10 political regions for data consistency.

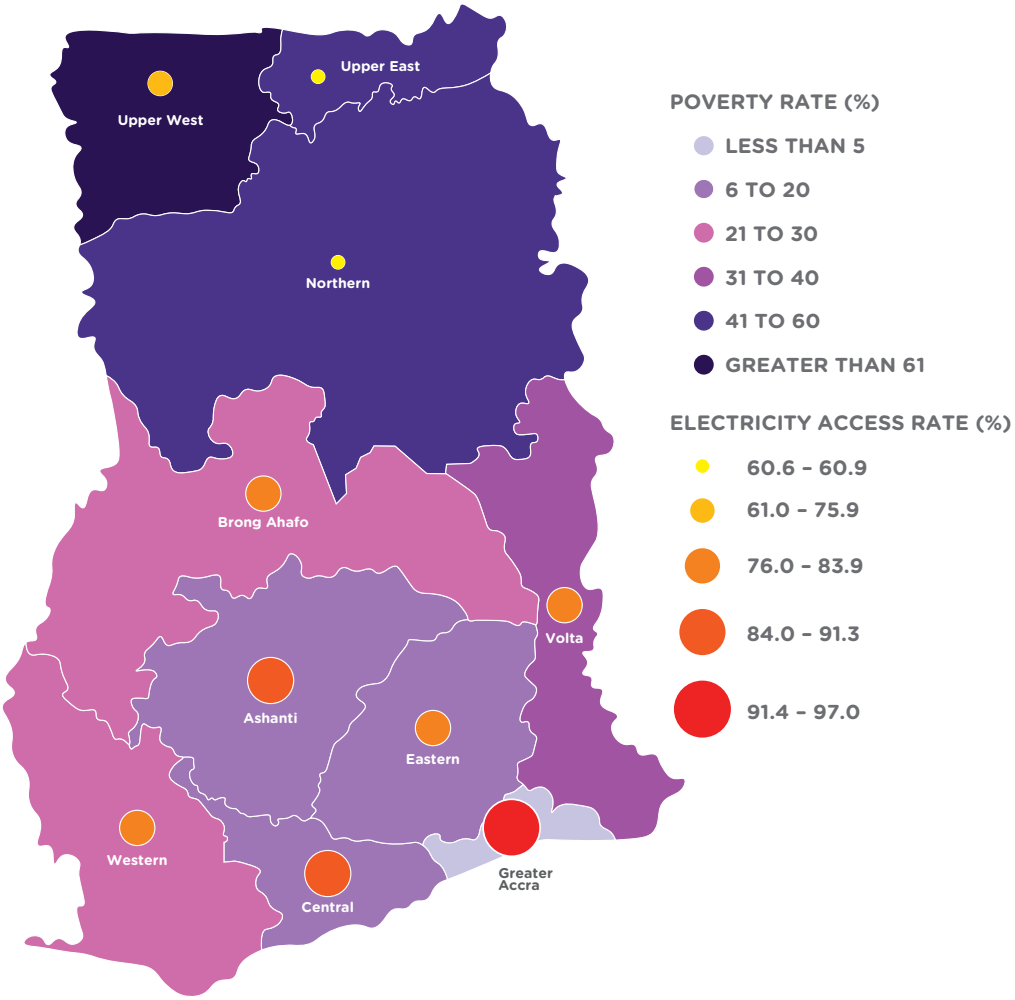
in the Northern, Upper East and Upper West regions of the country are relatively high, electricity access rates are relatively low compared to other regions. The reverse is the case for the southern part of Ghana. Greater Accra region for instance, has the lowest poverty rate and the highest electricity access rate in Ghana. This indicates a need for greater targeting of poor households in rural communities or regions with higher poverty rates and lower access levels when considering plans to extend electricity access.

The Government of Ghana initially established the National Energy Board (NEB) as the key initiater and implementer of its national electrification plans. Since then, the Ministry of Energy, the Energy Commission, the Energy Foundation of Ghana and other international collaborators such as the World Bank, Industrial Commercial Bank of China, Standard Chartered Bank Ghana Limited and other development agencies have been involved in the funding of the various phases of the NES/SHEP (Energy Commission 2018).

The implementation of the NES has faced several challenges. Many key informant interviewees noted that programs of the NES/SHEP have not been able to connect communities with smaller populations and those located far from the national grid, including island and lakeside communities, due to

Figure 7

Regional poverty and electricity access rates in the former 10 regions of Ghana, 2017



Source: Author's construction based on Energy Commission 2019a and GSS 2017 data.

Note: In 2018, Ghana's political regions increased from 10 to 16, with some of the former regions being partitioned. This study uses 2017 data and will refer to the former 10 political regions for consistency.

accessibility barriers. Location and transportation challenges drive up the cost of extending the national electricity grid to some communities.

Impacts and Experiences

In the years since the NES was launched, Ghana has made significant progress towards universal electrification, with the current community level electricity access rate of 85 percent one of the highest in Sub-Saharan Africa (Energy Commission 2019b). This high electricity access rate is the result of the establishment of the NES and SHEP. The SHEP allowed the expansion of electricity to communities that were more than 20 km away from the national electricity grid earlier than likely planned in the government's NES roadmap (Abavana 2008; Kemausuor and Ackom 2017). An estimated 3,515 communities were connected to the national grid under the SHEP from its inception in 1993 to 2011 (Energy Commission 2012). Several social impact studies of the NES/SHEP revealed that electricity expansion programs enabled beneficiary communities, both in rural and urban areas, to access modern energy services for productive uses

(Abavana 2008; Energy Commission 2017; Kemausuor and Ackom 2017). The following broad categories of the benefits and impacts of the NES/SHEP on society were identified from key informant interviews:

- Enhancement of general economic activities
- Increase in welfare, especially entertainment
- Creation of employment opportunities for local electricians
- Enhancement in the diffusion of information through advertisements on radio and television.

The NES has made significant progress in increasing electricity access rates in Ghana. The key informant interviews with stakeholders as well as other studies reveal that the NES and the SHEP have supported the operation of social projects, productive ventures and economic activities in both rural and urban areas. The electrification extension programs have alleviated poverty and promoted growth in the beneficiary areas (Energy Commission 2018; Ministry of Energy 2018). Abavana (2008) and Adjoa (2014) indicate that the social (improvement in health care delivery and education) and economic (telecommunication, agricultural development and industrial/non-agricultural activities) impacts of the NES and SHEP ultimately reduced poverty in diverse ways and have improved the living conditions and quality of life of the beneficiaries.

Despite these benefits, key stakeholders noted that a majority of the poor and vulnerable households in the rural areas who received electricity connections were unable to sustain their consumption due to the cost of the electricity tariffs. During interviews, stakeholders note affordability of the connection costs or monthly charges as the main reason 63 percent of urban households and 30 percent of rural households lacked an electricity connection in 2017 (GSS 2019).

THE LIFELINE TARIFF SCHEME IN GHANA

Background, Design, Evolution and Implementation

The Lifeline Tariff was instituted to provide affordable electricity to the poor who have lower consumption levels, in order to promote electricity access in line with the GPRS I (Kumi 2017). While other programs, such as the NES and the SHEP, were initiated to promote physical connections to electricity, the Lifeline Tariff was created to address the affordability component of electricity use by the poor.

In 1997, the Public Utilities Regulatory Commission (PURC) was formed and given a mandate to determine electricity tariffs. The PURC reviewed electricity tariffs on two occasions in 1998, in February and September. These reviews saw a reduction in the lifeline consumption band, created in the early 1990s, from 100 kWh to 50 kWh per month with the lifeline tariff increasing from USD 0.52 (1,200 GHS)[iii] to USD 1.73 (4,000 GHS)[iv] (Edjekumhene et al. 2001). The 50 kWh threshold is a common lifeline threshold in Africa (Kojima and Trimble 2016). The tariff system was such that those consuming within the lifeline band paid a fixed amount whilst other consumers who consumed more than 50 kWh/month paid a per kWh rate. The PURC based the determination of the lifeline tariff on four main parameters: the national monthly minimum wage, affordability for rural consumers, the price of a gallon of kerosene and the average cost of hydro electricity (PURC 1999). The monthly minimum wage in 1998 was GHS 54,000 (USD 23) and the price of a litre of kerosene was GHS 500 (USD 0.244). The 1998 tariff rates are illustrated in Table 2. It can be seen that there was a fixed monthly charge for consumers who consume up to 50 kWh while other consumers paid per kWh of electricity consumed.

A fixed monthly charge (revised annually) remained in place for the 0-50 kWh lifeline tariff

Table 2

Electricity tariffs in Ghana, 1998

TARIFF CATEGORY (RESIDENTIAL)	RATE		
		FEBRUARY	SEPTEMBER
0-50 kWh [lifeline block]	(USD/month)	0.87 GHS 2000 (0.20)	1.73 GHS 4000 (0.40)
51-150 kWh	(USD/kWh)	-	0.05 GHS 120 (0.0120)
151-300 kWh	(USD/kWh)	-	0.06 GHS 150 (0.0150)
51-300 kWh	(USD/kWh)	0.02 GHS 50 (0.0050)	-
301-600 kWh	(USD/kWh)	0.03 GHS 75 (0.0075)	0.10 GHS 220 (0.0220)
601+ kWh	(USD/kWh)	0.09 GHS 180 (0.018)	0.15 GHS 350 (0.0350)

Source: PURC 1998
Note: Exchange rate reflects 1998 GHS valuation. GHS in parenthesis is July 2019 exchange.

band until it was abolished in 2006, and the lowest band tariff structure was changed to 0-300 kWh per month. The following year, the lifeline band was reintroduced but with a kWh price of USD 0.10 (GHS 0.095). Consumers using more than 50 kWh a month did not benefit from the lifeline tariff. In March 2018, the lifeline tariff was fundamentally changed from a volume differentiated tariff to an increasing block tariff, meaning all electricity customers benefited from a lower rate on the first block of electricity usage. The 2019 lifeline tariff rate was USD 0.06 per kWh (GHS 0.03/kWh). Lifeline customers also pay a USD 0.40 (GHS 2.13) monthly service charge that is lower than the service charge for consumers using more than 50 kWh a month. Table 3 shows the electricity tariffs in Ghana for residential consumers as of July 2019. The lifeline rate is below the composite bulk generation charge of GHS 0.045/kWh that is received by electricity generators (PURC 2019).

Impacts and Experiences

Data obtained from the PURC reveal that in 2018, 45 percent of Power Distribution Services (PDS)[v] customers in the southern regions of Ghana were residential consumers and 38 percent of the total number of customers served (including non-residential customers) were lifeline consumers. In the northern regions, 33 percent of Northern Electricity Distribution customers were residential consumers and 27 percent of total customers were on the lifeline tariff.[vi] However, there are no data to indicate what proportion of these customers are considered poor.

Even without official data, many stakeholders reported the lifeline tariff to have enhanced the standard of living of the poor and vulnerable who are connected to the national electricity grid.[vii] In particular, they highlight that the lifeline tar-

Table 3

Electricity tariffs in Ghana, July 2019

TARIFF CATEGORY (RESIDENTIAL)	RATE (USD/kWh)	RATE (GHS/kWh)
0-50	0.06	0.030
51-300	0.12	0.061
301-600	0.15	0.080
600+	0.17	0.89
MONTHLY SERVICE CHARGE		
Lifeline consumers	0.40	2.13
Other residential consumers	1.33	7.04

Source: PURC 2019

iff has enabled the poor to gain access to media through radio and television. However, the benefits of the lifeline tariff reaching the poor have been offset by the following challenges:

- **Highly inefficient appliances:** Inefficient and older appliances such as refrigerators can consume much more power than newer, more expensive ones. Poorer households owning these appliances may consume more power than their non-poor counterparts, resulting in a household consumption rate higher than the lifeline tariff band. For instance, according to the Ghana Living Standards Survey Round 7 (GLSS7), 23.4 percent of Ghanaians were poor in 2017 (GSS 2019). A survey conducted by the PURC in 2018 found out that only 1.7 percent of households consumed below 50 kWh/month. This suggests that many poor households may not benefit from the lifeline tariff, perhaps due to use of inefficient appliances that consume more electricity and push them past the consumption level of the lifeline tariff band.
- **Meter sharing within compounds:** Some key informants suggested that the poor in rural areas benefit more from the lifeline tariff than the poor in urban areas due to the practice of meter sharing in urban centers. It is not unusual for multiple households to live together in one compound and share a single electricity meter. The cumulative consumption of multiple households places the collective meter users above the lifeline tariff threshold and results in higher charges, regardless of the poverty levels or electricity consumption of the individual households. This is consistent with findings by Kojima and Timble (2016) who argue that shared meters deprive low-income electricity users of the benefits of lifeline tariffs. While there is also a lack of data on this subject, key

informants shared their views on this challenge during stakeholder interviews.

- **Limited education:** Limited education is a major factor affecting the ability of the poor to benefit from the lifeline tariff. There is little education for poor households on how to stay within the lifeline bracket and it is difficult to access general information on electricity tariffs in Ghana. This lack of information pushes some segments of the poor beyond the lifeline band and in some cases leads to power theft. According to Yakubu et al. (2017), higher electricity tariffs contribute to problems of electricity theft in Ghana.

Ghana's lifeline tariff structure does not directly target poor households. Until 2018, only customers consuming less than 50 kWh per month benefited from the lifeline tarif. However, it cannot be assumed that all customers consuming less than 50 kWh per month are poor; poorer households may consume more than 50 kWh and wealthier households may consume less. Outside of Ghana, a study that examined socially inclusive electricity tariffs in six South Asian countries found that only 29 percent of the total subsidy reached the target beneficiaries (Siyambalapitiya 2018). This implies that poor tariff targeting can prohibit benefits from reaching the intended population. While Ghana's lifeline tariff structure attempts to reduce the cost of electricity for low-consuming households, it is not currently an efficient measure to ensure that the poor and vulnerable have access to and use electricity.

SOLAR PV ELECTRIFICATION PROGRAMS IN GHANA

Background, Design and Evolution

The establishment of the NEB in the 1980s marked the beginning of national policies to create access to modern energy services through solar PV systems (Obeng and Evers 2009). Prior to 1991, Ghana had roughly 335 solar PV installations across the country with a total estimated power of approximately 160 kWh (Owusu & Asumadu-Sarkodie 2016; Bawakyillenuo 2009; Mas'ud et al. 2016). Due to the NES program, the number of solar PV systems increased to nearly 5,000 with an overall installed power of 1.0 MWp by 2003 (Obeng & Evers 2009; Owusu & Asumadu-Sarkodie 2016). The introduction of new policy directions to expand the use of solar PV in rural electrification programs, as part of GPRS I (2003–2005), also led to increased access to solar energy services for the poor and vulnerable (Mas'ud et al. 2016). Under the NES, solar PV systems were also made available to island communities far from the national electricity grid.

Multiple governments have sustained efforts to increase access to electricity through solar PV systems, especially for off-grid island and lakeside communities. Several solar PV electrification projects have been implemented, including:

- a 1998 pilot project in 10 rural communities in the Volta region to assess the potential for solar PV electrification. The project installed a battery charging center and household solar systems (50 Wp and 100 Wp) (Obeng and Evers 2009; Bawakyillenuo 2011)
- the Renewable Energy Services Project (1999–2003), which installed stand-alone PV systems in 13 communities in the Northern region, covering about 1,800 households (Obeng and Evers 2009; Ministry of Energy 2019)
- the Renewable Energy Development Project (1999–2002), which provided off-grid electrification to 14 rural communities in the Ashanti, Brong Ahafo, Upper West and Northern regions (Obeng and Evers 2009)
- the Ghana Energy Development and Access Project (GEDAP), which sought to increase access through solar home systems (SHS) and solar PV lanterns under a 2007 project called *Improving Rural Energy Access through Solar Home Systems in Ghana*

- the National Rooftop Solar Programme (NRSP), initiated in 2016, with a target of 200,000 installations and 200 MW total installed capacity and the main aim of relieving peak load on the grid. The program provides a capital subsidy for solar PV panels up to 500 Wp to households that have switched to LED lights and installed batteries, inverters and other essential equipment. The subsidy is equivalent to between 30 percent and 40 percent of the total cost to the household (Appiah 2017)

Although diverse solar PV programs have been implemented, the most successful program captured by this case study is the *Improving Rural Energy Access through Solar Home Systems in Ghana*. This project forms part of GEDAP and is supported by funding from the World Bank and GPRBA.

Implementation

Key informant interviews revealed that many of the solar PV programs, especially the *Improving Rural Energy Access through Solar Home Systems in Ghana*, had subsidies close to 60 percent with guaranteed access to loans from banks for those households who could still not afford the remaining cost of the package. The *Improving Rural Energy Access through Solar Home Systems in Ghana* program was implemented in 2010. The aim of this program was to improve access to solar energy for 15,000 households in isolated islands in the Volta Lake enclave through the provision of SHSs and PV lanterns. The project provided a 50–60 percent subsidy of the total cost for four products, amounting to USD 40 (GHS 157) for solar lanterns, USD 300 (GHS 1,177) for small SHSs (10–20 Wp), USD 450 (GHS 1,766) for medium SHSs (21–49 Wp) and USD 550 (GHS 2,160) for large SHSs (50 Wp) (GPRBA 2016). The program partnered with the ARB Apex Bank Ltd.[viii] to manage a line of credit financing the remaining 40-50 percent cost for households to purchase the products. Service providers were required to (i) supply and install the solar systems; (ii) provide satisfactory maintenance and timely repair service over three years; and (iii) provide one battery replacement at the end of year two or three (Stojanovski, Thurber & Wolak 2017). The project exceeded its target of 15,000 households and supported the purchase of 8,831 SHSs and 7,991 lanterns for 16,500 households, benefiting approximately 100,000 residents in remote, off-grid areas in the Volta Lake area (Stojanovski, Thurber & Wolak 2017).

By 2015, various government programs providing access to electricity through solar PV had distributed 72,000 solar lanterns, installed 2 MW of stand-alone generation capacity and 2 MW of grid-connected generation. Targets for 2030 increase the number of solar lanterns to 1,000,000, stand-alone PV capacity to 20 MW, and distributed PV to 200 MW. In addition the Ministry of Energy established a target to increase the number of mini-grids from 13 in 2015 to 300 by 2030 (2019). One effect of government support has been to provide an incentive to solar dealers to extend their distribution to remote rural communities, typically more expensive to reach due to increased transportation costs (Climate Investment Funds 2015).

Impacts and Experiences

The implementation of solar PV programs in Ghana has not been without challenges. Stakeholders mentioned politicization of the programs and weak targeting of the poor and vulnerable as some of the critical challenges that impeded the implementation of the solar PV programs.

Key stakeholders concurred that the solar PV programs implemented have increased access to electricity for lighting (study at night) and quantities of store vaccines/medicines in health centers, and promoted productive uses for livelihood activities. Interviewees noted that the Government of Ghana's 2013 removal of subsidies covering

more than half the cost of petroleum products affected the consumption of kerosene by the poor and vulnerable who depend on kerosene as a source of lighting. Solar lantern programs were subsequently initiated to support access to alternative household lighting methods. The substitution of kerosene for solar lanterns also had positive benefits for the environment since kerosene is a non-renewable energy source that emits toxic pollutants.

GPRBA's assessment of the *Improving Rural Energy Access through Solar Home Systems in Ghana* project reveals that there was a reduction in the use of kerosene from 86 percent to 21 percent at the close of the project (2016). Many users also reported that their children were able to study at night in their homes. Additionally, 47 percent of beneficiaries reported using their energy for direct income generation (GPRBA 2016).

LIQUEFIED PETROLEUM GAS (LPG) PROMOTION PROGRAMS IN GHANA

Background, Design and Evolution

The Government of Ghana has promoted LPG access and use since as early as the 1980s. The chief objective of these early LPG promotion programs was to foster the broader adoption and use of LPG as a substitute for fuelwood and charcoal to reduce the rate of deforestation and environmental degradation (Ahunu 2015). These early programs targeted households, public catering facilities and small-scale food vendors, making significant efforts to improve LPG access, affordability and availability (UNDP 2014).

The main LPG promotion program, initiated in 1989, distributed 14.5 kg and 5 kg LPG cylinders to households in urban areas (Acharibasam and Apatinga 2014; Asante et al. 2018). Consumers received empty cylinders free of charge and were only required to pay the cost of the gas (Asante et al. 2018). The Ministry of Energy, in its drive to ensure a sustained supply of LPG to consumers, adopted a delivery strategy that involved supplying trucks to registered LPG retailers who then provided on-the-spot cylinder refilling at consumers' houses. This delivery model was abandoned in the 1990s due to safety concerns (Asante et al. 2018). The LPG promotion program was later extended to public institutions such as schools and hospitals, with free installation of LPG cylinders and accessories for targeted institutions. The number of cylinders in use increased from 80,000 in 1989 to 600,000 in 1997 (Global LPG Partnership 2018).

In 1998, the tax on LPG sales, which previously part-funded the LPG promotion program, was replaced with a price subsidy for domestic consumers to enable them to afford the cost of LPG. Many vehicle owners realized that LPG was less expensive than other fuels and began using it to power their cars around 2005. This compelled the government to remove the subsidy in 2013, resulting in many LPG consumers reverting to the use of fuelwood for cooking (Daily Graphic 2010; Biscoff et al. 2012; Ackah & Tetteh 2016).

Another endeavor by the government to promote access to LPG was the establishment of the Ghana Cylinder Manufacturing Company and Sigma Gas Ghana, as well as three refilling stations in the coastal and northern areas around the 2000s. Later, the Ministry of Energy, through the Energy Sector Strategy and Development Plan, supplied several new cylinders to the Ghanaian market and gave price incentives to consumers in order to expand LPG access and use in rural areas (Biscoff et al. 2012; Asante et al. 2018).

In 2013, when the LPG subsidy was removed, the government initiated a rural LPG promotion program (RLP) to distribute small-size cylinders to rural communities free of charge. This was essentially an expansion and replication of the 1989 LPG promotion program. The program set

a target to distribute 170,000 cylinders by 2017. By the end of 2017, about 150,000 cylinders had been distributed in 108 of Ghana's 217 districts (Asante et al. 2018).

The most recent LPG promotion program initiative in Ghana is the introduction of the 'cylinder recirculation' model, which was announced in October 2017. Under this delivery model, the LPG distributor retains ownership of the cylinder and consumers pay only for gas. It is similar to the original approach that began in Ghana in 1989 (Global LPG Partnership 2018). Although the recirculation distribution model has yet to be operationalized due to resistance from private LPG retailers over fears of losing out in the process, it is expected that it will help improve LPG storage and distribution, increase access and safety and reduce high costs associated with LPG use (Asante et al. 2018; Global LPG Partnership 2018).

Although successive governments have promoted LPG use since the late 1980s, access and usage of LPG by households remains very low. LPG use in Ghana in 2004 and 2005 was just 6 percent and 9 percent, respectively (Asante et al. 2018). Of this, about 70 percent was in the largest urban cities of Accra and Kumasi. Prior to 2012, the rate of LPG use in rural areas was 3 percent (Asante et al. 2018). Currently, Ghana's national LPG access rate is about 25 percent, against the government's national target of 50 percent by 2020. The access rate is also highly skewed towards urban areas where 35 percent of households use gas for cooking compared with 9 percent in rural areas (GSS 2019).

Implementation

Government support for access to LPG in Ghana has had three main phases. Between 1989 and 1998, the approach supported connections for LPG consumption by distributing cylinders free of charge to households that could afford to fill them with gas, mainly in urban centers. Between 1998 and 2013, the focus shifted to supporting LPG consumption through a subsidized gas price. When the subsidy was removed in 2013, support for connections became the main focus again, with a greater emphasis on distributing cylinders in rural areas.

Stakeholder interviews for this case study resonated with findings in previous studies (Asante et al. 2018; Ackah & Tetteh 2016; Ahunu 2015; UNDP 2014; Acharibasam and Apatinga 2014; Biscoff et al. 2012), indicating that rollout of these LPG promotion programs did not target a particular group of people. The goal of the programs has been to increase LPG usage among the general population of Ghana in both urban and rural areas.

Initially, LPG promotion was aimed at households that used fuelwood and charcoal as their main cooking fuel with the goal of curbing deforestation. Public facilities, such as schools and hospitals, and small-scale food sellers were also targeted (Energy Commission 2012). Stakeholder interviews for this study suggested there had been political biases in the selection of districts, communities and household beneficiaries. Asante et al. (2018) also reported political interference in LPG promotion and the selection of districts and beneficiaries. Because the poor and vulnerable were not specifically targeted, they may have been excluded from beneficiary lists because of lack of political voice. Other challenges for the implementation of LPG promotion programs have included the inaccessibility of LPG refilling/service stations, lack of education and awareness on safety measures and the steep cost of LPG due to the removal of the subsidy[ix] (Asante et al. 2018; Acharibasam and Apatinga 2014; and Ahunu 2015).

A key challenge for extending access to LPG is the supply constraint. Interviewed stakeholders and consulted studies indicate the critical remaining challenge is that the distribution system for LPG

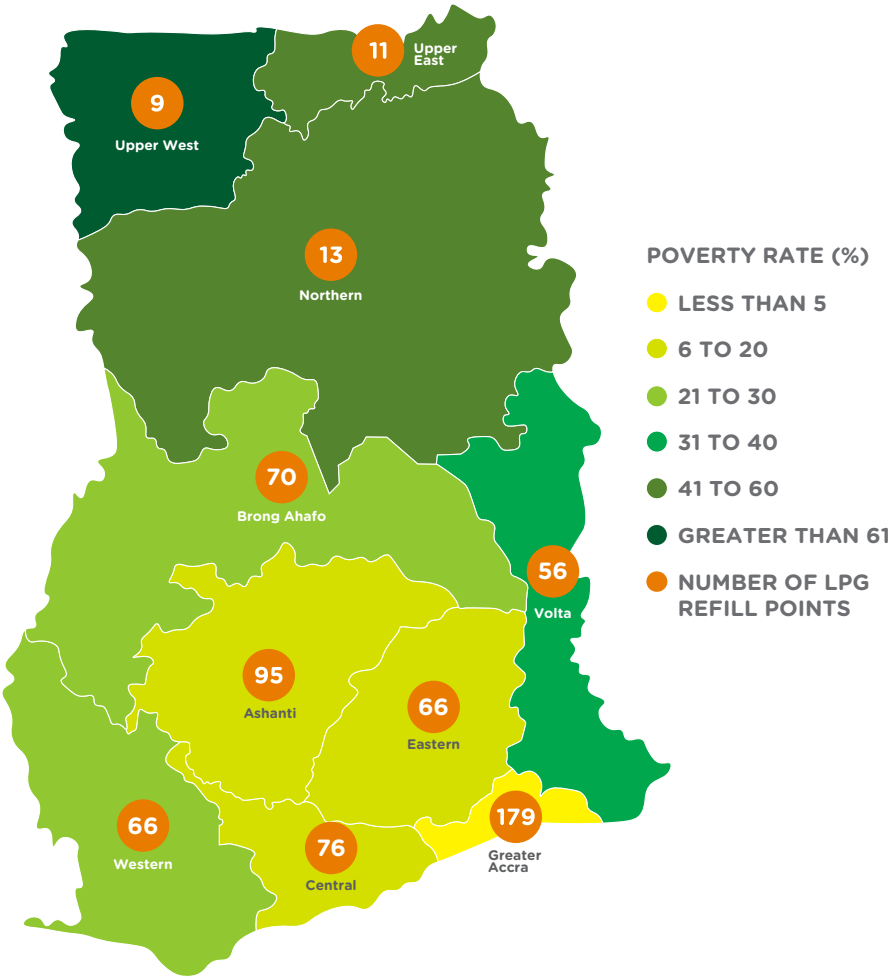
gas is solely accessible to customers through the pumping or refilling stations. At the end of 2003, 64 of Ghana's 98 LPG refilling stations were in the Greater Accra region (Broni-Bediako & Amorin 2018). This number is not supported by the information in Figure 8 that shows five regions as having no data on LPG refill points, but these are not evenly distributed. In 2017, the Greater Accra region (the smallest region in terms of land size) and Ashanti region had about 179 and 95 LPG refilling stations respectively, while the Northern, Upper West and Upper East regions had 13, 9 and 11 refilling stations respectively (Asante et al. 2018). Comparing the regional distribution of refill points and regional poverty rates reveals an inverse relationship between poverty rates and LPG refill points. As shown in Figure 8, regions with comparatively higher rates of poverty have fewer LPG refill points and vice versa. Given that most rural communities are remote and far from LPG refill or service stations, transportation costs are prohibitive for rural people to refill their cylinders after use, discouraging rural household LPG use.

Impacts and Experiences

The aim of the LPG promotion program at the time of its initiation was to reduce deforestation.

Figure 8

Regional map of Ghana showing poverty and distribution points for LPG refills, 2017



Source: Author's own construction based on data from Asante et al. (2018)

Note: In 2018, Ghana's political regions increased from 10 to 16, with some of the former regions being partitioned. This map refers to the former 10 political regions for data consistency.

Later, with a better understanding of the adverse health risks posed to women and children due to the use of fuelwood for cooking, the government included health as one of the main reasons for promoting enhanced LPG access (Asante et al. 2018). The exposure of women to heat and smoke from charcoal and fuelwood during the cooking process puts them at risk of reproductive problems, respiratory complications and other diseases. Although the LPG promotion programs would appear to have contributed to the prevention of some of these negative health outcomes among women who have been able to switch from fuelwood to LPG usage in Ghana, there has been no empirical evaluation of the impacts.

During the time of the promotion program, the government offered a subsidy for LPG, making it cheaper to purchase than fuelwood and charcoal. However, this subsidy primarily benefited households in higher income quintiles. In 2005–2006, over 80 percent of LPG users in the top two income quintiles and less than 1 percent of households in the lowest income quintile used gas as a cooking fuel (Cooke et al. 2014). However, many households reverted back to the use of fuelwood and charcoal once the subsidy was removed in 2013.

The LPG subsidy intended to promote use in households was exploited by vehicle owners, particularly commercial taxi drivers operating in cities, who modified their vehicles to be compatible with LPG. The Energy Commission assessment revealed that roughly 37 percent of LPG sales were consumed by commercial vehicle drivers (2018). Amorin et al. (2018) estimated that close to 75 percent of commercial vehicles in the Greater Accra region run on LPG. This exploitation of low fuel costs was one of the reasons that triggered the removal of the subsidy. However, the government's inability to come up with a targeting approach to ensure the subsidy benefited the poor was a weak point in the program design.

Many stakeholders interviewed for the study were of the view that the LPG promotion programs are positive initiatives and have increased households' access to LPG and usage. However, the use of LPG as fuel for cooking remains skewed towards urban centers and higher-income households. In 2012 only 3 percent of rural households used LPG for cooking (Asante et al. 2018). By 2017, this had increased to almost 9 percent, although in the Northern region it remained close to 3 percent, while in Accra over half of households used LPG (Government Statistical Service 2019). This is partly explained by the limited number of LPG refilling stations in Ghana, especially in the poorer three northern regions.

IMPROVED COOKSTOVES (ICS) IN GHANA

Background, Design and Implementation

Over the years, there have been several programs to promote the adoption and use of improved biomass cookstoves (ICS) in Ghana by both private and public sector organizations. The Energy Commission was the first organization behind such initiatives with its introduction of the *ahibensu* stove as far back as the late 1980s–early 1990s (Akolgo et al. 2018). At the time, a survey was conducted to determine which type of stoves women, as traditional preparers of food within households, preferred. The results of this survey led to the production of two ICS models, the *ahibensu* stove that uses charcoal, and a second stove for brewing *pito* (a local beer), using fuelwood. In a project specifically targeting women, an estimated 12,000 *ahibensu* stoves were distributed free of charge in the 1990s.[x] After the ICS prototypes were distributed, the private sector capitalized on what it saw as a business opportunity, resulting in the mass production of different types of ICS.

Within the government sector, the Ministry of Energy and a private Korean company signed a deal in 2018 for the annual distribution of at least 500,000 ICS in Ghana for the following five years, based on a carbon credit arrangement. Under the agreement, the Korean company is required to deploy 5 million ICS to end users in Ghana between 2018 and 2022[xi] to help close the access gap for millions of Ghanaians without access to clean energy.

The private sector and NGO partners have also implemented multiple projects to increase access to cooking technologies in Ghana. In 2013, the Council for Scientific and Industrial Research (CSIR), through sponsorship from the Clean Cooking Alliance (CCA), established a cookstove laboratory. Around the same time, CSIR, in partnership with the Energy Commission, led a biogas and cookstove technology transfer from China to Ghana.[xii] Currently, according to a key interview with the Ghana Alliance for Clean Cookstoves and Fuels (GHACCO), the CCA is installing improved cookstoves in 100 schools, with cookstoves installed in 10 schools as of 2019.

As social enterprises, private stove companies have access to carbon funds, which give them the opportunity to sell ICS at subsidized rates to end users. For example, Relief International, a private company, is able to sell *gyapa* ICS at a subsidized rate of USD 3.77 (GHS 20) per unit compared to the unsubsidized market price of USD 15 (GHS 80) and in turn receives carbon credit for avoided emissions due to improved cooking conditions. As of June 2019, the company had sold about 200,000 cookstoves.[xiii] Another stakeholder, SNV Ghana, has played a major role in the ICS sector with contributions in developing stove technologies, developing the stove market and advocating for improved cooking technologies and fuels. SNV Ghana also partnered with the Government of Ghana and USAID to design an improved fish smoking stove (*ahotor* oven) in 2016 that benefits women, in particular those working as fishmongers, in coastal Ghana (CSIR et al. 2016).

While multiple companies are currently distributing thousands of ICS in Ghana, there is no coordinated government framework to guide their actions or specifically target the poor and vulnerable with additional support.

Impacts and Experiences

Stakeholders had mixed reactions to the impact of ICS distribution efforts in advancing clean cooking access for Ghana's poorest households. Some believe that early government efforts did manage to reach poor communities, but that subsequent private sector business models have driven up costs and made commercially available stoves unaffordable for many.

There are little data to confirm that poor households have exclusively received the benefit of subsidized ICS sales. However, the market for these stoves is typically comprised of poorer segments of the population. The thousands of improved cookstoves distributed to households throughout Ghana have yielded health benefits for individuals through reduced household air pollution, to local environments through reduced deforestation, and in some cases to household budgets through reduced expenditures on fuelwood.

Acknowledging the potential benefits of adopting ICS, significant challenges remain to improving their use by Ghana's poorest communities:

- **Production location:** To date, ICS production and manufacturing has been concentrated in urban areas such as Accra, Kumasi, Takoradi and Cape Coast.
- **Carbon credits:** The procurement of carbon credits is one way of providing financing for clean cookstove companies or projects. In order to receive carbon credits indicating re-

duced emissions from the use of ICS in households, companies must undergo fairly rigorous monitoring. This level of reporting can be difficult in rural areas where higher concentrations of poor and vulnerable Ghanaians may live.

- **Education and promotion:** There is little education on the benefits of purchasing and using ICS, particularly in rural communities in Ghana. According to Shen et al. (2014), publicity for and demonstrations of new cookstoves result in their adoption and usage. This corroborates findings of this study as interviewed stakeholders highlighted the role of education in ICS usage.

Within the many policy documents relating to energy in Ghana, there are only a few statements addressing the promotion of ICS. There is no coherent document on how the country intends to increase the use of this technology by households. A clear policy on ICS is needed to address critical barriers in their adoption and uptake.

CONCLUSIONS AND RECOMMENDATIONS

Ghana has embarked on several social assistance programs with the aim of enhancing the welfare of the poor and vulnerable. Some of these programs have come from the non-governmental sector, some have come from the public sector and others have been a combination of both. Taken together, these programs have been successful in increasing electrification rates and access to clean cooking technologies in Ghana. However, there are many hurdles to overcome to ensure that the poor receive the benefit of future ESNs. Challenges include the absence of proper targeting of the poor and vulnerable, poor coordination among the stakeholders involved in programs, politicization of implementation processes, and a lack of sustainability measures. Other programs have been ineffective due to poor education and the relatively high cost of technology that has excluded the poor and vulnerable. Of the five programs assessed, the most successful was the Solar PV Electrification Programme due to its relatively effective implementation. The project exceeded its target of 15,000 households and supported the purchase of 8,831 SHS and 7,991 lanterns for 16,500 households, benefiting approximately 100,000 residents in remote, off-grid areas in the Volta Lake area. Notwitstanding the challenges, Ghana's social assistance programs have supported the poor, vulnerable, and disadvantaged to access modern and efficient energy services and provide a platform for policymakers to improve upon in order to reach universal access.

GENERAL POLICY RECOMMENDATIONS

The following recommendations are based on the findings of this case study regarding the design, implementation and impacts of ESNs in Ghana:

- Poor targeting that has plagued most of the ESN programs should be addressed so their key objectives of serving the interests of the poor and vulnerable can be achieved.
- Future ESN programs should not be developed with short-term objectives, but rather as complete programs with long-term perspectives.
- The government and other stakeholders involved in ESN programs should educate the public, in particular poor households, on opportunities to participate in various ESN programs and how they can benefit from them.

POLICY RECOMMENDATIONS SPECIFIC TO DIFFERENT PROGRAMS

NES/SHEP

- Policymakers and officials at the Energy Commission and Ministry of Energy should set up an integrated national plan for electricity expansion programs and ensure pro-poor programs to target vulnerable communities and households.

Lifeline Tariffs

- The government should introduce a program that ensures electricity grid connections are subsidized and meters are made available to different households within shared living compounds.
- The government should undertake research to reassess the electricity consumption of poor and vulnerable households with a view to revising the 50 kWh per month threshold of the lifeline tariff. Similarly, policymakers should conduct research to better understand the prevalence of energy efficient appliances within households and their impact on electricity consumption trends.

Solar PV

- The government should adopt innovative approaches that will support the poor and vul-

nerable to build the needed financial capacity to be able to afford solar PV services, especially in rural areas.

LPG Promotion Programs

- The government should prioritize the establishment of LPG refill and service stations in close proximity to communities, especially in rural areas, to make LPG easily and readily accessible to all users.
- The government should adopt innovative approaches to subsidize LPG solely for the poor and vulnerable without the risk of subsidy capture.

Improved Cookstoves (ICS)

- The government should support the development of a comprehensive program to ensure effective synergy between ICS distribution programs run by individual stakeholders to increase their level of coordination and sustainability.
- The Ministry of Local Government and Rural Development (MLGRD) and the Metropolitan, Municipal and District Assemblies (MMDAs) should be involved in the implementation of ICS programs. Currently, ICS programs are run by the central government through various ministries and agencies with little coordination amongst community-level partners.

REFERENCES

Abavana, C. G. (2008). Ghana: The National Electrification Scheme (NES); Electrifying Africa: Grid Extension Models in Sub-Saharan Africa. Energypedia.

Abavana, C.G. (2004). Ghana: Energy and Poverty Reduction Strategy. Paper prepared for Facilitation Workshop and Policy Dialogue. EU Energy Initiative pp.1-3.

Abebrese, J. (2011). Social Protection in Ghana: An Overview of Existing Programmes and their Prospects and Challenges: Friedrich-Ebert-Stiftung.

Acharibasam, J. B., and Apatinga, G. A. (2014). Ghana and the Liguidified Petroleum Gas Dilemma Critical Analysis of Ghana's LPG policy. *International Journal of Energy and Environmental Research*, 2(2), 1–8.

Ackah, I., and Tetteh, E. N. (2016). Determinants of autogas demand among taxi drivers in rural Ghana. https://mpra.ub.uni-muenchen.de/74242/.

Adjoa, G. S. E. (2014). Impact of the National Electrification Scheme on Poverty Reduction in Rural Ghana: A Case Study of the Amansie West District, Ashanti Region (Thesis). Department of Geography and Rural Development, Kwame Nkrumah University of Science and Technology.

Ahunu, L. (2015). LPG Promotion Program. Accessed 19 April 2019 at: https://newacep- static. s3.amazonaws.com/working-reports/THE+LPG+PROMOTION +PROGRAMME+(1).pdf.

Akolgo, G. A., Essandoh, E. O., Gyamfi, S., Atta-Darkwa, T., Kumi, E. N., and de Freitas Maia, C. M. B. (2018). The Potential of a Dual Purpose Improved Cookstove for Low Income Earners in Ghana – Improved Cooking Methods and Biochar Production. *Renewable and Sustainable Energy Reviews*, *82*, 369-379.

Al-Hassan, R. and Poulton, C. (2009). Agriculture and Social Protection in Ghana, FAC Working Paper 09, Brighton: Future Agricultures Consortium.

Amorin, R., Broni-Bediako, E., Worlanyo, D., and Konadu, S. A. (2018). The Use of Liquefied Petroleum Gas (LPG) as a Fuel for Commercial Vehicles in Ghana: A Case Study at Tema Community 1. Current Journal of Applied Science and Technology, 1-8.

Appiah F. K (2017). The National Rooftop Solar Programme. Presentation At Anglophone African Regional Workshop**.** Accessed 10 May 2019. https://www.transparency-partnership.net/sites/default/files/u2612/1-the_national_rooftop_solar_programme_ghana_appiah_25.04.17.pdf.

Asante, K. P., Afari-Asiedu, S., Abdulai, M. A., Dalaba, M. A., Carrión, D., Dickinson, K. L., Abeka, A.N., Sarpong, K. and Jack, D. W. (2018). Ghana's Rural Liquefied Petroleum Gas Program Scale Up: A Case Study. *Energy for Sustainable Development*, *46*, 94-102.

Bailis, R., Cowan, A., Berrueta, V., and Masera, O. (2009). Arresting the Killer in the Kitchen: the Promises and Pitfalls of Commercializing Improved Cookstoves. World Development, 37(10), 1694-1705.

Bawakyillenuo, S. (2009). Policy and Institutional Failures: Photovoltaic Solar Household System (PV/SHS) Dissemination in Ghana. *Energy and environment*, 20(6), 927-947.

Bawakyillenuo, S. (2011). Shifting the policy paradigm of solar photovoltaic and other renewable energy technologies supply in rural Ghana. World Renewable Energy Congress, 8-13 May 2011: 2650-2657.

Biscoff, R., Akple, M., Turkson, R., and Klomegah, W. (2012). Scenario of the Emerging Shift from Gasoline to LPG Fueled Cars in Ghana: A Case Study in Ho Municipality, Volta Region. *Energy policy*, 44, 354-361.

Blimpo, M. P., and Cosgrove-Davies, M. (2019). *Electricity Access in Sub-Saharan Africa: Uptake, Reliability, and Complementary Factors for Economic Impact*. World Bank Publications.

Botchway, F. N. (2000). The State, Governance and the Energy Industry in Ghana. Verfassung und Recht in Übersee/Law and Politics in Africa, Asia and Latin America, 176-211.

Broni-Bediako, E., and Amorin, R. (2018). The Ghana Liquefied Petroleum Gas Promotion Programme: Opportunities, Challenges and the Way Forward. Innov Ener Res, 7(197), 2576-1463.

Climate Investment Funds (2015). SREP Investment Plan Ghana. SREP/SC.13/4.

Cooke, E. F.A., Hague, S., Cockburn, J., El Lahga, A-R. and Tiberti, L. (2014). *Estimating the impact on poverty of Ghana's fuel subsidy reform and a mitigating response*. Working paper 2014/02. Partnership for Economic Policy and UNICEF.

Coulombe, H., and Wodon, Q. (2007). Poverty, livelihoods, and access to basic services in Ghana. In Ghana CEM: Meeting the Challenge of Accelerated and Shared Growth. Washington, DC: World Bank.

Creswell, J. W. (2013). *Qualitative inquiry and research design: choosing among five approaches*. Los Angeles: SAGE Publication.

Daily Graphic (2010). Don't Transfer LPG from Cylinders into Vehicles-EPA Warns Taxi-Drivers, 9 September, 2010.

Edjekumhene, I., Amadu, M. B., and Brew-Hammond, A. (2001). Power Sector Reform in Ghana: the Untold Story. A Paper written as part of a collaborative project on Power Sector Reform and Public Benefits in Developing and Transition Economies coordinated by the World Resources Institute. Kumasi Institute of Technology and Environment (KITE). http://pdf.wri.org/power_politics/ghana.pdf.

Energy Commission (2012). Sustainable Energy For All: Rapid Assessment Gap Analysis Ghana. Accessed 10 May 2019. https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_RAGAs/Ghana_RAGA_EN_Released.pdf.

Energy Commission (2016). National Energy Statistics (2006–2016). Accessed from: http://energycom.gov.gh/files/National%20 Energy%20Statistics_2016.pdf.

Energy Commission (2017). Ghana: 2017 Energy (Supply and Demand). Accessed from: http://www.energycom.gov.gh/planning/data-center/energy-outlook-for-ghana?download=31:energy-outlook-for-ghana-2017.

Energy Commission (2018). 2018 Energy (Supply and Demand) Outlook for Ghana. Accessed 15 May 2019. http://www.energycom.gov.gh/planning/data-center/energy-outlook-for-ghana?download=76:energy-outlook-for-ghana-2018.

Energy Commission (2019a). 'Ghana Energy Access Database'. Retrieved 19 August 2019. http://167.114.144.200/Dataset/SelectedDS?datasetid=12.

Energy Commission (2019b). *National Energy Statistics 2009-2018*. http://www.energycom.gov.gh/files/ENERGY_STATISTICS_2019_Updated.pdf.

GHACCO (N.D.). Cookstoves Data 2015–2016.

Ghana Statistical Service (2014). Ghana Living Standards Survey Round 6 (GLSS6). Accessed from Accra: GSS. https://www.statsghana.gov.gh/gssmain/fileUpload/Living%20conditions/GLSS6_Main%20Report.pdf.

Ghana Statistical Service (2017). *Poverty Profile Report (2005–2017)*. http://www2.statsghana.gov.gh/docfiles/publications/GLSS7/Poverty%20Profile%20Report_2005%20-%202017.pdf.

Ghana Statistical Service (2019). Ghana Living Standards Survey Round 7 (GLSS7): Main Report. http://www.statsghana.gov.gh/gssmain/fileUpload/pressrelease/GLSS7%20MAIN%20REPORT_FINAL.pdf.

Global LPG Partnership (2018). *National Feasibility Study: LPG for Clean Cooking in Ghana*. Global LPG Partnerhsip, KfW and European Union.

GNA (2018). GHACCO Commends Government for Deploying Improved Cookstoves to Rural Communities. Accessed from http://www.ghananewsagency.org/social/ghacco-commends-government-for-deploying-improved-cookstoves-to-rural-communities-141648.

Government of Ghana (2011). Renewable Energy Act, 2011: The Eight Hundred and Thirty-Second Act of the Parliament of Republic of Ghana. Parliament of Ghana, Government of Ghana.

Global Partnership for Results-Based Approaches (GPRBA) formerly Global Partnership for Output-Based Aid (GPOBA) (2016). Lessons Learned: Improving Rural Energy Access through Solar Home Systems in Ghana. Note Number 12. Washington, DC; World Bank; 2016.

Hanania, J., Stenhouse, K., Donev J. (2018). Energy Education – Access to electricity [Online]. Available: https://energyeducation.ca/encyclopedia/Access_to_electricity. [Accessed 21 July 2019].

IEA, IRENA, UN Statistics Division, WHO and World Bank (2019). *Tracking SDG7: The Energy Progress Report 2019*. A joint report of the custodian agencies. Washington, DC: The World Bank.

IMF (2013). Energy Subsidy Reform in Sub-Saharan Africa: Experiences and Lessons. https://www.imf.org/external/pubs/ft/dp/2013/afr1302.pdf.

Institute for Industrial Research - CSIR, Ghana Standard Authority, Kwarteng, E. (2016). Testing of Low PAH Improve Fish Smoking Stove (Ahotor oven). The USAID/Ghana Sustainable Fisheries Management Project (SFMP), Narragansett, RI: Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island. GH2014_ACT067_SNV. 19p.

Jagger, P., and Shively, G. (2014). Land Use Change, Fuel Use and Respiratory Health in Uganda. *Energy policy*, 67, 713-726.

Karimu, A. (2015). Cooking Fuel Preferences Among Ghanaian Households: An Empirical Analysis. Energy for Sustainable Development, 27, 10-17.

Kemausuor, F., and Ackom, E. (2017). Toward Universal Electrification in Ghana. Wiley Interdisciplinary Reviews: *Energy and Environment*, 6(1), e225.

Kimble, M. (2012). Cookstoves in West Africa, Global Alliance for Clean Cookstoves. In Owusu et al (2015). https://www.researchgate.net/profile/Joseph_Ribeiro3/publication/305443540_Adoption_and_Utilization_of_Improved_Cookstoves_in_Ghana/links/578f55f808aecbca4cadce4c.pdf.

Kojima and Trimble (2016). *Making Power Affordable for Africa and Viable for Its Utilities*. Washington DC: The World Bank.

Kumi, E. N. (2017). *The Electricity Situation in Ghana: Challenges and Opportunities*. CGD Policy Paper. Washington, DC: Center for Global Development. https://www.cgdev.org/publication/electricity-situation-ghana-challenges-and-opportunities.

Legros, G., Havet, I., Bruce, N., Bonjour, S., Rijal, K., Takada, M., and Dora, C. (2009). The Energy Access Situation in Developing Countries: a Review Focusing on the Least Developed Countries and Sub-Saharan Africa. World Health Organization.

Mas'ud, A. A., Wirba, A. V., Muhammad-Sukki, F., Albarracín, R., Abu-Bakar, S. H., Munir, A. B., and Bani, N. A. (2016). A Review on the Recent Progress Made on Solar Photovoltaic in Selected Countries of Sub-Saharan Africa. Renewable and Sustainable Energy Reviews, 62, 441-452.

Ministry of Energy (2018). Medium Term Expenditure Framework (MTEF) for 2018–2021. Programme Based Budget Estimates. Accessed 19 April 2019. www.mofep.gov.gh/sites/default/files/pbb-estimates/2018/2018-PBB-MoEn.pdf.

Ministry of Energy (2019). *Renewable Energy Master Plan*. Accra: Ministry of Energy.

Ministry of Gender, Children and Social Protection (MOGCSP) (2015). Ghana National Social Protection Policy: Final Draft. Accra: Ministry of Gender, Children and Social Protection.

Ministry of Power (2016). Power News. The Official News Magazine for the Ministry of Power, Maiden Edition. Accra.

Mundial, B. (2001). Attacking Poverty: Opportunity, Empowerment, and Security. In World Development Report 2000/2001: Attacking poverty (p. 12). Oxford University Press, Inc.

National Development Planning Commission (2005). Growth and Poverty Reduction Strategy II. Accra: National Development Planning Commission, Government of Ghana.

National Development Planning Commission (2010). Medium-term National Development Policy Framework: Ghana Shared Growth and Development Agenda (GSGDA), 2010–2013.

National Development Planning Commission (2015). Ghana Shared Growth and Development Agenda II. Accra: National Development Planning Commission, Government of Ghana.

Obeng, G. Y., and Evers, H. D. (2009). *Solar PV Rural Electrification and Energy Poverty: a Review and Conceptual Framework with Reference to Ghana* (No. 36). ZEF Working Paper Series.

Owusu, P. A., and Asumadu-Sarkodie, S. (2016). A Review of Renewable Energy Sources, Sustainability Issues and Climate Change Mitigation. *Cogent Engineering*, *3*(1), 1167990.

Pachauri, S., Brew-Hammond, A., Barnes, D. F., Bouille, D. H., Gitonga, S., Modi, V., and Zerrifi, H. (2012). Energy Access for Development. Accessed 10 May 2018 at: http://pure.iiasa.ac.at/id/eprint/10069/1/GEA%20Chapter%2019%20Energy%20Access%20for%20Development.pdf.

Patton, M. Q. (2002). *Qualitative Research Evaluation Methods* (Third ed.). Thousand Oaks: Sage Publications.

Phillippi, J., and Lauderdale, J. (2018). A Guide to Field Notes for Qualitative Research: Context and Conversation. *Qualitative health research, 28*(3), 381-388.

PURC (1998). Publication of Power Tariffs. http://www.purc.com.gh/purc/sites/default/files/sept_1998_electricity.pdf.

PURC (1999). Electricity Rate Settings Guidelines. http://purc.com.gh/purc/sites/default/files/purc_electricity_rate_setting_guidelines.pdf.

PURC (2006). Publication of Electricity Tariffs. http://www.purc.com.gh/purc/sites/default/files/may_2006.pdf.

PURC (2019). Publication of Electricity Tariffs. http://purc.com.gh/purc/sites/default/files/purc_approved_2019-2020_electricity__tariffs.pdf.

Saldana, J. (2009). The Coding Manual for Qualitative Researchers. London: Sage Publications.

Scott, A., and Pickard, S. (2018). Energy Safety Nets: A Literature Review. London: Overseas Development Institute and Catholic Agency for Overseas Development.

Shen, G., Lin, W., Yue, D., Liu, Z., Chen, Y. and Yang, C. (2014). Factors Influencing the Adoption and Sustainable use of Clean Fuels and Cookstoves in China: A Chinese Literature Review. Report to the Program *Review of Chinese Evidence on Adoption of Clean Cookstoves and Fuels (RFP 13-1)* Sponsored by Global Alliance for Clean Cookstoves. https://www.google.com/url?sa=tandsource=webandrct=jandurl=https://www.cleancookingalliance.org/binary-data/RESOURCE/file/000/000.

Siyambalapitiya, T. (2018). Tariff Appraisal Study: Balancing Sustainability and Efficiency with Inclusive Access. https://www.adb.org/sites/default/files/publication/462676/swp-060-tariff-appraisal-study.pdf.

Stake, R. (1995). *The Art of Case Study Research.* Thousand Oaks, CA: Sage Publications.

Stojanovski, O., Thurber, M., and Wolak, F. (2017). Rural Energy Access through Solar Home Systems: Use Patterns and Opportunities for Improvement. Energy for Sustainable Development, 37, 33-50.

UNDP (2014). Liquefied Petroleum Gas (LPG) Substitution for Wood Fuel in Ghana – Opportunities and Challenges. United Nations Development Programme in Ghana.

United Nations (2013). A Life of Dignity for All: Accelerating Progress Towards the Millennium Development Goals and Advancing the United Nations Development Agenda Beyond 2015. Report of the Secretary-General. New York: United Nations.

United Nations (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. New York: United Nations.

United Nations (2018). Interlinkages among Energy, Poverty and Inequalities; Accelerating SDG 7 Achievement Policy Briefs in Support of the First SDG 7 Review at the UN High-Level Political Forum 2018. Retrieved from New York, Policy Brief #8.

WageIndicator (2019). Minimum Wage Timeline (1963–2015). https://mywage.org/ghana/salary/minimum-wages/minimum-wage-timeline.

Wickramasinghe, A. (2011). Energy Access and Transition to Cleaner Cooking Fuels in Sri Lanka: Issues and Policy Limitations. Energy Policy, 39, 7567-7574.

Yakubu, Osman & Babu, N.C. (2017). Type and nature of electricity theft: A case study of Ghana. International Journal of Mechanical Engineering and Technology. 8. 170-179.

Yin, R. (2009). *Case Study Research: Design and Methods* (Fourth ed.). Thousand Oaks, CA: Sage Publications.

Endnotes

i The Ministry of Energy measures electrification as the proportion of communities that have an electricity supply, while the Ghana Statistical Service and SDG7 Progress Report use the proportion of households with a connection.

ii Using the current exchange rate between the US dollar and Ghana cedi of USD 1 to GHS 5.30 (August 2019).

iii The cedi was redenominated in 2007. GHS 1 in the old denomination was redenominated to GHS 0.0001 in the new currency.

iv Average 1998 LCU to USD exchange rate: USD 1.00: GHS 0.231 (World Bank).

v PDS' licence to distribute power has been suspended since the beginning of August 2019, with the Electricity Company of Ghana temporarily carrying out this responsibility.

vi Key informant interview with a senior research officer at PURC, 27 May 2019. The percentage of the lifeliners is high because the scheme is open to all residential consumers.

vii Figure 4 shows that over 40 percent of rural households and over 60 percent of urban households in the lowest quintile are electricity consumers.

viii A 'mini'-central bank for the Rural and Community Banks in Ghana.

ix Prior to the subsidy removal, a 14.5 kg cylinder of LPG was USD 9 but upon its removal the price jumped up to USD 18 – an increase of 100 percent.

x Interview with key informant, 6 June 2019.

xi Interview with key informant, 18 June 2019.

xii Interview with key informant, 17 June 2019.

xiii Interview with key informant, 16 June 2019.

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