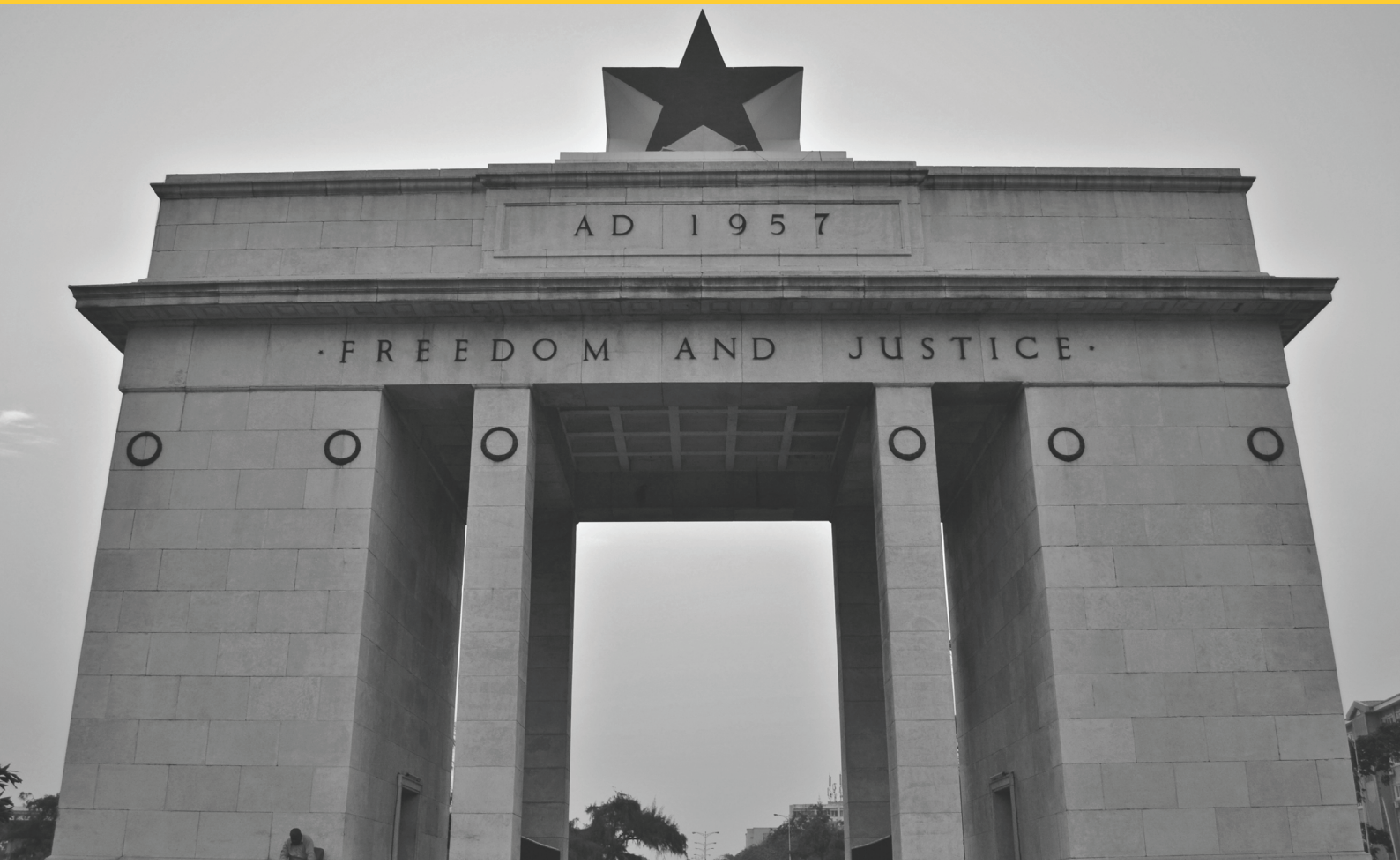
MALABO MONTPELLIER PANEL

Ghana

ENERGIZED

Policy innovations to power the transformation of Africa's agriculture and food system



Ghana has one of the highest rates of access to electricity in SSA. At 80 percent in 2017, it is considerably higher than the continental average of 43 percent. Between 1992 and 2013, the electricity expansion indicator[i] increased by 9.49 thereby being slightly above the average of 8 for Africa as a whole. The agricultural value added per worker annual growth rate averaged 4.55 percent. In addition, Ghana was among the top three performers in Africa south of the Sahara (SSA) as measured by the RISE index[ii] in 2017. With a score of 63 out of 100, Ghana rates as a middle performer in terms of policies and regulations that support the access to modern energy, energy efficiency and renewable energy.[1]

Ghana's success has been driven largely by strong political will, clear policies reflecting long-term planning with clear targets, and smart, bottom-up implementation.[2] Large hydropower and oil-fired power plants provide most of Ghana's electricity, although there is a growing supply from renewable sources, particularly solar.[3] The country's mature policy framework for clean energy access is reflected in the RISE score too.

i- This indicator is expressed in logarithm of the difference of number of Nighttime Lights pixels between 1992 and 2013.

ii - The World Bank's Regulatory Indicator for Sustainable Energy (RISE) assesses countries' policy and regulatory support for each of the three pillars of sustainable energy–access to modern energy, energy efficiency, and renewable energy. RISE classifies countries in three groups based on their score levels as strong performers (those with a score ≥ 67), middle performers (those with a score ≥ 34 and < 67), and weak performers (those with a score ≤ 33).

Institutional Innovations

Regulatory capacity for private sector engagement

Rural electrification in Ghana is led and managed by the Ministry of Energy (MoE), which is responsible for the formulation, implementation, and monitoring of energy, power, and petroleum sector policies.[4] The Ministry has undergone several iterations since independence, and most recently has absorbed the Ministries of Power and Petroleum.[5] As a result, MoE oversees various generation, transmission, and distribution agencies in both the power and petroleum sectors. Although MoE has a budget of its own, it also receives financial support from the Ministry of Finance and Economic Planning.[6]

In 1994, liberalization of the energy sector opened the market to private investment, introducing Independent Power Producers (IPPs) to increase power generation and refinery capacity and to deploy technical innovation to accelerate progress towards the electrification target.[7] Therefore, to regulate an increasingly complex power sector with multiple actors, an Energy Commission was established in 1997 through the Energy Commission Act 541. Overseen by MoE, the Energy Commission provides a legal, regulatory, and supervisory framework covering development and use of Ghana's energy resources. It also advises on national energy policy; licenses public utilities, fosters competition, and promotes energy efficiency. In addition, the Energy Commission promotes the use of local and indigenous energy, including renewable sources such as solar, wind, and biomass. Public utilities in Ghana are regulated by the Public Utilities Regulatory Commission (PURC), established in October 1997. Created as an independent body and administered by the Office of the President, the PURC monitors the quality of service that consumers receive and regulates the electricity tariffs charged to consumers.[8]

In 2012, the Energy Commission initiated a process under the Sustainable Energy for All (SE4ALL) initiative to review the progress being made, and to recommend actions to ensure that Ghana fully met its targets. The process highlighted gaps in incentives to attract private sector investment and the application of productive use of electricity to accelerate agricultural development. In order to accelerate progress, the resulting Country Action Plan proposed the expansion of irrigation on river banks with electricity, wind pumps, and mini hydro-dams; agro-processing such as solar drying and multifunctional platforms for grinding and milling; clean cookstoves; and cold chain refrigeration as opportunities to enhance the use of energy in Ghana's agriculture sector.[9]

Research and technical capabilities

To complement efforts in harmonizing national institutions, significant investments are also being made in capacity building through the education sector. For instance, The Energy Centre at the Kwame Nkrumah University of Science and Technology contributes towards the replication and scaling up of successful energy technologies, policies, and management practices in partnership with other departments at the university, including agriculture and engineering. Similarly, the University of Energy and Natural Resources, established by an Act of Parliament in 2011, provides interdisciplinary research programs to support the development of Ghana's energy sector. The university's School of Agriculture and Technology was established in 2015 to promote higher productivity, modernization, efficiency, and competitiveness of the agriculture sector through the application of science, technology, and economics.[10]

Policy Innovations

The use of improved energy in Ghana's agriculture sector is increasing gradually, driven by innovative policymaking and comprehensive implementation. The sector is evaluated independently through SE4ALL process to ensure that it remains on track to meet its national target of providing universal access to energy services by 2020.

Liberalization for private sector investment and energy diversification

Ghana's government gradually liberalized the energy sector through the 1990s to improve efficiency and effectiveness among the state-owned generation, transmission, and distribution agencies. Recognizing the critical role that energy plays in achieving its ambition of reaching middle-income country status by 2020, Ghana's 1996–2000 development plan recommends setting specific goals to establish an efficient, dependable, and integrated energy system, which maximizes the use of renewable energy.[11]

The 2006 Strategic National Energy Plan (SNEP) provided an overview of the energy resources available to Ghana and pathways to exploit them for sustainable economic growth. To accelerate progress towards poverty alleviation, SNEP recommended increased access to modern energy services in off-grid areas, combined with a strong program to enhance productive uses of energy to ensure that electricity is used to support economic activities. In addition, to increase the use of modern energy in Ghana's agriculture sector to improve productivity and overall food

security, SNEP encouraged the replacement of diesel with biodiesel in agricultural mechanization, the use of solar dryers to dry exportable farm produce, and replacement of diesel for irrigation with grid electricity and mechanical wind pumps.[12]

Although the SNEP was not formally adopted by the government, elements of its recommendations were reflected in both the Energy Sector Strategy and Development Plan 2010 and the National Energy Policy 2010.[13] The former identified off-grid renewable technologies in the agriculture sector as the focus for government funding,[14] and the latter aimed to create a conducive environment for investments to develop the energy sector's vision of an economy with universal access to energy services by 2020. To do so, the National Energy Policy proposed increasing access to electricity through: increased funding for the National Electrification Scheme and rural electrification; co-financing private sector initiatives; and promotion of productive uses of electricity. The National Energy Policy identified the high cost of renewable energy technologies as a challenge to their adoption and outlined policy direction to increase their uptake through fiscal and regulatory instruments.[15]

Initiating a transition towards renewables

Following the discovery of offshore oil and natural gas deposits in 2007, Ghana has restructured its energy and development goals in order to use this endowment to diversify the economy and catalyze the growth of other sectors, including agriculture. In line with this ambition, both the Ghana Shared Growth and Development Agenda I (2010–2013) and II (2014–2017) aspired to leverage the resources from oil and gas development to improve national infrastructure, increase agricultural productivity, and accelerate agricultural modernization through greater use of technology. These national development plans also promoted the use of renewable energy in the national energy supply mix, acknowledging the vast potential for solar, wind, and small hydro sources in the country.[16] Although specific targets for renewable energy had not been specified in the National Energy Policy, the share of renewable energy also grew exponentially, supplying nearly half of total national energy supply.

The use of renewable energy was further bolstered through the passing of the Renewable Energy Act (Act 835) in 2011, which provides the fiscal and regulatory framework to institute a licensing regime for renewable energy producers (especially from the private sector), create a feed-in tariff scheme, and establish a renewable energy development fund. Although the fund had not yet been established at the time of writing, it would provide financial incentives, capital subsidies, production subsidies, and equity participation for renewable energy

power generation. Act 835 also provides for off-grid electrification for more isolated, rural communities, the promotion of clean cookstoves, research and development, and the establishment of a Renewable Energy Authority. The Renewable Energy Master Plan 2019 refines the act into an implementation plan to increase the proportion of renewable energy from 42.5 MW in 2015 to 1363.63 MW in 2030.[17]

Programmatic Interventions

Ghana's institutional structure for its energy sector is well established, allowing the country to make significant strides in achieving its electricity access objectives. By 2011, nearly 85 percent of urban and 42 percent of rural populations had access to electricity. Rural electrification in Ghana began in the 1970s to drive rural economic activity, reduce the inequalities between urban and rural areas, and to mitigate pressures to migrate to urban centers. At the time, Akosombo Hydroelectric Power Station on the Volta River, managed by the Volta River Authority, provided the largest share of electricity. However, following severe droughts in the 1980s, thermal power plants were introduced to Ghana's energy mix and now provide 60 percent (the largest share) of electricity.[18] National development plans have since promoted the complementary efforts to provide access to electricity across the country, increase the uptake of renewable energy, and improve agricultural productivity.

Drive for universal access

The government formally instituted its commitment to universal access to electricity with the establishment of the National Electrification Scheme (NES) in 1989. Starting from a national access rate of only 15 to 20 percent, the goal of the NES is to provide universal access to electricity by 2020 by extending the interconnected transmission grid to small towns and rural areas. The NES has two main programs: the District Capitals Electrification Programme (DCEP) and the Self-Help Electrification Programme (SHEP). DCEP connected 110 district capitals and towns/villages with a population greater than 500 to the grid. For communities that didn't qualify under DCEP, a grid connection was sped up through the SHEP. Under the SHEP, communities that fell within a 20 km radius of a national grid connection, had a minimum of 30 percent households that were already wired were asked to provide electricity poles and labor to reduce the cost incurred by the government program. By 1999, just over half of the original 4,200 communities were connected to the grid, and by 2016, all district capitals had been connected.[19] NES was also the basis of electrification programs of successive governments.[20] Nevertheless, later research has shown that households opted to consume electricity mainly for domestic lighting, and hence consumed less than 50 kWh per month. Although a Productive Uses of Energy program had been designed to complement the electrification scheme, implementation was limited. For the agriculture sector, this program was expected to target activities that enhance income such as pumping for irrigation and agro-processing.[21]

A second successful project that has contributed to the high rate of electricity access in Ghana is the Ghana Energy Development and Access Project (GEDAP), initiated in 2007. Funded by the World Bank, Swiss Economic Cooperation, and the African Development Bank, GEDAP was overseen by the Rural Energy Directorate created at the Ministry of Energy. The project was designed to enhance institutional efficiency and performance, improve electricity distribution, and increase the share of electricity from renewable sources such as small hydropower, wind, and biomass below 10 MW. Solutions were implemented based on the geographical location, potential electricity demand, and distance from the existing grid. GEDAP offered finance, technical assistance, and training to intensify and extend the grid, construct mini-grids for remote and rural communities, and deploy over 7,500 solar systems for schools, hospitals, and rural households. GEDAP financing subsidized half of consumers' cost of purchasing appliances, while the remaining costs were financed over three years by Apex Bank or other Ghanaian SMEs.

Investors in electricity generation also benefited from a total import duty exemption on renewable energy technologies such as solar generators and wind turbines as well as plant, machinery, and equipment imported exclusively for the establishment of new, small private energy companies. Renewable energy products were also exempted from the value-added tax. Through GEDAP, 150,000 households were connected to national distribution networks. An additional 17,000 remote rural households, with little prospect of getting grid supply in the near term, were provided with solar PV systems through an innovative financing model involving small rural credit agencies. By upgrading the distribution system, GEDAP also reduced power losses by 11 percent by 2012. Furthermore, the GEDAP project led to the development of Ghana's Renewable Energy Act in 2011.[22]

Energy for homes, farms and processing in rural areas

Ghana's agriculture sector benefited from the Energising Development (EnDev) partnership. Arising from the 2002 World Summit on Sustainable Development in Johannesburg, EnDev is an energy access partnership currently financed by six donor countries: the Netherlands, Germany, Norway, the United Kingdom, Switzerland, and Sweden. In Ghana, the project prioritized grid extension for irrigation, solar PV irrigation systems, and improved stoves for processing cassava, designed to consume less energy

(usually in the form of biomass) and reduce emissions. From 2014, the project focused on training, technical advice, and business development services and offered subsidies to farmers for grid extension for irrigation. For smallholder farmers who preferred solar PV irrigation pumps, grants were made available to purchase equipment. At least 307 additional farmers without previous access to energy for irrigation benefited from an electric connection for irrigation. An additional 300 farmers, employing more than 1,700 people, benefited from 79 installed solar PV systems. In addition, by the end of 2018, 538 improved stoves were sold to communities, processing groups, and individuals for roasting *gari*—a storable fermented flour made from cassava. The stoves are approximately 30 to 40 percent more fuel efficient than traditional methods, which reduced the cost of production, and produce about the same amount of indoor pollution. Demand for the safer, more convenient, and more efficient Burro Gari Elephant stove surpassed supply and has since been supplemented by a hire-purchase scheme since 2017.[23]

In addition to the strong policy framework and an active international development sector, Ghana also has a very active private sector providing clean energy solutions for rural populations. The Gyapa stove is an efficient cookstove that requires 50 percent less fuel, saving families as much as US$100 per year in energy costs. The Gyapa cookstove also produces less smoke, hence reducing health impacts for users. Since the stove also reduces carbon emissions, Gyapa stoves benefit from carbon financing through Climate Care (an international NGO), which in turn enables them to be sold at a more affordable price. Gyapa stoves were developed in 2002 with initial start-up capital from USAID, Shell Foundation, and the U.S. Environmental Protection Agency. The stoves are manufactured by 350 accredited local ceramicists using a scrap metal casing with a ceramic liner inside, and are sold by approximately 500 retailers in Ghana, thus providing local employment opportunities. The Gyapa cookstove is a gold-standard fuel-efficient stove, a global standard achieving maximum positive impact in climate and development, measured in credible and efficient ways. Approximately 130,000 units are sold in Ghana per month. More than 831,000 stoves had been sold by June 2015, preventing nearly 2 million metric tons of CO2 emissions.[24]

To address food waste in the mango value chain and improve processing, Sustenance Agro Ventures (a warehousing and agribusiness service provider), Eucharia Farms Ltd (a large farm), Ujuizi Laboratories (a digital technology provider), and the Horticulture Department at Kwame Nkrumah University of Science and Technology formed an alliance in 2015 to develop a low-cost solar dryer. The dryer uses a combination of solar, gas, and electricity to dry fruits and vegetables at approximately half the cost of standard commercial fruit dryers. It is manufactured by local artisans using local materials. Although an independent review of the impacts has not yet been conducted, initial observations suggest that postharvest losses have been reduced from 40 percent of production to 5 percent, and incomes have increased by over 180 percent.[25, 26, 27]

In the cocoa value chain, both Cargill and Barry Callebaut (a Swiss chocolate and cocoa brand), installed solar PVs at their processing facilities in Tema, in 2017 and 2019 respectively. The Cargill site added a 764 MwH fully automated, digital solar system to its site, while Barry Callebaut added a 504 kw array.[28, 29] Furthermore, the University of Nottingham, the Centre for Energy, Environment and Sustainable Development Ghana, the Ghana Cocoa Board, and Kwame Nkrumah University of Science and Technology initiated a project in late 2018 to develop a new technology to produce biofuels from discarded cocoa husks to supplement electricity in rural areas of Ghana.[30]

Ghana has clearly made great progress towards universal electrification, thanks in part to private sector friendly strategies as well as investment in local technical capacities. To ensure that the agriculture sector draws maximum benefits from this progress, it is essential that agriculture and energy policies are implemented concurrently —as identified in the SNEP. This in turn would require closer institutional cooperation between the Ministries of Agriculture and Energy.

Endnotes

1 ESMAP. 2018. Regulatory Indicators for Sustainable Energy. ESMAP Report. Washington, DC: World Bank.
2 Kemausuor, F., Ackom, E., 2017. Toward universal electrification in Ghana. WIREs Energy Environ 6, e225. https://doi.org/10.1002/wene.225
3 IRENA, 2015. Ghana: Renewables Readiness Assessment. International Renewable Energy Agency (IRENA), Abu Dhabi.
4 Kumi, E.N., 2017. The Electricity Situation in Ghana: Challenges and Opportunities. CGD Policy Paper 30.
5 Ministry of Energy, n.d. About. Welcome to the Ministry of Energy. http://www.energymin.gov.gh/index.php/about [27/11/2019].
6 Kumi, E.N., 2017. The Electricity Situation in Ghana: Challenges and Opportunities. CGD Policy Paper 30.
7 Ibid.
8 Ibid.
9 Government of Ghana, Energy Commission, Sustainable Energy for All, UN Ghana, 2012. Ghana: Sustainable Energy for All Action Plan. Accra.
10 University of Energy and Natural Resource, 2018. School of Agriculture and Technology. School of Agriculture and Technology. https://www.uenr.edu.gh/courses/school-of-agriculture-and-technology/ [27/11/2019].
11 Government of Ghana, 1995. Ghana - Vision 2020 (The First Step: 1996-2000). Presidential Report Co-ordinated Programme of Economic and Social Development Policies, Policies for the Preparation of 1996-2000 Development Plan. Government of Ghana, Accra.
12 Energy Commission, 2006. Strategic National Energy Plan 2006 – 2020 (Main Report). Energy Commission, Accra.
13 IRENA, 2015. Ghana: Renewables Readiness Assessment. International Renewable Energy Agency (IRENA), Abu Dhabi.
14 Ministry of Energy, 2010. Energy Sector Strategy and Development Plan. Republic of Ghana, Accra.
15 Ministry of Energy, 2010b. National Energy Policy. Ministry of Energy, Accra.
16 Ministry of Energy, 2019. Ghana Renewable Energy Master Plan. Energy Commission, Accra.
17 Ibid.
18 IEA, 2019. Electricity and heat. Statistics. Electricity generation by source, Ghana 1990-2017. [28/11/2019]. International Energy Agency, Paris. https://www.iea.org/statistics/; Kumi, E.N., 2017. The Electricity Situation in Ghana: Challenges and Opportunities. CGD Policy Paper 30.
19 Asumadu-Sarkodie, S., Owusu, P.A., 2016. A review of Ghana's energy sector national energy statistics and policy framework. Cogent Engineering 3. https://doi.org/10.1080/23311916.2016.1155274
20 Opam, M., 1995. Institution Building in the Energy Sector of Africa: A Case Study of the Ghana Power Sector Reform Programme. Presented at the 6th Session of the Africa Regional Conference on Mineral and Energy Resources Development and Utilisation, Accra.
21 Government of Ghana, Energy Commission, Sustainable Energy for All, UN Ghana, 2012. Ghana: Sustainable Energy for All Action Plan. Accra.
22 The World Bank, 2015. International Development Association Project Paper on a Proposed Additional Credit in the amount of SDR 42.7 million (US$60 million equivalent) to the Republic of Ghana for the Development and Access Project (No. PAD1260). The World Bank, Washington D.C.
23 Energising Development, 2017. Ghana. Ghana. https://endev.info/content/Ghana [15/10/2019].
24 The Gold Standard, n.d. The Gyapa Cookstoves Project. The Gyapa Cookstoves Project. https://www.goldstandard.org/projects/gyapa-cookstoves-project [15/10/2019].
25 Solar drying technology for smallholder farmers in Ghana, n.d. . Food & Business Knowledge Platform. https://knowledge4food.net/research-project/arf1-solar-drying-technology-ghana/ [15/10/2019].
26 Etu-Bonde, K., n.d. Development of automated solar powered fruit drying technology for smallholder farmers in Ghana: Factsheet final findings Applied Research Fund Call 1.-
27 Etu-Bonde, K., n.d. Development of automated solar powered fruit drying technology for smallholder farmers in Ghana. NWO. https://www.nwo.nl/en/research-and-results/research-projects/i/49/12549.html [15/10/2019b].
28 Cargill installs renewable energy facility at cocoa plant in Ghana, 2017. C&CI Mag. https://www.coffeeandcocoa.net/2017/12/04/cargill-renewable-energy-facility-ghana/ [15/10/2019].
29 Renews Ltd, 2019. Solar hits sweetspot for Ghanaian cocoa factory. reNEWS - Renewable Energy News. https://renews.biz/51827/solar-hits-sweetspot-for-cocoa-factory/ [15/10/2019].
30 Barrett, T., 2019. How to...turn cocoa beans into electricity for off-grid Ghanaian farmers. Environment Journal. https://environmentjournal.online/articles/how-to-turn-cocoa-beans-into-electricity-for-off-grid-ghanaian-farmers/ [15/10/2019].

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Dakar, Senegal: International Food Policy Research Institute. December 2019.