



STATE OF THE SDGs
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Ensuring access to affordable, sustainable and clean household energy for all in Ghana

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Abstract

This study explores the key challenges to accessing affordable energy (SDG 7) at the household level in Ghana, and determines the groups of people that are 'left behind' using the decision tree analysis. Evidence shows that rural poor households in Ghana have the lowest levels of access to clean energy. The same pattern is reflected in electricity use. The study also applied a scenario-based analysis to explore the synergies and trade-offs between attaining equitable energy access and other SDGs, from 2010 to 2030, using the Long-range Energy Alternatives Planning-Integrated Benefits Calculator tool (LEAP-IBC). Results showed the existence of trade-offs between SDG 7 on clean energy and SDG 3 on health, SDG 2 on food security and sustainable agriculture, SDG 5 on gender, SDG 11 on cities, and SDG 13 on climate change.

Using the transmission mechanism and a causal loop analysis, the study analysed global systemic issues by illustrating interlinkages with national issues in enabling clean energy access in Ghana. Essentially, regional cooperation in the form of research and knowledge transfer and partnership can be fruitful for narrowing inequalities in the access of household energy if they are adequately funded and equitably implemented.

Keywords: Trade-offs, synergies, clean energy access, left behind, global systemic issues.

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Introduction

The 2030 Agenda includes a historic, first-ever universal energy goal: to 'ensure access to affordable, reliable, sustainable and modern energy for all' (SDG 7). Such access is crucial to achieving many of the other Sustainable Development Goals (SDGs): poverty eradication through advancements in health, education, water supply, industrialisation and mitigating climate change. Yet 1.1 billion people still do not have access to electricity (International Energy Agency, 2017) and 2.8 billion people—38% of the global population and almost 50% of the population in developing countries—rely on polluting and inefficient energy systems such as biomass to meet their daily cooking needs (World Health Organization [WHO], 2016).

Ghana faces a similar challenge, where 76% of households cook mainly with polluting fuels and technologies (Ghana Statistical Service [GSS], 2017). Across the rural–urban divide, 90% and 57% of households respectively rely primarily on polluting fuels such as firewood for cooking (GSS, 2017), highlighting steep inequalities in both access and use. Reliance on biomass fuels affects air quality, both indoors and outdoors. In Ghana, 14,000 premature deaths per year are caused by household air pollution, primarily due to cooking with biomass fuels and technologies (WHO, 2017). Thus, disparities in health outcomes among and within households can be perpetuated by inequality in access to clean cooking fuels. While Ghana's electricity development has progressed well, that progress has not been uniform or consistent across the country. Access to electricity has reached 78% of Ghanaian households. Approximately 58% of rural households compared to 90% of urban households use electricity as their primary source of lighting (GSS, 2017). Yet these figures may not be a true reflection of access to electricity, as other factors such as regularity of supply also need to be considered when drawing conclusions.

Against this background, this study aims to:

- Investigate the household energy sector in Ghana to identify the left behind and their shared circumstances.
- Examine the synergies and trade-offs between the implementation of SDG 7 and other SDGs.
- Examine the global systemic issues that affect the implementation of SDG 7 in Ghana.

To do this, the study takes a predictive analysis approach using a decision tree to identify those excluded from accessing clean energy. Since the achievement of SDG 7 is intrinsically linked to other SDGs, the study adopts the Integrated Benefits Calculator (IBC), which is a new application of the Long-range Energy Alternatives Planning system (LEAP). It provides an integrated analysis of the synergies and trade-offs between Ghana's current household energy policies and alternative policy measures and the impacts of those policies on other

SDGs. Furthermore, using the transmission mechanism and causal loop diagrams, the influence of global systemic issues on household energy access in Ghana is analysed to show how foreign and domestic interests and views interact to shape energy development partnerships that tackle inequalities in access to clean energy.

Only the household sector of Ghana is studied and modelled in this research. The modelling of the household only considers end-use appliances and energy-consuming tools. Clean energy access, in this study, is defined as: (1) access to electricity; and (2) primary reliance on clean fuels, in line with SDG targets 7.1.1 and 7.1.2.

Box 1. SDG progress in Ghana

Ghana, since its independence in 1957, has been a signatory to a number of bilateral and multilateral development partnerships and agreements, with the 2030 Agenda being among them. The National Development Planning (Systems) Act, 1994 (Act 480), forms the basis by which the Agenda is implemented in Ghana. New structures set up to foster stronger collaboration and partnerships for SDG implementation are: the High Level Ministerial Committee, the SDGs Implementation Coordination Committee, the Technical Committee, and CSOs Platform for SDGs. A number of in-country consultations have also been held to foster partnership and adaptation of the 2030 Agenda at the local level.

On the progress of SDG implementation, the National Development Planning Commission in collaboration with Ghana Statistical Service produced Ghana's SDG Indicator Baseline report in 2018. The report covers indicators on the SDGs and highlights that close to 70 out of the 169 SDG targets are reflected in the policies and strategies of the country's previous Medium-Term National Development Policy Framework (2014–2017), which preceded the 2030 Agenda. Currently the SDG targets and indicators have been integrated into the Medium-Term National Development Policy Framework (2018–2021). The Multiple Indicator Cluster Survey (MICS), Demographic and Health Survey (DHS) and Ghana Living Standards Surveys are among the key data sources for Ghana. However, these national surveys are conducted every five years, making it difficult to track implementation progress. Furthermore, the level of data disaggregation is limited, and does not capture the full range of disaggregation recommended in the SDG metadata.

The National Statistical System captures 62 indicators, while 63 other indicators, which do not currently meet the SDG metadata due to gaps in definitions, concepts or coverage, are captured by other government agencies.

Research methodology and results

Using secondary data from the latest household survey 'Ghana Standard Living' (GSS, 2017), a nationwide household survey designed to generate information on living conditions in the country, and primary data from a qualitative field survey, the study identified the underlying reasons for inequalities in household energy access in

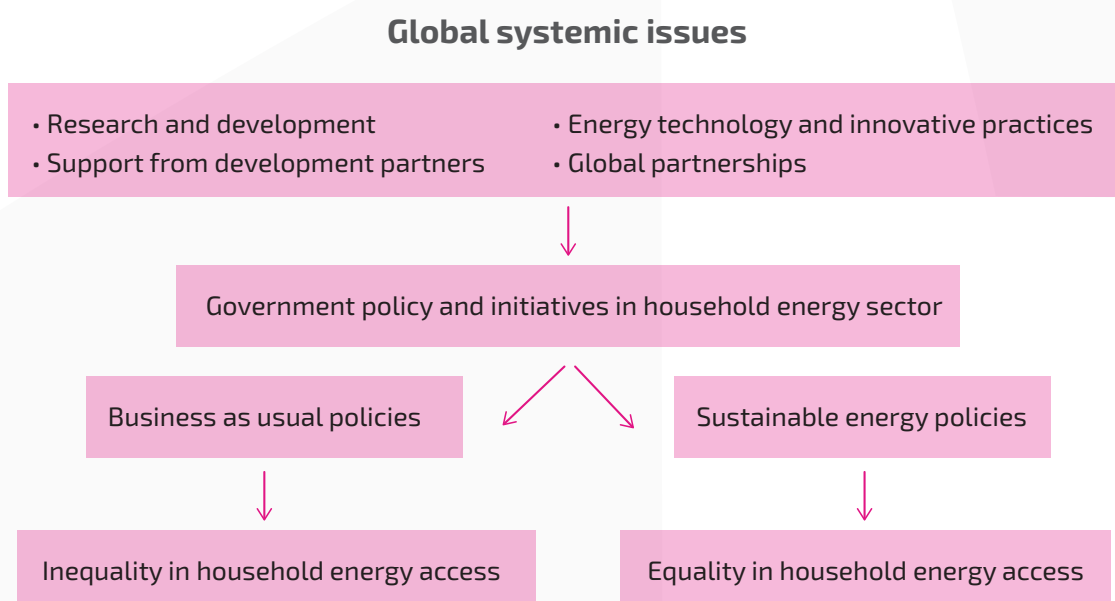
Ghana. Desk reviews of key documents, which included policy documents, strategic plans, and published literature, were conducted. Personal communications with key experts, advocates and government officials in the energy sector as well as other relevant sectors broadened the scope of findings and challenges.

The decision tree approach was used to identify the groups with the lowest access to clean energy. In particular, an algorithm was applied that splits the value of the target indicators into groups based on predetermined circumstances, namely: household wealth, residence (urban and rural), region, and highest level of educational attainment for any member in the household. In each replication, the decision tree ascertains significantly different groups and identifies those that have the lowest and highest access to electricity and clean fuels. These groups consist of households sharing common circumstances. To strengthen the analytical findings, logistic regressions were conducted to identify risk factors related to a household's access to clean energy.

The possible synergies and trade-offs between household energy use (SDG 7) and the other SDGs are quantified using an energy modelling and simulation software, LEAP-IBC. Multiple indicators, based on the extant literature, are selected for SDGs related to household energy used. The impact of household energy is quantified by comparing a baseline scenario and a policy success scenario.

Finally, the study also analysed global systemic issues. Researchers employed the transmission mechanism (see Figure 1) enhanced by the use of causal loop analysis to illustrate the interlinkages of global with national issues in enabling access to clean energy by all groups in Ghana.

Figure 1. Transmission mechanism of the influence of global systemic issues on household energy access in Ghana.



Elaborated by the authors.

Urban households have the highest rates of access to electricity. Rural households located in the Upper East region have the lowest access.

Findings show that reliance on clean fuels is a question of both accessibility and affordability in Ghana. According to the research, a gap exists in access to different types of energy by the rich and poor and across administrative regions, residency (rural–urban), and educational levels. In particular, 1,029 urban households in the Western, Central, Greater Accra, Volta and Ashanti regions with a secondary or higher educational level had the highest access to clean cooking fuels, compared to 112 rural households with similar educational attainment.

With regard to electricity, findings demonstrate that urban households have the highest rates of access to electricity (91%), while the group with the lowest rates of access is that of rural households located in the Upper East region, where the head of the household had no formal education (71%).

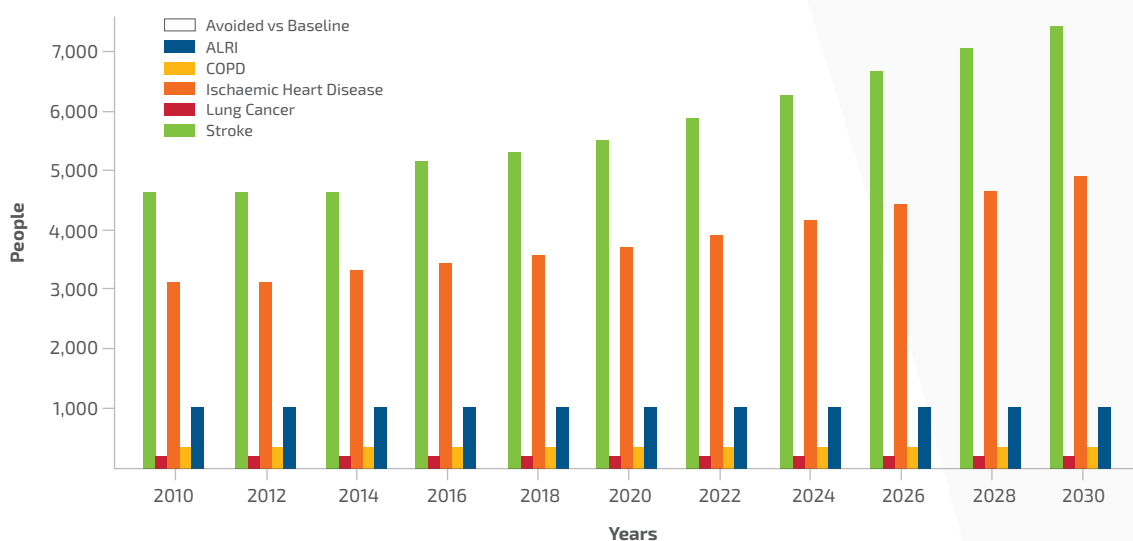
Synergies and trade-offs are inevitable outcomes in the country's quest to improve access to affordable and clean energy. The LEAP-IBC tool provided an integrated analysis of Ghana's current household energy policies and an alternative policy measure to show the interlinkages of SDG 7 (clean energy) with SDG 3 (health), SDG 2 (food security and sustainable agriculture), SDG 5 (gender), SDG 11 (cities) and SDG 13 (climate change).

The current energy consumption pattern in Ghana shows that negative interactions exist between SDG 7 and the other SDGs under consideration. In particular, the impact of the rural–urban disparity in access results in a negative trade-off when working towards SDG 13. Emission levels from rural households are higher than emissions from urban households. Findings show that total green-house gas (GHG) emission levels are projected to increase from 6,333 thousand metric tonnes of CO₂ equivalent in 2010 to 10,712 thousand metric tonnes of CO₂ equivalent in 2030 under the business as usual (BAU) scenario. The high use of polluting fuels such as firewood and charcoal in inefficient cooking devices in rural areas are contributing factors for these high values. Emissions from energy consumption also include other short-lived climate-pollutant emissions, such as soot, methane and ozone, which have damaging effects on health. Using the scenario analysis, it is apparent that if Ghana continues with its current implementation plan, the country's contribution to global temperature due to household energy use will continue to rise, no matter how negligible these increases might be. For instance, under the BAU scenario, temperature levels are projected to rise from 0.0010c to 0.0150c through 2010–2030, a clear contravention to both SDG 13 and the Paris Agreement to which Ghana is a signatory.

Access to clean household energy (SDG 7) targets are also highly intertwined with goals set to achieve healthy lives and promote the wellbeing of all (SDG 3). Results show that total deaths for all age

categories are projected to increase from 9,1038 deaths in 2010 to 13,920.8 in 2030 because of exposure to household energy pollution under the BAU scenario. The age categories under threat are the elderly and children under five years of age. Our results show that the three leading causes of death due to household energy use in the country are strokes, ischemic heart diseases (mostly in adults), and acute lower respiratory infections (mostly in children) (see Figure 2). These three diseases are among the 15 leading causes of death in Ghana (WHO, 2017).

Figure 2. Disease specific deaths due to household energy use



Source: GSS, GLSS 7 (2017); elaborated by the authors.

The qualitative analysis also shows the implications on health and gender (SDG 5) of the use of unclean cooking fuels in Ghana. Women's roles in the household expose them to increased hazards from the use of less efficient cooking fuels. One woman explains:

"...I was severely sick, at first it started with some kind of heat in my body [...] my head continues to ache me, [...] the first thing the doctor asked was if I cook and stay with huge fire for long, I said yes and so the doctor explained to me that I was sick because I always stay by firewood my blood is reducing ..."

Trade-offs between current energy consumption levels and food security (SDG 2) also exist. Exposure to household energy pollutants is projected to cause crop losses, of staples such as maize and rice, to the tune of 4,005.07 thousand tonnes by 2030, an increase of 2,114.07 thousand tonnes from the figure recorded in 2010. The impact is even greater when considering the inter-linkages between bio-fuel energy consumption, acid rain formation and food production as well as agricultural labour supply. For instance, excess concentration of carbon



The country has failed to develop national actionable plans to reduce trade-offs caused by limited access to clean energy, particularly on climate change.

dioxide and methane gases in the atmosphere in addition to other GHGs, will give rise to acid rains that have the potential to destroy food crops and contaminate natural drinking water sources.

In mitigating these negative trade-offs and pursuing a culture of enhancing synergies in the implementation of the SDGs, the study considers some of the global systemic concerns that help ensure equitable access to affordable energy by all groups, such as access to international funding. International organisations, like the United Nations Development Programme, the African Development Bank, USAID, and the Global Alliance for Clean Cookstoves have formulated key policies and provided crucial funding to implement initiatives such as the 'Sustainable energy for all' initiative. As a result, 17,000 households have been given access to liquefied petroleum gas (LPG) for cooking in 2018, through the provision of single-burner LPG stoves and accessories. Also, the national electrification coverage stood at 76% as of January 2015, up from 67% in 2009 (Government of Ghana, 2015).

Even though Ghana has positive collaborations with its development partners and other multilateral agencies, the country has failed to develop national actionable plans to reduce trade-offs caused by limited access to clean energy, particularly on climate change. In fact, lack of access to clean energies in Ghana increases CO2 emissions at the global level, which shows that not only do global systemic issues affect the achievement of the SDGs at the national level, but the reverse is also true.

Energy inequality at the household level enforces the need for policy change. According to the research findings, household energy inequalities will increase if status quo or business as usual policies are implemented. Equality in household energy access will be possible when sustainable energy policies are implemented.

Conclusions and implications

The analysis shows that Ghana is facing a range of challenges in providing universal access to clean energy at the household level. While some regions or localities have good access to clean household energy resources, others are struggling. Lack of access to clean cooking fuels and electricity negatively affects people's health and wellbeing, as well as their opportunities for education and productive work. Improvements for gender equality and the environment are also restrained.

A comparison between access to clean cooking fuels and access to electricity shows that the former is the most unequally distributed, with access gaps of 71% between the best-off and the furthest behind.

The interplay of geographical location (urban or rural residence) and household poverty status illustrates that reliance on clean fuels is a question of both accessibility and affordability. These results have important policy implications because they suggest the need to focus on such factors in policy designs. In particular, government policies targeting the use of cleaner fuels should not only focus on increasing the supply of modern fuels, but also on how modern fuels accelerate economic growth, especially for households.

The integrated analysis adopting the LEAP-IBC tool shows that current household energy consumption patterns negatively affect household users' health (SDG 3), their environment (SDG 11 and 13), livelihoods (SDG 2) and productivity (SDG 5). Access to clean household energy (SDG 7) targets are highly intertwined with those of SDG 3. As women prepare food for their families, they inhale thick smoke for hours on end, which has negative impacts on their health. Children, the elderly and other vulnerable people also suffer disproportionately because, like women, they spend more time at home. Both scenarios studied show that these negative interlinkages between the SDGs are going to continue if pro-poor policies are not implemented. More premature deaths and disease will occur due to exposure to pollutants from cooking fuels. It is, therefore, important that households have access to clean energy and technologies, not purely for health benefits, but also to advance sustainable development and reduction in the emission of climate-affecting greenhouse gases. However, such solutions rely on the right technologies, commercially viable business models, supply chains that can reach remote areas, consumer information and acceptance, community involvement, and innovative financing, which in most cases are beyond the capabilities of the country.

Clearly, Ghana needs global support in the form of foreign aid, partnerships, research and development leading to energy efficient technologies to be able to archive SDG 7, and particularly SDG 7.1. This process will entail the enactment of institutional reforms that will help transform the culture of working in silos to one that enables cross-sectoral collaboration to deal with trade-offs and other negative externalities. This study suggests that policymakers can no longer work in silos; instead, they should consider the synergies and trade-offs linked to the goals. To do this, they need to work with both local sectors and international organisations to achieve the other SDGs.



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Recommendations

The following are key recommendations for policymakers and leaders:

Identification of common circumstances shaping household choices to access clean energy. Energy inequality is strongly linked to unequal outcomes in other human circumstances. Knowledge of the key circumstances affecting household energy choices is therefore vital to addressing not only energy inequalities but others as well.

Explore household energy behaviour to understand reasons for localised disparities in clean energy access. Multi-stakeholder consultations, such as community engagement and research are needed in areas with high energy inequalities to understand household motivations and choices. Research demonstrates that households abandoned most cooking technologies that were not suitable for traditional fuels.

Encourage collaboration among government ministries and agencies to strengthen household incentives for choosing clean energy sources. Given the impact that energy inequalities have on the other SDGs, cross-sectoral and inter-ministerial coordination is imperative since different SDGs are in the domain of different ministries in Ghana. For example, a collaboration between the Ministry of Health (custodian of SDG 3) and the Ministry of Energy (custodian of SDG 7) is needed to ensure that SDG 3's targets are met.

Encourage global partnerships, research and development. The government should encourage greater global cooperation to enable appropriate technology and knowledge transfer.

Support data collection to understand how energy inequalities affect individual household members. Existing data does not allow for a full understanding of household choices, behaviours or the subsequent inequalities arising among and within households. Disaggregated data is therefore necessary for understanding how different members of a particular household are impacted.

Improve national energy policies that are “pro-poor” (successful in reducing poverty). Energy policies should support the development of sustainable alternatives and ensure energy access for the poorest groups. Policies are needed to help key technologies become truly competitive and widely used. Technologies should be adaptable to the cultural needs of users. Energy goals should be redefined to address development outcomes including health, gender equality, and access to essential services.

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Southern Voice is an open platform for think tanks that contributes to the global dialogue on the Sustainable Development Goals (SDGs). It does this by disseminating evidence-based policy analysis by researchers from the Global South.

The 'State of the SDGs' is a conceptually innovative, policy relevant empirical research initiative. The initiative unpacks some of the critical relationships underpinning the 2030 Agenda. The aim is to identify those who are 'left behind' within diverse contextual realities, to reveal the complex relationship of trade-offs and synergies among specific SDGs, and to explore the global governance factors affecting implementation within a country.

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