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Greening the COVID-19 Recovery in Ghana: Electricity investment needs to meet the GH-NDC targets.

Jen Cronin[1]
Simon Bawakyillenuo[2]
Aba Obrumah Crentsil[2]
Steve Pye[3]
Jim Watson[1]

1 Institute of Sustainable Resources, University College London, United Kingdom

2 Institute of Statistical Social and Economic Research, University of Ghana, Legon, Ghana

3 UCL Energy Institute, University College London, United Kingdom

ZIPAR Zambia Institute for Policy Analysis & Research

ISSER University of Ghana Knowledge for Development

Key messages for COP26

Large investment is required for the Ghana energy sector as the country recovers from COVID-19 and accelerates growth. For the power sector, we estimate this at USD 61bn over the period 2020-2050.

There is a significant opportunity for this to be climate compatible investment. In our research, sustainable energy is highlighted as key priority by many stakeholders.

Delivering the GH-NDC targets will require substantial additional investment in the power system. To help deliver the Unconditional and Conditional GH-NDC targets, the power sector requires investments that are 42% and 201% higher than the Baseline over the next decade. This reflects the capital-intensive nature of the generation assets.

With additional international financial support, further action would be possible which would bring greater emissions reductions and co-benefits for health and well-being, such as low carbon public transport in urban areas and clean cooking solutions.

Introduction

Like many countries, Ghana has experienced significant challenges related to the Covid-19 pandemic, including increased government debt burden as a result of electricity subsidisation for citizens during lock-downs, reduced access to clean cooking energy (LPG) by citizens and stalled clean cooking energy infrastructure development. As the economy recovers from the effects of the pandemic, there is an opportunity for new investment and economic growth to be aligned with Sustainable Development Goals (SDGs) and the Ghana Nationally Determined Contribution (GH-NDC) pledges made under the Paris Agreement.

This is particularly so in the energy sector, which is projected to grow significantly over the next decade. There is a huge opportunity for this demand growth to be met by renewable energy, but large levels of investment are required. As of 2020, Ghana has 5134 MW of installed electricity generation capacity. Of this, 32% was large hydro power, and just 1.2% other renewable capacity. Ghana's Renewable Energy Master Plan (REMP) projects renewable capacity (other than large hydro) to increase to over 1360 MW by 2030, 23 times higher than the current level[1]. This strategy alone requires $5.6 billion of funding.

Ghana's focus on renewable generation capacity, and the shift away from the domestic use of fossil fuels, is laudable and logical given the huge cost reductions in renewable technologies in recent years, and the potential to avoid ongoing fossil fuel costs. A build out of renewable energy will also allow Ghana to reduce its GHG emissions, and in turn, help deliver on its NDC pledges. There are also many other co-benefits from moving to a low carbon energy system, including reductions in air pollution and a reduced reliance on imported energy resources.

However, high levels of investment need to be mobilised to realise the transformation of Ghana's energy system to one that is clean, reliable and provides affordable access to energy. It is imperative that the international community supports this process, as is implied by the UNFCCC process and the structuring of GH-NDC pledges to be both unconditional and conditional. An important outcome of COP26 would be to see financing commitments firmed up, supporting the delivery of conditional pledges.

In this policy brief, we use the results of new modelling to argue that the delivery of Ghana's NDC can help drive energy sector investment towards clean technologies, to meet the projected increase in demand for energy. We also highlight the much larger investment needs under Ghana's Conditional GH-NDC target, and the need for international support to help deliver this target. Our analysis draws on research under the Greening the Recovery in Ghana and Zambia project, funded by UK Research and Innovation (UKRI)[2].

Assessing the role of NDCs

Under its NDC published prior to COP21 in 2015, Ghana set a goal to reduce its national Greenhouse Gas (GHG) emissions by 15% relative to the projected business-as-usual (BAU) emissions of around 74 MtCO2e by 2030 (up from 19.5 MtCO2e in 2010)[3]. A more ambitious 'conditional' target was also set, which would see a 45% reduction by 2030, again relative to the BAU projection, contingent on sufficient financial support being provided. Ghana launched a revision process of these targets in September 2020; the resulting revised GH-NDC is currently with parliament for consideration and approval, and yet to be published.

While the GH-NDC includes a target for emission reductions across all sectors, most of the specific actions identified in the document focus on the energy sector. These include the need to scale up renewable generation, promote clean lighting for rural households, expand clean cooking technologies, and increase energy efficiency improvements in power plants and industry facilities. While the energy system accounts for approximately 35% of the country's total emissions (Figure 1), it is likely to make a substantial contribution to emission reduction actions, particularly in the coming decades. This includes the provision of low carbon electricity for use across different sectors. Currently, the residential and transport sectors together account for 41% and 37% of Ghana's total energy use respectively.

For this briefing, we draw on preliminary results from the newly developed Ghana OSeMOSYS model to assess the implications of the GH-NDC targets for the energy sector. This model derives the least cost mix

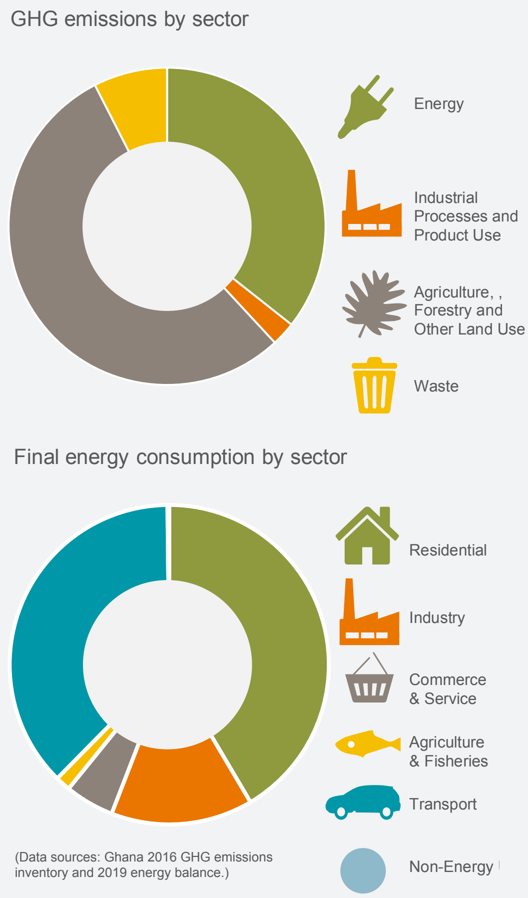

Figure 1. Breakdown of emissions and energy use by sector

of energy technologies and fuels that meets future energy demands, within technical and policy constraints e.g. the GH-NDC target.

Three scenarios have been constructed using the model. A baseline scenario for the energy sector is based on drivers of energy demand derived from the publication *Ghana at 100* [5]. This includes projections of population, levels of urbanisation, GDP growth, and changing sectoral contribution to GDP. This scenario estimates energy sector CO2 emissions, as shown in Figure 2 below. The NDC targets are then estimated relative to the Baseline's emission trajectory. These are labelled Unconditional and Conditional, and are 15% and 45% below the baseline level in 2030, as shown in Figure 2. For the period between 2030 and 2050, the same level of ambition is maintained.

The reductions in emissions in the official GH-NDC are for the whole economy. Therefore, we have made the implicit assumption that energy sector will reduce emissions under the GH-NDC at the same level as other sectors. It is also important to note that the baseline used in this analysis may not be fully aligned to that published in the official GH-NDC, as we are likely using different assumptions concerning emissions growth.

To meet these GH-NDC targets, alternative pathways are constructed using the model based on future investment choices.. For example, given the need to supply growing energy demand whilst lowering emissions, new power generation capacity choices are determined e.g. renewable, nuclear or fossil fuel-based, and options for providing transport and household energy services.

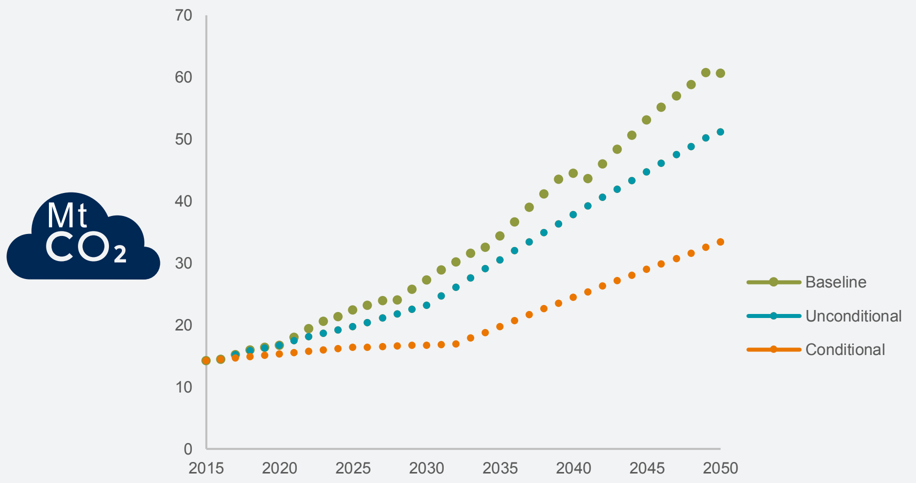

Figure 2. Annual CO2 emissions for the energy sector under baseline and NDC scenarios

Pathways for a green recovery in the energy sector

The modelled pathways illustrate the required changes in Ghana's energy system to meet the GH-NDC pledges, but also the growth in the system to meet future energy demands. Much of the required emission reductions from the energy system, are provided by the power system, which is decarbonised but also expands to allow for increased use of low carbon electricity in sectors such as transport and households, as an alternative to fossil fuels.

In all three scenarios, the total size of the power system grows substantially in the coming decades to meet growing demand. From an installed capacity of ~5GW in 2015, the total system grows to ~40GW by 2050 in each scenario, and grows significantly earlier in the Conditional scenario. From a level of 18TWh in 2015, the total annual electricity generation grows to 96 TWh by 2050 in the Baseline and

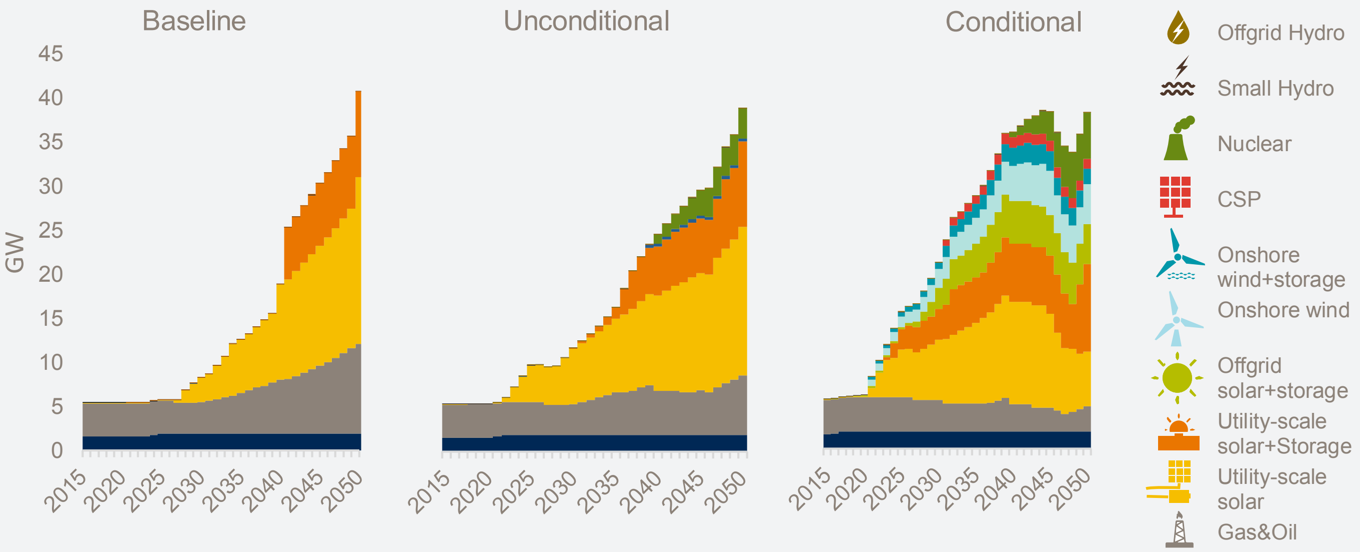

Figure 3. Installed capacity of power sector technologies

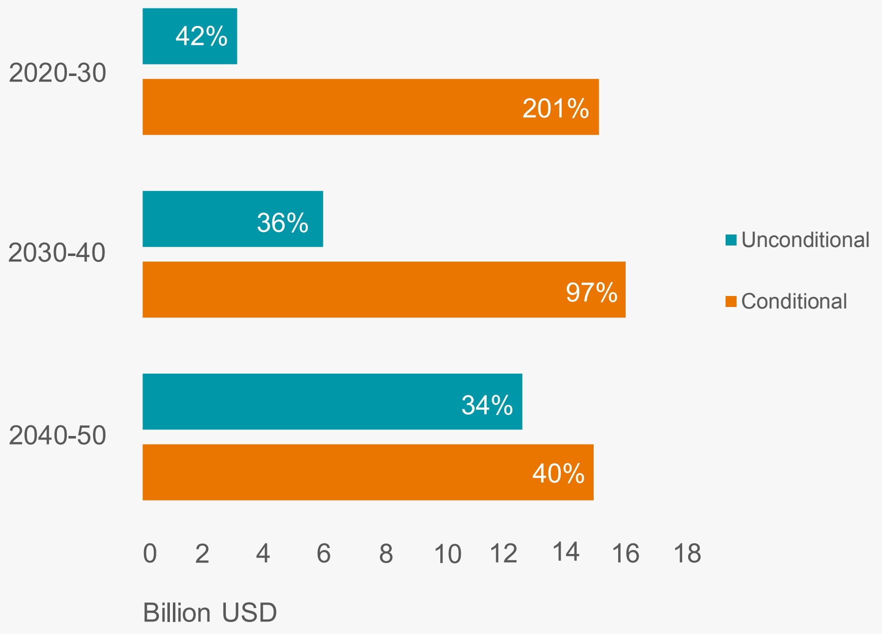

Figure 4. Additional capital investments required for the power sector, over and above the Baseline scenario costs. The percentage figures indicate the proportional increase compared to the Baseline.

Unconditional scenario, and 104 TWh in the Conditional scenario. The higher growth in the Conditional scenario provides for additional demand in energy using sectors, notably transport, which sees the introduction of electric cars from around 2032, as opposed to 2047 in the Baseline and Unconditional scenarios.

Across all scenarios, the rapid growth in solar power reflects the increasing cost-competitiveness of this technology, compared to other thermal power plants. Even without the emissions target, there is a strong emphasis on the deployment of utility-scale solar, along with some battery storage. Fossil fuel-based generation, which mainly consists of fossil gas, increases in the Baseline but its contribution to the generation mix out to 2050 remains broadly constant. In the Unconditional scenario, the capacity of fossil fuel generation stays constant while it declines in the Conditional scenario.

In the Conditional scenario, the capacity expansion is more rapid, and a more diverse set of low carbon generation technologies emerges.

This reflects the increased ambition to reduce emissions to a greater extent. There is an immediate deployment of utility solar, onshore wind and battery storage. CSP is also deployed from around 2030, and nuclear from 2040[6].

A key insight that emerges from the scenarios is that the growth of the electricity system will require substantial investment: in the Baseline scenario, capital investments of approximately USD 7.5bn, 16.5bn and 37.0bn will be required over the coming three decades respectively to meet growing demands.

Additional capital investment is required under the GH-NDC targets, as shown in Figure 4. Most notably, this highlights that the level in the conditional GH-NDC is substantially higher than that observed in the Baseline. To achieve the Conditional GH-NDC, the power sector requires double the investment of the Baseline scenario in the next 10 years. Over the period 2020-2050, the power sector requires 36% and 75% higher investments to achieve the Unconditional and Conditional emissions reductions respectively.

It should be noted that there are likely to be reduced running and fuel costs in the GH-NDC scenarios.

As noted above, a rapidly expanded low carbon energy, and particularly electricity, system offers the opportunity for substantial economic and social benefits for Ghana. The large capital costs of expanding it in such a way that meets the GH-NDC targets mean international finance is almost certainly required to support this transition. Policy and regulatory frameworks must be developed to attract this investment, and support of the international community is vital.

References

1. Ghana Ministry of Energy (2019). Renewable Energy Master Plan (REMP).
2. Greening the recovery in Ghana and Zambia project, https://www.ucl.ac.uk/bartlett/sustainable/research-projects/2021/oct/greening-recovery-ghana-and-zambia
3. Ghana's intended nationally determined contribution (INDC) and accompanying explanatory note, Republic of Ghana, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ghana%20First/GH_INDC_2392015.pdf
4. OSeMOSYS is an energy system model framework used to assess future energy system evolution under different assumptions, including across energy demands, technology deployment, and policy objectives. Further information on OSeMOSYS can be found here – http://www.osemosys.org/.
5. Ghana National Development Planning Commission (2019). Ghana@100. November 2019.
6. Note, the model includes a simplified representation of system operation in terms of renewable integration, which will be developed in future modelling.

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The authors would like to thank the interviewees in Ghana who contributed to the research summarised in this briefing