

Power in Diversity: Climate Services for Renewable and Resilient Electricity Generation in Ghana

Key points

- Renewable electricity generation in West Africa, including Ghana, has thus far been dominated by hydropower. Dependence on hydropower has in the past led to power crises during droughts in several West African countries. Diversification of renewable portfolios could help to mitigate both the risk of overdependence on hydropower and the future impacts of climate change.
- The CIREG project aims to help policymakers build a more diverse and resilient system of electricity generation based on a mix of renewable energy sources. It uses climate scenarios, energy and water management tools, and science-stakeholder dialogues to develop different pathways to climate-resilient renewable electricity generation.
- Preliminary results show that hydropower, solar power and wind power can complement each other very well at the hourly, seasonal, multiannual and spatial scales. Results also indicate how Ghana could increase the share of renewable energy in its energy mix and achieve its national targets on renewable energy by taking advantage of these complementarities. In the coming 12 months, CIREG will facilitate a science-stakeholder dialogue to jointly develop pathways that can help policymakers make informed decisions on building a more climate-resilient, renewable electricity generation system capable of spurring economic and social development.

CIREG: Climate services in support of developing low-carbon and resilient electricity generation pathways

The Climate Information for Integrated Renewable Electricity Generation (CIREG) project aims to support West African countries to improve energy access and the resilience of electricity generation from renewable sources. To this end, CIREG is developing demand-driven climate services that support the planning and implementation of renewable energy projects and investment decisions that are aligned with the Sustainable Development Goals (SDGs) and national commitments made in the Paris Agreement. These services are based on climate scenarios and integrated energy and water management models.

Furthermore, science-stakeholder dialogues will be used to develop climate services that take account of national and regional climate and development policies. The results derived from these climate services will provide decision makers with scientific knowledge about the risks and opportunities presented by the various sources of renewable electricity under different climate and development scenarios. The goal is to support decision makers to develop pathways to low-carbon electricity mixes that can cope with the impacts of climate change.

Climate service development process

The provision of climate services in the CIREG project comprises a *preparation* phase and a *development* phase. Policymakers and experts from Ghana are involved in each phase. During the preparation phase, CIREG researchers assessed existing policies, strategies and plans, with a focus on identifying possible interlinkages between renewable electricity generation and other national

development goals and targets, including the NDCs and the SDGs. The preparation phase was concluded in October 2018 with interviews of stakeholders in Ghana's water and power sectors.

During the development phase, CIREG will develop an integrated climate service consisting of climate scenarios and energy and water management tools, some of which are already being used by the Ghanaian authorities. The development phase began with a workshop involving experts from the Water Resources Commission, the Energy Commission and the Volta River Authority in March 2019. Importantly, the tools developed will allow policymakers and experts to understand the consequences and trade-offs of four electricity generation development scenarios:

- The **business-as-usual scenario** examines the performance of existing and planned national capacity for renewable electricity generation.
- The **INDC/National Renewable Energy Action Plan (NREAP) scenario** uses the goals identified in the national NDCs and NREAPs to examine how achieving these goals and targets will influence electricity generation and water management.
- The **climate smart scenario** examines the integrated potential of hydropower, solar power and wind power, and optimal ways to exploit and pool these resources in environmentally sustainable and climate-resilient ways.
- The **SDG scenario** focuses on how fulfilment of selected SDGs and sustainable development targets would affect the electricity and water sectors.

Preliminary results

The preliminary results suggest that the main levers for optimal exploitation of renewable resources in West Africa are: (i) adapted management of hydropower plants; (ii) diversification away from hydropower towards more solar and wind power; and (iii) resource pooling among West African countries through greater interconnectedness. The observable strong decrease in cost trends for solar and wind power in West Africa and worldwide means that the resulting smart mix can also deliver economic benefits compared to the use of fossil fuels such as natural gas and diesel.

The findings thus far also show how climate change might affect hydropower generation in Ghana, in line with each climate scenario. Annual power generation at the Akosombo reservoir could be several hundred GWh lower compared to today in the worst-case climate scenario. Preliminary results also indicate that if the Noumbiel dam is built upstream in Burkina Faso, there may only be a mild change in annual electricity generation on the Bui Reservoir, albeit accompanied by an alteration in the monthly pattern of production.

Next steps to climate-resilient and renewable electricity

Between October 2019 and October 2020, CIREG will host a number of workshops with policymakers and experts to discuss the preliminary results, iteratively refine the four scenarios and discuss their findings. This science-stakeholder dialogue will build mutual understanding of stakeholders' expectations and needs, as well as scientists' findings on the complementarity of and trade-offs between renewable electricity sources and climate change impacts.

The dialogue will also enable policymakers, experts and CIREG researchers to jointly develop and discuss different pathways to scaling-up renewable electricity generation, achieving the SDGs and honouring the commitments made in the Paris Agreement. These pathways will help policymakers make informed decisions in support of a more climate-resilient, renewable system of electricity generation that can spur economic and social development.