# Topic: Resilience and energy security in Ghana

## Overview

Electricity supplies and power networks are critical national infrastructures, but they are subject to the impacts of climate change. Droughts can impact hydropower production, whilst floods, landslides, extreme heat, and wildfires can impact transmission infrastructure and substations. With rapidly increasing amounts of renewable energy (especially solar PV) being connected to power networks, there is need for additional investment in network capacity and reconfiguration. Overall, a strategic approach is required to achieve a *resilient transition* in which power networks can be transitioned towards ever-increasing amounts of renewable electricity supply, whilst also being resilient to the inevitable impacts of climate change.

In Ghana, the National Interconnected Transmission System (NITS) is the backbone of energy supply and by extension energy security for Ghana and some of its neighbours that rely on Ghana for power. However, the NITS has been subject to damage and disruption from floods, droughts, extremely high temperatures, and windstorms that have been disruptive to NITS equipment. The knock-on effect has been rolling blackouts leading to long periods of outages to customers. This affects socio-economic life and results in loss of human life, displacement of communities, destruction of property, and financial loss. This disruption, and its socio-economic consequences, could be mitigated by more effective resilience prioritisation and asset management. The Government, through its energy transition plan, seeks to address some of these challenges to electricity supply.

Climate risk analysis and network modelling provides the tools to identify hotspots of climate vulnerability in electricity supply, transmission, and distribution networks, and to prioritise resilience interventions. This can be done for existing networks, to design programmes of resilience enhancements, and for new assets, to ensure that they are resilient to the anticipated impacts of climate change. These interventions can attract adaptation finance, as well as climate finance for low-carbon assets.

## Research Questions

The CCG programme seeks to support the development of a spatial systems model of the electricity supply, transmission, and distribution infrastructure in Ghana. This will be combined with climate hazard data to identify climate-related risks to the power network, expressed in terms of expected direct damages and indirect losses, in order to identify hotspots of climate vulnerability in the power network. The analysis will examine options for enhancing the resilience of the exiting network. It will also review plans for future investments in renewable energy, analyse risks to those investments, and propose strategies for climate-proofing the future network. These will be aligned with appropriate financing mechanisms.

Research questions:

1. Which assets within Ghana's electricity supply, transmission, and distribution system are most exposed to climate-related hazards? What is the risk of possible damage and disruption from climate impacts on the NITS?
2. How might Ghana's electricity supplies and NITS be configured in the future and what new climate hazards might that expose the network to?

3. How can the resilience of the NITS be enhanced, through targeted retrofits and resilient future investments?
4. What are the options for financing a resilient and just energy transition in Ghana?
5. What institutional and governance mechanisms can enable joined up, integrated, and cross-sectoral strategies to balance short-term and long-term energy security considerations.

## Key stakeholders

An essential requirement of research funded on this topic is that it is carried out in close cooperation with key Ghanaian stakeholders. This means proposals should also include a clear plan for consultation with stakeholders, working with them from the start to discuss assumptions and methods and to communicating results clearly. Proposals should also include plans for capacity building where appropriate. Stakeholders may include:

- Government departments and agencies: The Ministry of Energy and Petroleum (MoEP), Ministry of Environment, Science, Technology, and Innovation (MESTI), Ministry of Finance
- Power suppliers and grid operators, including Ghana Grid Company Limited
- Research institutions with capabilities in energy systems modelling and climate risk analysis
- Financial institutions: e.g. DBG, GIIF, Ecobank, ABSA, etc.