CIREG

Climate Information for Integrated Renewable Electricity Generation

Context

Energy access and affordability are key elements for the economic development in Least Developed Countries (LDCs). However, many countries, like LDC's in West Africa (WA), are facing an energy crisis already today. The Gross Domestic Product (GDP) and electricity demand in most WA countries are rising faster than electricity generation and population is assumed to double in the coming two to three decades. Electricity for all is urgently required to enable countries' development plans. This will further increase energy demands and requires large future investments in electricity supply and infrastructure. In this situation, the WA countries are at a crossroad of deciding between investments in fossil-fuel technologies or energy systems based on renewable energy. Both have implications for future economic development, energy prices, greenhouse gas (GHG) emissions, and local environmental impacts. Today, there is an opportunity for WA countries to leapfrog on new energy technologies and to "skip" the fossil fuel era. African countries have already shown such abilities, for instance in the mobile telecommunication sector by largely skipping landline technologies. Initiatives, like those planned in this project, will accelerate such trends by strengthening renewable energy networks between European and African partners by up-scaling and transferring technologies and best practices. While investing in renewable resources has many advantages (e.g., reduce GHG emissions), it increases the climate vulnerability of the respective energy system. Renewable energy strategies further come with a wider range of local economic, social and environmental impacts which need to be taken into consideration if national policy and decision makers pursue such a development pathway. The dependency of renewables on hydroclimatological conditions also exposes energy systems to the stochastic nature of climate variability and change.

Many WA countries have a high share of large hydropower plants in their energy portfolios, whilst other renewable sources for electricity generation (e.g. wind, solar, small hydro power) are much less developed. However, especially in rural areas these technologies are potentially suitable for satisfying future energy demands. Given future climate variability and change, the climate resilience of renewable electricity generation (REG) must be based on improved climate services, including short-term, seasonal, and long-term projections of climate variables and impacts, integrated with context-specific economic, social, and environmental sustainability dimensions.

Objectives

The aim of the interdisciplinary Climate information for Integrated Renewable Electricity Generation (CIREG) project is the co-development by scientists and stakeholders of climate-resilient and sustainable REG systems. For that it aims to provide model-based support for decision-makers,including governments and the private sector, in particular by integrating energy and water planning, as a basis for climate-resilient and sustainable REG deployment. The project establishes demand driven and context-specific climate services for WA at various spatio-temporal scales (seasonal, short- and long-term). Local, national, regional, transboundary, and large river basin scales

are addressed using a transdisciplinary, model- and user-driven approach. CIREG investigates the regional potential for REG, such as wind- solar- and hydropower, and will identify possible transition pathways towards REG systems considering present climate variability (CV) and projected future climate change (CC) in WA. All project partners work in close collaboration with local and regional scholars and policy- and decision-makers to develop and co-design climate-resilient REG systems, with focus on two large WA river basins, the Volta, and Niger River basins.

Conclusions

The African continent stands before a unique chance to plan its future electricity (and energy) systems from the outset with a high VRE penetration as one of the targets. Many African countries are practically “greenfields” for VRE deployment, where even comparatively small capacity additions of VRE could have important ramifications for power system operation. It is therefore of high importance that all currently available technologies (notably flexible hydropower and gas plants, as well as interconnections and power pooling) are used to support an initial push for increased VRE penetration. At the same time, research, and development efforts to further the prospects for earterm deployment of battery and other storage technologies, and those for longer-term demand response and sectoral coupling approaches, will be indispensable to go beyond what generationdriven flexibility can provide in terms of VRE support.

Various studies have shown that increasing VRE penetration across Africa could be cost-competitive as compared to continued fossil fuel- and hydro-dominance, and carry various climate and other environmental benefits, thus helping to achieve the goals of the Paris Agreement. Recently, however, the carbon lock-in risks for Africa have been estimated as high, with the share of nonhydro renewables projected to remain below 10% by 2030 unless a rapid shift to modern VRE and other renewable resources is undertaken. It is therefore urgent that all solutions mentioned above are leveraged to the extent possible to facilitate the transition to low-carbon electricity supply across Africa, while at the same time growing power grids and increasing electricity supply to larger shares of the population.

Next to the technological and economical aspects, governmental support for VRE will be imperative if such a transition is to succeed. This support can come in various forms; examples include explicit policy support for renewables65, the creation of dedicated governmental agencies for renewable, and training and capacity building of national stakeholders in all matters concerning long-term power systems planning with high VRE shares.

Keywords

West Africa, renewable electricity generation, climate services.