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Climate Vulnerability of Hydro-power infrastructure in the Eastern African Power Pool

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At present there is around 6000 MW of installed hydropower capacity in the Eastern African power pool (EAPP)[1]. With countries aggressively planning to achieve the Sustainable development goal (SDG) of ensuring access to affordable electricity for all, a three-fold increase in hydropower capacity is expected by 2040 [1]. Most of the existing and planned infrastructure lie inside the Nile River Basin. The latest assessment report (AR 5) from the Intergovernmental Panel on Climate Change (IPCC) indicates a high level of climatic uncertainty in the Nile Basin. The Climate Moisture index (CMI) for the Eastern Nile region and the Nile Equatorial lakes varies significantly across the different General Circulation Models (GCM)[2]. Such high uncertainty casts a shadow on the plans to expand hydropower capacity, doubting whether hydropower expansion can contribute to the goal of improving access to electricity or end up as sunk investments. In this assessment, we analyze adaptation strategies for national energy systems in the Eastern African Power Pool (EAPP), which minimize the regret that could potentially arise from impacts of a changed climate. An energy systems model of the EAPP is developed representing national electricity supply infrastructure. Cross border transmission and hydropower infrastructure is defined at individual project level. The energy systems model is coupled with a water systems management model of the Nile River Basin that calculates the water availability at different hydropower infrastructures under a range of climate scenarios. The results suggest that a robust adaptation strategy consisting of investments in cross border electricity transmission infrastructure and diversifying sources of electricity supply will require additional investments of USD 4.2 billion by 2050. However, this leads to fuel and operational cost savings of up to USD 22.6 billion, depending on the climate scenario.
[1] “Platts, 2016. World Electric Power Plants Database,” World Electric Power Plants Database. [Online]. Available: http://www.platts.com/Products/worldelectricpowerplantsdatabase. [Accessed: 01-Mar-2016].
[2] Brent Boehlert, Kenneth M. Strzepek, David Groves, and Bruce Hewitson, Chris Jack, “Climate Change Projections in Africa-Chapter 3,” in Enhancing the Climate Resilience of Africa’s Infrastructure[U+202F]: The Power and Water Sectors, Washington DC: The World Bank, 2016, p. 219.