2.16 Hydropower Generation in Merowe Dam in response to Great Ethiopian Renaissance Dam (GERD)

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This paper aims to investigate both qualitatively and quantitatively the influence of Great Ethiopian Renaissance Dam (GERD) on Merowe Dam (MD) in Sudan regarding hydropower generation. The study is mainly concentrating on hydropower issues from MD power plant. River Nile (RN) Basin covers Sudan, Ethiopia and other countries. MD is located on RN in the North Sudan, about 800 km downstream Khartoum. MD reservoir length is about 200 km (to Abu Hamed), with a total capacity of 12.4 Km³. RN annual runoff is estimated to an average of 85 Km³, formed from Blue Nile (57%), White Nile (29%) and Atbara River (14%).GERD reservoir capacity is 74 Km³, with installed capacity of about 6000 Megawatts, while the installed capacity of MD is 1250 Megawatts, from 10 Francis turbine units, and the average annual energy output is about 6000 Giga-watts. About eighty percent of the required water for the generation is coming from the runoff river, while the reservoir provides 15% of water per year. No doubt that GERD is going to regulate the Blue Nile and change its hydrological regime, which will affect the regime of the RN. This will put MD under new unknown circumstances that will result in changing hydropower generation scope and magnitude. The two main problems are:

The expected influence of First Filling of GERD on MD Generation.

The long run operation of GERD reservoir on MD Generation

Among the most important questions that this study is to answer is how much GERD will affect the generation in MD? And, at what time?

Comprehensive study for the RN Hydrological system was performed, using the most recent advanced RIVERWARE software from Colorado University. A Simulation model was developed, calibrated and tested. Boundary conditions were established and different operation policies were
applied. After while, different scenarios were studied, results were found, outcomes concluded and the crucial points were highlighted.

The study, significantly, helped to identify and quantify GERD effects on MD regarding Hydropower Generation, beside, deeply, understanding and figuring out the consequences of different probable operation scenarios. For wide range of expected operation modes, it’s found that, effects of GERD on MD are varying from increasing in Hydropower by 19%, to decreasing in energy by 10% per year.