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Viability of Small Hydropower on the Zambezi Basin under Current and Future Conditions

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Lack of access to power in rural areas of the Zambezi basin is one of the many challenges facing the region. Significant quantities of untapped hydropower resources exist in the basin and present a means of improving livelihoods through better energy access. It is, however, crucial that hydropower installations properly assess the trade-offs between the social, environmental and economic effects of hydropower projects. Large hydropower projects have a mixed track record of both negative and positive socioeconomic and environmental impacts, particularly in developing countries. Small run of the river hydropower plants are widely regarded as being more environmentally benign, although the possible cumulative environmental impacts of numerous projects have not been addressed in detail. Such schemes also lack several of the ancillary benefits of reservoirs.

A key objective of this study is to understand the relative environmental and social impacts of few large hydropower reservoirs, compared to extensive small run of the river hydropower implementation, particularly considering future climate and population changes. To investigate this, this research seeks to create a large scale hydrodynamic model of the Zambezi Basin suited to small hydropower estimation and siting, analysing the trade-offs between the socioeconomic, environmental and social consequences of different hydropower configurations, as well as forecasting impacts into the future.

A basic hydraulic model has been constructed of a section of the lower Zambezi Basin using a LISFLOOD-FP large scale hydrodynamic model based on a HYDROSHEDs derived hydrographic network, with flow inputs based on monthly flow data at points where the watershed area exceeds a certain threshold. Initial power estimates based on river slope and flow rate will be extracted to identify locations with a high hydropower potential. This will be followed by an assessment of trade-offs between costs and benefits at each location. As the project progresses, the study region will be expanded to encompass the whole basin and to include environmental and social impacts, as well as forecasting future performance based on climate change and population growth predictions.