MINISTRY OF WATER AND ENVIRONMENT
CLIMATE CHANGE DEPARTMENT

# Economic Assessment of the Impacts of Climate Change in Uganda

## Briefing Note: Water and energy sector impacts in the Mpanga river catchment

An Economic Assessment of the Impacts of Climate Change has been completed at the national level in Uganda. As part of this nation-wide study, this case study seeks to assess the impacts of climate change and their costs in the water and energy sectors in the Mpanga river catchment, drawing on national projections of climate change. For further information see www.cdkn.org, or http://ccd.go.ug/index.php/projects/cdkn or contact olivier.beucher@baastel.com

The Mpanga river catchment is suffering increased conflict between the water and energy sectors for the use of the river to serve multiple users. Both water supply and energy production are projected to be negatively impacted by climate change. A vast proportion of the economic costs may fall on the energy sector, estimated at US$25 million to US$98 million annually by 2030 to 2035. Some adaptation options, such as water resource regulation and diversified energy sources, only have to offset between 2.8% to 15% of this loss to be economically justified, and therefore action on adaptation is a high priority.

Figure 1: Mpanga river catchment, Uganda

## Introduction

The potential exists for significant conflict between the energy and water supply sectors for the use of river water for hydroelectricity generation and supplying the needs of multiple users. This potential is likely to be exacerbated by socioeconomic development, population growth and climate change, all of which are likely to place significant additional stresses to water systems in Uganda. This study attempts to value the impact of climate change on these two sectors, drawing on the results of an analysis of a range of climate change models (in liaison with a companion study funded by *Expertise France* (BRL ingénierie,2015). Field data was collected via questionnaires and semi structured interviews of local officials and a sample of households in the villages.

The River Mpanga was selected to be the focus of the case study because the river basin faces a number of challenges, including pressures on both the quantity and quality of water in the river as well as socioeconomic development. There is an existing hydroelectric plant which has suffered significant outages in the past 3 years. There are also likely to be increases in demand for water supply for agricultural, industrial as well as domestic purposes.

The findings of this study are subject to a number of uncertainties, including model uncertainty, and uncertainty both related to the values of water and energy losses, and the cost of adaptation options.

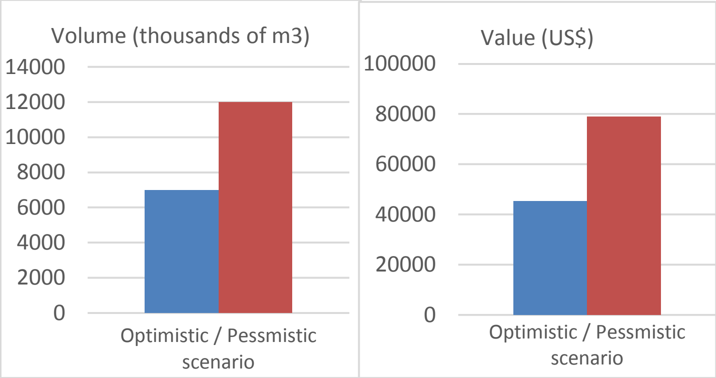
## Climate Change

This study has modelled the impact of climate change in the Mpanga River Basin. The modelling, based on a number of models, shows that rainfall may decrease and that temperature may to rise significantly.

The most significant impacts on water supply are likely to fall in the Rushango area of the catchment due to the water demand in the area and the expected impacts of climate change. Annual average economic losses to the water supply sector in this area may amount to between US$ 45,000 - US$79,000. These costs may more than double (US$188,000) if higher willingness to pay and future scenarios of GDP and

baastel Metroeconomica MAKERERE UNIVERSITY CIDT population are taken into account. The costs may also increase if industrial demand expands more significantly than expected.

Figure 2. Unmet demand and value in 2035 in Rushango
Average year with 2035 demand, 2015 prices, no discounting*




** The rationale for not discounting in this figure is that it reflects the value as it might be in 2035. It is a value of an impact in 2035 (in current prices).*

Compared to the water sector, the most significant economic costs fall on the energy sector. Transferring economic estimates of the value of lost load from a study in Kenya, adjusting for income differences and inflation, we find annual costs by 2030 to 2035 may be as high as US$25-98 million.

# Adaptation

The costs of a number of potential adaptation options were estimated for Mpanga. The percentage of losses that these options would need to offset in order to be economically justified was then estimated. The adaptation costs were based on scaling national level cost estimates from an earlier national sectoral study, which were in turn based on costs developed as part of the National Climate Change Policy - Costed Implementation Strategy of the Government of Uganda, using appropriate multipliers for Mpanga (e.g. proportion of hydro-electricity generation, area or proportion of electricity produced). Cost data is therefore uncertain and further analysis and research is required to develop more robust cost estimates. On the basis of the existing data, actions would only need to offset between 2.8 and 32.8% of estimated losses in order to be justified (10% discount rate).

Ranked from lowest to highest level of impact needed for economic efficiency (i.e. most favourable first), these options are:

1. Promote and participate in water resource regulation between users so as to ensure the availability of water for hydropower production;
2. Conduct further research to determine the potential impacts of climate change elements on the country's power supply chain and act on findings.
3. Diversify energy sources by promoting the use of alternative renewable energy sources (such as solar, biomass, mini-hydro, geothermal and wind) that are less sensitive to climate change; and
4. Promote and participate in water catchment protection as part of hydroelectric power infrastructure development, through soil conservation practices such as agroforestry for example.

Further, it should be noted that these interventions would be likely to have other nearer term benefits – such as enhanced water supply security, ecosystem services, and tourism impacts. The benefits considered here only reflect the average variation and not an extreme event (hence the benefits may be underestimated).

A number of barriers to effective policy on water in particular have been identified, including the need for strong political will and sufficient funding for employing Community Development Officers to enforce existing laws. Enabling factors also include better weather forecasting and early warning systems for water supply shortage and measures to reduce wood fuel demand and avoid deforestation.

There is a clear need for effective integrated river basin management in the Mpanga River Basin to ensure that costs are minimised and that effective adaptation strategies are implemented. Further work is needed to improve the data on river flows to ensure appropriate policy action is taken.

It is also worth noting that national level policy on energy supply will either directly or indirectly impact on the case of the hydroelectric dam in the Mpanga River. Actions to reduce biomass demand, for instance, will improve the quality of water in the river due to reduced soil erosion and measures to reduce energy consumption would reduce demand, and hence the losses due to climate change in the energy sector, in the Mpanga River Basin. Direct measures including actions to promote efficient management of resources – particularly by those sectors with significant consumption – will likely reduce the impact of the lost load.