DAFNE: A Decision Analytic Framework to explore the water-energy-food nexus in African transboundary river basins

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ABSTRACT

Water, energy, and food are three essential resources for human development that are strictly interconnected. Water is essential to both food production and energy generation: agriculture is responsible for 70% of global water withdrawals and cooling thermal processes in electricity production account for almost another (non-consumptive) 22%. Water is also diverted from natural streams to hydropower systems to produce electricity, often reducing availability for irrigation and aquatic environments. Energy is consumed to supply water (e.g., water extraction, treatment, and delivery) and produce food (e.g., fertilizer production, water pumping for irrigation). In the near future, demand for water, energy and food is forecasted to increase due to population and economic growth, while water resource availability will be highly impacted by a changing climate.

Many large international river basins worldwide, particularly in fast-developing African countries, will eventually be impacted severely from these growing pressures, which may ultimately threaten sustainable use of water for the production of food and energy. For example, the population of the Zambezi River Basin in Africa is estimated to reach 51 million by 2025 (+27.5% of the population in 2008), leading to a 60% increase in the food needed to feed the region by 2050, and a subsequent growth in energy and water demand. Energy consumption and irrigation water withdrawals are foreseen to rise up to 50% by 2035 and 10% by 2050, respectively (ZAMCOM, 2016). As far as water availability is concerned, predictions indicate that several riparian countries will be water stressed (e.g., Tanzania and Zimbabwe) or will severely suffer from water scarcity (e.g., Malawi) by 2025.

In this context, the H2020-DAFNE[1] project is exploring a novel methodological approach to understand, model, and manage the Water-Energy-Food (WEF) nexus in complex and transboundary water resources systems. DAFNE advocates an integrated and adaptive water resources planning and management approach (Castelletti and Soncini-Sessa, 2006) that explicitly addresses the WEF nexus from a novel participatory and multidisciplinary perspective. This includes social, economic, and ecologic dimensions, which involve public, private and civil society actors. The DAFNE approach is socially inclusive, enhances resource efficiency and prevents the loss of ecosystem services in regions where large infrastructures exist or are being built and intensive agriculture is expanding. The Zambezi and the Omo-Turkana river basins are the two transboundary study sites where DAFNE intends to demonstrate this novel WEF nexus approach. Robust WEF development pathways will be designed and evaluated accounting for changing socio-economic conditions and climate.

[1] Decision Analytic Framework to explore the water-energy-food Nexus in complex transboundary water resource systems of fast developing countries

In this contribution we provide an overview of the DAFNE concept, and discuss the preliminary results so far obtained in both case studies.

Figure 1 Stakeholder meeting in Lusaka, Zambia: DAFNE project partners and stakeholders collaboratively exploring issues, actions and indicator on the Zambezi river basin.

Acknowledgements: The financial support by H2020 DAFNE contract No. 690268 is greatly appreciated.

References:

Castelletti, A. and R. Soncini-Sessa (2006), A procedural approach to strengthening integration and participation in water resource planning, *Env. Mod. & Soft.* 21 (10), 1455-1470

ZAMCOM (2016), Integrated Water Resources Management Strategy Implementation Plan for the Zambezzi river basin, Zambezi Watercourse Commission.