

# Discussion brief – Rapid appraisal of the Water-Energy-Food nexus in Zambia

Zambia aims to become a mid-level economy by 2030, partly underpinned by a transformation of the agriculture sector to boost productivity to meet domestic food demands and generate income from exports. At the same time, the energy sector is currently undergoing a transition from being predominantly biomass based, to meeting growing demands of modern energy sources for industry, agriculture and domestic use. Rural electrification remains a challenge in a sparsely populated country. Despite the country's generally rich endowment with natural resources, scarcity and degradation of resources hampers development and threatens sustainability, and food and energy security still remain pertinent issues. Water demands for irrigation and hydropower generation are increasing, while undermining environmental flow requirements in regulated rivers and lakes. Moreover, deforestation rates are high, driven by an expanding agriculture as well as the need for charcoal for cooking purposes.

## Nexus approach

The Water-Energy-Food (WEF) nexus concept addresses inter-connected water, energy and food development challenges at different levels, in order to enable decision-makers to work together to meet human aspirations. Quantitative assessments of current and new policy frameworks and mechanisms, which take into account interdependencies between food, energy, water and environment, can support decision-making processes, investment planning and administrative procedures to enable more coherence and sustainability.

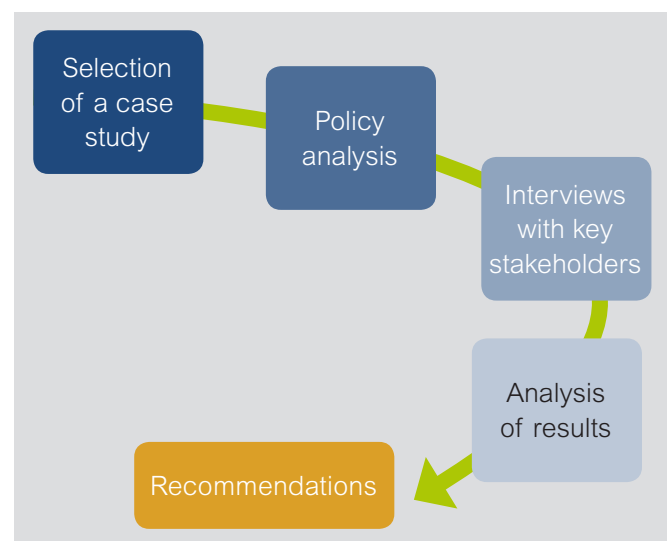
## Scope of the rapid appraisal

GFA Consulting Group (GFA) and the Stockholm Environment Institute (SEI) joined forces to explore the potential to integrate the nexus perspective in development projects. In this pilot-study GFA and SEI assess the WEF nexus in Zambia from a governance and bio-physical perspective, emphasizing interdependencies between the environment (natural resources and ecosystems) and human development (food, energy and water security). Issues defined by stakeholders are taken as an entry point. The objective is to explore whether a nexus perspective can have added value to the implementation of the current policy framework and to guide new policy development in Zambia.

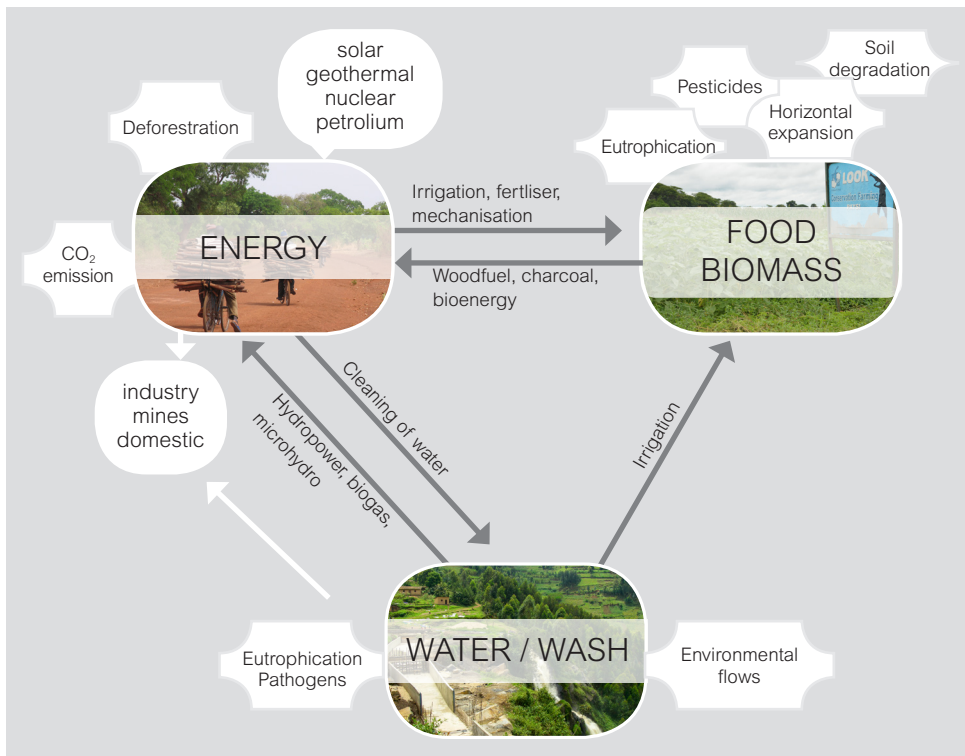
A method for conducting a rapid appraisal WEF nexus study was developed within the pilot study. This consisted of a desk-study of the current policy frameworks, stakeholder interviews and an indicative quantitative assessment of inter-sectoral dependencies (see below).

## Assessing the WEF nexus in Zambia

**Water demand:** Of the current water withdrawals in Zambia, 73% is for the agricultural sector, while 19% is for municipal and 8% is for industrial use. Large investments in storage of water for irrigation and hydropower generation are necessary to meet the sectors' demands. Hydropower production accounts for over 94% of the total national energy supply (excluding fuelwood) and utilizes around 40% of the available surface water. Future expansion of irrigated agriculture and hydropower production will most likely lead to conflicting interests between the agriculture and water sector, in particular during the dry season (March/April) when water demands peak. At the same time, the need to secure water to meet environmental flow requirements is already a challenge in many water bodies in the country.



**Energy security:** Energy security consists of stable supply and access. By 2015, the goal is to increase the rural access to electricity from 3.5% to at least 15% and the national access from 22% to 40%, and to increase the production of hydropower to balance higher demands. The current energy demand of Zambia is around 70 TWh and is expected to increase to around 300 TWh by 2030. For accessibility and cost reasons, however, 70-80% of this demand is met by biomass today. Our analysis indicates that only parts of the future energy demand can sustainably be met by hydropower, suggesting that biomass will continue to play a major role in the energy sector. The role of alternative energy sources is still unclear. Future developments of the energy sector depends on the direction taken by other sectors, such as agriculture, which is both a user of energy, a competitor for water, and a potential supplier of feedstock for bioenergy production.



Future development goals for the country are outlined in the current national policy framework. A policy analysis reveals that many of the targets in the sector policies are partly conflicting. For instance, intensified agricultural systems may be in conflict with sustainable water use.

Cross sector collaboration is facilitated by regular meetings in Sector Advisory Groups (SAGs) that meet quarterly. However, the modus operandi of these SAGs need to be more proactive to new implementation projects. For instance, there seems to be a lack of cross sector strategic planning underpinned by rigorous quantitative assessments of resources use and cross-sector linkages. For instance, environmental water flow requirements are not met in several locations in the limnic ecosystems due to hydrological alteration from e.g. hydropower (Kafue flats). Moreover, the planning of future irrigation and hydropower projects does not account for the strategic use of limited water resources.

**Food production:** Food security remains a challenging issue in many part of Zambia. The current agricultural sector predominantly consists of small-scale, low yielding farms and a few large-scale, input-intensive commercial farm enterprises. With a growing urban middle class and increasing agricultural exports, Zambia's demand for food is rising. As a response, agriculture is gradually being intensified (e.g. maize, sugar cane, tobacco and wheat) and expanding into forestlands, while the government recently started a program to build commercial farm blocks to attract large-scale investment.

A first estimation of future resources demand for the agriculture sector thus shows a growing competition for water with the energy sector, higher energy needs, and large scope for improving production on current croplands to meet the domestic food demand and sustain a growing export industry. While the demand for water and land for the energy sector for bioenergy and hydropower production is far greater than that of the agriculture sector, it is not possible for the agriculture sector to substitute these resources to produce food. The energy sector has the option of exploring other development pathways which would be less land and water intensive, such as solar and wind power for instance.

### Inter-sectoral dependencies

The processes of agricultural transformation and energy transitions are thus interdependent and partly also compete for the same resources, e.g. water and biomass. Through the increasing agricultural intensification energy demand also increases. In contrast, there is a potential to increase the production of energy by using biomass from croplands for bioenergy (biofuels, crop residues).

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### Conclusions and recommendations

Agricultural transformation and energy transitions are interconnected, partly competing for the same resources and are driven by an increasing population, a changing climate and a growing economy. Future resource use efficiency and sustainability will strongly depend on the development trajectories for the energy and agriculture sectors, and their ability to collaborate.

In order to attain the national development goals it therefore appears that there is a need for integrated quantitative assessments of future development trajectories for the country, accounting both for cross sector inter-linkages and competing demand for resources. These findings jointly call for informed cross-sector strategic planning and cross-sector linkages. At the moment, there is a window of opportunity in this regard in Zambia since several of the current policies are under revision.

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