Energy, Water and Food Security in Poor Rural Regions

The Nexus Concept from a Basic Energy Services Perspective

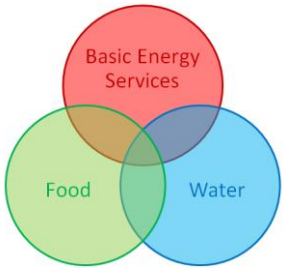
The Challenge

Energy, water and food security are essential for people to survive, to improve their livelihoods and for the functioning of a society and its development. Most developing countries still suffer from significant deficits in the energy, water and food sectors: According to IEA, about 1.3 billion people have no access to electricity and about 2.6 billion people rely on traditional biomass such as wood, charcoal, dung or plant remains for cooking and heating. Globally, 900 million people have no access to safe water and twice as many lack food security. With a growing world population it can be expected that demand for energy, water and food increases constantly with the greatest increase coming from non-OECD countries.

Basic energy services are important for improving access to water, agricultural productivity, health care, education, job creation and environmental sustainability. They do not only play a role in meeting energy demand of poor rural regions, but also contribute to water and food security. Likewise water and agriculture play an important role in energy provision.

To meet rising demand in all three sectors, besides increased resource efficiency, integrated approaches are necessary. In the case of basic energy services, the interrelations particularly with the water and food sectors are of great importance. In order to reach expected impacts and avoid unexpected negative ones, tradeoffs and direct or indirect synergy potential among these different sectors need to be taken into account.

The „Energy-Water-Food Security Nexus“ serves as a synonym for approaches that (at least partially) focus on issues arising from the interrelationship between energy, water, agriculture, food production and food security.



The Basic Energy – Food Linkage

Energy is central at all levels of the food supply chain ranging from production, post-harvest and storage activities to agro-processing, marketing and food transportation. FAO estimates that energy consumption of food production and supply chain accounts for 30% of global energy demand.

To promote food security in a sustainable way, basic energy services based on renewable energies are indispensable. Wind and micro-hydropower can provide sustainable energy for agro-processing activities such as milling or pressing, while solar energy plays an important role for food drying and refrigeration - important means to make agricultural products longer lasting. Even lighting and information and communication technologies indirectly contribute to food security. Clean and sustainable lighting allows for longer opening hours of shops. Access to information and communication technologies allows for better product marketing and up to date market information. People can inform themselves about new agricultural technologies and lean about healthy nutrition.

Most important: As 95% of staple foods need to be cooked before being eaten, energy is indispensable for the provision with nutritious meals. A lack of cooking energy often leads to malnourishment, food rationing and hunger. Globally, wood fuel is the most used cooking fuel, but is often harvested unsustainably. This leads to soil degradation, negative effects for the local water system. Clean cooking energy therefore is an important step towards food security.

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On the other hand, food can contribute to energy production. Plant remains such as dung or rice husks can be used to generate energy for multiple purposes. Micro-gasifiers use agricultural remains to provide for cooking energy. They further can produce biochar as a side product which can be used as a fertilizer and enhance water resilience when incorporated into soils. In biogas plants, the process of anaerobic digestion is used to turn dung into electricity.

Improved food production not only depends on energy, but at the same time competes with it. There is a trade-off between land use for growing energy crops or for growing food crops. Compromises have to be negotiated when agriculture for energy and food production compete. In order to avoid land use competition, energy crops are introduced which grow on marginal land (e.g. Jatropha). To obtain high yields and economic profitability, these crops usually need irrigation, fertilizers and pesticides - all of which require energy to be produced and/or delivered. Therefore, the energy balance of these crops seems rather questionable.

The Basic Energy - Water Linkage

On the one hand, energy plays an important role on every level of the water supply chain, be it water extraction, treatment, distribution or collection and treatment of waste water. The Environmental Protection Agency estimates that by 2050 about half of the population will lack access to clean drinking water. Following the UN, annually about 3.5 million people die due to polluted water or insufficient sanitation. People in developing countries are most affected, besides others, due to poor or non-existing electricity supply. Household water treatment and safe water storing can lead to significant improvements in water quality and reduction of diseases. Most treatment methods need direct or indirect energy input, such as solar or ultraviolet purification technologies.

On the other hand, water contributes significantly to basic energy supply. Micro-hydropower plants can provide rural communities with off-grid electricity. Fossil fuels which are widely used for heating, cooking or lighting in developing countries feature water intensive exploitation and refining processes. Fossil fuels should therefore be replaced by fuels which require lower water inputs.

The Basic Energy – Water - Food Linkage

According to the UN, irrigated crop yields are almost three times higher than rain fed crop yields. Especially in times of climate change, irrigation is often indispensable to counteract the increasing risks in rain-fed systems.

In developing countries, water resources are often used inefficiently and are rapidly depleted. In the long-run this leads to falling water levels. At this point more energy is needed to pump water from lower levels. Water use for irrigation can lead to increased water scarcity and competes with water use for other purposes such as drinking water. In addition, irrigation can increase soil and water pollution through agricultural runoff polluted with fertilizer. Advanced pumping and irrigation technologies, which use renewable energy as power input, can significantly reduce energy and water use and contribute to food security without endangering energy and water supply.

Nexus Outlook

To arrive at an integrated approach and implement cross-sectoral projects, governments, international organizations, donors, the private sector and NGOs of different sectors must work together and establish cross-sectoral activities, regulations and standards. Besides technological innovation and finance an enabling environment and boosting initial activities are essential for the implementation of such activities.

Without awareness and cooperation on government and institutional level, synergies in improved energy, water and food security are not to be expected. The target group (households, institutions and SMEs) needs to be enabled to take an active role and assume responsibility as they are the knowledge holders and experts in their environment.

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