WATER, FOOD AND ENERGY

The water-food-energy nexus is central to sustainable development. Demand for all three is increasing, driven by a rising global population, rapid urbanization, changing diets and economic growth. Agriculture is the largest consumer of the world's freshwater resources, and more than one-quarter of the energy used globally is expended on food production and supply.

The inextricable linkages between these critical domains require a suitably integrated approach to ensuring water and food security, and sustainable agriculture and energy production worldwide.

Rising demand

Water is a finite resource having to serve exponentially more people and usages, and so ensuring everyone has access to a reliable supply is crucial to human survival and sustainable progress.

As water resources become more stretched, the energy and food sectors' dependence on water, and the fact that all three underpin several of the Sustainable Development Goals, means that decision-makers in all three domains are now increasingly focusing on water resource management, ecosystem protection and water supply and sanitation as part of their policy and practice.

Energy mix

Fossil fuel production, still a dominant and growing part of the global energy mix, is highly water intensive, as is biofuel production and the growing practice of shale gas extraction – or 'fracking'. There will need to be much more support for the development of less water-intensive renewable energy, such as hydropower and wind, before it makes a significant impact on water demand. For instance, geothermal energy has great potential as a long-term, climate independent resource that produces little or no greenhouse gases and does not consume water.

Agricultural efficiency

Agriculture looks set to remain the biggest user of water into the middle of this century. While the shift to biofuels is generally welcomed, their production could demand as much water as fossil fuels. In terms of food, the volume of demand is growing with population expansion, and we are seeing a significant global move away from a mainly starch-based diet

to an increasing demand for more water-intensive meat and dairy as incomes grow in many countries.

Efficiency measures along the entire agrifood chain can help save water and energy, such as precision irrigation based on information supplied by water providers, which can motivate farmers to invest in their systems to ensure the best returns from their water investment.

Serving cities

Most of the world's rapidly growing cities are in low-income countries where authorities and utilities can have limited capacity to plan for and control urban expansion and its impacts on water and energy demand.

Consumption can be reduced, and supplies made more reliable, by such practices as using multiple water sources, including rainwater harvesting and wastewater reuse, and only treating water to be ready for its intended use, rather than treating all water to a safe drinking standard. Removing biosolids from wastewater and using them for cooking or heating, for example, can help replace fossil fuels and reduce the amount of processing at the wastewater treatment plant.

Ensuring food and nutritional security

Globally, there is sufficient water to produce food for everyone, but food and nutritional insecurity remains widespread. Furthermore, where people have limited or no access to safe water or sanitation, the prevalence of diarrhoeal diseases is a major factor in high child mortality rates, malnourishment and loss of productivity.

In water scarce regions, there needs to be robust strategies to protect water availability to maintain agricultural production and avoid food price volatility. Advances in genetics and technologies that allow the sustainable intensification of crops, livestock and fish production can help meet demand as efficiently as possible.

Facts and figures

- Agriculture accounts for 70% of global water withdrawal. (FAO)

- Roughly 75% of all industrial water withdrawals are used for energy production. (UNESCO, 2014)

- The food production and supply chain accounts for about 30% of total global energy consumption. (UNESCO, 2012)

- 90% of global power generation is water-intensive. (UNESCO, 2014)

- Global water demand (in terms of water withdrawals) is projected to increase by 55% by 2050, mainly because of growing demands from manufacturing (400% increase). More than 40% of the global population is projected to be living in areas of severe water stress by 2050. (UNESCO, 2014)

- Power plant cooling is responsible for 43% of total freshwater withdrawals in Europe (more than 50% in several countries), nearly 50% in the United States of America, and more than 10% of the national water cap in China. (UNESCO, 2014)

- By 2035, water withdrawals for energy production could increase by 20% and consumption by 85%, driven via a shift towards higher efficiency power plants with more advanced cooling systems (that reduce water withdrawals but increase consumption) and increased production of biofuel. (UNESCO, 2014)

- There is clear evidence that groundwater supplies are diminishing, with an estimated 20% of the world's aquifers being over-exploited, some critically so. Deterioration of wetlands worldwide is reducing the capacity of ecosystems to purify water. (UNESCO, 2014)

- It typically takes 3,000 – 5,000 litres of water to produce 1 kg of rice, 2,000 litres for 1kg of soya, 900 litres for 1kg of wheat and 500 litres for 1kg of potatoes. (WWF).

- While almost 800 million people are currently hungry, by 2050 global food production would need to increase by 50% to feed the more than 9 billion people projected who live on our planet (FAO/IFAD/UNICEF/WFP/WHO, 2017).

Find out more:

FAO (2011): The state of the world's land and water resources for food and agriculture
FAO: Water-Food-Energy nexus
UNECE: Water-food-energy-ecosystem nexus in transboundary context
FAO/IFAD/UNICEF/WFP/WHO: The State of Food Security and Nutrition in the World 2017: Building Resilience for Peace and Food Security.