UNEP-DHI CENTRE

UN environment programme | copenhagen climate centre

POLICY NOTE

Working with the Water-Energy-Food-Ecosystems (WEFE) nexus

Summary and perspectives on the WEFE nexus for climate-resilient sustainable development

Key messages

1. There is a strong inter-relationship between water resources, energy generation, food production and freshwater ecosystems. **Understanding the key interactions, potential synergies and trade-offs**, between these is important for addressing growing societal demands in a situation of accelerating climate change, growing biodiversity loss and damaging pollution.

2. **Improving policy coherence and planning** across water, energy and food production, as well as freshwater ecosystems, is vital to accelerate sustainable, resilient and equitable socioeconomic development.

3. Effective and sustainable implementation of Water-Energy-Food-Ecosystems approaches involves taking a **systems approach to assess the potential efficiencies, synergies or trade-offs** that exist within specific inter-connected contexts – including considerations of climate change impacts and the integrity of all the ecosystems that provide the required goods and services.

4. **Expert knowledge and tools to support countries with such an approach are available through the UNEP-DHI Centre and the UNEP Copenhagen Climate Centre. The two centres** can provide support to identify and **quantify** key interactions and evaluate various cost-benefit scenarios taking ecosystem impacts into account. The use of such tools must be balanced with **qualitative** decisions linked to broader social, political and environmental considerations.

The Water-Energy-Food-Ecosystems nexus

Our societies are complex systems with interlinking environmental, economic and political dimensions. For ease of understanding and management, we typically break down the economic part of this system into individual sectors such as energy, manufacturing, transport, etc. However, these sectors cannot operate in a siloed way as they are often heavily dependent on each other and may draw on the same water resources.

A good example of this sectoral relationship is between the water, energy, agricultural, and environment sectors. Agriculture is the largest consumer of freshwater resources while energy generation is also highly dependent on water e.g. for the extraction of fossil fuels, hydropower, cooling of power plants and biofuel production. Both the food and water sectors are energy intensive, with around a quarter of total energy consumption related to food production and supply. In addition, a significant amount of the operating costs of water and wastewater utilities are energy-related costs linked to cleaning, desalination and pumping.

On the other hand, broader environmental dimensions are more specifically manifested through freshwater ecosystems and environmental services. For example, natural or constructed/modified water-related ecosystems such as lakes, rivers, wetlands or aquifers provide goods in the form of water and soil, as well as services in the form of flood mitigation, cleaning and recycling. This close relationship is often termed the WEFE nexus.

At the same time, agriculture, hydropower, biofuel production, and ecosystems, among others, are affected by climate change. They are also affected by the increased frequency and severity of extreme events as well as by more subtle climatic shifts often leading to highly complex, cascading and compounding impacts and frequently across jurisdictional boundaries. These perspectives must also be considered for the WEFE nexus to be successfully implemented.

Cost-benefit trade-offs - the unplanned and the planned

Today, priority setting with associated trade-offs is the norm. Until people become aware and start to discuss the negative impacts, there is often little political will to consider any changes. The same is true for economic sectors. For example, by the early 1990s it became obvious that demands on water resources from various sectors were unsustainable in many parts of the world. One challenge in addressing this situation was that the environmental sector had a weak voice and was often regarded as trying to constrain economic growth. However, with increasing climate change impacts and increasing competition for the same limited and declining water resources, growing calls for action led to countries adopting Integrated Water Resources Management (IWRM). This approach helps balance competing demands for water and strengthen resilience to climate change through adaptation while maintaining the health of the resource itself.

A common complaint about IWRM is that it takes too much time and is simply too demanding to equitably work across all sectors. However, in practice people have learnt to prioritize and scope efforts based on situational needs and available resources. The WEFE nexus approach is a good example of this prioritization, whereby shared consideration is given to water as a resource for, or a threat (floods) to, energy for power and lighting, food for people, and ecosystems. It offers a way to help address critical issues such as rapid climate change, growing biodiversity loss and damaging pollution.

Applying the WEFE nexus in practice

Like IWRM, there is no fixed formula for applying the WEFE nexus in practice, as it all depends upon the specific context. However, the IWRM approach can be used as a guide to WEFE nexus implementation. For example, as with IWRM, a hydrological system approach is necessary since water resources are confined to and inter-connected within hydrological boundaries. Key considerations include the need to establish and create coherence between 1) the enabling environment of policies, laws and plans 2) the institutional set-up and key stakeholder engagement 3) management instruments or tools to guide decisions and actions, and 4) finance for investment and recurrent costs to sustain the work. Also, as with IWRM, sustainable management requires engagement with key stakeholders within a shared freshwater ecosystem. However, whereas IWRM is almost always water-centric, the WEFE nexus puts greater emphasis on trying to give more equal consideration to all sectors for the greater benefit of people and sustainability. The key to applying the WEFE nexus in practice is the fundamental need for and availability of reliable data and information to support economic cost-benefit trade-off decisions and evaluate ecosystem impacts. These are typically directly linked to the value of the water consumed or polluted, the crops grown, the energy generated, and the ecosystem goods and services provided or harmed. An important caveat is that economic assessments need to be considered alongside several important secondary factors, such as the protection of rural livelihoods, national development ambitions, and biodiversity conservation. Only then can well-considered trade-offs be made, later evaluated and adjusted.

While the WEFE nexus typically manifests itself at the landscape scale, policy decisions and governance-related issues primarily take place at national levels, but also at global and regional levels. Successfully and sustainably managing changes in decision-making, power, or resource access and profits in the context of the WEFE nexus requires integrated environmental policy approaches within and across jurisdictional boundaries that include stakeholders and ensure co-ownership of planning, implementation, and benefit sharing.

What makes the WEFE nexus indispensable are the all too familiar pressures of ever-increasing societal demands for water, energy and food coupled with declining environmental health, in a situation that is further complicated by accelerating climate change. The WEFE nexus approach can also help address poor decision-making regarding cost-benefit trade-offs that can have seriously negative consequences for us and the environment. Improving policy, planning and action coherence across water, energy and food production is necessary to implement and accelerate sustainable, resilient and equitable socioeconomic development.

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Experts in technologies and knowledge for freshwater resources management and the application of DHI's technology to support UNEP's mandate and policy leadership.

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UNEP CCC works to implement UNEP's climate change strategy and energy programme and assist developing countries deliver on the Paris Agreement and SDGs.

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