SNV Impact that matters

Exploring the agri-food, energy and water sector nexus

January 2025

Disclaimer: The views and content expressed in this report do not necessarily reflect the position or endorsement of any affiliated institution. This article is being shared to contribute to knowledge co-creation and learning.

Author: Dr David Ojwang is a horticultural crop physiologist and is currently the SNV Sector leader for agri-food systems in Kenya and Burundi.

Cover photo: A farmer in Kenya using solar energy to irrigate her farm. Photo credit: SNV.

Suggested citation: SNV, 'Exploring the agri-food, energy and water sector nexus,' Kenya, 2025.

Agri-Food | SNV

Impact of climate change on agri-food systems

Climate change has both direct and indirect negative impacts on global food security, food production, and, consequently, the availability, accessibility, and quality of food. These changes further threaten livelihoods by affecting health, causing displacement, and undermining peace and security, with women, children, and vulnerable communities bearing the heaviest burden.
There is a need, therefore, to address resource security and the inherent just distribution among communities that depend on them. Climate change projections for East Africa, and Kenya in particular, indicate rising temperatures, reduced precipitation, seasonal variability, and an increase in climate shocks, which have the potential to negatively impact the agri-food sector. As the sector becomes increasingly vulnerable to climate change, the profitability and long-term sustainability of production systems are at risk.

With the African population projected to reach 2.5 billion by 2050, which is a 950 million increase from 2024 and increasing cases of food insecurity, the current food production must rise by 70 percent by 2050. This will involve investing in resilience to climate change so that the continent can feed the expanding food demand. Increasing food production will entail putting more pressure on natural resources such as water, energy and environmental services like forests. Competition for these resources will potentially lead to natural resource-based conflicts. We need, therefore, to build synergies between these resources while managing them sustainably, for now, and in the future.

Part of climate change mitigation in Kenya

Experts opine that to achieve transformative change within the agri-food sector, solutions addressing climate change cannot be applied in silos. Integrating these solutions in a holistic approach is necessary to create synergies.

Water-Energy-Agrifood nexus approach

Water, energy and food are essential for human well-being, poverty reduction and sustainable development. Their contribution towards the Agri-food sector is enormous. Generally, the sector accounts for about 80 percent of total freshwater use, 30 percent of total energy demand, and about 21 percent of man-made greenhouse gas emissions worldwide. Therefore, there is pressure on sustainable water and energy management to support the agri-food sector, the increasing global population, changing diets, and economic growth. Climate change pundits opine that to achieve a transformative change, solutions addressing climate change cannot be applied in silos. In addition, with the rapidly growing human population in an increasingly variable climate situation, it is critical to find ways to secure food and nutrition security, energy and water security in an equitable manner.

As demands for water, food, and energy increase, the trade-offs between the sectors will become increasingly complex, placing even greater emphasis on the need for an integrated approach.[1]

[1] Awandu, W., Kanda, E.K., Kimokoti, S.N. (2024). The Water-Energy-Food Nexus in Kenya: Climate Change Impacts and Adaptation Strategies—A Review. The Water, Climate, and Food Nexus. Springer, Cham. https://doi.org/10.1007/978-3-031-50962-9

Harnessing solar energy for water access in agri-food system

In recent years, governments, development partners, and donors have focused more on the interactions between water, energy, and food, the so-called water-energy-food (WEF) nexus, and the need for an integrated approach to support sustainable development. They have realised that single-sector, top-down, and compartmentalised approaches are insufficient in tackling the challenges of a changing climate. This nexus-based approach is widely recognised as enabling improved use of limited natural resources to support sustainable development.

The context of nexus among different organisations

(1) Humanitarian, development, peacebuilding and advocacy nexus:

A number of organisations mainly working in the humanitarian and conflict context such as **World Vision's**[2] definition of nexus is based on humanitarian, development, peacebuilding and advocacy integration. At the heart, is the agility to shift from meeting immediate humanitarian needs to addressing root causes even in the context of continued fragility, in order to support transformative change whenever possible, so that communities can build resilience to shocks over the long term. **Oxfam** has conceptualised Tripple nexus approach[3], which integrates 'humanitarian relief, development programmes and peacebuilding. They believe that these three sectors are all needed at the same time, to tackle the systemic inequalities that trap people in poverty and expose them to risk. The triple nexus, or programming across humanitarian-development-peace pillars, thus means creating synergies and common goals across short-term emergency response programmes and longer-term social change processes in development, as well as enhancing opportunities for peace so that individuals can enjoy the full spectrum of human rights. The **World Food Programme (WFP)** applies the humanitarian-development-peace (HDP) nexus[4] approach to address the needs of people affected by crises. The approach helps WFP transition from humanitarian crisis responses to prevention, resilience, and systems strengthening.

(2) Nexus in the health context: MOMENTUM Integrated Health Resilience[5], has adopted the Humanitarian-Development nexus in their Maternal, Newborn, and Child Health, Voluntary Family Planning, and Reproductive Health project implemented in fragile context. They view humanitarian and development nexus as complimentary and have the capacity to enhance health resilience capacities across individual, household, community, and health system levels. This ensures that interventions are responsive, feasible, operational, and measurable.

(3) Trade and climate change intersect nexus: The **World Bank** postulates that while trade contributes to climate change, it is also a central part of the solution- enhancing both mitigation and adaptation[6].

[2] World Vision International, "A Brighter Future for Children: Our Approach to Fragile Contexts," 2019.
[3] Oxfam International. (2019). The Humanitarian-Development-Peace Nexus: What Does It Mean for Multi-mandated Organizations? Discussion Paper. Oxford, UK: Oxfam International. Retrieved from: https://policy-practice.oxfam.org/resources/the-humanitariandevelopment-peace-nexus-what-does-it-mean-for-multi-mandated-o-620820/
[4] WFP. 2023. Operationalising the HDP Nexus in WFP Western Africa Case Study: WFP Nigeria. https://docs.wfp.org/api/documents/WFP-0000154652/download/
[5]USAIDMomentum.org
[6]https://documents1.worldbank.org/curated/en/644711632894241300/pdf/The-Trade-and-Climate-Change-Nexus-The-Urgency-and-Opportunities-for-Developing-Countries.pdf

They posit that trade contributes to the emissions that cause global warming and is itself also affected by climate change. In turn, climate change disrupts traditional comparative advantages, particularly in agriculture and tourism. Therefore, challenges related to trade and climate change cannot be tackled in isolation but require an integrated, holistic approach that addresses both simultaneously.

(4) Climate, Biodiversity and Poverty nexus[7]: The Global Centre on Biodiversity for Climate (GCBC) is UK Official Development Assistance (ODA) research programme that promotes the Climate, Biodiversity and Poverty nexus. They believe that Climate change, biodiversity loss and poverty are intrinsically linked.
It recognises that climate change, biodiversity loss, and poverty are intrinsically linked. GCBC highlights that poor communities in developing countries are particularly vulnerable to the impacts of climate change. While biodiversity loss can exacerbate climate risks and deepen poverty, nature can also be part of the solution. By working with vulnerable communities to protect and sustainably manage ecosystems, it is possible to create more resilient livelihoods while safeguarding both people and nature from the extremes of climate change.

Nexus approach at SNV

SNV's mission - to strengthen capacities and catalyse partnerships that transform agri-food, energy, and water systems, enabling more sustainable and equitable lives for all- serves as a foundation for its work on the nexus.
SNV's nexus approach highlights the interdependence of water, energy, and food (WEF) security, identifying mutually beneficial responses based on a deep understanding of their synergies. This approach helps us better understand and navigate the complex and dynamic interrelationships, ensuring the sustainable use and management of limited resources. It compels us to consider the broader impacts of decisions within and across sectors. Changes in one sector inevitably affect others: food production relies on water and energy; clean water supply and distribution require energy and land-based ecosystems; and energy production depends on water and land. Decisions about food production influence energy and water use, while choices in water and energy supply shape land use. By anticipating potential trade-offs and synergies, we can design, appraise, and prioritise response options that deliver viable, cross-sectoral benefits.

Novel approaches for the sustainable use of WEF resources at SNV

SNV seeks to implement innovative approaches to support national and local governments in the efficient and sustainable management of water, energy, and food (WEF) resources. Some of these approaches include:

- Customising WEF nexus assessment tools to suit local conditions.
- Co-creating WEF nexus solutions with local communities through Living Labs.
- Establishing WEF nexus Communities of Practice to ensure robust and sustained stakeholder engagement.
- Integrating real-time data and Indigenous knowledge systems, which are essential for effective WEF resource management.

***Laikipia, Isiolo, Samburu transforming the environment through nexus (LISTEN)[8]*:** Through the LISTEN project, SNV has applied the interconnections between water, energy, and agri-food systems to enhance food security while diversifying agri-based enterprises among pastoralist communities. The project has promoted the use of solar-powered water pumps and rehabilitated boreholes, integrating solar technology to support crop irrigation

[7] https://www.gcbc.org.uk/
[8] https://www.snv.org/project/listen-laikipia-isiolo-samburu-transforming-environment-through-nexus

The adoption of climate-resilient technologies, such as solar-powered irrigation systems, not only addresses food insecurity but also enables farmers to cultivate their land year-round, enhancing productivity and resilience.

Slamdam technology[9]**:** SNV, in partnership with Zephyr Group and Nelen & Schuurmans (N&S), with additional funding for the LISTEN project from the Embassy of the Kingdom of the Netherlands, has demonstrated the potential of Slamdam, a mobile flood barrier, as a potential for mitigating flood risks. This portable, refillable dam is designed not only to protect local pastoralist communities from flooding but also to serve as a water storage solution for irrigation during periods of drought.

Sustainable Energy for Smallholder Farmers in Ethiopia, Kenya, and Uganda (SEFFA) project: In partnership with GIZ and RVO, and with funding from the IKEA Foundation, SNV's interventions through SEFFA have supported thousands of farmers in Kenya by introducing solar-powered irrigation, cooling, and drying systems in the dairy and horticulture value chains. These efforts aim to enhance the livelihoods of smallholder farming households and agri-businesses, strengthening their resilience to climate change.

Professionalizing the Small-holder Dairy Value Chain INCREASE ('Pro-Dairy') in Zambia, funded by SIDA, is enabling the Dairy Association of Zambia (DAZ) to professionalise dairy production by incorporating climate-resilient dairy practices and modern supply chain management in the dairy value chain. The project promotes green energy-powered irrigation systems for producing pasture and fodder banks while using energy from BIOGAS to heat chicken brooding systems.

Evidence-based research around nexus innovations: Within the regenerative agriculture context, evidence-based research studies are being undertaken to pilot novel climate-resilient innovations to support nexus through participatory community engagement and the provision of innovation funds for scaling up. Adoption of these innovations requires a conducive environment for promotion and access. Through structured stakeholder engagements, SNV is creating a public-private partnership (PPP) platform for dialogue around relevant policies to unlock climate investments around the water-energy-food nexus.

Using slamdam to protect the local pastoralists from flooding.

[9] https://nation.africa/kenya/counties/laikipia/slamdams-the-technology-that-saved-laikipia-from-flooding-4624928

Challenges with implementing nexus approaches

Addressing the challenges of climate change requires a holistic and participatory approach, focusing on changing participants' social behaviours through behaviour change communication strategies. However, climate change itself has become a multifaceted challenge, as outlined below:

- In 2024, the communities around the northern frontiers of Kenya faced increased incidences of flooding, droughts and outbreak of pests such as locusts and army worm. Building resilience to these challenges requires interdepartmental collaborations to put in place early warning systems as part of the community preparedness.
- The fragile context in which the nexus approach is being applied is characterised by natural resource-based conflicts (e.g., water and fodder shortages), which hinder efforts to sensitise communities, expose them to new technologies, and encourage adoption. Integrating peacebuilding into the wider nexus approach is both relevant and crucial.
- The pastoralist communities within these landscapes share resources such as grazing land under a unique and complex tenure system, which presents a great potential for persistent violent conflicts in the absence of functional resource governance institutions.
- Socio-cultural norms, such as cattle rustling being considered a rite of passage among adolescent boys, contribute to insecurity. The promotion of non-traditional value chains, such as poultry and vegetables, which are viewed as livestock forage, is hindering the scaling up of these industries and limiting gender inclusion.
- Policy challenges surrounding investment in water, energy, and market access create disincentives to adopting technologies. This requires advocacy and policy influencing within a multi-stakeholder platform to create an enabling environment for change.

Conclusions and recommendations

The food production sector relies heavily on water and energy resources for production, processing, storage, and preparation. Managing water, energy, and food resources requires a comprehensive, integrated approach that ensures no one is left behind. Sustainable agricultural production practices are becoming increasingly critical, demanding greater efficiency across the entire agri-food system to conserve water and energy. The adoption of climate-resilient water initiatives will enhance these efficiencies.

Promoting a green economy requires investment in green infrastructure, such as slam dams, solar-powered irrigation pumps, and rainwater harvesting at the farm level. Such investments necessitate collaboration among water, food, and energy stakeholders to foster dialogue, learning, and the exchange of best practices. A deeper understanding of the interactive nature of water, energy, and agri-food systems—both spatially and over time—is essential to strengthen resource security and facilitate inter-sectoral, holistic decision-making for long-term sustainability. This requires investing in research and development to validate innovative practices. Sharing these practices through forums will support learning, knowledge dissemination, and scaling up.

The time to act is now. Improving integrated water-energy-agri-food nexus planning is crucial for poverty eradication and climate resilience. We need to shift our mindset and engage with governments and development partners to create an enabling environment that accelerates adoption.


SNV
Impact
that matters