



# Water-Energy-Food Nexus

## SECURING RESOURCES FOR SUSTAINABLE LIVELIHOODS

CTCN works with developing countries to accelerate, develop and transfer technologies for low carbon, climate resilient development.

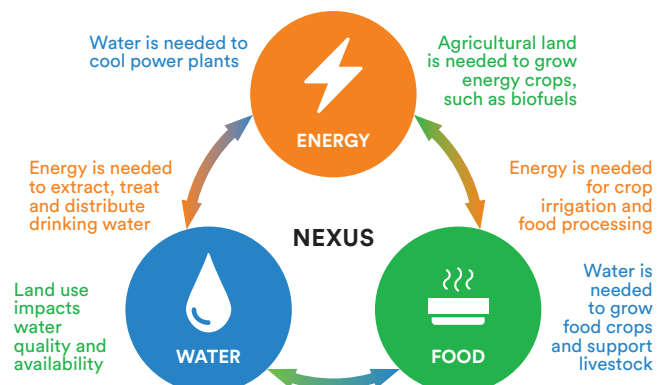
### The water, energy and food ecosystem

With a global population expected to reach 9 billion people by 2050, approaching water, energy and food (WEF) as a nexus with complex relationships is crucial for sustainable climate strategies and solutions.

Climate change is threatening livelihoods by accelerating water scarcity and energy and food insecurity, and contributing to a set of other issues affecting health, people displacement, and peace and security, with women, children and vulnerable communities paying the highest toll.

The WEF nexus approach integrates aspects of the hydrological, biological, social and technological spheres to understand the complex interactions between water, energy, and food production, distribution and consumption.

The approach also helps determine how these interactions are affected by policies and various other factors, and how technology and innovation can enhance efficiency and efficacy.



CTCN case studies, pilot projects, RD&D, and concept notes can be leveraged/are pivotal to attract investments and funds. CTCN collaborates with The Green Climate Fund, The Global Environmental Facility, The Adaptation Fund Climate Innovation Accelerator, and several regional and national development banks, supporting systems transformation in over 30 countries.

# CTCN responds to the water, energy and food needs of developing countries

For over a decade, CTCN has worked with National Designated Entities (NDEs)<sup>1</sup> and over 800 Network members,<sup>2</sup> to provide a range of technical assistance, capacity-building and knowledge-sharing, including:

- ▶ Supporting countries in developing innovative solutions and leveraging energy as a key enabler for sustainable agriculture, increasing crop yields by up to four times,<sup>3</sup> improving water efficiency and expanding post-harvest storage.
- ▶ Developing aggregated agro-processing technologies and trade-related capacities that support agriculture value chains.
- ▶ Boosting the use of renewable energy on smallholder farms to tap into groundwater available in shallow aquifers.
- ▶ Supporting action for national and regional innovation in cooling systems and energy-efficient transportation.
- ▶ Increasing availability, accessibility and affordability of food by developing sustainable and reliable water management strategies for agriculture.
- ▶ Promoting energy efficiency and renewable energy sources to enhance the resilience of food systems and reduce the vulnerability of food production to energy price fluctuations.
- ▶ Mitigating soil degradation by promoting sustainable agricultural practices within the WEF nexus framework, such as conservation agriculture, agroforestry, and integrated soil and water management.
- ▶ Increasing productivity and efficiency in agriculture value chains to minimize agriculture-related deforestation.

In parallel, technical assistance and each intervention work to strengthen National Systems of Innovation<sup>4</sup> (NSI) and digitalization as proven technology enablers.

The WEF nexus approach emphasizes the need for integrated and sustainable management of these systems to build long-term resilience. It also encourages cross-sectoral collaboration, stakeholder engagement and the empowerment of women to find effective solutions to water scarcity, energy inefficiency and food insecurity.

## SLAMDAM: A portable and refillable dam is helping Africa counter rising waters



CTCN is helping countries adapt to the impacts of climate change, including floods, rising seas, extreme temperatures, and storms, by introducing responsive climate technologies.

Weather extremes are expected to become more common as Burundi's climate changes. Because of this, CTCN implemented SLAMDAM: a portable and refillable dam designed to protect Mpanda and its 25,000 residents from flooding while also acting as storage area for water during times of drought. Two people can fill a 100-metre-section of the barrier in an hour by pumping water into it from a nearby lake or river, whereas building a traditional 100-metre flood barrier with sandbags would take 14 people at least 20 hours.

With SLAMDAM the community was able to harness the flood water to plant and irrigate during the dry season, thus enhancing food security for the community. There are plans to scale up the project to cover a larger area and support more communities.

# How CTCN is enabling transformative solutions

A two-pronged approach of facilitating partnerships and knowledge exchange, while supporting the design of policies and solutions for building a resilient **WEF ecosystem**, has helped CTCN deliver tangible changes in achieving national-level energy goals, while supporting the development of relevant national WEF policies, strategies and plans.

By implementing innovative climate adaptation financing mechanisms, and a conducive policy framework for technology regulation and trainings, the approach has enhanced local governments' and communities' use of selected technologies, and has allowed small- and medium-sized farms and enterprises to access sustainable climate technologies. Led by a demand-driven process working with National Designated Entities, CTCN also supports national decision-making, sectoral technology roadmaps, market assessments and feasibility studies to create an enabling environment for climate technology development and transfer.

## Selected examples of CTCN WEF nexus technical assistance, including anticipated country impact

Examples of CTCN technical assistance	Countries	Impacts
Strengthen the National Disaster Management Agency (NDMA) capacity's application of unmanned aerial vehicles (UAVs) and remote sensing technology for vulnerability assessments and response planning	Eswatini	<ul style="list-style-type: none"> <li>• <b>Enhanced capacity</b> of the use of modern technologies such as remote sensing and UAVs for better analysis of agricultural vulnerabilities.</li> <li>• Provision of a foundation course as the basis for more capacity building.</li> </ul>
Cost-benefit Assessment of Mitigation Options in Rice Production: Data compilation, tools and training	Viet Nam	<ul style="list-style-type: none"> <li>• Better integration and <b>upscaling of climate-smart agricultural practices</b>.</li> <li>• <b>Optimized investment</b> portfolios with cost-benefit analysis in line with Nationally Determined Contributions (NDC) implementation.</li> <li>• <b>Enhanced capacity of the government</b> to programme similar investments at scale and mainstream them into agricultural commodity programmes.</li> </ul>
Application of environmental flows and river basin management framework for the Tebicuary River basin	Paraguay	<ul style="list-style-type: none"> <li>• Enhanced management of control of flow, water intake and discharge, resulting in a conserved and resilient environment.</li> <li>• Reduction of the vulnerability to floods by a 20 per cent (affecting over 112,000 people).</li> </ul>
Improvement of water supply management through a server-based Geographical Information System (GIS) for monitoring and control of water loss reduction in Grenada	Grenada	<ul style="list-style-type: none"> <li>• Creation of a server-based GIS for the National Water and Sewerage Authority (NAWASA) – including in-depth training for internal staff.</li> <li>• <b>Creation of enhanced GIS infrastructure layers</b> instrumental for an effective assessment of non-revenue water in selected pilot areas.</li> </ul>
Saline water purification technology at the household level and low-cost durable housing technology for coastal areas	Bangladesh	<ul style="list-style-type: none"> <li>• Enhanced knowledge of the local government and communities on the use of selected technologies.</li> <li>• <b>Improved livelihood</b> for approximately 38 million people living in the rural area of the coastal zone.</li> <li>• Increased access to safe water for coastal communities.</li> </ul>

“The deployment of climate-smart technologies, such as solar pumping irrigation systems, not only addresses food insecurity but also helps to provide opportunities for farmers to farm throughout the year.”

*Christopher B. Kabah, NDE, Environmental Protection Agency of Liberia*

## Inclusive and just WEF production, access and consumption

Working with various constituencies under UNFCCC, including businesses and industry, NGOs, youth, women and indigenous communities, CTCN is closing the technology gap, and ensuring developing countries have access to and reap the benefits of reliable, affordable and sustainable innovation and technology.

Investing in the WEF nexus sets a solid foundation for securing access to sustainable food, water and energy sources, which can trigger a virtuous circle generating an array of socio-economic benefits in the longer term, including improved livelihoods, job creation, better economic growth and national and regional security. This investment also supports entrepreneurship and improvements in gender equality.

# Next-generation WEF

The WEF nexus is critical for all countries to conserve precious and often dwindling resources, such as water and viable soil, in the face of climate impacts, and to transform entire food supply chains to reduce emissions, build resilience, and meet climate and sustainable development goals.

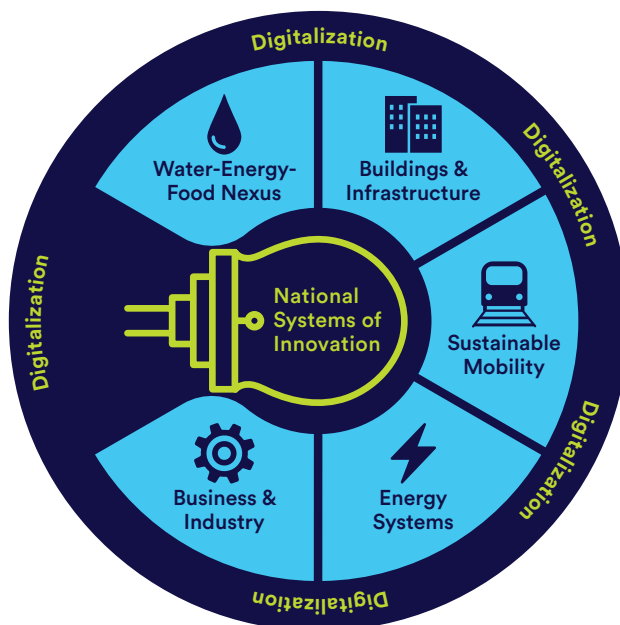
CTCN supports countries in the collection and sharing of data and information, strengthens institutions, and delivers programmatic and multi-country technical assistance. It also harnesses emerging technologies and solutions to maximize synergies across water, energy and food systems, including:

- ▶ Enhanced platforms and tools for collaboration and learning on agri-food technology development and transfer, such as CTCN's new technical assistance in Malawi focusing on using simple mobile technologies for collecting climate data.<sup>1</sup>
- ▶ Supporting the development of relevant national strategies, policies and develop implementation plans.
- ▶ Using digital technologies for the WEF nexus. For example, in Nigeria, CTCN is implementing the Radio-Internet (RANET) climate disruptive technology initiative: harnessing the combined potential of radio and the internet to enhance agricultural resilience.
- ▶ Providing opportunities for integrated planning and management. Examples include the development of flood early warning systems that help farmers to plan accordingly and avoid losses caused by flooding incidents.
- ▶ Designing knowledge transfer and capacity building programmes, such as integrated water resource management, sustainable agriculture and renewable energy technologies. For example, in the Democratic Republic of Congo, CTCN is developing an incubation programme for innovative companies based on climate technologies.
- ▶ Sensor deployment to aid food and crop resilience.
- ▶ Improved water management, accounting, and productivity.

## About CTCN

The Climate Technology Centre and Network (the implementation arm of UNFCCC's Climate Change Technology Mechanism, mandated under the Paris Agreement) provides accelerated development and transfer of environmentally sound technologies for low carbon and climate resilient development at the request of developing countries.

CTCN provides a portfolio of technology solutions, capacity building and advice on policy, legal and regulatory frameworks tailored to the needs of individual countries by harnessing the expertise of a global network of technology companies and institutions. CTCN is hosted by the UN Environment Programme and is headquartered in Copenhagen, Denmark.



<sup>1</sup> NDEs are technology representatives selected by each country's government representing 164 parties to the UNFCCC <https://www.ctc-n.org/about-ctcn/national-designated-entities/national-designated-entities-by-country>

<sup>2</sup> CTCN's Network includes members from national technology and regional climate technology centres; intergovernmental, international, regional or sector organizations; and research, financial, non-governmental, industry, SME and private sector organizations.

<sup>3</sup> <https://www.jstor.org/stable/resrep28389?seq=1> Insert full reference

<sup>4</sup> IPCC defines national systems of innovation (NSI) as: "the set of institutions to create, store and transfer the knowledge, skills and artifacts which define technological opportunities" (Metcalfe, 1995). National systems of innovation reflect a complex mixture of institutions (e.g., financial, legal, scientific and technological and educational), public policies (regarding, e.g., taxation, export/import promotion, science, technology and innovation), and business and social relationships.

<sup>5</sup> Digitalization: Digital technologies impact positively and negatively on greenhouse gas (GHG) emissions through their own carbon footprint, technology application for mitigation, and induced larger social change. Whether the digital revolution will be an enabler or a barrier for decarbonization will ultimately depend on the governance of both digital decarbonization pathways and digitalization in general (medium evidence, high agreement). CTCN will use the approach that positive impacts of digitalization are realized for emission reductions and creation of resilience.

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Become a CTCN member,  
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