

FROM NEEDS TO IMPLEMENTATION:

STORIES FROM THE TECHNOLOGY NEEDS ASSESSMENTS

2025



2025

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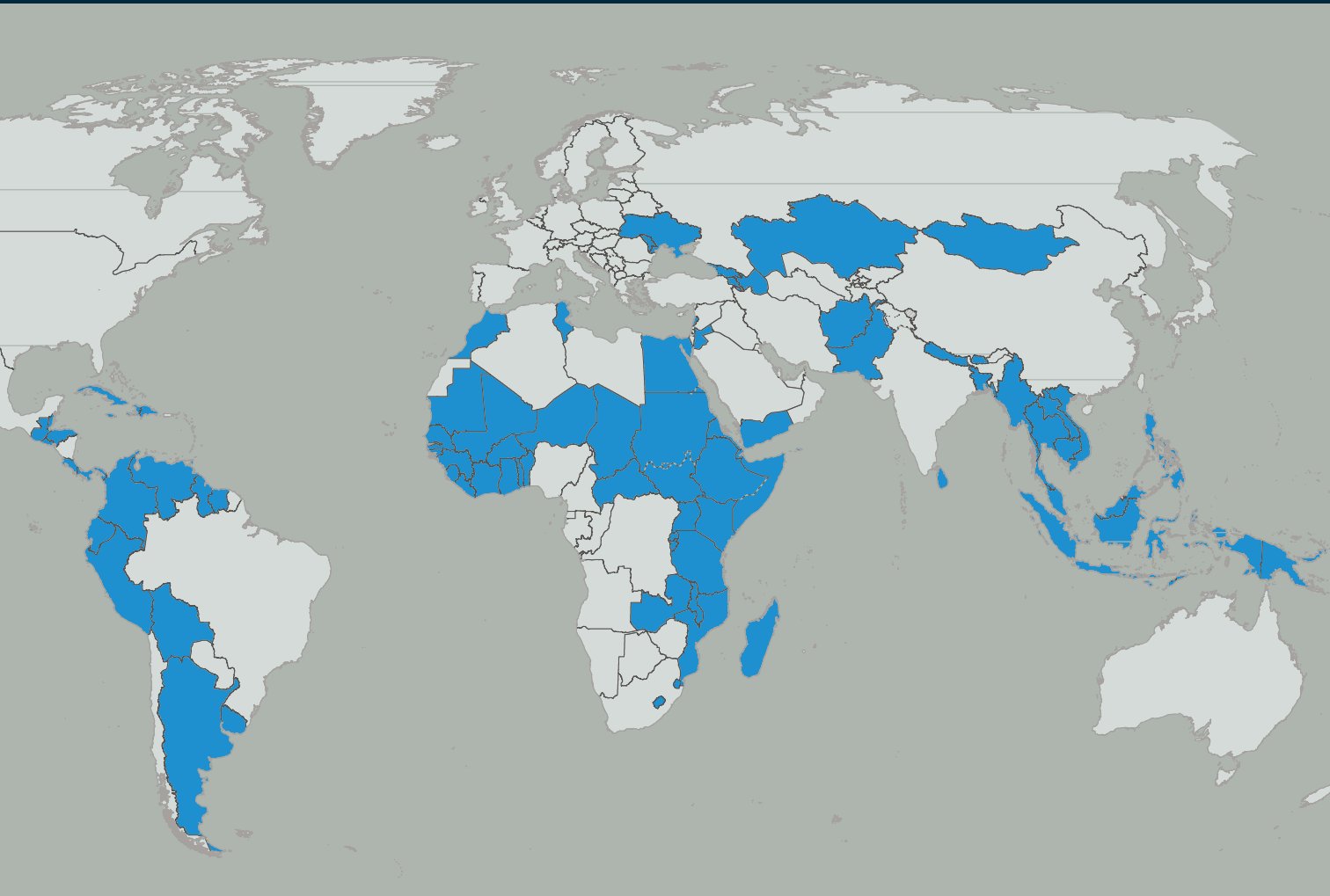


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TECHNOLOGY NEEDS ASSESSMENT



TECHNOLOGY NEEDS ASSESSMENT COUNTRIES

INTRODUCTION

Technology Needs Assessments: Driving Implementation and Unlocking Climate Finance

As the global community gathers for COP30, this brochure showcases how Technology Needs Assessments (TNAs), including Technology Action Plans (TAPs), are delivering real-world impact in developing countries. Implemented by UNEP and executed by UNEP Copenhagen Climate Centre (UNEP CCC), the TNAs have evolved from planning tools into strategic instruments that guide implementation, align national priorities, and mobilize resources. Countries are using TNA results to shape policies, strengthen institutional frameworks, and deploy climate technologies that support both mitigation and adaptation goals.

Crucially, TNA efforts have now triggered nearly USD 3 billion in financing from the Green Climate Fund (GCF), the Global Environment Facility (GEF), and the Adaptation Fund (AF). This reflects growing recognition of TNAs as foundational inputs for climate action and investment. The stories featured here highlight how countries are translating TNA outcomes into tangible progress, demonstrating that targeted technology planning can unlock transformative change and accelerate the path toward resilient, low-carbon development.

Turning Climate Ambition into Action: TNAs as Strategic Tools for NDC Enhancement

TNAs are proving to be essential instruments for translating climate ambition into practical action. Far beyond technical inventories, TNAs help countries identify and prioritize technologies for both mitigation and adaptation, while fostering stakeholder engagement, policy alignment, and resource mobilization. Based on the 64 new NDCs (Nationally Determined Contributions) submitted by 64 Parties to the Paris Agreement, 97% of Parties provided information on technology development and transfer, highlighting their priorities and needs at varying degrees of granularity. 27% of Parties referred to TNAs as a source of information for NDC formulation or as an instrument for advancing NDC implementation. Additionally, 72% of Parties elaborated on technology-related measures focused on adaptation, highlighting the growing relevance of technology planning in national climate strategies.¹

As countries prepare their third-generation NDCs, TNAs are being enhanced to better integrate with national planning processes.

¹ United Nations Framework Convention on Climate Change (UNFCCC) (2025). Nationally determined contributions under the Paris Agreement: Synthesis report by the secretariat (FCCC/PA/CMA/2025/8). <https://unfccc.int/documents/650664>



INTRODUCTION

They support the identification of current and emerging technology needs aligned with sustainable development, ensure selected technologies are feasible and scalable, and enable technology transfer in sectors critical to achieving climate targets.

When strategically aligned, TNAs can maximize their impact by assessing what is needed to implement existing NDCs, aligning sectoral focus with national priorities, and creating synergies with development plans and climate finance strategies. In this way, TNAs become embedded tools for implementation and continuous improvement.

Several countries have demonstrated this integration in their submitted NDC 3.0. For example, Mongolia used its TNA to inform mitigation targets in energy, transport, and forestry. Sri Lanka integrated its TNA priorities into the NDC, aligning it with the National Adaptation Plan (NAP) as well. In its updated NDC, São Tomé and Príncipe incorporated several of the TNA-identified technologies and sectoral priorities. For example, the NDC outlines measures such as construction and maintenance of dams and reservoirs, and integrated watershed management, directly reflecting water-sector technologies from the TNA. Other examples include

Somalia and Vanuatu, who used TNAs to engage communities and set adaptation targets, that were integrated into their NDCs.

Even where TNAs aren't explicitly mentioned, countries like the Maldives are implementing Technology Action Plans that reflect TNA principles. The continued integration of TNAs into the NDC process reflects a maturing approach to climate planning, one that is strategic, inclusive, and focused on implementation.



MITIGATION



ENERGY

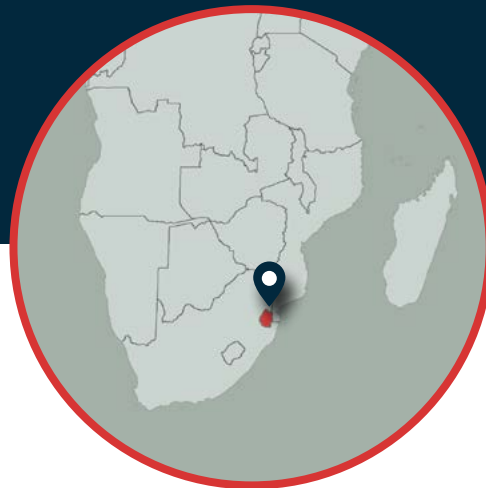
Solar PV



AFRICA

Photo: Unsplash

ESWATINI



Eswatini's 2018 TNA identified solar PV as a priority for climate mitigation. The TNA helped shape Eswatini's NDC and informed its GCF Country Programme, finalized in 2024. This programme outlines a strategic pipeline of climate projects, including solar PV expansion. It also supported Eswatini Bank's efforts to gain GCF accreditation.

As a result Eswatini has set ambitious targets for 13,000 solar home systems and 15,000 institutional installations. These goals contributed to the foundation for a national energy transition, influencing policy, investment, and project development.

In recent years, there has been a solar PV boom in Eswatini. Among the developments are the planned Globeleq-Sturdee 30 MW, a tender for 75 MW capacity, and ongoing construction of the 100 MW Edwaleni Solar Power Station.

Off-grid technology like the Sigcineni Mini-Grid is also expanding rural energy access. As of the 2025 end-year, the wide-scale rollout of small-scale embedded generation across the country is underway, with significant developments confirming the advancements made toward the 37 MW target capacity.

To accelerate solar PV deployment in Eswatini, national, regional, and international sources have allocated financing and project preparation and blended finance have come from Development Bank of Southern Africa, while donors like GET.invest, UNDP, and European governments have supported capacity development and feasibility studies.



ADAPTATION



WATER



AGRICULTURE

Drip Irrigation, Climate Smart Agriculture



Photo: Unsplash

AFRICA

MADAGASCAR

Madagascar completed its TNA in 2018, focusing on agriculture and water resources for adaptation, and energy and industry for mitigation. Extended droughts, floods, and increasingly variable rainfall are being exacerbated by climate change in Madagascar, where over 80% of the population base their livelihoods on agriculture. Issues with food security and widespread hunger between 2018 and 2022 resulted in reaching near-famine proportions. The agriculture sector is the backbone of the economy, generating 43% of GDP, making agriculture a priority area for the country's TNA.

A recently approved GCF project, "Increase Resilience to Climate Change of Smallholders Receiving the Services of the Inclusive Agricultural Value Chains Programme (DEFIS +)", now under implementation by IFAD, addresses the climate change challenges facing the rural population. The project implements adaptation measures to reduce negative climate change impacts of a value of USD 150 million, largely following the TNA's findings and recommendations. The initiative incorporates elements from the TNA, such as optimization of water management and drip irrigation; adoption of landscape conservation techniques; technical and



financial support for risk management; adoption of adapted farming techniques and stress-tolerant varieties; rehabilitation of irrigation infrastructure; and diffusion of drainage systems.

The DEFIS+ initiative strengthens the climate resilience of over 447,000 smallholder farmers in Madagascar, with indirect benefits reaching 3.5 million rural residents. The project enhances food security, income stability, and environmental sustainability in vulnerable farming communities.



ADAPTATION AGRICULTURE

Climate Information Services



Photo: Unsplash

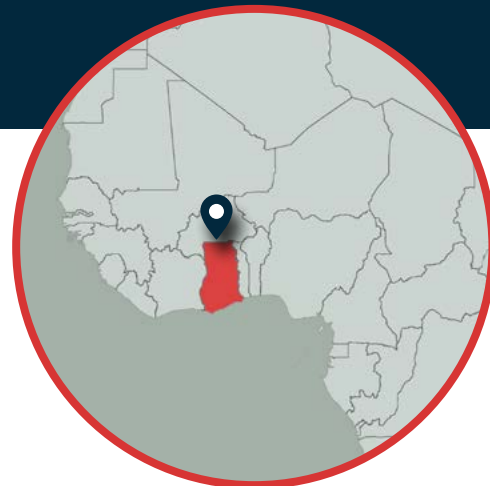
AFRICA

GHANA

Ghana faces increasing climate risks, including erratic rainfall, prolonged droughts, and flooding, particularly in northern regions. These challenges threaten agriculture, water security, and livelihoods. Through strategic planning and international support, Ghana is advancing climate-resilient development, prioritizing adaptation, mitigation, and sustainable growth in its national climate policies.

Ghana's 2013 TNA, focusing on agriculture and water sectors, helped develop a strategic foundation for identifying climate technologies aligned with national development goals, provided a roadmap for translating national climate strategies into actionable, fundable projects, and also contributed to the country's NDC. Technologies prioritised in the 2013 TNA included integrated nutrient management, community-based extension services, and rainwater harvesting systems, all aimed at empowering rural communities and enhancing adaptive capacity.

Most recently, in July 2025, a new USD 70 million project was approved by the Green Climate Fund to serve more than 3.6 million people, particularly smallholder farmers in climate-vulnerable regions, promoting sustainable agriculture, water resource management, and ecosystem restoration.



The project focuses on strengthening climate information services, promoting and implementing climate-resilient agricultural practices, restoring degraded landscapes to reduce vulnerability to droughts and floods, facilitating smallholder farmers' access to finance, and enhancing local knowledge and awareness of climate risks and adaptive practices to support long-term adoption.

In 2025, Ghana rejoined the Global TNA project using the country's GEF STAR allocation. This will be used to update the earlier TNA and pave the way for further accelerating technology implementation.



ADAPTATION **COASTAL ZONES**

**Rock Revetments and
Coconut Tree Planting**

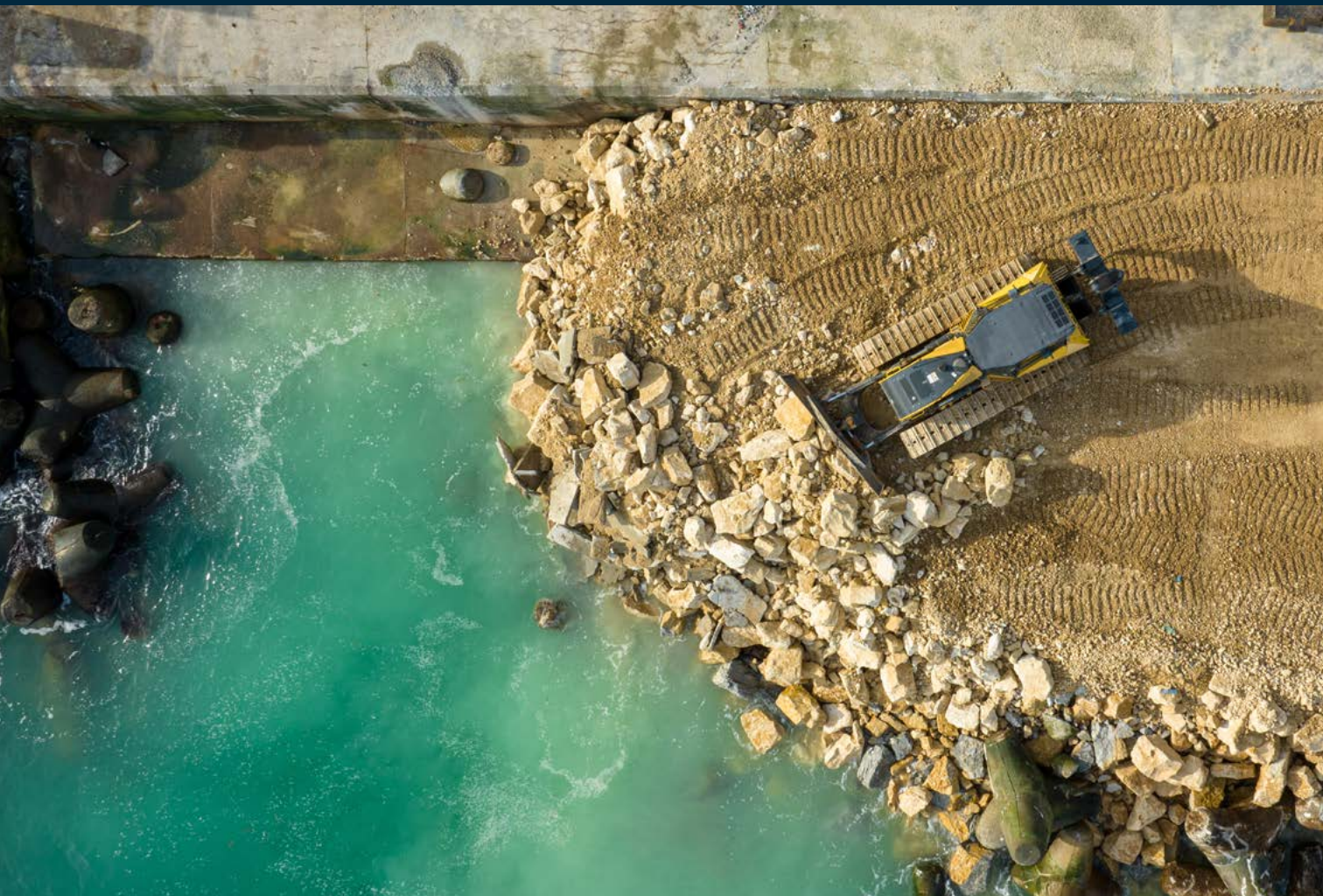


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AFRICA

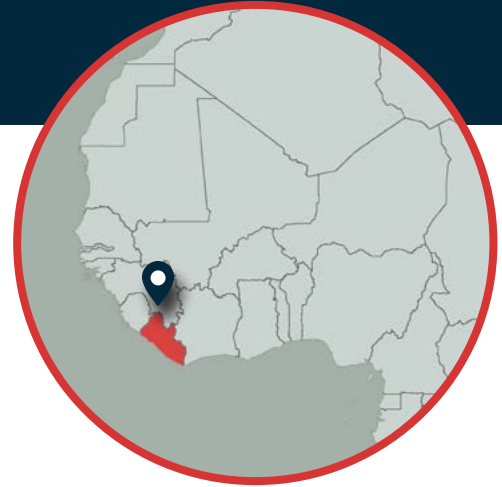
LIBERIA

Sixty percent of Liberia's population lives along the coast and depends heavily on climate-sensitive sectors such as farming and fishing. The country's 580-kilometer coastline faces increasing threats from sea-level rise, coastal erosion, and storm surges. These impacts severely affect food security, as traditional farming seasons become unpredictable, while rising seas and erosion threaten infrastructure and livelihoods in coastal communities.

Liberia completed its TNA and TAPs in 2023, focusing on agriculture and coastal zones for adaptation, and energy for mitigation. Among the adaptation options, coastal revetment was prioritized to protect against climate-induced erosion and flooding. A combination of rock revetments and coconut tree planting was identified as a suitable solution, supported by the availability of ideal rock quarries. Beyond protection, revetment construction also creates jobs and coastal habitats for wildlife.

Building on TNA recommendations, Liberia has launched coastal protection projects, most recently in Greenville, Sinoe County.

The USD 20 million project, including a USD 9 million GEF grant, "Enhancing the Resilience of Vulnerable Coastal Communities in Sinoe County of



Liberia" is making significant strides in protecting communities from climate change impacts. It reduces vulnerability to sea-level rise and erosion through hybrid solutions, strengthens local planning capacity, introduces innovative technologies for early warning, and promotes diversified, climate-resilient livelihoods. Over 560,000 people are directly benefiting from improved resilience, income stability, and environmental protection.



ADAPTATION



MITIGATION

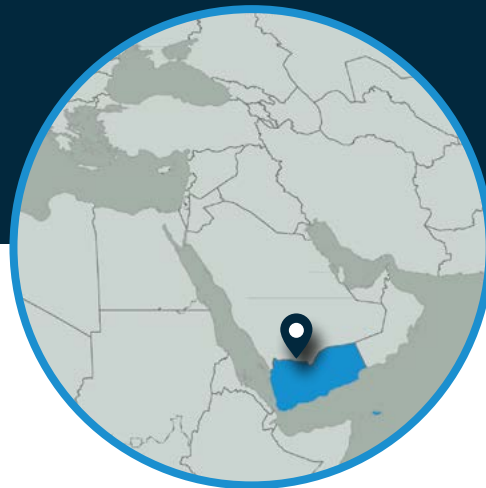
Linking the TNA with
National Processes



Photo: AdobeStock

ASIA & PACIFIC

YEMEN



Yemen faces extreme climate challenges, from water scarcity to food insecurity, economic weakness, and displacement, all of which can accelerate political instability. However, Yemen's TNA outlines concrete pathways to emissions reductions and climate resilience through targeted technological solutions. Completed in 2024, Yemen's TNA underscores how climate technology can be a lifeline in highly vulnerable contexts.

Developed with broad stakeholder engagement, the TNA has become integral to shaping Yemen's climate plans and programmes, including the Climate Finance and Capacity Programme (CFCP 2025 - 2030), new NDC, and forthcoming Long-Term Low Emission Development Strategy (LT-LEDS). In parallel with, and informed by, its TNA process, Yemen developed its GCF country programme, which was approved in late 2024. This enabled funding to be allocated to the most efficient and prioritised technologies in Yemen. The TNA process has thus contributed to a cohesive, long-term framework for Yemen's climate response across these plans.

For example, the CFCP utilizes the TNA to match financial resources with key technologies, such as desalination and renewable energy, essential for

resilience in water-scarce regions and recommended adaptation technologies, as well as the other selected technologies in priority sectors. In Yemen's NDC 3.0 and forthcoming LT-LEDS, the TNA adds specificity to emission-reduction strategies by promoting renewable energy and sustainable practices in line with economic recovery and development pathways.



ADAPTATION



WATER



AGRICULTURE



**PUBLIC
HEALTH**



**COASTAL
ZONES**

**Climate Information and
Early Warning Systems**

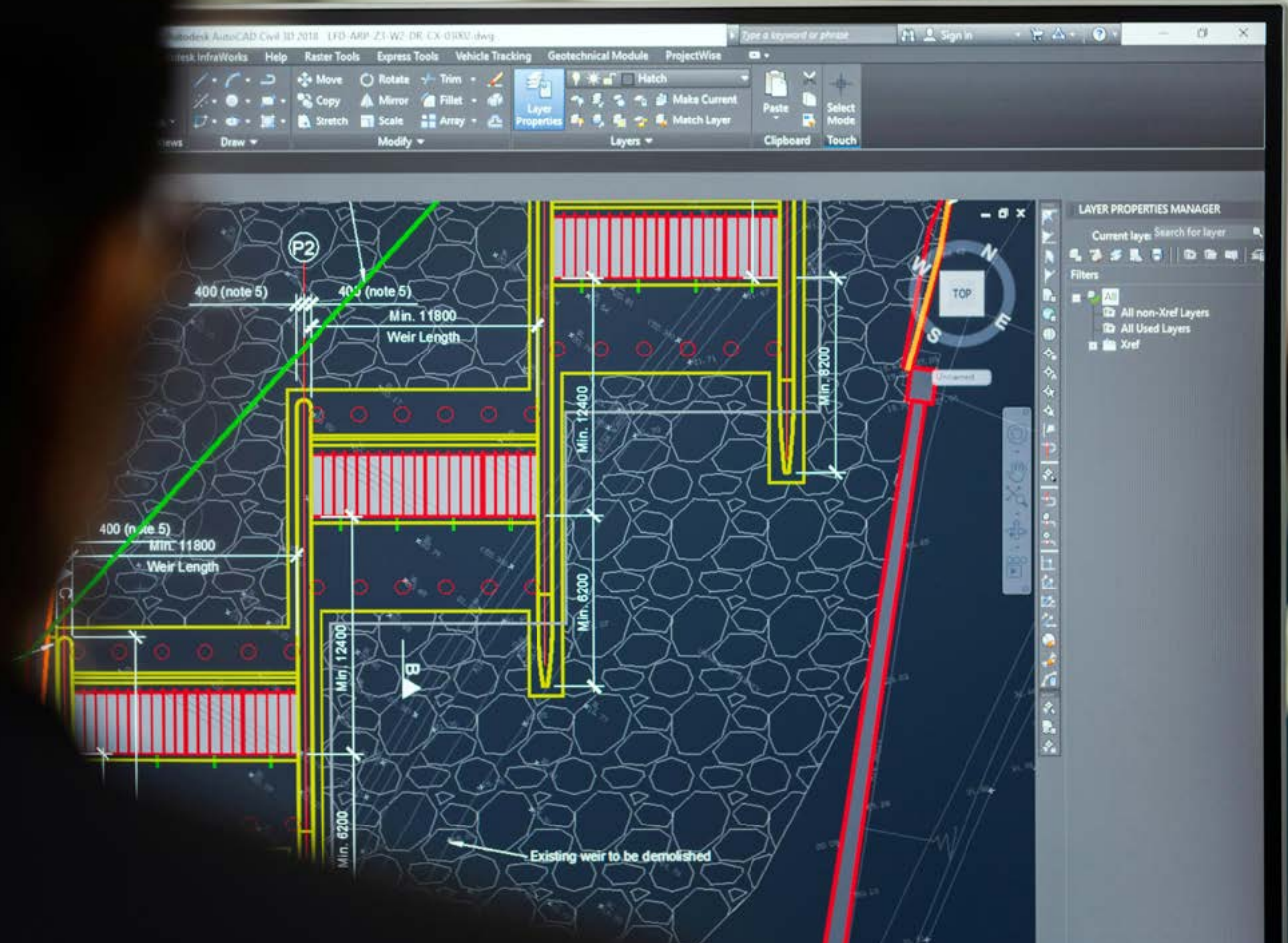
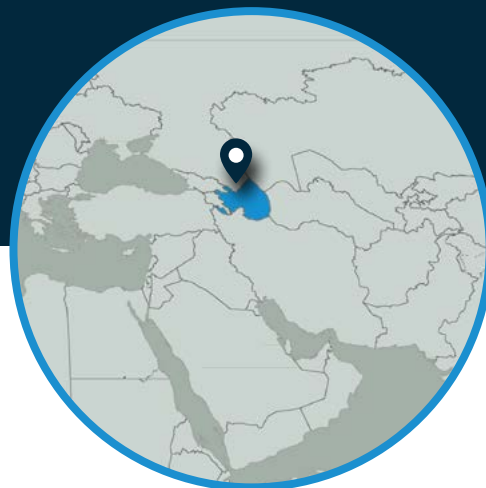


Photo: Pexels

ASIA & PACIFIC

AZERBAIJAN



In recent years Azerbaijan has increasingly faced extreme weather events, ranging from water stress and heatwaves to extreme rainfall, floods, and landslides. In 2024, the capital city, Baku, experienced heavy rains and widespread flooding, highlighting the urgent need for strengthened adaptation and warning mechanisms.

Limited access to usable climate information and early warning systems remains a critical challenge, with implications for agriculture, water management, coastal zones, and public health. Addressing this gap is essential for safeguarding communities and sustaining the country's socio-economic stability.

In its 2012 TNA and TAPs, Azerbaijan proposed the establishment of monitoring and early warning systems to improve scientific understanding of rainfall patterns, enhance adaptive foresight, and to protect vulnerable populations in flood-prone areas. Building on the foundations laid by the TNA and TAPs, Azerbaijan launched a USD 35 million GCF-supported and UNEP-led project in mid-2025 aimed at strengthening climate information and multi-hazard early warning systems for increased resilience. This six-year, USD 35 million initiative enhances Azerbaijan's resilience to climate hazards

by modernizing its climate information services and early warning systems. It directly benefits 5.7 million people and indirectly reaches 3.6 million more. The project introduces impact-based forecasting, climate shock-responsive social protection, and forecast-based financing, shifting from reactive to proactive disaster risk reduction

In parallel with this initiative, Azerbaijan re-joined the Global TNA project using the country's GEF STAR allocation. This will allow for updating the country's earlier assessment, identify new and relevant climate technologies, and support the implementation of its NDC.



ADAPTATION



AGRICULTURE



FOREST



WATER

**Early Warning Systems and
Disaster Impact Reduction**

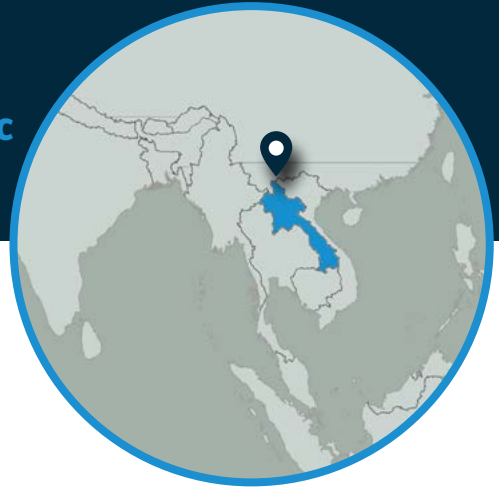


Photo: AdobeStock

ASIA & PACIFIC

LAO

PEOPLE'S DEMOCRATIC REPUBLIC



Lao PDR is increasingly vulnerable to climate change, facing intensified floods, forest fires, and extreme rainfall. The country is advancing ecosystem-based adaptation and transparency systems to strengthen resilience, reduce emissions, and support evidence-based climate action under its national commitments. Lao PDR's 2018 TNA outlined a strategic foundation for climate action by identifying priority technologies in agriculture, water, forestry, and disaster resilience sectors. These priorities are now being advanced by the GCF's regional project "Collaborative Research and Business Development Programme for Promoting the Innovation of Climate Technopreneurship in Southeast Asia". The project will mobilize over USD 221 million of funding to target five Southeast Asian countries namely Cambodia, Indonesia, Lao PDR, the Philippines, and Viet Nam.

The project funds the development of a regional climate technology incubation and acceleration platform, responding to the TNA's call for stronger enabling environments and institutional capacity. By establishing national innovation systems and supporting local entrepreneurs, the project supports Lao PDR's shift from planning to action, delivering fit-for-purpose climate technologies to where they are needed most.

Lao PDR's TAP for adaptation prioritizes early warning systems and disaster impact reduction. Support for start-ups and SMEs enables scaling of local technologies like mobile alerts and insurance products. The TAP also promotes climate-resilient agriculture, driving innovations suited to rural areas, such as crop diversification and livestock disease management. In its mitigation TAP, Lao PDR identified protected area management and sustainable community forest management. These priorities are also reflected in the GCF project, which will support digital tools for participatory land use planning, biodiversity monitoring, as well as other technologies that aid in upholding the country's low-carbon development goals.



ADAPTATION



WATER



AGRICULTURE

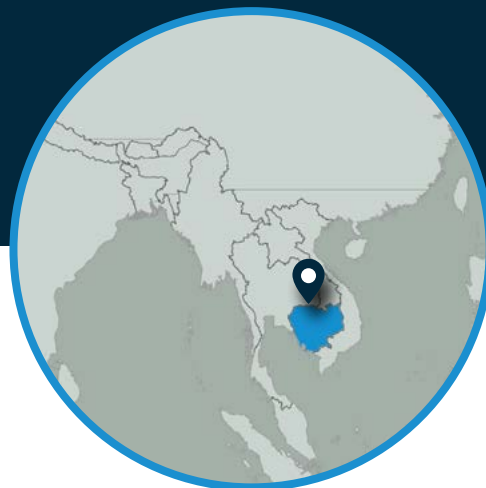
Irrigation Systems



Photo: Unsplash

ASIA & PACIFIC

CAMBODIA



Cambodia is facing mounting challenges from increasingly severe and unpredictable floods alongside prolonged droughts. Subsistence farmers cultivating staple crops such as rice are among the most vulnerable, already contending with the impacts of extreme heat. Projections suggest that climate change could reduce Cambodia's GDP by nearly 10% by 2050, underscoring the urgent need for robust adaptation strategies.

With more than 76% of the population living in rural areas and heavily reliant on rain-fed agriculture, climate-resilient irrigation technologies have become essential for safeguarding livelihoods, underscoring the pivotal role of water resources in strengthening both agricultural productivity and national climate resilience.

Cambodia first TNA (2013) outlined actionable measures and recommendations to support the adoption of climate-resilient technologies in the water sector. Since then, the country has made significant progress in transforming these recommendations into concrete projects.

Building in part on the findings of the TNA, the country established the Climate Adaptive Irrigation and Sustainable Agriculture for Resilience (CAISAR)

project. CAISAR represents a USD 240 million investment supported by the GCF, the Asian Infrastructure Investment Bank (AIIB), and the International Fund for Agricultural Development (IFAD). The project aims to modernize irrigation systems, promote sustainable farming practices, and strengthen institutional capacity to manage climate risks.

CAISAR's overarching goal is to make Cambodia's agriculture sector both climate-resilient and sustainable. It will provide farmers with energy- and water-efficient technologies, timely weather and climate information and early warning systems to enhance the country's ability to anticipate and respond to climate threats. The project is expected to directly benefit approximately 1.7 million Cambodians, significantly enhancing the resilience of smallholder farmers.



ADAPTATION COASTAL ZONES

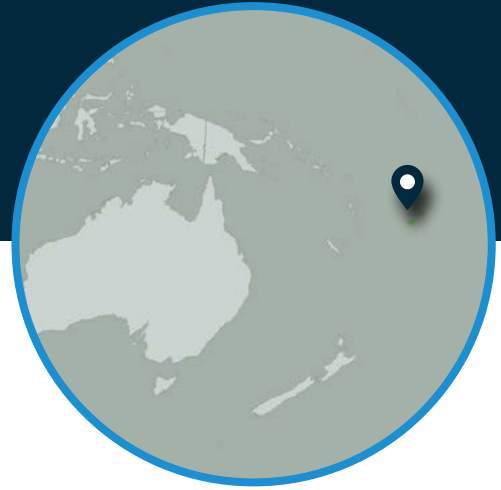
Nature-Based Seawalls



Photo: Unsplash

ASIA & PACIFIC

FIJI



The implications of climate change can already today be felt in the Fiji archipelago, with rising temperatures and increased severity of extreme weather events like cyclones, which threaten its low-lying islands and coastal communities. Fiji is experiencing rising temperatures, more intense tropical cyclones, and sea-level rise, leading to coastal flooding, salt-water intrusion, and displacement of communities.

Fiji's 2024 TNA and TAPs identified coastal protection as a top priority for adaptation. Among the technologies assessed, ecosystem-based approaches like mangrove restoration and nature-based seawalls stood out for their sustainability, cost-effectiveness, and alignment with community values.

The findings of the TNA directly influenced the design and implementation of a new project "Strengthening the Adaptive Capacity of Coastal Communities of Fiji to Climate Change through Nature-Based Seawalls". The project, approved in 2024 and funded by USD 5.7 million from the Adaptation Fund, integrates traditional engineering with natural buffers, using locally sourced materials and community labour to construct seawalls that mimic and enhance natural coastal defences. The project enhances resilience in six vulnerable

villages. By combining traditional knowledge and nature-based engineering, it protects shorelines, improves livelihoods, and directly benefits about 2,500 people through sustainable, community-led climate adaptation, and is expected to indirectly benefit around 30,000 people, around 3.2% of total population in Fiji.

By drawing on the TNA's prioritization of ecosystem-based technologies, the project ensures that adaptation is not only technically sound but also socially inclusive and environmentally sustainable. It empowers communities to take ownership of their resilience, while preserving biodiversity and cultural heritage.



ADAPTATION AGRICULTURE

Caterpillar Tunnels



Photo: AdobeStock

CARIBBEAN

TRINIDAD & TOBAGO



Trinidad and Tobago, a Small Island Developing State, faces rising climate risks including coastal erosion, ecosystem degradation, and water stress. With high emissions from energy and industry, its TNA and TAPs from 2022 prioritizes low-carbon solutions and resilient infrastructure, aligning with national goals for sustainable development and global climate commitments.

Trinidad and Tobago's agriculture sector faces rising climate threats erratic rainfall, droughts, flooding, and saltwater intrusion. Small-scale farmers are especially vulnerable, with declining yields and water scarcity. The TNA emphasize climate-smart agriculture, pressurized irrigation systems, and data-driven planning to safeguard food security and rural livelihoods amid intensifying climate impacts

The TNA findings were reflected in the country's NAP, which incorporated protective agriculture and efficient irrigation systems as strategic interventions under the Agriculture and Food Security Adaptation Pathway. The NAP emphasized the importance of technology transfer and innovation as tools for achieving the country's adaptation vision of strengthening resilience across vulnerable sectors. Further building on this, the project "Strengthening the Evidential Basis for the Adoption of Adaptation Tech-

nologies for Smallholder Farmers" was approved by the GCF in 2025 under its Readiness Programme. With USD 1.5 million in grant funding and implementation by the Food and Agriculture Organisation (FAO), the initiative promotes climate-resilient agriculture through protected systems like caterpillar tunnels and integrated irrigation. It develops technical designs for Climate-Resilient Production Units (CRPUs), monitors performance, and builds farmer capacity, especially among women, youth, and Indigenous groups, while engaging the private sector to support sustainable financing and technology adoption. The project will generate further evidence on the viability and benefits of climate-resilient agricultural technologies, supporting a GCF Concept Note to mobilize investment for national-scale adoption.

THE GLOBAL TECHNOLOGY NEEDS ASSESSMENTS PROJECT, PARTICIPATING COUNTRIES

2009-2013

34 COUNTRIES

Africa and Middle East: Ivory Coast, Ghana, Kenya, Lebanon, Mali, Mauritius, Morocco, Rwanda, Senegal, Sudan, Zambia

Asia and CIS: Azerbaijan, Bangladesh, Bhutan, Cambodia, Georgia, Indonesia, Kazakhstan, Lao PDR, Moldova, Mongolia, Nepal, Sri Lanka, Thailand, Vietnam

Latin America and Caribbean: Argentina, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Peru

2015-2018

24 COUNTRIES

Africa and Middle East: Burkina Faso, Burundi, Egypt, Eswatini, Gambia, Jordan, Madagascar, Mauritania, Mozambique, Seychelles, Tanzania, Togo, Tunisia

Asia and CIS: Armenia, Kazakhstan, Lao PDR, Pakistan, Philippines

Latin America and Caribbean: Belize, Grenada, Guyana, Honduras, Panama, Uruguay

2018-2022

22 COUNTRIES

Africa: Benin, Central African Republic, Chad, Djibouti, Guinea, Niger, Liberia, Malawi, São Tome and Principe, Uganda

Eastern Europe: Ukraine

Asia and Pacific: Afghanistan, Fiji, Myanmar, Nauru, Vanuatu

Caribbean: Antigua & Barbuda, Dominica, Haiti, Jamaica, Suriname, Trinidad & Tobago

2020-2023

17 COUNTRIES

Africa: Comoros Union, Ethiopia, Guinea-Bissau, Lesotho, Somalia, South Sudan

Asia and Pacific: Kiribati, Maldives, Niue, Papua New Guinea, Solomon Islands, Timor-Leste, Tonga, Tuvalu, Yemen

Caribbean: Bahamas, St. Kitts & Nevis

2025-2027

17 COUNTRIES

Africa: Côte d'Ivoire, Eritrea, Ghana, Mali, Morocco, Senegal, Sierra Leone, Tunisia

Asia and Pacific: Azerbaijan, Bahrain, Cook Islands, Federated States of Micronesia, Mongolia, Philippines, Thailand

Latin America: Peru, Venezuela



This is the fifth set of country stories from the TNA project. Learn more by reading previous stories, which are available on the **TNA website.**



More information about the global Technology Needs Assessment Project can be found at: tech-action.unepccc.org

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TNA TECHNOLOGY NEEDS ASSESSMENT

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