FROM NEEDS TO IMPLEMENTATION:

# STORIES FROM THE TECHNOLOGY NEEDS ASSESSMENTS

2023

TNA TECHNOLOGY NEEDS ASSESSMENT

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**2023**

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TECHNOLOGY NEEDS ASSESSMENT

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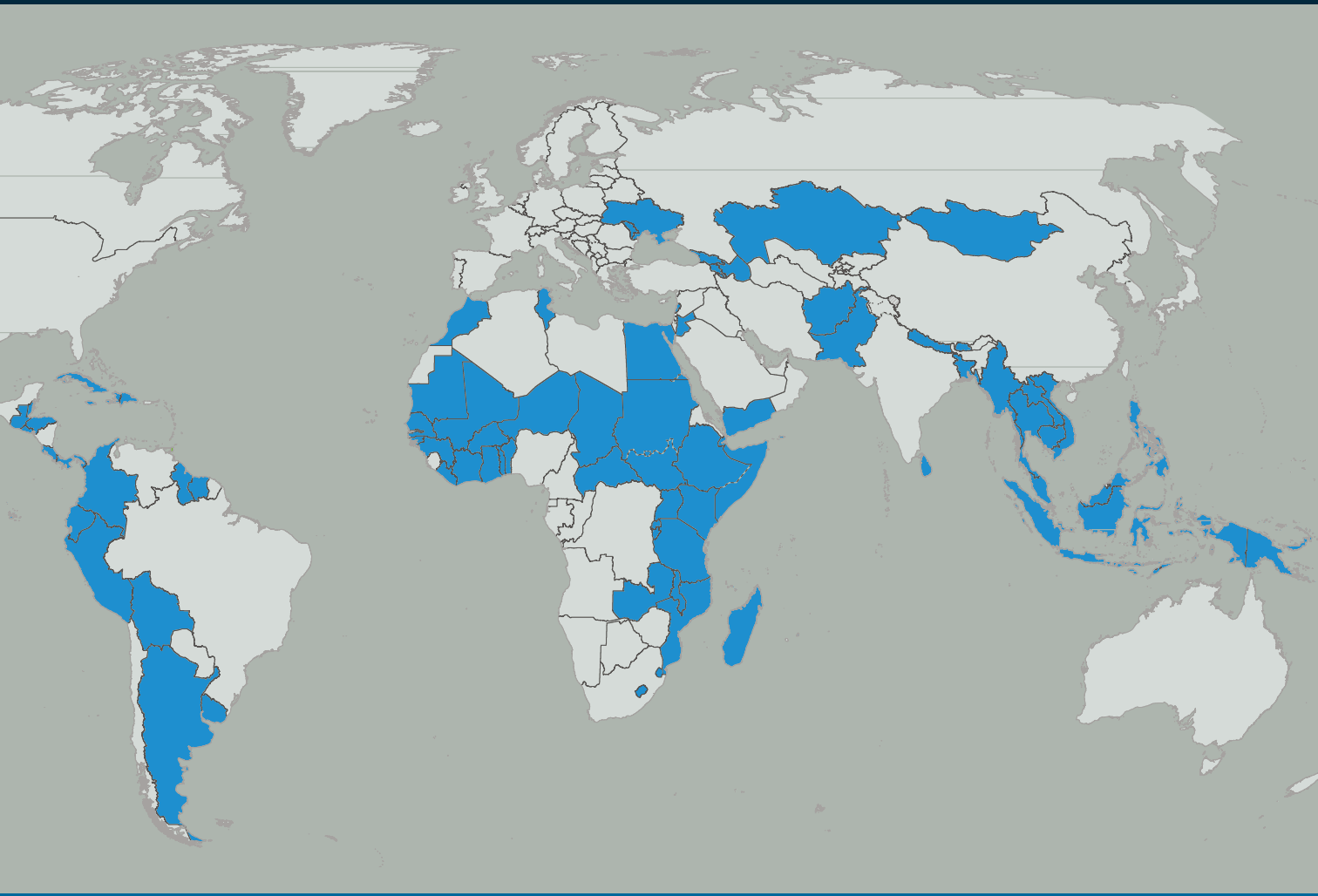
TNA TECHNOLOGY NEEDS ASSESSMENT



# TECHNOLOGY NEEDS ASSESSMENT COUNTRIES

# INTRODUCTION

Innovative climate technologies are of paramount necessity for our global efforts to respond to the climate crisis. Their significance has been acknowledged for decades, culminating in the adoption of the Technology Framework under Article 10 of the Paris Agreement. The Framework officially recognises the integral role of climate technologies in developing sound national climate plans.

As the impacts of climate change become increasingly visible across the globe, enhancing cooperative action on technology development and transfer becomes even more important. Further, this decade will be significantly shaped by the outcomes of the first ever Global Stocktake – to be completed in 2023. Being a fundamental component of the Paris Agreement, the two-year process strives to raise global climate ambitions by assessing the collective response to the climate crisis. The Global Stocktake will provide clear information on: where the global community stands in its progress on climate action; where countries are collectively making progress – and where they are not. The Global Stocktake is designed to inform Parties regarding updating and enhancing their climate actions, including through their revised NDCs, ultimately striving to raise climate action.

Starting in 2009, UNEP and the UNEP Copenhagen Climate Centre (previously UNEP DTU Partnership), in close collaboration with the UNFCCC Secretariat, have led the implementation of the Global Technology Needs Assessment (TNA) project. The project is funded by the Global Environment Facility (GEF) and has guided to date around 100 countries in identifying and assessing climate technology deployment pathways, providing them with measures to mitigate and adapt to the global challenge of climate change. Through the TNA process, national TNA teams develop their TNAs and Technology Action Plans (TAPs) for priority sectors, outlining challenges for key technologies as well as pathways for their successful deployment and uptake. The process guides them towards the implementation of their Nationally Determined Contributions (NDCs) to the Paris Agreement, along with achievement of the Sustainable Development Goals (SDGs), as well as other nationally set targets

Building on the success of more than a decade of TNAs, UNEP and UNEP-CCC have started to engage with interested countries and the GEF to jointly develop a fifth TNA phase. TNA V builds on the four previous phases, and will target two groups of countries: countries that have already conducted a TNA

Photo: Shutterstock

# INTRODUCTION

in an early phase and now requires updating, and countries that have not yet conducted TNAs.

TNA V will support a mix of countries, comprising LDCs, middle-income and high-income countries, including a number of SIDS. Common to all is that they have expressed in their NDCs, National Communications or national climate strategies the need for external support to conduct technology transfer in a consistent manner, or a need to update the earlier TNA to take account of new issues and developments. With TNA V, the TNA process will be further enhanced and updated, providing greater linkage to recent additions to the climate change architecture, especially NDCs, Net-Zero and Long-Term Strategies, Transformational Change, as well as providing a more flexible approach for the participating countries with different starting points.

The following pages showcase how TNAs and TAPs have played a role to drive climate action beyond the duration of the TNA project. The stories illustrate how countries have used the results of the TNA process as a foundation both to scale-up and implement action on climate technologies to meet their national emission reduction targets, and to build resilience against climate-change related risks. The stories also highlight how the participatory and collaborating approach of the TNA can lead to identifying synergies of ongoing climate technology projects, increasing project implementation, national climate action and improving livelihoods.

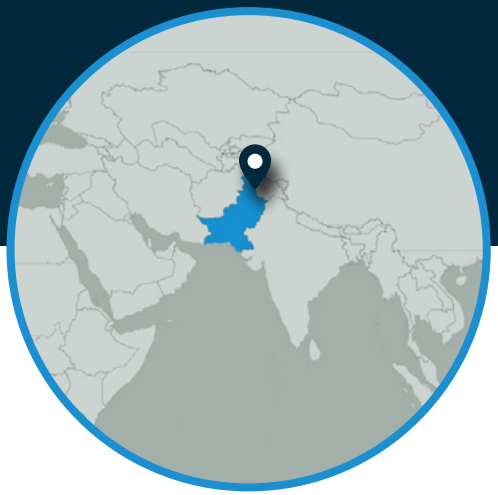
MITIGATION TRANSPORT

Bus rapid transit (BRT) system.

Photo: Daniel Lerman, Unsplash

# ASIA

# PAKISTAN



Pakistan has the highest rate of urbanization in South Asia. In 2017, 36.4% of the population lived in cities. By 2025 this number is expected to reach 50%. However, unplanned and unmanaged urban growth is often accompanied by the formation of slums, environmental degradation and poverty. Taking this into account, Pakistan completed its TNA in 2017, with the ambition to pave the way for GHG emission reductions and for the Government of Pakistan to draw up a comprehensive National Climate Change Mitigation Technology Development Programme. Given the climate and environmental challenges associated with rapid urban growth, Pakistan, in their TNA, focused on the transport sector, and in particular on Bus Rapid Transport (BRT). This is in line with the Pakistan Vision 2025, targeting provision of access to safe, affordable, accessible, and sustainable transport systems for all. Building on the TNA and the TAP, the Government of Pakistan has received financial support totaling USD 583 million to implement a BRT system in Karachi, Pakistan's main urban hub. The project is funded with 49 million from the Green Climate Fund (GCF) and USD 534 million from the Asian Development Bank.

The current public transportation system in Karachi fails to provide mobility for all and is characterized by long commuter trip times, and the rise of private vehicle ownership and paratransit modes, leading to higher emissions and rising air pollution. The project aims to establish a 30 kilometre, rapid transit (BRT) system, fully separated from other transport modes, and operated with the "world's first" biomethane hybrid bus fleet. The project includes innovative features such as a dedicated biogas plant covering 100% of the fuel demand and the last-mile connectivity via bikes and e-pedicabs and includes flood proofing of the entire system.

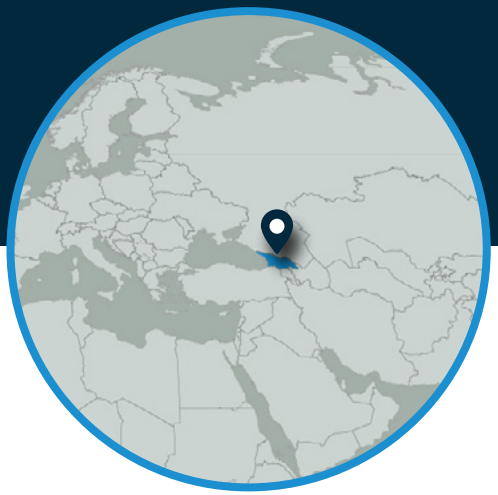
ADAPTATION FORESTRY

Early warning systems

Photo: Karsten Winegeart, Unsplash

ASIA

# GEORGIA



With forests covering more than 40% of the country´s surface, Georgia is considered a richly forested county. However, wildfires have had devastating impacts on forests, destroying entire ecosystems. In 2017, a massive wildfire broke out in the Borjomi - Kharagauli National Park, raging for more than a month. In addition, the region's mountainous landscape, coupled with extended periods of drought, favours soil erosion and landslides. With ongoing climate change, the risk of frequently occurring extreme weather events such as heatwaves and heavy rainfalls increases in the area, posing a significant risk to the Caucasus republic. Recognizing the importance of Georgia´s agriculture, forestry, and land use sector, the TNA identified early warning systems to build resilience and to strengthen disaster response capacities as a vital climate technology for the country. Taking these recommendations into account, Georgia received funding from the CTCN to develop an integrated monitoring and early warning forest fires detection system in the Borjomi - Kharagauli National Park. Preservation of forests contributes to the significant reduction of Greenhouse Gas (GHG) removal towards improvement of the resilience of ecosystems to climate change while minimizes the impact of extreme weather phenomena such as flooding.

The development of a site-specific fire monitoring policy will allow local populations with high risks of exposure to forest-fire hazards to take appropriate actions to avoid or reduce risks and to prepare effective responses. The early warning and integrated monitoring systems will also establish procedures to inform the populations living close by and define an evacuation plan. Finally, it is expected that the early warning system will enable more efficient management of future forest fires and avoid the destruction of forest lands, as well as the resultant unexpected GHG emissions.

ADAPTATION

WATER

# Localization of water resources management technology

Photo: Anne-Lin, Unsplash

## ASIA

# VIET NAM

With its long low-lying landscape and stretching coastline, Viet Nam´s economic and social development is severely affected by the implications of climate change. It has therefore become an imperative objective of the Vietnamese government to respond to this immense challenge. In order to address the country's growing need to adapt to climate-related threats, Viet Nam completed its TNA already in 2012. The TNA enabled the nation to identify the significant advantages of strengthening the resilience of key sectors and lowering GHG emissions, as well as determining areas for improved ecosystem management. For the water sector, the government prioritized the improved management of river basins as a key technology to adapt to climate change. Here, a roadmap outlined pathways to improve skills and capacity, along with suggestions for potential project sites for improved river-basin management. Appreciating the results of the TNA, the government finalized water-resource management plans for the major river basins in the country, including the Hong-Thai Binh. The river basin is of great importance for Viet Nam, in terms of agriculture, food production, drinking water, transport, etc., as it covers 25 provinces with a population of 29 million people. In 2021 funding was received from the CTCN for technical assistance to further select and customize technologies that can provide science-based information on river water flow in the basin. The science-based information provided by the selected and customized technologies will contribute to more accurate, integrated planning for water-resource management in the Hong-Thai Binh River basin, enhancing Viet Nam's capacity to address water-related climate change risks and improving capacity for flood monitoring and warning.

The project will contribute to the country's updated NDC's adaptation component, amongst others identifying improving adaptation efficiency through strengthening state management and resources and enhancing resilience and adaptive capacity of communities, economic sectors, and ecosystems, as national targets.

MITIGATION TRANSPORT

# Technology Roadmap for E-mobility Ecosystem

Photo: Vouchlim Ton, Unsplash

## ASIA

# CAMBODIA

Due to economic growth and an increase in the number of vehicles, GHG emissions from the Cambodian transport sector have been rising dramatically in recent years.

The country´s transport sector currently accounts for over 50% of the total energy-related emissions.

As part of its TNA, Cambodia recognized this challenge already in 2013. The transport sector was identified, among others, as a priority for climate-change mitigation, selecting energy-efficient mass transport and improved vehicle emission standards as key climate technologies. Here, the TNA named the often-limited technical capacities and a lack of targeted policies and regulatory frameworks as key barriers to the improvement of the status quo. The findings of the TNA later informed the country's Intended Nationally Determined Contribution (INDC) and Biennial Update Report (BUR), striving to reduce GHG emissions by implementing and further adoption of these technologies.

In order to reduce transport related emissions, a number of frameworks and policies have already been developed, striving to ramp up climate action.

In 2021, the Cambodian government obtained USD 224,000 from the GCF to develop a Climate Technology Deployment Roadmap for E-mobility Ecosystem in Cambodia, striving to further support the countries ambitions. The project is paving the way for reducing emissions in the transport sector by identifying and consulting with relevant stakeholders to develop a roadmap, setting out long-term policy and technology goals and actions. The project is designed to benefit government entities such as the Ministry of Public Works and Transport, and Ministry of Mines and Energy, by providing them with overarching guidance in transitioning to an e-mobility ecosystem. Ultimately, the roadmap is envisaged to contribute to providing better urban transport options and reducing air pollution.

ADAPTATION WATER AGRICULTURE

Flood control and irrigation technologies

Photo: Flowdzine Creativity, Unsplash

# ASIA

# THAILAND

Over the past decades, Thailand has made remarkable progress in terms of social and economic development. This, however, has increased pressure on the country´s ecosystems services e.g., river systems and wetlands. Meanwhile, climate change events of drought and floods are hitting the country more severely and frequently, impacting water resources in terms of water capacity and quality. This is especially challenging as river basins, such as the Great Chao Phraya River Basin Area, are of great significance for Thailand's agricultural sector, employing over 50% of the population.

In its TNA, Thailand identified the agriculture and water sector as key priorities, particularly highlighting the cross-sectoral linkages. Several actions and recommendations were proposed for the sectors to strengthen climate resilience by the means of improved water infrastructure management, early warning systems and improved climate data collection. The results are directly referenced in the NDC.

Further, the Thai government approached the GCF and UNDP to develop a project that brings the recommendation of the TNA towards implementation. As a result, a co-financed project was established, aiming to improve water management, food security, and the agricultural livelihoods of inhabitants in the Yom and Nam sub-river basins, including the Great Chao Phraya River Basin Area. The project has a volume of USD 33.9 million and is grant financed by the GCF (USD 17.5 million) and UNDP (USD 16.3 million). Over the course of the years 2023 - 2027, the project aims to improve water management by integrating ecosystem-based adaptation 'green' measures with 'traditional' grey infrastructure for flood control and irrigation, supported by enhanced technology and climate-informed planning and capacity development. Once fully implemented in 2027, the project will benefit some 25 million inhabitants of the Greater Chao Phraya River Basin, who live within or downstream of the project area.

MITIGATION

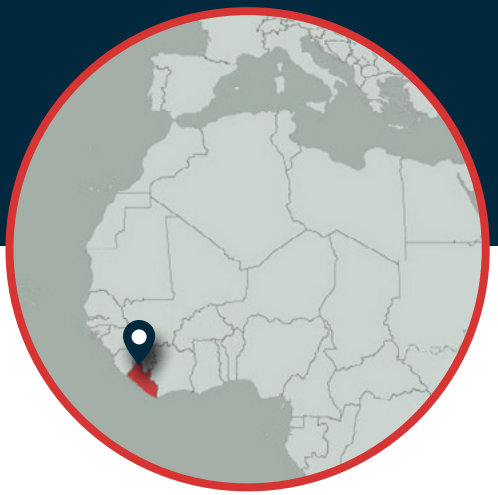
ENERGY

# Development of a renewable energy investment framework

Photo: Shutterstock

## AFRICA

# LIBERIA



Liberia, belongs to the group of Least Developed Countries. Agriculture represents one of the country's most important sectors, employing approximately 70% of the population. Its dependency on the production of agricultural goods makes Liberia highly vulnerable to the impacts of climate change, as increasingly frequent extreme weather scenarios threaten the livelihoods of millions. However, the significant availability of biomass generated by the sector, in combination with other technologies, can also provide measures to reduce CO2 emissions. Taking these synergies into account, Liberia completed its TNA in 2022, prioritizing among other technologies sustainable agriculture practices and the increased deployment of renewable energy facilities.

Following the recommendations of Liberia's TNA, the GCF is currently funding a Readiness project with approximately USD 600,000 supporting the development of a renewable energy investment framework to increase the share of renewable energy-based electricity generation to achieve Liberia's NDC commitments. In its NDC, Liberia pledged to generate 30% of its energy from renewable energy sources by 2030. The renewable energy investment framework will support the country in developing financially sound investment opportunities to meet these targets. Liberia estimates that a total of 100 MW of renewable energy generation (solar, biomass and small hydro) and investments of about USD 242 million will need to be made by independent power producers to achieve the national climate change and energy targets. The investment framework will therefore help to support the development of policy, regulatory, and investment frameworks, as well as procedures to translate the nation's renewable energy programmes into action.

ADAPTATION WATER

# Rainwater harvesting

Photo: Shutterstock

## AFRICA

# MOZAMBIQUE

Climate change in Mozambique threatens the country on several fronts, for example causing soil erosion and floods, as heavy storms and severe droughts hit the country on a yearly basis. The impacts of these extreme weather events are particularly challenging for the agricultural sector that employs more than 80% of the economically active population, most of whom are subsistence smallholders. Among the climate change events in Mozambique, drought is the most devastating due to its high intensity and frequency.

The effect of drought on the agriculture sector is exacerbated by the limited availability of water for crop irrigation and livestock watering. Consequently, Mozambique identified, in its TNA from 2018, conservation agriculture and rainwater harvesting as key priority technologies for adaptation in the agriculture sector. The TNA proposed a project to scale up these technologies by smallholders in arid and semi-arid areas. Both technologies have the potential to improve agricultural production and benefit a large portion of the population in Mozambique, as they can strengthen resilience in communities that are particularly vulnerable to drought. Developed in parallel and informed by the findings of the TNA, Mozambique developed a comprehensive water-sector action plan in 2018, aiming to increase water storage capacity. To supplement the work under the TNA project and to assist the national government, the CTCN is currently supporting Mozambique to further explore various rainwater harvesting technologies through technical assessments of applicability and effectiveness, as well as through cost-benefit analyses.

Once fully implemented, the project will help drought-prone regions to better access scarce water resources, supporting vulnerable communities living in southern and inland Mozambique.

The next step is gaining access for international climate funds to implement the technologies identified and prioritized in the TNA.

ADAPTATION COASTAL ZONES

# Adaptation Plan for the Havana Coastal Zone

Photo: Mauro Lima, Unsplash

## LATIN AMERICA & THE CARIBBEAN

# CUBA

In 2013, Cuba completed its TNA, putting a special focus on climate resilience in the coastal zones. This is particularly pressing, as Havana, Cuba´s capital and biggest urban area, is expected to face severe climate-related challenges in the future. The area houses 37% of the population within 208 km2; the highest population density in the country.

The Havana Coastal Zone is located in a region that is most frequently hit by hurricanes of different categories and cold fronts of varying intensities.

The degree of exposure and sensitivity of this area to climate-change impacts makes it highly vulnerable to sea-level rise and to extreme weather events. To face and adapt to these climate-change impacts, Cuba's TNA proposed the revision and improvement of the housing planning above sea-level. The TAP formulated a demonstration project to construct twenty climate-resilient houses in the coastal town of Troya, to be built from sustainable materials, paving the way for climate-resilient houses in future residential construction projects along the coast.

Building on the TNA, the GCF has supported the development of an adaptation plan for the Havana Coastal Zone in 2021. The project complements the ongoing implementation of the State Plan for Facing Climate Change "Tarea Vida" and aims to formulate a climate adaptation plan for the area, which incorporates the medium- and long-term climate risks and specific vulnerabilities. It also integrates adaptation measures and investment decisions into the development-planning process with the involvement of key national and local stakeholders.

The project involves areas from Bajos de Santa Ana, in Playa municipality, to Rincón de Guanabo, in Habana del Este.

MITIGATION TRANSPORT

Battery Electric Vehicle (BEV)

The transportation sector is the second largest emitter of greenhouse gases in Antigua and Barbuda with around 55,000 vehicles registered to a population of approximately 100,000. Most of these vehicles are inefficient, foreign-used vehicles. In 2021, the Government of Antigua and Barbuda submitted its revised NDC to the UNFCCC which included the conditional target to transition from Internal Combustion Engine (ICE) vehicles to Electric Vehicles (EVs) with an indicative start date to restrict the import of new ICE vehicles in 2025 and complete transition of the government fleet to electric vehicles by 2035.

Antigua and Barbuda completed its TNA in 2023, with transportation as one of the target sectors, prioritizing electric vehicles. In parallel with, and building on, the TNA, the Department of Environment started the transition to EVs through innovative projects such as the Italian Electric School Bus Project.

The Electric School Bus Pilot Project funded by the Government of Italy, purchased two electric school buses to be used in the Antigua and Barbuda School Bus System. The project aimed to gather information on

Photo: Leslie Von Pless/Environmental Defense Fund

# LATIN AMERICA & THE CARIBBEAN

# ANTIGUA & BARBUDA

the applicability of electric buses in Antigua in preparation for scale-up projects, to reduce greenhouse gas emissions and build local capacity on the operation and maintenance of EVs. Both buses were delivered in 2020 and integrated into the school bus fleet.

Following the Electric School Bus Pilot Project, the Government with the support of the UNEP and GEF began the implementation of the Sustainable Low-Emission Island Mobility Project, funded by a USD 3.2 million GEF grant and USD 9.7 million in co-financing by the Government. The project is being implemented between 2021-2025 and aims at facilitating the uptake of low-emission vehicular transportation systems. Major project components include piloting EVs in the public transport sector, building an EV charging network supported by grid-interactive renewable energy, and developing the needed policy to support a sustainable EV transition.

As part of the recently completed TNA, closely related to the EV transition, a concept was developed to address the "just transition of the workforce" through Technical and Vocational Education and Training (TVET). This would form a crucial component of the country's programme to implement its NDC by facilitating the adaptation of the workforce as industries evolve to address climate change.

Currently, there is a limited number of skilled, certified technical workers in Antigua and Barbuda in several important areas, including the electric vehicle and electrical sectors. These priority sectors thus have a projected high demand for TVET-level qualified personnel. Moreover, in Antigua and Barbuda, these sectors are traditionally dominated by men, and the TVET programme will focus on addressing this gender disparity to diversify the workforce.

Through this proposed TVET initiative, specifically targeting crucial climate-technology related skills, the Government seeks to address issues of capacity building and gender responsiveness. This would put Antigua and Barbuda in alignment with the just transition process and NDC targets for the transformation of the current and future workforce to adjust to the energy transition, increase female inclusion in the energy and construction sectors and facilitate the deployment of back-up renewable energy systems.

TNA TECHNOLOGY NEEDS ASSESSMENT

## 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

**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/**

**More information about the global Technology Needs Assessment process under the UNFCCC can be found at: unfccc.int/ttclear/**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TNA TECHNOLOGY NEEDS ASSESSMENT

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