

FROM NEEDS TO IMPLEMENTATION:

STORIES FROM THE TECHNOLOGY NEEDS ASSESSMENTS

2019



TNA TECHNOLOGY
NEEDS
ASSESSMENT

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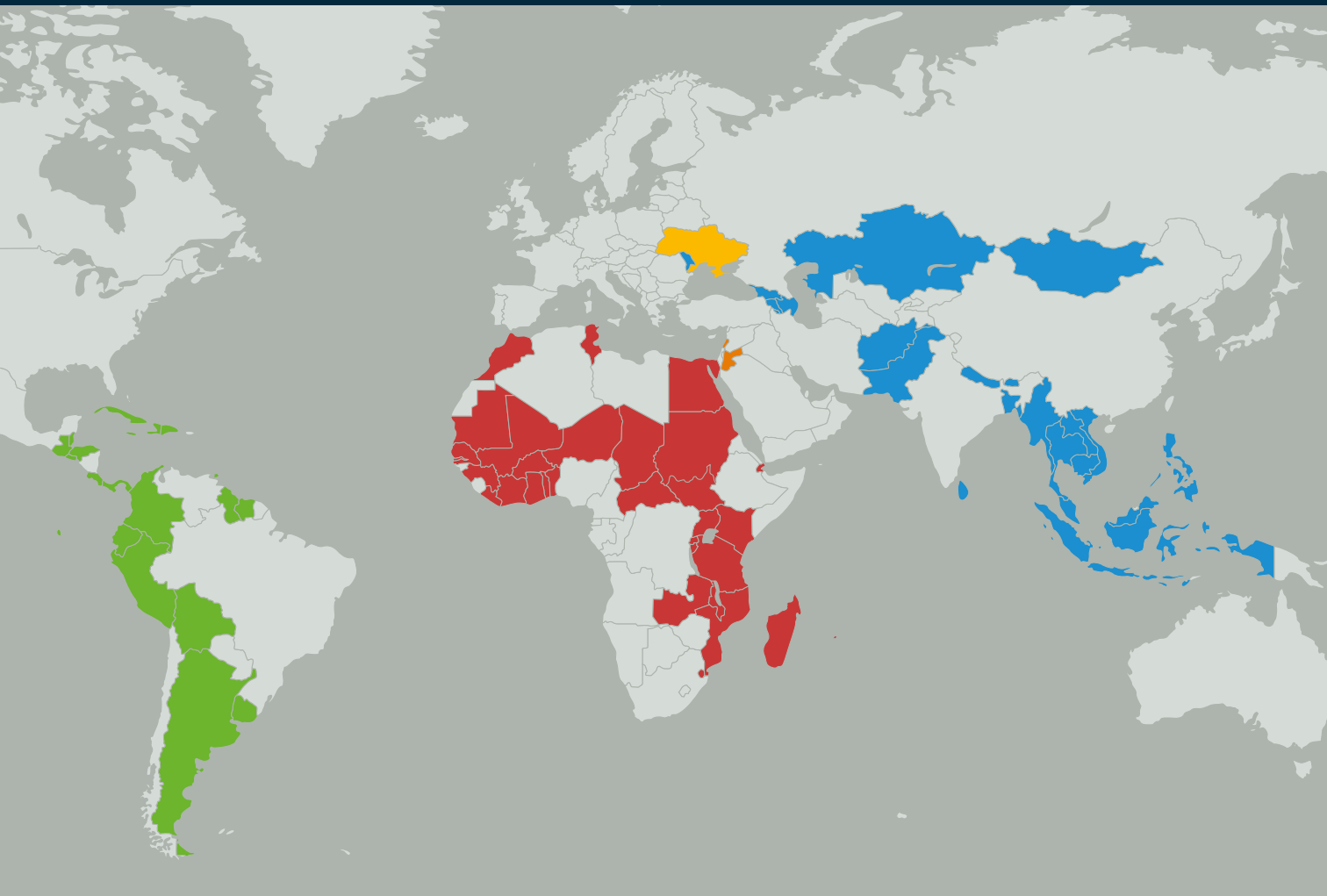


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INTRODUCTION

Enhancing the development, transfer, deployment and dissemination of technology is a key pillar of the international response to climate change. Technology Needs Assessments (TNAs) were strongly emphasized in the Paris Agreement, and they also play a central role under the ‘implementation’ theme of the newly agreed UNFCCC Technology Framework, which provides overarching guidance to the Technology Mechanism of the UNFCCC, itself comprised of the Technology Executive Committee and the Climate Technology Centre and Network. Henceforth, enhanced support to developing countries in conducting and implementing effective TNAs and implementing Technology Action Plans (TAPs) is instrumental to enhancing implementation of the Paris Agreement.

With funding from the Global Environment Facility, UN Environment, through the UNEP DTU Partnership, supports developing countries in developing their TNAs and TAPs within the global Technology Needs Assessment project.

Embedding the TNA and TAP results in existing sector and other ongoing plans and activities, such as those related to the Nationally Determined Contributions (NDCs), are of paramount importance to enhance the options for the implementation of these processes. Thanks to the information that TNAs pro-

vide about the potential, ability and scale of climate change technologies, they can play a unique role in the formulation and implementation of NDCs. Actions identified in the TAPs highlight what needs to be done to activate robust market systems and the enabling conditions for technology transfer, diffusion and uptake. These actions can in turn strengthen longer-term strategies elaborated in NDCs and national adaptation plans (NAPs), as well as potentially increasing ambitions by making the means of implementation more concrete.

Building on two previous publications, this publication provides a new set of success stories on how countries have used their TNAs and TAPs to advance the implementation of climate technologies. It provides examples from different regions and covers different sectors. The stories highlight how TNAs are used by developing countries as a highly practical tool that provides an effective and solid foundation upon which they can both scale up and implement action on climate technologies in their efforts to pursue the targets they agreed under the Paris Agreement, as well as in reaching their national Sustainable Development Goals.



ADAPTATION



AGRICULTURE



WATER

TECHNOLOGY:

Early Warning and Forecasting System



Photo: Djigiarov (Flickr.com)

AFRICA

GHANA



Climate change is threatening Ghana's growth by affecting some of its key economic sectors, such as agriculture, tourism and energy. Climate scenarios project a continuous increase in the impacts of climate change, which, left unabated, may have severe repercussions for rural livelihoods and the economy as a whole. As agricultural production in Ghana is predominantly rain-fed, changes in rainfall patterns are having a serious impact on the country's productivity and economy. The changing climate has deepened rural vulnerability and increased land degradation and desertification.

One consequence of the new and changed weather patterns induced by climate change was that the existing information and early warning systems in Ghana turned out to be insufficient due to poor baseline information and data inputs on which to develop appropriate institutional and government responses to changes in rainfall patterns. In 2013, the agricultural and water sectors were prioritized as focus areas for Ghana's TNA. Moreover, both sectors recognized an 'Integrated Climate Monitoring and Early Warning System' as a key priority technology for the country to increase its resilience to climate change.

On the basis of the TNA, Ghana then went ahead and prepared a readiness proposal to the Green Climate Fund, which was subsequently approved.

The aim of the readiness proposal is thus to strengthen Ghana's capacity to build an early warning system for droughts based on existing knowledge and capacity in the country. This will increase Ghana's capacity to adapt to climate change and increased climate variability within the agriculture and water sectors. Building this capacity will facilitate future interventions that will have positive impacts on organizations and stakeholders involved in dry-season management, including local farmers.

In addition, the readiness funds will also be used to develop both a road map and a Green Climate Fund Concept note proposing how this initiative can be scaled up further in order to facilitate future implementation and access to financing.



ADAPTATION



MITIGATION



AGRICULTURE



FORESTRY



WATER

TECHNOLOGY: Wetland Protection,
Conservation Agriculture, Agroforestry
and Livestock Selective Breeding



Photo: Torben Pedersen

AFRICA

ESWATINI



Eswatini is among the smaller African nations. Landlocked between South Africa and Mozambique, it has a population of around 1.3 million people. Agriculture is the backbone of the economy, with livestock prevalent. Climate change-induced dry spells and erratic rainfall patterns are affecting crop production in the country. Most farmers are dependent on rainfall for crop production and are therefore vulnerable to reduced rainfall. Eswatini's water and forestry sectors also face a number of challenges, with wetlands being drained for farms or roads, and pressure being placed on the environment through the clearing of indigenous forests due to the need of space for an increasing population.

Based on the recommendations from Eswatini's TAPs for mitigation and adaptation, technologies of wetland protection, conservation agriculture, agroforestry and livestock selective breeding were integrated into the Eco-Lubombo Biosphere project under the auspices of UNESCO. As part of the Lubombo Biosphere project, Eswatini is implementing a National Wetland Policy, free-range chickens as part of a Lubombo Eco-trails program, and an agroforestry program to supply households with fruit and indigenous trees. Eswatini is currently preparing to

package the different components of the Eco-Lubombo project under a Green Climate Fund proposal for further implementation of these actions.

Eswatini also included its TNA results in its Green Climate Fund 'country readiness report', which contributed to the country being given a grant under the Green Climate readiness Fund. The country also built on its TNA in a successful application to the Africa Climate Fund for a project with a value of USD 1.35 million.

The TNA also provided input into the development of the country's NDC report, and all the technologies prioritized by the TNA were included in the NDC.



MITIGATION

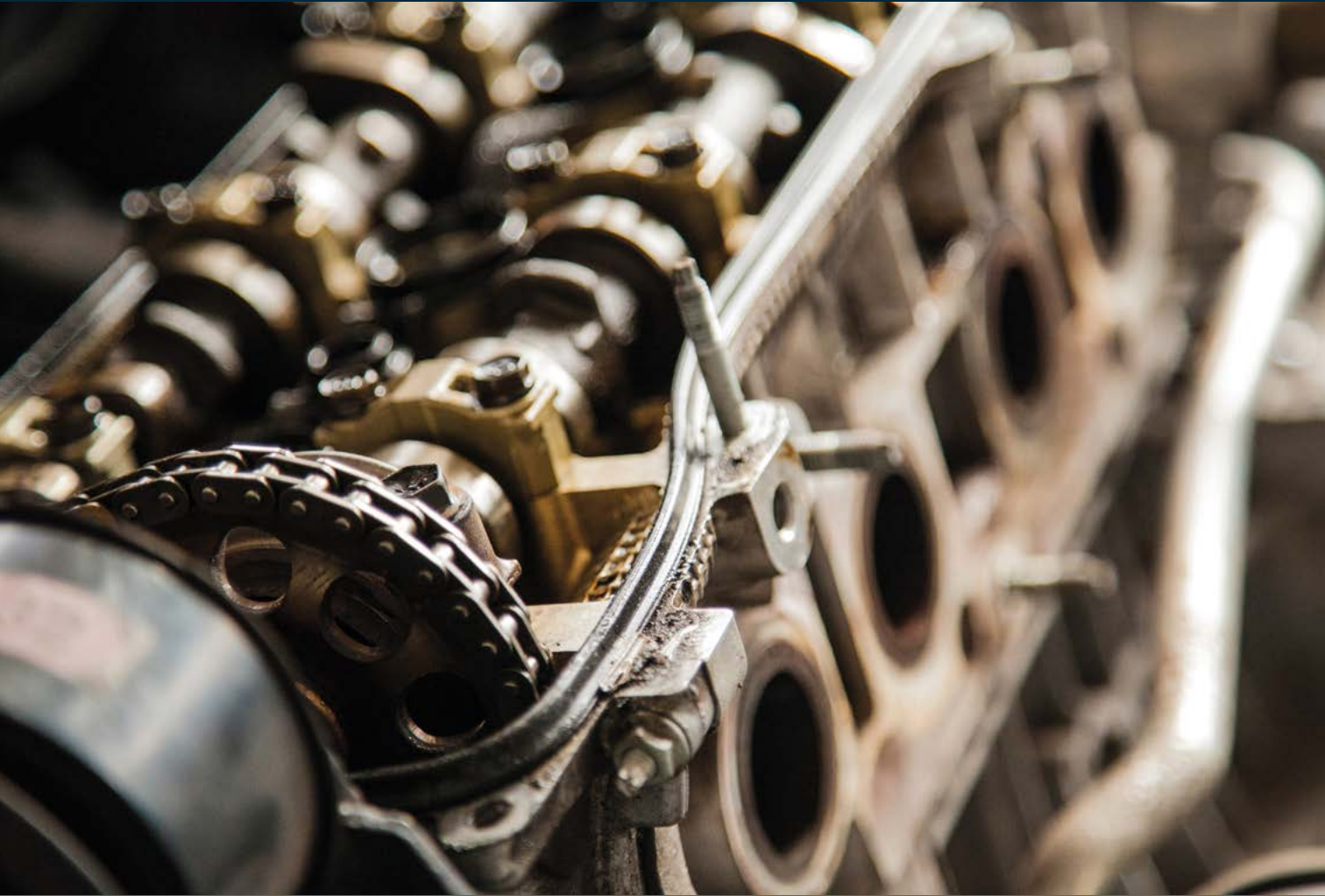


TRANSPORT



ENERGY

TECHNOLOGY:
Hybrid Cars and
High Performance Engines



AFRICA

Photo: Garrett Mizunaka

TUNISIA



The transport sector in Tunisia is a large contributor to the country's GHG emissions. According to the 2012 GHG emissions inventory, the sector accounts for 23.9% of GHG emissions attributable to energy. It is estimated that this figure will increase considerably in the following years given the steady increase in the number of vehicles in Tunisia, which reached two million in 2016, especially passenger cars.

Tunisia's TNA prioritized the technology of hybrid vehicles, in particular fully hybrid vehicles, because of its relevance to the Tunisian context. First, this technology has significant potential for reducing emissions, especially since the traffic in Tunisian cities is characterized by braking and stopping, which considerably increases fuel consumption and CO₂ emissions compared to a conventional vehicle. Secondly, it does not require huge investments since a special infrastructure does not need to be created. In addition, Tunisia has emphasized the environmental and social co-benefits of the technology, such as the reduction in pollution and noise levels in urban areas, which would have a visible impact on the health of its inhabitants. Hybrid cars are currently not on the market in Tunisia because of a lack of approved standards and the very low knowledge

of the technology. Tunisia's TNA laid down the goal of introducing hybrid cars into the Tunisian market by putting in place the appropriate regulatory and legal framework and by building the capacity of relevant stakeholders. Following the TNA project, the Tunisian government, acting outside any international cooperation, introduced a national program in support of hybrid cars.

In addition, together with a team from the United for Efficiency (U4E) initiative, Tunisia is exploring how to elaborate another TAP on 'High Performance Engines' for the energy industry sector into a concept note that will be presented to the Green Climate Fund in order to access Tunisia's readiness funds.



MITIGATION



ENERGY

TECHNOLOGY: Renewable Energy
and Energy Storage Technologies



Photo: Dana Smilie/World Bank

LATIN AMERICA

URUGUAY



Uruguay is pursuing a path towards diversified and low-carbon sustainable energy mixes. More than 92% of the country's electricity generation already comes from renewable energy sources, resulting in low national emissions from the energy sector in relation to the country's Gross Domestic Product when compared to the global average. Yet, Uruguay faces continuous growth in future electricity demand, covering which in a sustainable way is a key challenge for the country's economic and environmental goals.

Wind and solar energy are the main renewable sources of energy currently being used on a large scale in Uruguay. Nevertheless, the country's TNA identifies wave, geothermal and concentrated solar power as alternative avenues to be explored, since the expansion of wind and solar energy is limited to the capacity of the system to adapt to fluctuations in these resources.

After completing its TNA, Uruguay therefore requested follow-up technical assistance from the CTCN to develop road maps for geothermal energy, energy storage technologies, wave energy and concentrated solar power, the primary objective being to mitigate domestic GHG emissions. Moreover, eco-

nomical, environmental, social and cultural co-benefits will also come from the road maps, including decreased dependence on oil and fluctuations in fossil-fuel prices, potential job creation and the promotion of a culture of sustainable development among the population. In addition, gender-related topics will be addressed in the road maps, resulting among other things in achieving a gender balance in the sector and introducing affirmative measures to reduce potential gender gaps.



MITIGATION



ENERGY

TECHNOLOGY: Technology Standards
and Legal Frameworks



Photo: Lynn Friedman

LATIN AMERICA

ECUADOR



Energy efficiency is a strategic priority for the Government of Ecuador. Government policies are driven by a need to ensure energy security and reduce overall electricity consumption and GHG emissions, as well as contributing to a reduction in energy costs, thus benefiting final users and increasing competitiveness.

However, a lack of information, of the capacity to conduct performance verification tests and of human resources with basic skills in energy efficiency technology, as well as inadequate regulations, were all identified in Ecuador's TNA as barriers hindering the use of energy-efficient technologies.

In 2014 the Ecuadorian Ministry of Electricity and Renewable Energy started implementation of the Securing Energy Efficiency in the Ecuadorian Residential and Public Sectors (SECURE) project in order to address these barriers.

Henceforth, the project responded directly to TNA-identified priorities on the need for improvements in energy efficiency that specifically address appliances. More generally, Ecuador's TNA consistently stresses the need for technical support and capacity-building to enhance climate change mitigation and adaptation. SECURE not only achieved

its expected objectives but in some respects accomplished more, becoming a key instrument in boosting energy efficiency policies and extending them from central government to the municipal level. The project also included capacity-building in enforcing energy-efficiency standards, together with guidelines and practices for both the public and residential sectors.

By updating and enforcing technical regulations for appliances and strengthening the associated governance and legal frameworks, use of energy-efficient appliances in the residential and public sectors was increased, thus contributing to climate change mitigation.

Concluding in 2017, the project's exit strategy included a communication plan to promote energy-efficiency standards and to raise awareness among the general public about the advantages and benefits of energy-efficient appliances.



MITIGATION



ENERGY

TECHNOLOGY:
Energy Efficient Building Retrofits



Photo: Artak Petrosyan

ASIA & CIS

ARMENIA



Armenia is highly vulnerable to the adverse impacts of climate change. Unsustainable energy use in buildings is one of the core problems for the Armenian population, as about one third of Armenian households are energy-poor, meaning that they spend more than 10% of their budget on energy. At the same time, half of the energy use in buildings depends on imported fossil fuels, and 24% of the country's CO₂ emissions come from energy use in buildings, making domestic energy consumption a major GHG emitter of the country while also increasing energy dependence on foreign resources.

Armenia's TNA recognized these problems and identified improving energy efficiency in buildings as a high priority to reduce CO₂ emissions, energy poverty and dependence on fossil-fuel imports all at once.

As a result, a project focusing on improving energy efficiency through building retrofits has received funding from the Green Climate Fund alongside co-financing from other sources, resulting in a total project value of USD 29.8 million. The aim of the project is to build a market for energy-efficient building retrofits in Armenia, simultaneously cata-

lyzing private- and public-sector investments of up to USD 100 million.

The project will combat the three problems identified above simultaneously: first, achieve sizeable energy savings and emissions reductions of up to 5.8 tons of CO₂ both directly and indirectly over the lifetime of the project; second, reduce dependence on energy imports while creating green jobs; and third, reduce energy poverty and thus directly benefit over 200,000 people. This lays the basis for a more climate-sustainable energy sector and buildings in accordance with Armenia's NDC.



ADAPTATION



MITIGATION



ENERGY

TECHNOLOGY:

Renewable Energy Technologies



Photo: Neil Palmer

ASIA & CIS

CAMBODIA



As a least developed agrarian and rural country, Cambodia is highly vulnerable to the impacts of climate change. Especially vulnerable are the 80% of the population who live in rural areas and work in the agriculture sector, as temperatures and rainfall are predicted to increase and become more unreliable. This can be coupled with the fact that GHG emissions are increasing from an agriculture sector faced with high energy costs in processing the country's agricultural goods due to mechanization, in a country with one of the world's lowest electrification rates.

To address these issues, the Ministry of Environment, Forestry and Fisheries submitted a proposal to the Global Environment Facility to achieve a large-scale adoption of renewable energy technologies in the country's agricultural sector and build up its adaptive capacity. The proposal was based on recommendations from Cambodia's TNA reports, where the large-scale potential for introducing renewable energy technologies was confirmed as a solution to rising GHG emissions. The TNA findings further supported the country's existing national sustainable development and adaptation plans. Cambodia was successful in its submission and

launched a project worth USD 25.8 million that will benefit 10,000 smallholder farms by supplying them with biodigesters and solar energy systems to add agricultural value. The project also addresses barriers highlighted in the TNA, so that the enabling policy framework for stimulating the scaling up of renewable energy technologies through agriculture sector policy-making and resource allocation was supported.

This example shows not only how the TNA can inform and support other planning tools synergistically, but also how the TNA and its results can act as a basic building block for mitigation and adaptation actions, thus laying the foundations for the necessary scaling up and development of adaptive capacity within renewable energy.



MITIGATION



WASTE

TECHNOLOGY: Waste-to-Energy



Photo: Thibaud Saintin

ASIA & CIS

THAILAND



Thailand is becoming more and more concerned about the sustainable use of natural resources and city livability, as well as its increasing reliance on imported fossil fuels. The likely increase in future energy costs and the disruption in energy supply could jeopardize Thailand's economic growth. In addition, the country's increasing urbanization and population growth is causing significant environmental challenges in its cities.

The TNA process in Thailand identified the waste sector as one of the country's priorities, with greenhouse gas mitigation options in waste management and waste-to-energy conversion.

The TNA also identified mass transit and traffic management as mitigation options. In the waste and traffic sectors, both technologies have a broad range of positive spillover effects that could alleviate energy consumption and environmental challenges in the cities.

Based on these TNA priorities, and with a project preparation grant from the GEF, the Thailand Greenhouse Gas Management Organization (TGO) drew up the Achieving Low Carbon Growth in Cities through Sustainable Urban Systems Management in Thailand project, with focuses on waste management, sustainable transport and capacity-building.

The overall goal is to reduce future greenhouse gas emissions from cities and promote sustainable urban

systems management. In 2016, the United Nations Development Program (UNDP), TGO and three municipalities started implementation of the project with USD 3.15 million in funding from the GEF Trust Fund and USD 182 million in co-financing from the three participating municipalities.

Looking at the waste, transport and energy-efficiency sectors, the cities have created and implemented a low carbon plan, establishing energy-efficient urban demo systems and facilitating investments in energy-efficient urban systems by both the government and private sector.

The project will run until 2020, with an estimated total greenhouse gas emissions reduction of 186,500 tCO₂e, while almost 400,000 tons of waste will be recycled, composted or anaerobically digested. The project will result in improvements in public transport, waste management, air pollution and water supply, and is also expected to leverage USD 16 million in new investments.



MITIGATION



ENERGY

TECHNOLOGY: Energy Efficient Consumption Loan Programs, Business Loan Program for GHG Emissions Reductions, and Renewable Energy Program on Solar



Photo: David Gee

ASIA & CIS

MONGOLIA



Mongolia is committed to fulfilling its NDC goals of achieving a 14% reduction in national GHG emissions and supplying 30% of the countries' energy through renewables by 2030. However, additional actions have to be undertaken to reach these goals. The capital city of Ulaanbaatar has one of the highest global levels of air pollution, which is partly caused by households burning coal and wood for cooking and heating in inefficient stoves, with severe consequences for health and environment.

Mongolia's TNA prioritized technologies to improve heating and cooking stoves and solar photovoltaic. The Barrier Analysis identified a lack of proper financial incentives and the high costs of the technologies, which limits their uptake. Based on the recommendations from the TNA, XacBank, a large local commercial bank, took the initiative of addressing these barriers to technology uptake and submitted three different proposals to the Green Climate Fund, all of which were approved.

For the first project, which is to support micro, small and medium enterprises' investments in energy efficiency and renewable energy technologies, XacBank received a USD 20 million contribution from the Green Climate Fund. This was added to

XacBank's USD 60 million Business Loan Program, allowing it to lower its interest rates on loans to micro, small and medium enterprises and provide longer repayment terms. The second project is an Energy Efficient Consumption Loan Program to support lending to households to help them achieve energy efficiency. This program includes concessional loans to consumers purchasing energy-efficient heating appliances and housing solutions. The new loan program, which has a total project value of USD 21.5 million, will benefit more than 15,000 people directly and lead to a CO₂ emissions reduction of about 470,000 tons CO₂ equivalent over its ten-year lifetime. The third project, with a total project investment of over USD 17 million, will enable the financing of a 10 MW solar power plant, the second large-scale solar power plant in the country. All three projects support Mongolia's transition to a more sustainable future.



ADAPTATION



AGRICULTURE



WATER

TECHNOLOGY:
Integrated Water Management



Photo: Daniel Klein

ASIA & CIS

SRI LANKA



Sri Lanka is already experiencing significant climatic imbalances manifested through increasing average temperatures, drastic variations in rainfall patterns and extreme climatic events such as heavy rainstorms, flash floods, extended droughts and other weather-related natural disasters. Sri Lanka's economy is highly reliant on climate-sensitive sectors such as agriculture, forestry and energy production.

Smallholders who cultivate through village irrigation schemes in Sri Lanka are already poorer than those who have access to major irrigation works. The impacts of climate change will only exacerbate this through unseasonal rain and low water availability, which are driving down agricultural production and contaminating surface water. Poor communities using village irrigation schemes have suffered damage through flooding and extreme weather events, leaving them even more vulnerable to climate change and threatening their access to clean drinking water.

Accordingly, Sri Lanka's TNA adaptation component prioritized improved irrigation and drinking water technologies for the country's dry zones. Specific project ideas in support of these priorities were focused on the promotion of roof-top water-har-

vesting for drinking and the restoration of minor tank networks.

Building on this information, the Government of Sri Lanka and UNDP submitted a proposal to the Green Climate Fund, which was approved in 2016. The Green Climate Fund investment will allow irrigation to be improved in the northern and eastern provinces of Sri Lanka by upgrading community irrigation water infrastructure, scaling up decentralized drinking-water systems, and strengthening flood responses and early weather warnings. The project will run for seven years and will build on government investment in rural water management so that 77,500 people in smallholder households will benefit directly.



ADAPTATION



MITIGATION



TRANSPORT



WATER

TECHNOLOGY: Bus Rapid Transport,
Groundwater Recharge



Photo: Haroon Mughal

ASIA & CIS

PAKISTAN



Pakistan's climate vulnerability is linked to its arid to semi-arid climate, as well as its high dependency on a single river system along with snow and glacial meltwater to provide its agricultural water supply.

Pakistan's TNA prioritised rainwater harvesting either by collecting rainfall from the ground surfaces or harvesting floodwater flows from a river, stream, or other natural watercourses. The technology offers many benefits during seasonal dry periods and droughts especially in the face of climate change increasing the variability and intensity of rainfall. Rainwater collection also helps to stabilize the depleting groundwater level, while the storage infrastructure can reduce land erosion and flood inflow to major rivers. It acts as a convenient source of stored water that could enhance agricultural productivity, decrease travel time for rural women to remote water resources, resulting in better health, security and time for social activities.

Based on the recommendations from its TNA and TAPs, Pakistan has recently launched several nationally funded projects for water storage and ground water recharge, including construction of a Dosi Dam in Gawadar (USD 4.7 million), construction of a Reko Delay Action Dam in the Noshki Dis-

trict (USD 700,000), construction of 200 Small Check Dams for ground water recharge of Quetta (USD 4.2 million) and construction of Bhundaro Storage Dam in Khuzdar (USD 5.6 million)

In addition, the Government of Pakistan has, based on the recommendations from the TAP, started operationalizing a bus rapid transportation system in the major metropolitan cities of Pakistan to offset carbon emissions in the transport sector.

Finally, Pakistan also recently had approval of a Green Climate Fund project 'Transforming the Indus Basin with Climate Resilient Agriculture and Water Management' which is aiming to increase resilience among the most vulnerable farmers and strengthening government capacity to support communities to adapt. The project further supports the technologies prioritised under the adaptation component of the TNA project and has a total project investment of USD 47.7 million.



MITIGATION



AGRICULTURE



WASTE

TECHNOLOGY:
TNA and NDC Linkages



Photo: Ira Huz

EASTERN EUROPE

UKRAINE



As the second largest country in Europe, Ukraine has great agricultural potential and is among the world's largest grain exporters. However, research shows that climate change is having significant negative impacts on agriculture, forestry, water and the coastal zone.

In 2019, Ukraine analyzed and prioritized sectors through the TNA project by identifying criteria and assessing technologies for climate action mitigation.

Based on this work, the TNA for climate change mitigation in Ukraine focused on the agriculture and waste sectors, which in 2016 were together responsible for 16% of total greenhouse gas emissions without demonstrating downward trends, unlike the energy and industry sectors.

As part of the TNA project, the Ministry of Ecology and Natural Resources of Ukraine has published a report prioritizing technologies for climate change mitigation. As well as being the first TNA report from Ukraine, it is also the first report from the 23 countries currently in the third phase of the TNA project.

The report will not only guide the transfer of green technology and development in this eastern European country, it will also feed into the country's new NDC submission to the Paris Agreement.

Ukraine is currently working on finalizing its second NDC. Building on the first NDC from 2016, with its commitment to reduce emissions to 60% of 1990 levels, the second round of national commitments aims to increase the reduction ambition, building, among other things, on input from the TNA process.

Through the NDC, the TNA is linking emissions reductions to innovative growth, population welfare and the creation of fair market conditions, goals that cannot be achieved without technology transfer.

**THE GLOBAL TECHNOLOGY
NEEDS ASSESSMENTS PROJECT,
PARTICIPATING COUNTRIES**

2009-2013

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

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

2018-2020

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

2020-2022

Phase IV of the Technology Needs Assessment project was approved by the Global Environment Facility in June 2019 and will include 17 Least Developed Countries and Small Island Developing States.

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 third 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: www.tech-action.org/

More information about the global Technology Needs Assessment process under the UNFCCC can be found at: www.unfccc.int/ttclear/

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