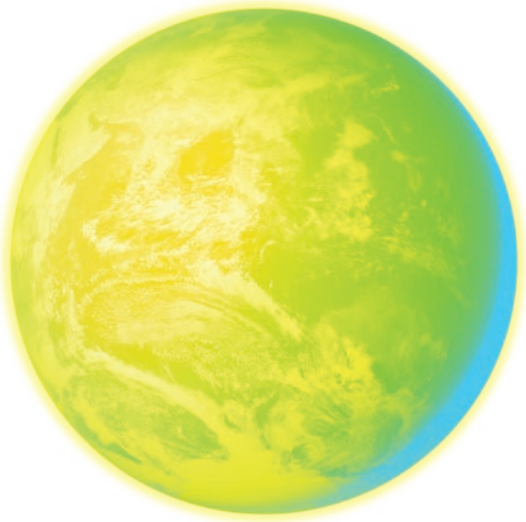
CHANGING THE SYSTEMS THAT CHANGE THE CLIMATE

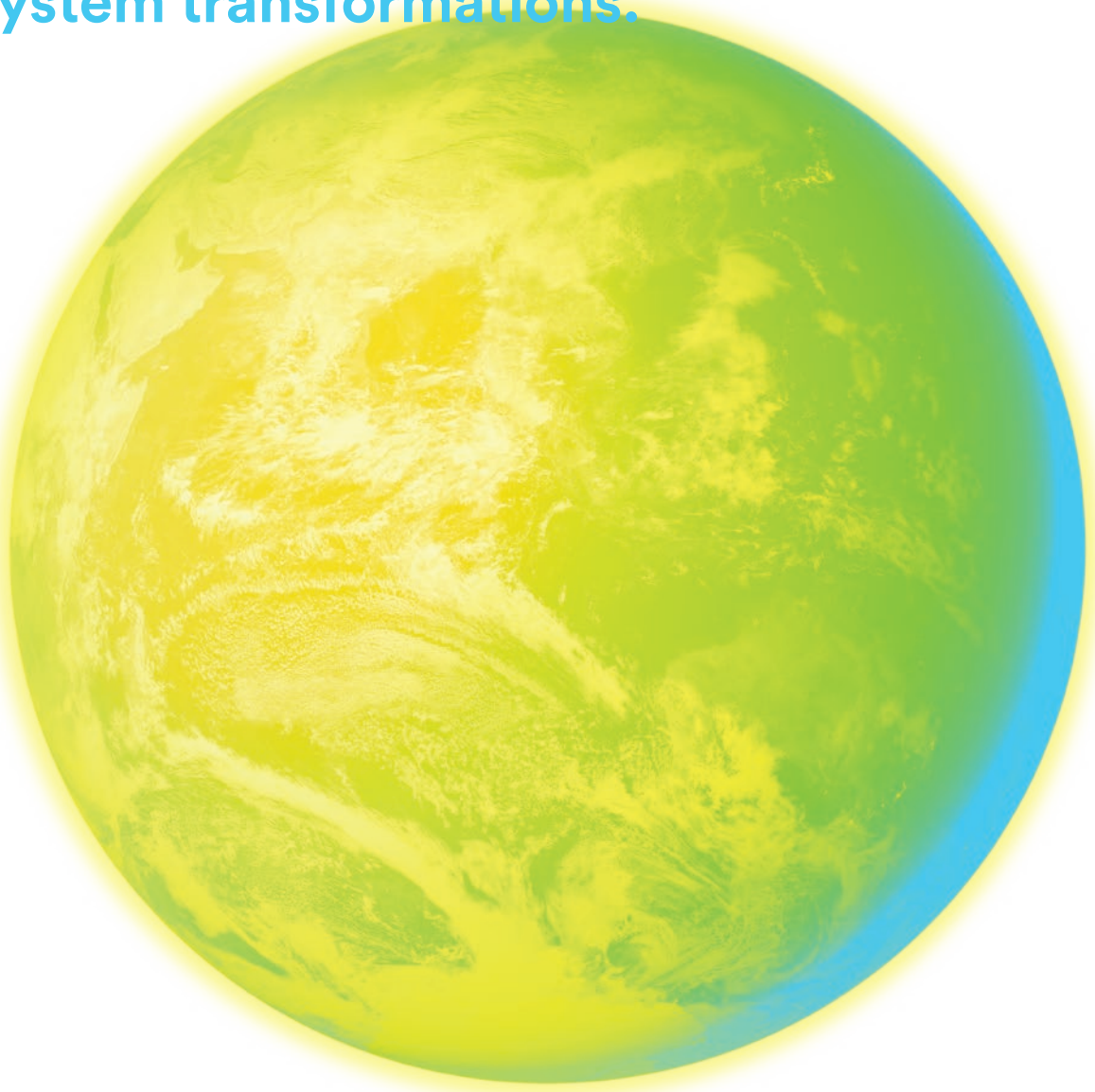
UN environment programme

CTCN
UN Climate Technology Centre & Network

The current decade is critical for climate action. The world faces daunting challenges if we hope to keep the impacts of climate change at bay and build resilience in our communities and ecosystems.



Introducing the third Programme of Work, 2023–2027. This programme aims to enhance transformational impact and scale across its core service areas through two proven technology enablers and five system transformations.



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With this programme of work, the CTCN acknowledges the need to rapidly accelerate the shift towards climate resilience and emissions reduction.
It will continue delivering on its mandate to respond to country-driven requests with a focus on strengthening developing country capacity to address technology challenges and opportunities for adaptation and mitigation.

Foreword

Omedi Moses Jura (Kenya)
Chair

Erwin Rose (USA)
Vice-Chair

The UN Climate Technology Centre & Network (CTCN) is pleased to present this third programme of work, which will guide its operations from 2023-2027. This programme brings a new focus to the CTCN, building on the successes and lessons learned from the past nine years. We are particularly excited about the increased collaboration that is planned between the UN Framework Convention on Climate Change (UNFCCC) Technology Executive Committee (TEC) and the CTCN through their first joint work programme, to be launched at COP27, of which this programme of work is a central element.

The CTCN was established by the parties to the UNFCCC in 2010 and began operations in 2014. The CTCN has supported climate technology solutions in 109 developing countries; aligned to the Technology Framework of the Paris Agreement; and continues to deliver on the Technology Framework's five key themes: innovation, implementation, enabling environments, collaboration, and support. The CTCN's new five-year strategy ensures that the Centre will remain responsive to developing countries' needs while continuing to align with the guidance from the parties to the UNFCCC and Paris Agreement.

This new programme of work emphasizes the transformative potential of national systems of innovation (NSI) and digitalisation as key enablers of technology development and transfer. The myriad benefits of digitalisation are manifest in every sector and are rapidly growing in importance. We must harness the power of these advanced technologies to accelerate progress on resilience and mitigation, including in the poorest communities, or the growing digital divide will exacerbate inequality. Supporting local innovation through an NSI approach, strengthening key institutions, and providing capacity building can be equally transformative, as highlighted in the IPCC's first chapter dedicated to innovation and technology development and transfer, which was released in 2022 (IPCC, AR6, WGIII, chapter 16). Novel technologies and innovative adoption of existing technologies are essential to accelerate progress on mitigation and respond to climate change impacts that are wreaking havoc on food security, infrastructure, livelihoods, health, natural systems, biodiversity, and well-being, among others.

Under this new programme of work, the CTCN will focus on five system transformations while ensuring that prioritized requests from developing countries are not jeopardized. The water-energy-food 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, as well as to transform entire food supply chains – which will be necessary to reduce emissions, build resilience, and meet climate and sustainable development goals. Buildings and infrastructure need to be made more resilient, but also present opportunities for increased energy efficiency and emissions reductions using new building standards, business models, nature-based solutions, and digital technologies. Sustainable mobility has rapidly picked up speed across the globe and is increasingly essential for climate mitigation and broader quality of life and development concerns. The CTCN will capitalize on energy system transformations that remain fundamental to reducing emissions, while cities and urban systems offer substantial opportunities for decarbonization. Business and industry are both a major source of emissions and an essential sector for developing and implementing climate technology solutions.

Recent UNFCCC and Paris Agreement decisions called for enhanced cooperation and collaboration with the Financial Mechanism, including engagement with the Green Climate Fund (GCF) with respect to the GCF Readiness and Preparatory Support Programme and the Project Preparation Facility. Through this collaboration and our increased coordination with the TEC via the new joint work programme, we are confident that the CTCN is poised to play an even stronger role in supporting climate ambition, the successful implementation of nationally determined contributions and the goals of the Paris Agreement.

Director's Message

Rose Mwebaza
Director

The current decade is critical for climate action. In the lead up to 2030, the world faces daunting challenges if we hope to keep the impacts of climate change at bay and effectively build resilience in our communities and ecosystems.

In developing the CTCN's third programme of work, we have formulated a firm and clear vision based on what we have learned and accomplished during our first two programmes of work. Since the CTCN first became operational, it has provided technical assistance and enhanced capacity-building for climate technology development and transfer at the request of developing countries. Within this third programme of work, the CTCN recognizes that enhanced action and creative approaches are required to enable the CTCN to strengthen and bolster countries' capabilities to take effective climate action in the context of the Paris Agreement and associated Technology Framework.

The approach to the development of this programme of work was the most inclusive to date, incorporating consultations with key stakeholders, including Advisory Board members, National Designated Entities (NDEs), Network members, and UNFCCC constituencies and constituted bodies. This extensive undertaking enabled us to glean extremely valuable insights into the diversity of issues and challenges to be addressed in the programme's development. The next 5 years of the CTCN will thus focus on a range of high-impact activities that will support countries to develop low-carbon, energy efficient, and resilient societies.

In the pages ahead, we are pleased to present our vision and how we intend to make it a reality. This programme of work will usher in a new era for the CTCN, one that is filled with ambition alongside a clear direction. We trust that stakeholders and beneficiaries will embrace this new programme with enthusiasm and eagerness to face the challenges and fulfil the aspirations of the coming years. The CTCN is ready to engage with countries and partners more deeply on their technology development pathways.

We also take this opportunity to express our deep gratitude and appreciation for the financial and substantive support provided by Parties, as well as the active engagement of the Advisory Board members, NDEs, and Network members since the CTCN's inception to implement activities across our core service areas and in the five thematic areas of the Technology Framework.

Progress Report 2023


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Work
2027

The goal of this programme of work is to enable the CTCN to fulfil its mandate under the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. Accordingly, the objective of the third programme of work is to:

> **"Support Parties to achieve their commitments to the Paris Agreement through technology development and transfer and to implement their NDCs, improve resilience to climate change impacts and mitigate climate change."**

The 2023-2027 programme of work responds to the need to rapidly accelerate the shift towards climate resilience and emissions reduction.

It aims to facilitate the implementation of mitigation and adaptation action, delivering transformational change and achieving sustainable outcomes and impacts.

It focuses on a suite of activities that contribute to the development, strengthening, and enhancement of countries' capabilities to take effective climate action in the context of the Paris Agreement and associated Technology Framework.

Integral to the CTCN's third programme of work is the continuation of the delivery of its mandate to respond to country-driven requests for services with a focus on building and strengthening developing country capacity to address technology challenges and opportunities for adaptation and mitigation.

A core dimension of this strategy includes the CTCN facilitating a network of national, regional, sectoral and international technology service providers, organizations and initiatives with a view to implementing technical assistance in a resource efficient manner while promoting participatory, inclusive approaches ensuring social and gender justice.

Enablers & System Transformations

The programme maintains its country-driven approach while seeking to enhance transformational impact and scale across its core service areas through two proven technology enablers (national systems of innovation and digitalisation) and five system transformations (water-energy-food nexus, buildings and infrastructure, sustainable mobility, energy systems, and business and industry).

The selection of the two enablers and five system transformations was informed by the IPCC AR6, and also in response to the decisions of the UNFCCC/Conference of Parties calling for programmatic, multi-country, and transformational work, findings from independent reviews, and the intensive stakeholder engagement that informed the development of this programme of work.

The CTCN Third Programme of Work at glance

The CTCN will:

Support countries in technology development and transfer across **5 systems transformations** using a demand-driven approach...

- Water-Energy-Food Nexus
- Buildings & Infrastructure
- Sustainable Mobility
- Energy Systems
- Business & Industry

...through the **3 core service areas**...

- Technical Assistance
- Capacity Building & Networking
- Knowledge Sharing

...delivered with the support of the 750+ member **CTCN Network** of academic research & finance institutions, civil society, and the private sector...

- Global, regional, and national engagement

...bolstered by **2 proven technology enablers**...

- Digitalisation
- National Systems of Innovation

...aligned with the **5 themes of the Paris Agreement's Technology Framework** in partnership with the Technology Executive Committee (TEC) under the Technology Mechanism...

- Innovation
- Implementation
- Enabling Environments
- Collaboration
- Support

...and promoting **inclusive collaboration**.

National Designated Entities, Network members, key groups including youth, women, and indigenous communities, multilateral partners leveraging technology to achieve transformative impact toward climate mitigation and adaptation goals.

The Enablers

The programme maintains its country-driven approach while seeking to enhance transformational impact and scale across its core service areas through two proven technology enablers. The selection of the two enablers is also informed by the IPCC AR6 B5 which highlights the importance of 'policies addressing innovation systems in helping overcome the distributional, environmental, and social impacts potentially associated with global diffusion of low-emission technologies' and 'digitalisation as an enabler for emission reductions and creation of resilience.'

National systems of innovation

The CTCN will support the development of national systems of innovation to support collaborative approaches to climate technology research, development, and demonstration (RD&D); the creation and promotion of relevant enabling policy to incentivize and nurture a supportive environment for innovation; and the active engagement of the private sector and closer collaboration between the public and private sector. With a focus on national systems of innovation as an enabler, the CTCN's programme of work aligns with the innovation, implementation, collaboration, and enabling environment themes of the Technology Framework. It also builds on the IPCC's findings (AR6) that 'support to strengthen technological innovation systems and innovation capabilities, including through financial support in developing countries, would enhance engagement in and improve international cooperation on innovation.'

The CTCN will aim to provide technical assistance to countries to enhance their national systems of innovation through approaches that include support for policy, institutional and regulatory framework development and planning processes, and the advancement of technology transition pathways that stimulate the uptake of climate technologies.

Digitalisation[1]

Digitalisation as an enabler entails taking advantage of digital tools to accelerate and amplify impact across the five system transformation areas. Digital systems will play an increasingly important role in almost every sector, from energy generation, distribution, and consumption to the agriculture sector, in which digitalisation is becoming essential in both developed and developing countries. Cloud computing, the Internet of Things, big data analytics, artificial intelligence, and other tools are increasingly being used in climate science and technology. The COVID-19 pandemic accelerated the global shift to a digital economy, leaving us with an opportunity to harness these changes to drive a more efficient transition to low-carbon economies.

Zambia develops national system of innovation for green development

As enshrined in its *Vision 2030*, Zambia intends to leverage innovation in order to become a prosperous, sustainable and climate resilient middle-income country by 2030. However, to date, most initiatives aiming to increase its innovative capacities have been met with limited success. The government of Zambia therefore requested technical assistance from the CTCN to develop a structured framework and roadmap to guide the creation of a national innovation system. Upon completion of an initial analysis of the science, technology and innovation (STI) environment in Zambia, the CTCN will engage key stakeholders in the development process and create STI platforms for continuous engagement and exchange, specifically focusing on climate change. It will also develop plans for incentivizing and promoting innovation through incubators and accelerators. The technical assistance is fostering innovation across all of Zambia's prioritized climate change sectors and technologies, and therefore innovation is seen as a key driver for Zambia to achieve its NDC.

Digitalisation is well-positioned not only to facilitate the achievement of mitigation and adaptation goals but is also enabling and accelerating action toward achieving the SDGs, especially in food systems, clean water, energy, industry, and even climate research (Mondejar et al. 2021).

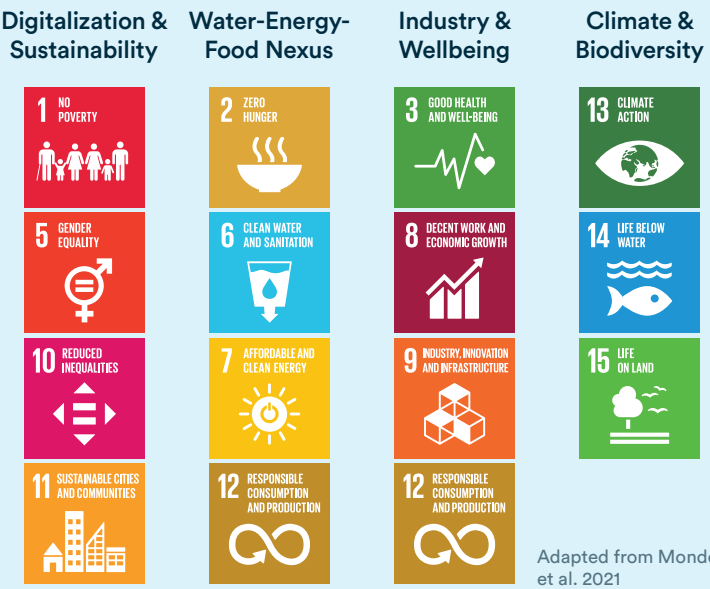
The CTCN will also focus on digital solutions which drive resilience in communities and promote Low Emissions Development Strategies (LEDs). It will explore how digital technologies and circular design can bring significant reductions in the global carbon footprint. In this regard, the CTCN could focus on promoting access to digital public goods (such as freely available and open-source software, data, and standards) that will enable the design of policies that support climate risk assessments, planning for adaptation and resilience at country level, promotion of low emission pathways, and informed climate investment decisions.

The IPCC AR6 identifies digitalisation as one of the reasons to expect a fast energy transition (p.369), cited as one of three megatrends that are transforming delivery of the services in innovative ways – digitalisation, the sharing economy, and the circular economy (p787). Governance can ensure that digitalisation not only reduces GHG emissions intensity, but also contributes to reducing absolute GHG emissions, constraining run-away consumption. Digital technology supports decarbonization only if appropriately governed (high confidence) (IPCC AR6, p14).

The programme of work cites examples of digitalisation and data to enhance system transformation in areas such as early warning systems, nature-based solutions and digital technologies to support off-grid energy systems, including blockchain technologies for urban transport and buildings.

With a focus on digitalisation as an enabler, the CTCN's programme of work aligns with the innovation, implementation, and enabling environment themes of the Technology Framework. It also builds on the IPCC's call (AR6) to 'deliver services in more efficient, timely, intelligent, and less resource-intensive ways through the use of increasingly interconnected physical and digital systems.'

Holistic Sustainable Impacts



Adapted from Mondejar et al. 2021

Eswatini digitalizes its data gathering for greater resilience

Digital systems are already playing an important role across several sectors, including agriculture, which is leveraging the digital transformation to increase resilience against climate impacts. In Eswatini, the CTCN helped to improve food security and climate resilience through the use of unmanned aerial vehicles (UAVs) and remote sensing technologies. CTCN Network member, the Regional Centre for Mapping of Resources for Development, trained Eswatini's National Disaster Monitoring Agency on the use of satellite technologies integrated with drones to support crop monitoring. By developing a data integration framework and combining satellite and UAV data, a strong set of actionable information was created, including landcover maps, crop area, statistical yield models, and yield data focused on maize crops. Baselines were created for key climate parameters as well as a database to track rainfall, temperature trends, and scenarios for outputs and climate projections. For the piloted areas, Eswatini's Monitoring Agency has significantly improved data quality while reducing the amount of time needed to collect data in the field. This technical assistance is contributing to Eswatini's NDC, which underscores the need to strengthen early warning systems, disaster risk management, and food security.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The System Transformations With this programme of work, the CTCN is responding to the need to rapidly accelerate the shift towards climate resilience and emissions reduction across five global systems in order to produce transformational change.

Water-Energy-Food Nexus

Water, energy, and food form a nexus at the heart of sustainable development (UN Water, 2021). This approach recognizes that water, energy, and food are linked in a complex web of relationships in the hydrological, biological, social, and technological spheres (D'Odorico et al., 2018; Liu et al., 2018; Märker et al., 2018). Agriculture is the largest consumer of freshwater; water is used to produce myriad forms of energy; and agriculture is of course dependent on energy. Demand is rising rapidly for all three, driven by an increasing global population which is quickly urbanizing, alongside changing diets, economic growth, and rising living standards. Feeding a global population expected to reach 9 billion people by 2050 will require a 60 percent increase in food production (FAO, 2022).

Yet, climate change is exacerbating these issues. Water, energy, and food shortages often act together to worsen conflict and political instability while threatening livelihoods (WRI, 2020). Historically, these issues have been managed in silos, and not as an interrelated crisis demanding an integrated nexus approach. Food systems are complex, and the IPCC AR6 points out that in order to improve food production and distribution, changes are required across the supply chain.

The nexus concept is not new. However, its use to address complex climate change and environmental problems in a more holistic manner has yet to be systematized as a management approach. The nexus approach opens the door to wider consideration of strategic interventions across these sectors through a better understanding of trade-offs (Albrecht et al., 2018). The IPCC acknowledges that challenges remain in devising solutions using the nexus and identifies data and knowledge in understanding the linkages and a lack of tools to address trade-offs as among these challenges (Liu et al., 2017a; Liu et al., 2018b).

Through the collection and sharing of data and information, strengthening of institutions, and delivery of programmatic and multi-country technical assistance, the CTCN will support countries to maximize synergies across water, energy, and food systems.

Examples of technical assistance, capacity building, and knowledge sharing that will be provided to support water-energy-food systems during the third programme of work include:

- Sensor deployment to aid food and crop resilience;
- Improved water management, accounting, and productivity;
- Enhanced platforms and tools for collaboration and learning on agri-food technology development and transfer;
- Supporting the development of relevant national strategies; and
- Using digital technologies for the water-energy-food nexus.

Mozambique pilots an integrated water-energy-food system

An estimated 80% of agricultural producers in Mozambique's Zambezi Valley use motor pumps in the irrigation process, which significantly contributes to water pollution through the spillage of oils, lubricants, and fuel. The use of charcoal and firewood, as well as inorganic fertilizers, further contributes to pollution. However, there has been low uptake of sustainable technologies due to the absence of inter-institutional coordination and access to basic information on the technology diffusion process.

The CTCN is working with local farmers to assess their needs, while developing a complete mapping of current water-energy-food systems and recommended improvements. It will then develop a fit for purpose system for one selected pilot farm that includes the use of integrated reservoirs for fish production coupled with horticulture (aquaponics), the utilisation of compost, the generation of biogas and biofertilizers, and hydraulic management systems (including water storage and solar pumping integrated systems for drip irrigation). Training materials and workshops will be developed in order to disseminate the information.

Ultimately, the implementation of the system will reduce GHG emissions through the use of biogas and clean energy, manage water more effectively, increase food and nutrition security, and support income generation. It is expected that additional funding will be leveraged to scale the system up to other locations in the Zambezi and throughout the country. The technical assistance is aligned with Mozambique's NDC, in which agriculture is featured as a top priority, alongside improved capacity for integrated water resources management. The assistance will also support the improved integration of women in the water-energy-food nexus.

Buildings&Infrastructure

The building and construction sector is responsible for nearly 15% of direct CO_2 emissions. The continuous growth in energy needs from this sector has been driven by improved energy access in developing countries, and an increasing demand for air conditioning and energy-consuming appliances (IEA, 2021). Yet two-thirds of countries still lack mandatory building energy codes. This is important, as most new construction is slated to occur in those countries without energy codes (Global Alliance for Buildings and Construction).

At the same time, it is critical that buildings and infrastructure are adapted for climate change to ensure greater resilience and safety of the populations utilising them. The IPCC notes that few adaptation plans for cities have been implemented, leaving several urban adaptation gaps around the world. It points out that continued rapid urbanization and the dearth of affordable and sustainable infrastructure present an opportunity to integrate adaptation strategies into development. The IPCC's 6th assessment report identifies retrofitting and the redesign of existing infrastructure combined with new design as a way to capitalize on existing knowledge with regard to nature-based solutions and grey infrastructure. This can lead to inclusive adaptation processes (IPCC AR6 Human Settlements Fact Sheet).

Early investment in resilient buildings is a vital way to save lives, protect development investments, and minimize costs. Estimates show that the net benefit of investing in resilience infrastructure in low- and middle-income countries would amount to $4.2 trillion, which is a $4 in benefit for each $1 invested (World Bank, 2021).

Examples of technical assistance, capacity building, and knowledge sharing that will be provided to support buildings and infrastructure during the third programme of work include:

- Building standards, new energy efficiency business models;
- Early warning systems;
- Nature based solutions and ecosystem-based approaches; and
- Using digital technologies to support off-grid energy systems, including approaches to utilise blockchain technologies to facilitate innovative technology that promotes trust and transparency.

Thailand develops energy-efficiency benchmarks for the building sector

The CTCN has made great strides in fostering resilience in buildings and infrastructure through its technical assistance and capacity building. For example, in Thailand the CTCN provided support to foster green building and scale up investment in building energy efficiency. Achieving emissions reductions is imperative to meeting national targets for the building sector, as defined in Thailand's National Energy Efficiency Plan (2015-2036) and its NDC Roadmap, which states that 113 million tonnes of GHG emissions reduced by 2030 should be achieved through renewable energy and energy efficiency. The national building energy code from 2009 had mandated minimum energy standards for new buildings, but they were difficult to enforce due to lack of knowledge and guidance on cost-efficient technologies.

The CTCN and its Consortium partners, the National Renewable Energy Laboratory and The Energy and Resources Institute, prepared a GCF Readiness proposal to facilitate the achievement of national targets for the building sector. Upon approval of the concept note, the International Institute for Energy Conservation led the development of energy consumption benchmarks for selected building types and a techno-financial assessment of energy-efficient building technologies. These results were shared with developers, architects, and investors to help inform investment decisions in the building sector, and are now contributing to market transformation, workforce development, and sustainable development in Thailand.

Sustainable Mobility

The transport sector is the most highly dependent on fossil fuels, comprising 37% of CO_2 emissions from end-use sectors, according to the IEA, which also asserts that the post-COVID19 rebound in emissions resulting from the sector has been most pronounced in developing nations. Strong regulations, fiscal incentives, and investment in zero and low-carbon vehicle operations are needed in order to make climate change progress in this area.

At the same time, sustainable mobility is advancing rapidly with cutting edge technologies, including battery electric and fuel cell electric vehicles, and alternative fuels. To ensure an effective and holistic system transformation, the transition to electric mobility is based on an accompanying energy sector transformation toward renewable energy and electrification. In terms of alternative forms of sustainable mobility, a revitalized interest in public transport is fortunately blossoming into the burgeoning trend of e-bike and scooter usage in cities across the world.

The transport sector is one of several sectors that will benefit from digitalisation as an enabler driving transformation. It is also worth noting that industry and transport have both been identified as sectors in need of reshaping to better support circular economies, and that rural and interurban mobility are emphasised as well (Partnership on Sustainable, Low Carbon Transport, 2021).

The CTCN will support transformational change in sustainable mobility systems, building upon its expertise in developing and strengthening enabling environments, developing roadmaps and sectoral plans, bolstering regulatory frameworks, and fostering South-South-North triangular knowledge sharing.

Examples of technical assistance, capacity building, and knowledge sharing that will be provided to support sustainable mobility during the third programme of work include:

- Shared mobility regulation development;
- Deployment of low emissions vehicles; and
- Using digital technologies and data to enhance intelligent urban transport systems and buildings.

Jakarta drives sustainable mobility in Indonesia

The transport sector contributes 25% of Indonesia's total GHG emissions. Since the economic boom began in Jakarta several decades ago, the traffic has significantly worsened, and the city's air pollution has become one of the worst globally. The CTCN, with its Network members the Institute for Transportation Development Policy and Cadmus Group LLC, supported the longest bus rapid transit system in South-East Asia, Transjakarta, in working closely with relevant e-mobility stakeholders to accelerate a large-scale e-bus deployment for Transjakarta's transit services. The CTCN provided policy recommendations, a charging strategy and operational plan, implementation road map, investment and business model, and assessment of grid and renewable energy adoption.

As a result, policies addressing the transition to e-mobility have begun to be implemented based on the strategic approach described in the country's NDC, which commits to promoting e-mobility as a strategy to leapfrog to zero emissions tailpipe technology and to develop charging infrastructure based on renewable energy sources. Transjakarta is using the electrification road map and investment plan to deploy 1635 e-buses (50% of Jakarta's bus fleet) by 2030. Roughly USD 1.4 million in investment opportunities has been identified to support Jakarta's charging facilities and grid infrastructure with the potential to integrate rooftop PV. Importantly, the technical assistance incorporated factors to ensure safe, inclusive, and accessible e-buses to the general public and vulnerable groups.

Energy systems

Developing and emerging economies comprise two-thirds of the global population, but account for only one-fifth of investment in clean energy and only one-tenth of global financial wealth. However, energy demand in developing countries is projected to expand by two-thirds by 2050. (International Atomic Energy Agency, 2021). It is estimated that annual capital spending on clean energy in these economies will need to multiply by more than seven times, to more than USD 1 trillion, in order to remain on track to meet goals (Ibid). And as the World Economic Forum points out, energy solutions for a just energy transition "are clear but will require pragmatism, political will, and an inclusive global approach with concrete mechanisms and real financial incentives."

The CTCN, its partners, and stakeholders know that investing in the clean energy transition in developing countries generates an array of benefits, including job growth, improved livelihoods, support for female entrepreneurs, and improvements to gender equality. The need for a global energy transformation is urgent – especially for renewable energy, energy efficiency and electrification. Relevant technologies are available today and are cost competitive. However, the task remains daunting, as there are still 800 million people with no electricity access and 2.6 billion with no access to clean cooking options (IEA, 2021).

Many developing countries are impeded in their efforts due to lack of a supportive policy and regulatory environment to propel rapid energy transitions. By working to improve such enabling environments, as well as promoting systemic innovation, building circular economy practices, and providing guidance on appropriate financing schemes, the CTCN can make substantial contributions toward enabling countries to activate a sustainable energy sector. In the last few years, the CTCN has increasingly supported technical assistance that advances several of these objectives. Demand for technical assistance has been growing steadily for the circular economy, green hydrogen, energy efficiency, and the power sector.

Examples of technical assistance, capacity building, and knowledge sharing that will be provided to support energy systems during the third programme of work include:

- Energy efficiency for industry applications, and certification;
- Countries are assisted in developing national institutional, legal, and regulatory frameworks in support of TNAs, TAPs, NDCs, and NAPs, which encourages a just transition and gender-responsive approaches;
- Investigation of emerging technology, policy, demographics, and economics reshaping energy supply and demand (for example, platforms for peer-to-peer renewable energy trading); and
- Decarbonisation initiatives investigating technology options, energy flows, materials flows, life-cycle emissions, costs, and policies.

Pakistan develops an energy auditor workforce

Prior to 2017, Pakistan had no professional certification system for energy auditors. When the country began renewing efforts to promote energy efficiency and conservation with the passage of the National Energy Efficiency and Conservation Act in 2016, the CTCN and The Energy and Resources Institute developed a national certification scheme for energy auditors and managers, including rules and regulations required for making the certification scheme effective. Training programmes and guidebooks were also developed to ensure that professionals obtained consistent training and knowledge to correctly perform energy audits. The National Energy Conservation Centre responsible for audits was supported to conduct certification examinations and select qualified energy auditors for the textile, cement, conventional power plant and pulp and paper sectors.

With a 20-25% energy saving potential in the industrial sector, implementation of the certification scheme has the potential to reduce 42k tonnes of CO_2 emissions per annum, and to defer the need to install additional electricity generation capacity. At the same time, the certification programme promotes green job growth by generating a pool of skilled energy auditors/managers to facilitate the achievement of a significant energy savings potential.

Business & Industry

Vulnerabilities to both economic and climate shocks are increasingly compounding an often dire situation in developing countries, running the risk of trapping these nations in a state of disruption, economic uncertainty, and slow productivity growth (UNCTAD, 2021). However, there is increasingly abundant evidence that climate action does not threaten economic growth. In fact, climate policies are benefitting economic growth through four main channels: 1. Boosting human capital by making people more productive and creative because they are healthier and better educated; 2. Boosting natural capital, building on the services nature gives us; 3. Boosting technological change and increasing productivity; and 4. Boosting efficiency and getting more with less. These channels are important for business and industry in developing countries to remember as they wrestle with decarbonization, risk management, and increased resilience in the face of climate change while remaining reliant upon economic growth (World Bank, 2022).

The World Bank articulates the crucial point that the central risk for developing countries is not that they will miss out on old, expensive, and polluting technologies, but rather that they will be denied access to newer, greener, and more efficient technologies while being "disconnected from global value chains and locked into technologies that have no future."[2]

Examples of technical assistance, capacity building, and knowledge sharing that will be provided to support business and industry during the third programme of work include:

- Decarbonization initiatives for carbon intensive business and industry, optimizing materials flow and reducing life-cycle emissions, costs, policies;
- Active partnerships facilitated by CTCN and TEC collaboration that provide matchmaking services (between scientific community, private sector, co-operatives and financial institutions) through regional fora to assist beneficiaries on new and innovative technologies, solutions, and business models; and
- Capacity building to develop youth entrepreneurship initiatives, and to support frameworks, policies, and programmes for early-stage innovation.

Chile activates technology uptake among agri-food SMEs

In Chile, micro, small- and medium enterprises (SMEs) comprise the majority of producers in the agriculture sector, which has long been vulnerable to climate change. However, uptake of both climate mitigation and adaptation technologies by SMEs has traditionally been quite low despite available financial instruments. The CTCN worked with the government of Chile to identify the barriers preventing SMEs (engaged in fruit, wine, vegetable, annual crop, beef, and dairy value chains) from utilising climate mitigation and adaptation technologies. It then identified opportunities to reduce GHG emissions and increase resilience through specific clean technologies, and analysed the effectiveness of select national financial instruments, such as Chile's voluntary Clean Production Agreements (the country's major initiative for the adoption of climate technologies within SMEs in the agri-food sector under which Chile committed to 18.4 million tonnes of emission reductions). The CTCN then proposed recommendations to increase technology deployment though either the Clean Production Agreements or a potential green investment bank.

The assistance enabled the SMEs to reduce emissions along the agri-food chains, while strengthening local institutional capacity for possible replication by other agri-chains and serving as a catalyst for further sustainable growth within Chilean SMEs. The CTCN's recommendations also facilitated the integration and prioritization of the agricultural sector in Chile's Green Investment Bank in order to render the bank more effective as a mechanism to combat climate change within the sector. Ultimately, the technical assistance contributed to Chile's NDC, which pledged to reduce GHG emissions intensity (per unit of GDP) by 30% below the 2007 levels by 2030.

The approach to the delivery of the third Programme of Work

The CTCN's approach to the delivery of its programme of work for the period 2023-2027 is based on three components:

Enhancing partnership with the Technology Executive Committee (TEC)

The CTCN acknowledges the importance of collaboration with bodies and constituency groups both under and outside the Convention. This programme of work seeks to enhance its coordination with the TEC to achieve the goals of the Technology Mechanism.

Demand driven approach to meet requests from countries

The CTCN serves as a demand driven and trusted technology partner, matching developing country needs for climate change-related equipment, methods, and capacity development with technology solution providers. Climate challenges and opportunities are dependent on various factors including local conditions, size of market, levels of economic development, and absorptive capacities. Climate change is an amplifier of existing climate variation and will affect diverse communities, regions, and industries in different ways, presenting both opportunities and risks. For example, Small Island Developing States (SIDS) face unique challenges due to their limited geographical area and particular exposure to rising sea levels and extreme weather events. At the same time, SIDS are heavily dependent on imported oil and other fossil fuels to meet their energy needs, which poses economic and energy vulnerability on the islands. By working closely with NDEs, the CTCN can ensure that support to climate technology adoption, development, and transfer is available in response to the challenges. In addition, the CTCN will focus on strengthening collaboration with the owners of technologies through its network of institutions including financial institutions, research institutions, consortium members, NDEs, and all key stakeholders.

Collaboration

Collaboration will be reinforced through:

Facilitation of information sharing across countries via South-South and triangular collaboration. Collaboration and knowledge sharing are central pillars of the CTCN. The CTCN aims to reinforce the capacity of countries to facilitate information-sharing, collaboration, and networking. This will enable the exchange of best recommended practices, experience and knowledge on technology development and transfer, and on endogenous technologies. This also involves strengthening the capacity of countries and communities to be more resilient in terms of skills and the ability to access suitable finance for scale up and replicative actions. This will build on the CTCN's existing efforts to implement gender mainstreaming in all its activities (guided by its Gender Policy and Action Plan) and its capacity building and mentoring support.

Multi-country programmatic approach. The CTCN approach uses a common framework of activities based on a theme or focus area adapted to different national circumstances, and can be used across a subregion, region, or continent. The CTCN will continue to replicate its multi-country and programmatic approaches in implementing technical assistance activities. Multi-country projects promote capacity building, analysis and research activities at a regional level that permeate direct support at country level. Efficiency gains will be achieved through learnings captured from previous CTCN implemented technical assistance requests where programmes can be delivered based on learning from similar NDE submissions. Multi-country projects also present several additional efficiency gains, such as lower transactional costs and harmonization of policies and regulations across a region. The new programme will build on initiatives utilising the multi-country technical assistance requests.

Engagement with the Financial Mechanism of the UNFCCC. Such engagement includes interaction with the Adaptation Fund, Green Climate Fund and the Global Environment Facility, as follows:

- **The Adaptation Fund:** The new mid-term strategy (2023-27) of the Adaptation Fund places a strategic emphasis on locally led adaptation action as a cross-cutting theme. This will allow for continuity of the Fund's work under the newly launched funding windows and grant modalities, such as innovation for adaptation technologies. The CTCN will continue to work with the Adaptation Fund to scale up innovative technologies for adaptation as well as take up new opportunities for engaging with the Fund's readiness grant funding and support for Direct Access Entities (DAEs). In particular, the CTCN will seek to scale up its work with the Adaptation Fund Climate Innovation Accelerator (AFCIA) to foster innovation in adaptation in developing countries.
- **The Green Climate Fund (GCF):** The CTCN remains the largest provider of the GCF readiness programme services to developing countries, with over 30 countries supported to access their GCF readiness funds. The GCF Secretariat is currently developing the draft strategic plan for 2024-2027, guided by the Board. The CTCN envisages future collaborative planning with the GCF and plans to work with parties to help prepare their readiness projects, including at the Project Preparation Facility, for GCF support. In the March 2022 meeting, the GCF committed to continue engaging with CTCN and TEC guidance with a view to promoting technology innovation, incubation, acceleration, growth, transfer, deployment, and gender mainstreaming. Following the COP 26 decision, the CTCN will incrementally move forward in the new programme of work towards supporting countries to access large scale GCF funding directly through the Project Preparation Facility.
- **The Global Environment Facility (GEF):** The CTCN will continue its engagement with the GEF and explore opportunities for accessing the GEF 8 funding cycle. The CTCN continues to engage with the GEF and its regional centres in supporting developing countries on technology-related needs and activities for enhanced climate action. The project *Piloting Innovative Financing for Climate Adaptation Technologies in Medium-sized Cities* (approved as part of the GEF Challenge Program for Adaptation Innovation) is executed by the CTCN. This is a 5-year pilot grant innovation programme (2020-2025) that will support selected cities in adopting a systematic approach to prioritizing infrastructure needs, identifying key investment projects, matching with private financiers, and leveraging the CTCN network for climate change technology data.

To achieve success, the CTCN will continue to work collaboratively with stakeholders in the delivery of the programme of work and ensure that the financial and technical parameters are in place.

About the UN Climate Technology Centre and Network

In 2010, the Conference of the Parties (COP) to the UNFCCC decided (Decision 1/CP.16)[3] to establish a Technology Mechanism under the guidance of, and accountable to the COP, which included the establishment of the CTCN.[4] The CTCN is the implementation arm of the Technology Mechanism and promotes the accelerated transfer of environmentally sound technologies for low carbon and climate resilient development at the request of developing countries. The CTCN provides 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.

The establishment of the CTCN was aligned to an acknowledgment by Parties that climate action should follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate.

In 2010, following a competitive selection process, the COP decided that the CTCN would be hosted by UNEP through a memorandum of understanding with the UNFCCC. In becoming operational the CTCN developed its mission: to stimulate technology cooperation and to enhance the development and transfer of technologies and assist developing country Parties at their request, consistent with their respective capabilities and national circumstances and priorities: to build or strengthen their capacity to identify technology needs, to facilitate the preparation and implementation of technology projects and strategies taking into account gender considerations, to support action on mitigation and adaptation, and enhance low emissions and climate-resilient development.[5] Consistent with the COP decisions, the CTCN serves three main functions:

Provision of Advice
Providing advice and support related to the identification of technology needs and the implementation of environmentally sound technologies, practices and processes.

Strengthening capacity
Facilitating the provision of information, training and support for programmes to build or strengthen capacity of developing countries to identify technology options, make technology choices and operate, maintain and adapt technology.

Facilitating action
Facilitating prompt action on the deployment of existing technology in developing country Parties based on identified needs.

The Climate Technology Centre is therefore a unique demand-driven organisation that has been created specifically to meet these needs. Since its inception in 2014, the CTCN has served over 109 developing countries, providing access to over 390 targeted mitigation and adaptation technologies that enable countries to achieve their NDCs and commitments under the Paris Agreement.

The CTCN accomplishes this by serving as a trusted matchmaker, delivering technology solutions by mobilizing the public and private sector and technology actors.

The CTCN's value proposition sets out its competitive advantage and seeks to articulate the value that is delivered through the CTCN's services.

The leading UN body for climate change and technology implementation

The designated body under the UNFCCC for technology implementation

A demand driven process

NDEs coordinate requests and provide oversight of CTCN service delivery

Tailored technology assistance

Developing customized responses to assistance requests and mobilizing the right experts

Creating economic opportunity

Utilising network expertise & fostering endogenous innovation & entrepreneurship

Support for the full technology cycle

...and complete spectrum of mitigation and adaptation technologies

Focus on gender and youth

The Centre is dedicated to gender mainstreaming and youth inclusion in its technology work

There are several characteristics that distinguish the CTCN from other organisations, including:

- **The CTCN is the only technology body in the broader climate technology space that has an official mandate from the UNFCCC and the Paris Agreement:** The CTCN supports developing countries at their request to develop and deploy technologies as they seek to meet their climate change and sustainable development goals. The CTCN also offers the world's largest online source of cleantech information (www.ctc-n.org) with access to mitigation and adaptation descriptions, case studies, publications, technology service providers, tools, and webinars.
- **The CTCN follows a demand-driven process:** National Designated Entities (technology representatives selected by each country's government representing 161 parties to the UNFCCC) coordinate requests from local communities, civil society, the private sector, and public institutions, ensuring alignment with NDCs and national climate change priorities in-country. Since its inception, the CTCN has received 398 requests for technology transfer from 109 countries. The ability to respond to the diverse range of requests and provide customised services is made possible through a continuously growing number of technology service providers in the CTCN Network (over 700 globally), who are contracted to provide technical assistance and capacity building to developing countries on environmentally sound technologies.
- **The CTCN delivers tailored technology assistance:** CTCN experts provide one-on-one support to National Designated Entities to identify and implement appropriate environmentally sound technologies that suit their national circumstances, ensuring all technical assistance is adapted to local conditions, socially and environmentally sound, gender responsive, and accessible for all.
- **The CTCN creates economic opportunities:** New opportunities are created by fostering endogenous innovation and entrepreneurship for environmentally sound or green technologies.
- **The CTCN's technical assistance is provided across the full technology cycle and for the complete spectrum of mitigation and adaptation technologies:** The CTCN delivers technical assistance, capacity building and knowledge sharing for a full range of technology priorities, from needs assessment and innovation to identifying financing sources for upscaling. The Centre also strengthens the underlying institutional structures which enable technology development and deployment, such as policies, regulatory frameworks, and market creation.
- **The CTCN is dedicated to gender mainstreaming and the inclusion of youth and indigenous people in its technology work:** The CTCN co-hosts the global Gender-Just Climate Solutions capacity building programme, operates the Youth Climate Innovation Labs, and provides an online Gender Hub with hundreds of gender-related publications, tools, and case studies.

To read this document online, visit pow.ctc-n.org

To read the official full CTCN Third Programme of Work 2023-2027, visit bit.ly/ctcn-pow3

To read the Joint Work Programme of the UNFCCC Technology Mechanism for 2023–2027, visit bit.ly/ctcn-tec5yr

Notes

1 Of course, when we consider the potential impacts of digital technologies, we must also account for the digital divide. According to the World Bank (2021), in late 2021, nearly 3 billion people lacked access to the internet, the majority of which reside in developing countries. 37% of the population, or 2.9 billion people, have still never used the internet, while 43% of the global population are not using mobile internet despite living in areas with mobile broadband coverage. The share of internet users in urban areas is twice as high as in rural areas. Globally, 62% of men use the internet compared to 57% of women. Youth are more likely to use the internet: 71% of the population aged 15-24 uses the internet compared to 57% of other age groups. However, there are clear opportunities for digitalisation, which can help overcome some of the commonly cited barriers to participation in economic and social activities.

2 World Bank, 2022: https://blogs.worldbank.org/climatechange/getting-it-right-development-we-do-not-have-choose-between-people-and-climate

3 Decision 1/CP.16, para. 117. All relevant decisions are available at: https://unfccc.int/ttclear/negotiations/decisions.html

4 All decisions relating to technology transfer are available at: https://unfccc.int/ttclear/negotiations/decisions.html. CTCN founding documents available at: https://www.ctc-n.org/about-ctcn/founding-documents

5 Decision 1/CP.16, page 20, para. 123.

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