



REFLECTION ON THE CTCN'S COLLABORATIVE RESEARCH DEVELOPMENT, AND DEMONSTRATION ACTIVITIES

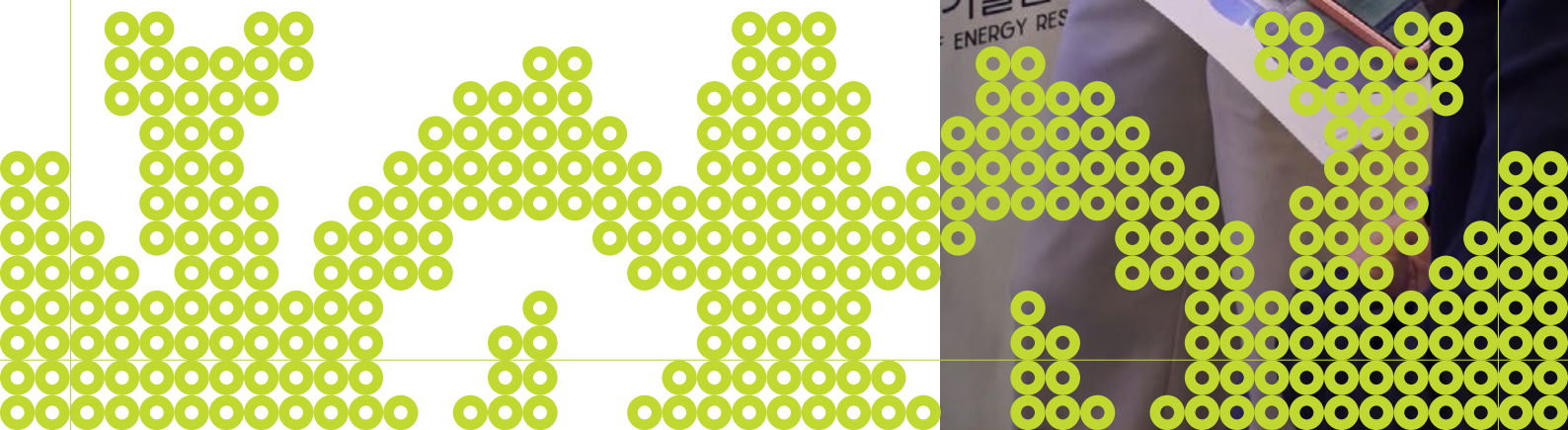
Lessons Identified
and Way Forward

EXECUTIVE SUMMARY

CTCN PALO, together with NIGT, offered an International research, development and demonstration (RD&D) programme consisting of a Learning Visit and Bridge-building activities in 2025. This programme facilitated technical exchange and established working level networks between delegates from participating developing countries and Korean Network members including Korea East-West Power (EWP) and several Korean government-affiliated research institutes (K-GRIs) such as KIST, KRICT, and NIGT and, supported by technical presentations and site-based engagement that showcased Korea's R&D capabilities and large-scale demonstration experience, including green hydrogen related technology and policy implementation. Building on this foundation, the CRD2B2 Workshop was implemented under the theme of energy storage system in conjunction with the World Climate Industry EXPO 2025, creating synergy between broad exposure to climate technology solutions at the EXPO and targeted engagement during the workshop.

This report outlines the background, objectives, and implementation process of the 2025 programme. It then consolidates key recommendations to ensure the smooth operation of the CTCN collaborative RD&D (cRD&D) Strategic Framework, as acknowledged by the Advisory Board in April 2025, as follows:

- Revise the characteristics of cRD&D Types 1 (Collaborative Research) and 2 (Technology Information Exchange), taking into account their application at different levels (global, regional, and national) and countries' varying levels of readiness for cRD&D.
- Support NDEs with strong interest and established national cRD&D strategies to participate in the international cRD&D programme, with a focus on aligning existing national strategies with existing and emerging climate technologies. The international programme should emphasize country status sharing and technical review of ongoing cRD&D projects to reduce fragmentation and strengthen adaptive management capacity.
- Integrate cRD&D Types 1 (Collaborative Research) and 2 (Technology Information Exchange) into national-level Technical Assistance projects for countries with limited or no prior cRD&D experience, with indicative activities including diagnostics, stakeholder mapping, learning visits, partnership formation, and project pipeline development.



BACKGROUND

Since 2014, CTCN is mandated to accelerate the transfer of climate technologies to developing countries, supporting their transition to low-carbon, climate-resilient innovation. Having served over 110 countries through technical assistance, capacity building, and knowledge sharing, CTCN added its mission by launching the Partnership and Liaison Office (PALO) in the Republic of Korea on July 21, 2022.

CTCN PALO is dedicated to supporting countries' collaboration with the Green Climate Fund and serves as the Centre of Excellence in Collaborative Research, Development and Demonstration (cRD&D). Its creation marked a key step in expanding CTCN's global outreach and fostering deeper partnerships among research institutions and industry actors, to support countries' endogenous capacity building on climate technologies

Following the demand-driven approach, the Nationally Designated Entities (NDEs) are crucial in acting as bridge-builders who identify domestic RD&D partners such as professors and researchers for joint RD&D initiatives. Their active engagement ensures that national priorities and technology needs are effectively linked with international expertise and financial mechanisms.

This bridging role was exemplified through the 2025 CRD2B2 Workshop in Busan, which built on the success of the inaugural 2024 edition in Songdo. By connecting NDEs with GRIs and private-sector innovators, the workshop operationalized the NDEs' mandate to catalyze partnerships for collaborative RD&D. The choice of Busan and its alignment with WCE2025 further amplified opportunities for cross-sectoral engagement and international cooperation on climate technology.

As shared during the 25th Advisory Board meeting¹, CTCN's cRD&D strategic framework aims to translate developing countries' climate technology priorities into actionable collaborative pathways by convening NDEs, research institutions, technology providers, and financiers

around shared problem statements and opportunities that are ready for demonstration. Thus, the activities of CTCN PALO focuses on:

- (i) Strengthens bridge-building among NDEs and Korean and global innovation actors,
- (ii) Supports the design of joint RD&D and joint demonstration concepts, and
- (iii) Promotes South–South, North–South, and triangular cooperation by mobilizing CTCN's Network and partners.

Recommended cRD&D activities therefore include:

- (a) An annual CRD2B2 workshop co-located with major climate-technology convenings to maximize exposure and matchmaking;
- (b) Thematic Learning Visits that link research excellence with real-world demonstration sites and operational considerations;
- (c) Structured Project Concept paper (PCP) clinics and light-touch coaching to move concepts toward investment readiness; and
- (d) A formal follow-up 'pipeline' that tracks concepts, connects them to technical assistance and seed resources, and monitors progress toward implementation.

The National Institute of Green Technology (NIGT), as network member of CTC, plays a critical role in the cRD&D strategy. NIGT coordinates national stakeholder engagement across Government-affiliated Research Institutions (GRIs), public entities, and private-sector innovators; curates thematic programme content aligned with the Republic of Korea's climate-technology roadmaps; and provides practical support for project concept development (e.g., matchmaking facilitation, PCP clinic organization, and follow-up coordination). NIGT also contributes to knowledge products to strengthen PALO's function as a regional hub for climate technology cooperation.

1 <https://www.ctc-n.org/sites/default/files/2025-04/21.2%20Collaborative%20RD%26D%20Strategy%202025-2030.pdf>

OVERVIEW OF THE PROGRAMME

Over 2024 and 2025, the CTCN PALO offered International cRD&D programme, consisting of two activities: Learning visit and Bridge-building workshop. This programme invited NDEs and relevant experts from the Asia-Pacific and globe for technical exchange and learning opportunities in cooperation with research and public institutions in the Republic of Korea.

The 2024 and 2025 programmes were specifically designed to focus on green hydrogen production and fuel cell technologies. It was operated as a joint programme with the participation of key K-GRIs including KIST² and KRICT³ and a demonstration institution such as Korea East-West Power⁴.

OBJECTIVES

The overarching objective was to provide a foundation for technical understanding and practical application by showcasing exemplary cases linked to Korea's hydrogen economy roadmap, focusing on Research, Development, and Demonstration.

The Collaborative RD&D Bridge-Building Workshop and Learning Visit 2024 and 2025 were designed to strengthen international cooperation on climate technology RD&D. Specifically, the workshop aimed to:

- Facilitate bridge-building among NDEs, research institutes, and private-sector actors for future collaborative RD&D activities in climate technologies;
- Enhance South–South, North–South, and triangular cooperation by promoting mutual learning, partnership development, and knowledge sharing;
- Showcase Korean climate technologies and foster linkages with global partners to explore opportunities for joint demonstration and commercialization;
- Provide a platform for NDEs to share national contexts, technology barriers, and collaboration priorities;
- Support the refinement of emerging project ideas through a Project Concept Paper clinic, enabling them to evolve into investment-ready proposals; and
- Highlight and accelerate the deployment of energy storage solutions, emphasizing their role in advancing clean energy transitions and climate resilience.

2 Korea Institute of Science and Technology: <https://www.ctc-n.org/networking-and-collaboration/collaboration/network-members/korea-institute-science-and-technology>

3 Korea Research Institute of Chemical Technology (KRICT): <https://www.ctc-n.org/networking-and-collaboration/collaboration/network-members/korea-research-institute-chemical>

4 <https://www.ctc-n.org/networking-and-collaboration/collaboration/network-members/korea-east-west-power-co-ltd>





PROCESS OF IMPLEMENTATION

Of the two-year programme, this report illustrates 2025 activities as below.

Table 1 Summary of 2025 cRD2B2 activities jointly delivered with CTCN and NIGT

Activity	Dates	Location / Venue	Technical focus	NDEs	Stakeholders engaged
Learning Visit 2025	22-24 July 2025	Seoul (KIST); Daejeon (KRICT); Donghae/ Samcheok (KEWP)	Hydrogen production and fuel cell technologies (R&D to demonstration)	The Gambia; Maldives; Belize; Panama; Zimbabwe	KIST, KRICT, KEWP, NIGT, Invited technical experts
CRD2B2 Workshop 2025	27-29 Aug 2025	Busan (WCE2025)	Energy Storage Systems (ESS) and collaborative RD&D partnership development	The Gambia; Tajikistan; Zimbabwe; Malaysia; Panama; Timor-Leste	CTCN & UNFCCC Secretariats; TEC/ Advisory Board members; Korean GRIs; Private sector; CTCN Network members

ACTIVITY 1 LEARNING VISIT 2025



DAY 1

KOREA INSTITUTE OF SCIENCE AND TECHNOLOGY, SEOUL: R&D STATUS

The programme commenced at KIST, focusing on the R&D landscape for hydrogen production and fuel cell technologies in Korea.

SESSION 1: R&D ACTIVITIES FOR LOW-TEMPERATURE H₂ PRODUCTION (DR. HYUN SEO PARK)

This session provided an overview of catalyst and system-level technologies for hydrogen fuel cells. Discussions included physicochemical mechanisms, catalyst structural properties, and thermodynamic constraints relevant to improving hydrogen production efficiency at lower temperatures. KIST's experimental data and development trends were shared.

SESSION 2: R&D STATUS OF SOLID OXIDE ELECTROLYSIS CELL (SOEC) TECHNOLOGY (DR. HO-IL JI)

SOEC technology was presented as a high-efficiency clean hydrogen production method operating at high temperatures (700-900°C).

Technology Overview: Derived from Solid Oxide Fuel Cell (SOFC) technology, SOEC leverages high temperatures for favorable thermodynamics and kinetics in water electrolysis.

Key Materials & Components: Standard components include Yttria-Stabilized Zirconia (YSZ) electrolytes,

air electrodes like (La,Sr)MnO₃ (LSM) or (La,Sr)(Co,Fe)O₃ (LSCF), and fuel electrodes typically made of Ni-YSZ cermet. Different cell designs (planar, tubular) and support structures (fuel electrode-supported, electrolyte-supported) were outlined.

KIST R&D: Since 2024, KIST has focused on SOEC stack design, performance validation, and demonstrating long-term operational stability. Research confirmed low power consumption and potential integration with Carbon Capture and Utilization (CCU) processes.

Challenges: Key remaining R&D challenges include achieving successful scale-up, mitigating degradation mechanisms (e.g., air electrode delamination, Ni coarsening), ensuring long-term durability (>20,000 hours target), and improving reproducibility.

LABORATORY TOUR: THE TOUR PROVIDED INSIGHTS INTO PRACTICAL ASPECTS OF SOEC R&D.

Efficiency and Operation: While theoretical efficiency targets 100%, practical limitations necessitate precise temperature and pressure control. Uniformity is critical to avoid system complexity. KIST utilizes simulation analysis for optimization.

SOEC vs. PCFC: Protonic Ceramic Fuel Cells (PCFCs) operate at lower temperatures (500-600°C) and can potentially use active protons in chemical synthesis, offering advantages for direct hydrogen use with Methylcyclohexane (MOHC) coupling. SOEC excels in high-efficiency production at higher temperatures.

MOHC Storage: Trends in MOHC-based hydrogen storage were discussed, including global projects developing direct fuel cell applications without intermediate separation steps. Comparative studies with alkaline electrolysis and other technologies (SLEC/SLEC-EA) are ongoing internationally.

DAY 2

KOREA RESEARCH INSTITUTE OF CHEMICAL TECHNOLOGY, DAEJEON: MATERIALS AND PROCESS INNOVATION

The visit to KRICT offered deeper technical exchange on chemical technologies, focusing on materials development and process innovation for the hydrogen economy.

SESSION 1: KRICT INSTITUTIONAL OVERVIEW (MS. EUNMI PARK)

Introduced KRICT's structure (research hubs in Daejeon, Sejong, Ulsan, Yeosu), key research areas (eco-friendly chemical processes, advanced materials, bio-based materials, chemical platform infrastructure), and its role in national R&D projects and international collaborations aimed at carbon neutrality and industrial competitiveness.

SESSION 2: HYDROGENATION OF UNSATURATED BONDS VIA ELECTROCHEMICAL PALLADIUM MEMBRANE REACTOR (EPMR) (DR. SAMUEL JAEHO SHIN)

Presented the activities of the CO₂ & Energy Research Center, focusing on CO₂ utilization, hydrogen storage/ utilization (including Liquid Organic Hydrogen Carriers - LOHC), and energy conversion technologies.

ePMR Technology: Detailed the mechanism of the ePMR for hydrogenating unsaturated bonds, integrating water electrolysis and chemical hydrogenation within a single reactor using a Pd membrane. This approach overcomes phase differences without crossover issues.

Applications: Potential applications span CCU, LOHC-based hydrogen storage and fuel cells, and biomass valorization, leveraging the role of hydrogen atoms in various chemical transformations. KRICT's LOHC R&D includes materials screening, catalyst development (including non-noble metals), reactor technology, and system integration.

SESSION 3: POLYMER ELECTROLYTE MEMBRANE (PEM) DEVELOPMENT FOR PEM WATER ELECTROLYSIS (PEMWE) (DR. SOONYONG SO)

Addressed the critical role of PEMs in PEMWE and the limitations of current commercial perfluoro sulfonic acid (PFSA) membranes like Nafion (high cost, high hydrogen permeability leading to crossover).

Hydrocarbon (HC)-based PEMs: KRICT presented its strategy to develop fluorine-free, HC-based PEMs (e.g., sulfonated poly (arylene ether sulfone) - BPSH) targeting low hydrogen permeability, high proton conductivity, and robust physical/chemical durability.

Strategies & Results: Key development strategies include hydrophilic channel alignment (via mechanical stretching), morphology control (random vs. block copolymers), entanglement control, and reinforcement (e.g., with porous PTFE). Results show HC-based membranes like random BPSH achieve significantly lower hydrogen crossover than Nafion, expanding the safe operating current density range for PEMWE. However, challenges remain regarding long-term chemical stability, particularly under oxidative conditions at the anode. Thicker or reinforced membranes are necessary to ensure safety and durability.

LABORATORY TOUR: DISCUSSIONS FOCUSED ON THE PRACTICAL CHALLENGES AND OUTLOOK FOR HYDROGEN TECHNOLOGIES.

Membrane Scale-Up & Commercialization: Optimizing operating conditions is key for large-scale electrolyzer deployment. While sulfonated polymer electrolyte membranes dominate commercially, the market potential for carbon-based (HC) membranes is growing due to environmental regulations and cost factors, with commercialization potentially achievable within 5-10 years through industry collaborations.

Hydrogen Utilization: Currently, hydrogen is primarily used in industrial feedstock applications (ammonia production, refining, metals). Its use in the energy sector is nascent (~1-2%) but targeted for significant expansion. Korea aims to develop and demonstrate PEMWE systems based on domestically developed membranes by 2030. The long-term vision positions hydrogen to potentially supply up to 80% of total energy demand.

DAY 3

KOREA EAST-WEST POWER, DONGHAE: DEMONSTRATION INFRASTRUCTURE & COMMERCIALIZATION

The final day focused on KEWP's role in demonstrating and scaling hydrogen infrastructure and utilization, connecting R&D efforts to commercial application.

SESSION 1: KEWP HYDROGEN TRANSITION ROADMAP & STRATEGY (MR. JIWOON MOON & PROF. INSOO CHOI)

EWP, one of Korea's five key power generation companies (9.6 GW capacity), outlined its strategy to transition towards clean energy.

Goals: Aiming for 60% domestic clean hydrogen self-sufficiency by 2050, aligning with Korea's national Hydrogen Economy Basic Plan. This involves significant hydrogen consumption (projected >1.2 Mtpa by 2050) through hydrogen/ammonia co-firing in existing and new combined cycle power plants.

Key Initiatives: Includes developing renewable energy-based electrolysis (Green Hydrogen Production Base in Donghae), building clean hydrogen import infrastructure (Ulsan), and pursuing full-cycle R&D through collaborations.

SITE VISITS:

Green Hydrogen R&D Cluster (Donghae): Toured Korea's only full-cycle green hydrogen demonstration platform. This facility integrates hybrid renewable power (solar PV, wind), various electrolysis technologies (Alkaline, PEM, SOEC tests), storage, and utilization pathways. Current R&D projects include developing 100kW-class SOEC systems, H₂/O₂ sensors for safety, non-metallic flexible hydrogen pipelines for transport, and next-generation chemical hydrogen storage technologies.

Bukpyeong SOFC Plant (Donghae): Visited the world's first heat-supplying SOFC power plant (4.2 MW). It utilizes city gas to produce electricity (for ~7,000 households) and thermal energy (for ~300 households), supplying heat to the adjacent Bukpyeong Leisure Center (building heating, swimming pool).

Samcheok Gyodong Distributed Hydrogen Production Base and Refueling Station: Toured the first hydrogen production base in Gangwon Province with shipping capabilities. It produces 1.3 tons/day of hydrogen via city gas reforming and can also receive hydrogen via tube trailers. It supplies hydrogen to refueling stations within the province and is registered in the national hydrogen distribution information system (Hying).

Hydrogen Town (Samcheok): Observed the energy-linked townhouse demonstration project designed for energy self-sufficiency. This pilot complex demonstrates an energy "prosumer" model, capable of 7-30 days of independent operation using renewable energy, battery storage, and a full hydrogen cycle (production via electrolysis, storage, and utilization via fuel cells) to manage energy supply-demand imbalances.



ACTIVITY 2

CRD2B2 WORKSHOP

The workshop's three-day programme integrated participation in WCE2025 with CTCN-organized sessions focusing on ESS and collaborative RD&D. The subsequent subsections outline the main activities and outcomes of each day.

DAY 1

ENGAGEMENT WITH WCE2025 AND GLOBAL FORM

Registration and climate exhibition tour: Participants registered for WCE2025, attended the Opening Ceremony, and heard a keynote address delivered by Dr. Fatih Birol, Executive Director of the International Energy Agency. They visited exhibition booths across the Future Energy, Clean Power, Carbon Neutral, and Climate Meteorological Industry halls, gaining exposure to cutting-edge technologies and innovations.

The Korea–World Bank Global Forum: Underscored the urgency of accelerating the green energy transition. Discussions highlighted the need for cross-sectoral cooperation, flexible policy frameworks, and blended finance mechanisms to address infrastructure and technology deployment challenges.

Networking with private-sector: Engagement was deepened through a presentation by Nuri Flex Co., Ltd, which introduced its global portfolio in energy metering and management systems. The session fostered direct dialogue on technology gaps, financing requirements, and opportunities for joint RD&D and international collaboration.

Country presentations: NDEs presented on their respective countries' ESS policies, national commitments, barriers, and priority technology needs. International case studies from Papua New Guinea, Honduras, Panama, and The Gambia provided valuable insights into policy, business models, and financing mechanisms supporting ESS deployment. A concluding panel discussion emphasized that successful ESS implementation in developing countries requires integrated approaches combining enabling policies, innovative finance, local capacity building, and sustainable business models.

DAY 2

COUNTRY PRESENTATIONS AND INDUSTRY COLLABORATION

NDEs continued booth visits focused on energy research, environmental technologies, and advanced energy systems

Information session on Global Climate Technology Future Strategy: NDEs joined the hosted by NDE of Republic of Korea, Ministry of Science and ICT. It aimed to showcase key climate technology innovations to address climate change by presenting RD&D results of green hydrogen and Carbon Capture and Utilization (CCU) technologies as key tools for accelerating carbon neutrality and exploring innovative technology development strategies.

DAY 3

COLLABORATIVE RD&D AND KNOWLEDGE EXCHANGE

The Asia Climate Tech Startup Partnership: Hosted by the Hyundai Motor Chung Mong-Koo Foundation (CMKF), the Global Industry Hub (GIH), and RMI's Third Derivative, creating new momentum to catalyze and commercialize innovative technologies. During the session, Mr. Han introduced the Youth Climate Innovation (YCI) Programme, reaffirming CTCN's commitment to nurturing the next generation of climate technology entrepreneurs. Meanwhile, Mr. Kinteh outlined his country's urgent climate challenges and highlighted its real-world needs given the national circumstances.

Seminar on Accelerating the Deployment of ESS: KIER and NIGT researchers highlighted ongoing work on PV-ESS microgrids, including demonstration projects in Jeju Island and Antarctica, and commercialization strategies for K-Energy technologies.

REFLECTIONS: OUTPUTS

The combined Learning Visit and CRD2B2 Workshop generated outputs aligned with CTCN's cRD&D strategic framework by promoting the development of innovative solutions for Collaborative Research⁵, supported relationship building with structured, demand driven dialogue and early stage concept development.

The workshops, as a Technology Information Exchange⁶ activity, provided a platform for NDEs to present country specific challenges, technology barriers, and national priorities, and this country led framing supported a shift from a supply push orientation toward a demand-pull approach that informed structured matchmaking, including sessions focused on ESS, and refinement through the PCP clinic.

Across these discussions, outputs also included clearer articulation of enabling conditions for deployment, including policy frameworks, financing models, local capacity building, viable business models, and institutional strengthening needs, alongside the technology considerations discussed in the ESS related sessions. The programme further introduced forward looking initiatives relevant to sustaining innovation pipelines, including CTCN's Youth Climate Innovation Programme and the Asia Climate Tech Startup Partnership, broadening engagement beyond traditional government and research actors and strengthening linkages with startups and youth innovation to meet the UN's value of inclusivity.

REFLECTIONS: OUTCOMES

The merged activity cycle strengthened foundations for follow up cooperation by combining trust based technical learning during the Learning Visit with structured convening and concept refinement during CRD2B2, resulting in a more coherent pathway from initial ideas to clearer cooperation concepts that can be pursued through follow up engagement and relevant CTCN mechanisms.

Participants gained a clearer understanding that demonstration-oriented collaboration depends on both technology and an enabling ecosystem, and that non-technical factors such as regulatory frameworks, institutional arrangements, financing pathways, local capacity building, and viable business models can be determinative for feasibility and sustainability, including in the context of ESS deployment discussions and related case-based exchanges.

Several delegates indicated an intention to pursue follow up actions, including potential CTCN Technical Assistance requests and exploration of joint research or cooperation with the Korean institutions engaged during the Learning Visit, suggesting potential for concrete follow up collaborations. In addition, the Learning Visit component contributed to increased visibility of Korea's hydrogen technology and policy linked approach, including reference to the Hydrogen Economy Roadmap as an illustrative model for aligning technology development, policy direction, and deployment planning, while the CRD2B2 component reinforced demand driven cooperation by centering NDE articulated priorities in matchmaking and the Project Concept Paper clinic processes.

RECOMMENDATIONS

To maximize the impact of the International cRD&D programme under the CTCN's cRD&D strategic framework, future activities could consider designing as an end-to-end pathway that translates developing countries' climate technology priorities into actionable collaborative RD&D and demonstration-ready opportunities through structured convening and follow-up. Building on these activities, the

need to establish a dedicated cRD&D pipeline, comprising sequential implementation tracks for long-term support, appears inevitable. In detail, this reflection piece suggests future programme to:

- Strengthen the nomination and selection of NDE participants through clearer criteria and more

⁵ cRD&D type 1 of the Strategic Framework

⁶ cRD&D type 2 of the Strategic Framework

systematic monitoring. Given the limited time and resources available to accelerate progress towards NDC goals, prioritizing participants who are ready to drive follow-up actions can significantly improve outcomes. This recommendation is aligned with the NDE function in coordinating engagement with CTCN services and ensuring alignment with national priorities.

- Formally integrate the Learning Visit as the front end of the CRD2B2 process so that both events operate as a single programme cycle. The Learning Visit should be used to validate needs, refine shared problem statements, and identify suitable Korean counterparts, while CRD2B2 should build on those outputs to structure partnerships and collaboration concepts that can progress towards demonstration.
- Provide sequential support across the cycle by introducing an online preparatory stage prior to the Learning Visit. A short series of virtual sessions can be used to confirm country priorities, agree on target technologies, align expectations among participating institutions, and prepare participants for technical discussions and site engagement, thereby supporting smoother implementation and more focused outputs during the in-person activities. This approach is consistent with CTCN's broader practice of capacity building and structured engagement with NDEs, including learning exchange activities.
- Before the activities, each participating country should provide a short priority note endorsed by the NDE and one to two well scoped problem statements. During the Learning Visit, the programme should

produce an initial matchmaking list and a shortlist of collaboration concepts. During CRD2B2, these concepts should be consolidated into one to two collaboration briefs per country, including a clear scope, roles, indicative resource needs, and a realistic pathway to demonstration.

- Engage implementation partners and financiers earlier in the cycle to increase feasibility and momentum. By inviting relevant funding and deployment actors to react to proposed concepts during CRD2B2, collaboration pathways can better reflect real world constraints and opportunities and become more likely to move beyond planning.
- Establish a systematic follow up mechanism after the events, such as structured check ins at 30, 60, and 90 days, to track partner engagement, concept refinement, and next steps. This aligns with the NDE role in coordinating and ensuring that support reflects national priorities and is effectively implemented.

With above reflections, a national level cRD&D TA project for a country with no and/or little experience in enhancing endogenous capacity for climate technology could take below activities:

Suggested TA title: Establishing endogenous national capacity of cRD&D on climate technology

Suggested TA activities: Research on national cRD&D status, Stakeholder mapping, Bridge-building activity, Learning visit, PCP development, and Project group formation

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