Funding Proposal Template

Application Template for Fully-Developed Proposal and Project Concept Proposal[1]



PROGRAMME ON INNOVATION: LARGE GRANTS PROJECTS

REQUEST FOR PROJECT FUNDING FROM THE ADAPTATION FUND

The annexed form should be completed and transmitted to the Adaptation Fund Board Secretariat by email.

Please type in the responses using the template provided. The instructions attached to the form provide guidance to filling out the template.

Please note that a project must be fully prepared when the request is submitted.

Complete documentation should be sent to:

The Adaptation Fund Board Secretariat
1818 H Street NW
MSN N7-700
Washington, D.C., 20433
U.S.A
Fax: +1 (202) 522-3240/5
Email: afbsec@adaptation-fund.org

[1] Single Country and Regional Concept proposals should complete Part I and Part II of the Project Proposal Template.

ADAPTATION FUND

SINGLE COUNTRY/ REGIONAL INNOVATION PROJECT/PROGRAMME PROPOSAL

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme: Microclimate–Energy Nexus Platform for Climate Adaptation in Remote Areas in Thailand

Countries: Thailand

Thematic Focal Area[2]: Disaster risk reduction and early warning systems

Type of Implementing Entity: Multilateral Implementing Entity

Implementing Entity: United Nations Industrial Development Organization (UNIDO)

Executing Entities: Department of Climate Change and Environment (DCCE), Ministry of Natural Resources and Environment, with United Nations Industrial Development Organization (UNIDO)

Amount of Financing Requested: USD 5,000,000

[2] Thematic areas are: Food security; Disaster risk reduction and early warning systems; Transboundary water management; Innovation in adaptation finance.

Project/Programme Background and Context:

Short Summary of the Project

Thailand faces increasing climate risks, including heat stress, droughts, and extreme rainfall events. Vulnerable communities in remote areas often lack access to timely and localised weather information, limiting their ability to prepare for and respond to climate impacts.

The Thai Meteorological Department (TMD) operates approximately 100 weather stations nationwide, which is insufficient for high-resolution forecasting and early warning systems. Additionally, Thailand's national risk maps are based on low-resolution and outdated data from 2020, limiting their utility for local adaptation planning.

This project proposes the deployment of microclimate sensors integrated with public-sector solar infrastructure in remote and vulnerable areas of Nakhon Ratchasima province. This initiative deploys a distributed network of climate sensors as the primary AF-financed adaptation infrastructure, co-located on existing public-sector solar PV assets (Tessaban, SAO and PAO installations already financed under the Provincial Governor budget and the Ministry of Energy fund) that serve only as physical host infrastructure. By leveraging this existing solar baseline as a mounting platform rather than constructing dedicated towers the project ensures uninterrupted monitoring and data transmission during climate shocks, safeguards the continuity of adaptation functions such as Early Warning Systems integrated with Thailand's MHEWS, and reduces the vulnerability of community-level adaptation services to climate-induced disruptions. The PV assets themselves are not financed, deployed or optimised under the AF investment; any benefits accruing to renewable-energy operation are treated as incidental co-benefits outside the project's results framework, while AF financing is ring-fenced strictly to the climate adaptation infrastructure (sensors, data platform, MHEWS integration, community capacity building) consistent with the AF's adaptation mandate and public-good principles. These sensors will feed into a cloud-based national climate data platform that will be institutionally anchored under the Climate Change Information Center (CCIC) of the Department of Climate Change and Environment (DCCE) Thailand's Designated Authority for the Adaptation Fund and the Ministry of Natural Resources and Environment (MoNRE) entity mandated to host national climate data as a public good. The platform supports AI-driven forecasting, risk mapping and climate resilience planning, with standards-based interoperability with MHEWS, the Thai Meteorological Department (TMD) national observation network and sectoral ministerial dashboards, ensuring that climate data and Early Warning Services are distributed free of charge to all users communities, ministries, sectoral agencies, provincial and local governments, academia, civil society and the public. The platform will be hosted in Thailand and developed with technical support from Malaysian experts under a South–South cooperation modality, adapting and innovating a proven Malaysian solar-monitoring application into a Thai climate adaptation data platform under DCCE/CCIC stewardship.

The AF investment is limited to climate adaptation infrastructure, including sensors, data systems, forecasting, MHEWS integration and community capacity-building. Existing public-sector solar PV assets are used only as host infrastructure for sensor co-location and are not financed, expanded or optimised by the project. Any renewable energy, PV yield, property development or commercial co-benefits are incidental externalities that are not measured by project indicators and do not drive any project decision. The "business case and project exit strategy" referenced during the PFG stage focuses exclusively on the institutional handover to DCCE/CCIC, the recurrent-cost absorption model by Thai public budget lines, and the replication pathway under DCCE leadership.

Climate hazards and future climate trends

Thailand is among the 16 countries globally identified as being in the “extreme risk” category for climate change impacts over the next three decades, according to UNDP and the country’s updated Nationally Determined Contribution (NDC). The country faces a future of more intense droughts and floods driven by a strengthened hydrological cycle and increased surface drying. These extremes are projected to directly undermine the agricultural sector, which remains the backbone of rural livelihoods and a significant driver of exports. Vulnerable households are expected to be most severely affected as precipitation becomes increasingly erratic, with more frequent intense rainfall events and prolonged dry periods. In recognition of these risks, Thailand’s National Adaptation Plan (2024) places climate-informed water management and climate-resilient infrastructure as central priorities for building resilience.

Several recent droughts have already highlighted the fragility of Thailand’s economy. As the UK Centre for Ecology and Hydrology notes, water shortages have disrupted food supplies, energy generation, and economic productivity. Agriculture, which employs roughly one-third of the labour force, is especially exposed.

Yet despite progress in drought monitoring, gaps remain in linking hydrometeorological data to real-world agricultural impacts. The lack of consistent datasets and stakeholder-informed impacts assessments limits the ability of farmers and water managers to translate forecasts into action. Closing this gap will be essential to improving preparedness, resilience, and livelihood security.

Long-term data confirm these trends. Research by the Thailand Development Research Institute Foundation shows that between 1951 and 2005, the frequency of severe droughts more than doubled, with a sharp increase in the mid-1970s due to surface warming. At the same time, the frequency of wet spells decreased by 2.5% per year, while the combined frequency of droughts and wet spells rose by 2% annually. Such volatility points to a future of increasingly frequent and damaging extremes. The catastrophic 2011 floods serve as a stark reminder of these risks: with damages estimated by the World Bank at USD 47 billion (equivalent to 13% of Thailand's GDP) the disaster revealed both the destructive power of extreme rainfall and the country's institutional weaknesses in water management. While large-scale floodways and reservoirs have often been favoured as solutions, experts caution that fragmented and centralised governance has hampered efficient and adaptive responses.

Further, monsoon storms frequently trigger flash floods that devastate local communities, and the country remains among the ten most flood-prone countries in the world. In the Sai-Ruak River Basin, heavy seasonal rainfall causes rapid river overflow, sending torrents of water, rocks, and debris downstream. These flash floods often result in landslides, destruction of homes and infrastructure, and loss of livelihoods. The 2021 floods in Mae Sai District, for instance, caused widespread damage to markets and residential areas, resulting in losses estimated at around half a million U.S. dollars. Studies by the Stockholm Environment Institute (SEI) and Mae Fah Luang University have shown that existing early warning systems in the region, designed to alert communities before flooding, have struggled to provide adequate lead time. In several recent events, warning sirens sounded only after river levels had risen sharply, leaving little opportunity for evacuation or asset protection. Many municipalities, including Mae Sai, face difficulties in forecasting floods accurately because they lack real-time data and hydrological modelling tools. National agencies such as the Thai Meteorological Department and the Department of Water Resources provide rainfall and river monitoring data, but these are often too broad or delayed to support rapid, community-level decision-making. Furthermore, upstream data gaps in transboundary areas limit the accuracy of predictions for downstream settlements in Thailand.

The human impact of these climate extremes is equally severe. In provinces like Nakhon Sawan, where the Yom and Nan rivers converge, floods and droughts have shaped daily life for generations. When water is scarce, crops fail, incomes collapse, and many farmers are forced to migrate to urban areas such as Phitsanulok or Sukhothai to seek temporary work, often in construction. These seasonal migrations strain household economies and fracture families, demonstrating how climate hazards ripple far beyond physical damage to reshape social and economic dynamics. Further,

The scale of losses from storms, droughts, and floods underscores the urgency of action. According to Thailand's National Adaptation Plan, storms damaged nearly 1,179 km² of agricultural land in 2022, drought affected 2,848 km² in 2020, and floods inundated more than 9,120 km² in 2021, destroying an additional 3,341 km² of farmland. Between 2011 and 2019 alone, economic damages amounted to USD 17.5 million from storms, USD 119.4 million from drought, and USD 23.7 million from floods. These events not only jeopardise food security but also undermine livelihoods, housing, and critical infrastructure.

Additionally, resilience of the energy system to climate shocks is an issue that requires further analysis and should be addressed / included in planning of the future energy system.
Together, these findings from national and international institutions point to a clear conclusion: Thailand is facing a future of intensifying climate extremes that threaten its agricultural base, economic stability, and community well-being.

A critical barrier to effective adaptation across Thailand is the lack of localised, high-resolution, and real-time climate and hydrometeorological data, according to the Thai Meteorological Department (TMD). Existing systems are too sparse and fragmented to capture the microclimatic variations that drive floods, droughts, and heat extremes at the community level. Without improved data infrastructure, predictive analytics, and integrated modelling, national and local institutions will remain constrained in their ability to provide timely early warnings, plan resilient infrastructure, and protect vulnerable populations. Addressing this foundational data gap is therefore central to strengthening Thailand's climate resilience and achieving the priorities outlined in its National Adaptation Plan.

Project Area

Nakhon Ratchasima Province, also known as Khorat, is a critical hub for Thailand's economy and food security. The province has a strong dependence on agriculture and is recognised as a major processing centre for rice, tapioca, and sugar production from the Isan region, which contributes nearly half of Thailand's total exports of these commodities. Beyond agriculture, Nakhon Ratchasima also plays an industrial role, housing significant manufacturing facilities such as Seagate Technology's hard disk production site. However, this economic importance is increasingly threatened by climate risks. [3]

Overall Climate Vulnerability and Hazard Trends

Nakhon Ratchasima is facing accelerating climate-related risks that affect both people and the economy. The province has experienced a clear rise in extreme events such as droughts, floods, windstorms and heatwaves over the past decade. In 2019, a severe drought affected 473,975 households, directly limiting water availability for domestic and agricultural use. In 2020, the province recorded 135 flood events, impacting 105,356 households and damaging lives, property and livelihoods. Between 2012 and 2021, both flood and drought events increased in frequency and severity. Windstorms are another growing hazard, with 339 reported events in 2020 alone, posing risks to settlements and infrastructure. Climate projections indicate a continued upward trend in maximum and minimum temperatures and a decline in rainfall, leading to prolonged dry spells, heavier storms and greater variability. The province has one of Thailand's highest historical heat hazard scores at 0.49, which is projected to increase to 0.55 in 2016–2035, 0.61 in 2046–2065 and 0.65 by 2081–2099 according to the Centre for Climate Change and Environment.

Water Resources and Groundwater Risks

Water availability and quality are major concerns for both households and agriculture. Current annual water storage stands at 4.07 cubic meters per person, which is considered adequate for now; however, rising temperatures and anticipated demand growth are expected to strain supplies. Groundwater salinity is already a pressing problem, with several areas reporting contamination levels that render water unfit for consumption and key risks to this sector include disruptions to domestic water supplies and declining groundwater quality due to contamination and salinity. Flash floods have also been contributing to water system instability and damage to water infrastructure. Without intervention, these trends will undermine both public health and economic stability.

Agriculture and Food Security

Agriculture in Nakhon Ratchasima is both highly productive and highly vulnerable. Yet shifting climatic patterns and recurrent disasters have eroded productivity. In 2018, drought damaged approximately 900,936 rai (144,150 hectares) of farmland. The most affected districts Non Sung, Thepharak, Pak Thong Chai, Mueang Nakhon Ratchasima, Sikhio, Sung Noen, Prathai and Sida - are also the ones classified as high-risk for droughts. Although the area of affected land has declined since 2018, agricultural yields continue to drop due to rising temperatures, unpredictable rainfall and plant diseases. Current water storage for agriculture is only 235.33 cubic meters per rai, placing the province within the water scarcity range (0–250 m^3/rai).

Economic Importance and Sectoral Impacts

The economic importance of Nakhon Ratchasima extends far beyond agriculture into other areas which are increasingly threatened by climate shocks, which disrupt supply chains, damage infrastructure and reduce productivity. Tourism has also suffered climate-related declines. Between 2013 and 2022, the province experienced a drop in visitors and overnight stays, resulting in lower tourism revenue. Heatwaves and more frequent flooding have been identified as major contributors to this downward trend. In the human settlements and security sector, climate hazards threaten livelihoods, homes and public assets, disrupting local economies and slowing development.

Public Health Impacts

Climate change is also directly affecting health outcomes in Nakhon Ratchasima. The province has faced recurring outbreaks of food-borne and water-borne diseases driven by higher temperatures and water contamination. Although the public health system has implemented Multi-hazard Early Warning Systems that have reduced some outbreaks, risks remain high. Vector-borne diseases linked to changing temperatures and humidity patterns are also a concern. Heat-related illnesses are on the rise: reported heatstroke cases

[3] All relevant statistics and information in this section are provided by the Thailand Greenhouse Gas Management Organisation (TGO)

increased from six in 2022 to nine in 2023 and are expected to grow as climate conditions worsen. The principal risk identified in the public health sector is the loss of life and property due to health-related climate impacts.

Ecosystems, Conservation and Wildlife Conflict

While Nakhon Ratchasima has made progress in forest restoration and conservation through protected areas, reclamation projects and ecotourism initiatives, climate change is disrupting ecological balance. Rising temperatures and flash floods are degrading habitats and food sources for wildlife. As a result, elephants, wild boars and other animals are increasingly leaving forests in search of food during the dry season. Incidents have been reported particularly in Khon Buri, Soeng Sang, Pak Chong and Wang Nam Khiao districts, with wildlife entering agricultural lands between January and March each year. In 2018, there were seven recorded wildlife intrusion incidents affecting 36 households. The key climate risk in the natural resource management sector is the loss of ecosystem diversity and increased human-wildlife conflict.

Urban Settlements, Infrastructure and Livelihood Security

Rising temperatures, windstorms, floods and droughts are increasingly affecting human settlements and local economies. The frequency and severity of these hazards threaten housing, small businesses and public and private assets. Climate-related damage impacts livelihoods, displaces residents and places pressure on local authorities to rebuild and respond. The disruption of critical infrastructure, including roads, electricity and water systems, could further limit resilience and recovery.

Emissions Profile and Mitigation Potential

Nakhon Ratchasima is also a major emitter of greenhouse gases (GHG). In 2019, it released 7.95 million tonnes of CO_2 equivalent, ranking seventh among Thai provinces, while only 1.95 million tCO_2eq was absorbed. Without intervention, emissions could exceed 9 million tCO_2eq by 2030. However, mitigation actions have the potential to reduce this by more than 2.26 million tCO_2eq according to the Centre for Climate Change and Environment. This dual challenge of high emissions alongside high vulnerability highlights the need for integrated adaptation and mitigation solutions.

And as such Nakhon Ratchasima sits at the intersection of high climate risk, economic importance and sector-wide vulnerability. It is central to Thailand's agricultural exports, manufacturing supply chains, rural livelihoods and ecosystem services. The province faces mounting threats across water resources, food security, public health, infrastructure and biodiversity, with clear evidence that current coping measures are insufficient. Rising temperatures, declining rainfall and increasing disaster intensity will only deepen existing challenges. Targeted intervention in this province will deliver outsized benefits by protecting national food systems, safeguarding critical infrastructure, enhancing public health resilience and securing livelihoods across rural and urban areas. For these reasons, Nakhon Ratchasima is a priority location for this project.

Target Groups

Farmers and agricultural workers represent one of the most climate-vulnerable populations in Thailand, and this is particularly evident in Nakhon Ratchasima Province, a region deeply reliant on agriculture for livelihoods and income[4]. The province is a leading producer of rice, cassava, maize, and sugarcane, all of which are highly sensitive to temperature fluctuations, rainfall variability, and water scarcity. Climate change directly threatens the productivity and stability of these farming systems, placing smallholder farmers at increasing risk of income loss and food insecurity.

National climate data from the Thai Meteorological Department shows that the mean temperature in Thailand increased by an average of 0.09°C per year from 2011 to 2021, with annual means reaching 28.0°C in 2020 and 27.5°C in 2021. The number of days when the heat index exceeded 35°C has risen dramatically from just 1.9 days in 1950 to nearly 50 days in 2020, signalling a steady intensification of heat stress conditions. For farmers, these rising temperatures accelerate crop water loss, reduce yields, and increase risks of heat-related stress on both crops and livestock.[5]

At the same time, rainfall patterns have become highly erratic. Over the past seven years (2015–2021), Thailand has experienced significant oscillations in total precipitation, including the lowest rainfall in four decades recorded in 2019 (1,343 mm). Such irregular rainfall undermines the reliability of planting cycles, reduces soil moisture, and increases dependence on irrigation. This variability is compounded by climate

[4] See publication https://www.sciencedirect.com/science/article/pii/S2949911924000443

[5] All relevant statistics and information in this section are from the Climate Change Action Plan for the Agricultural Sector

phenomena such as El Niño–Southern Oscillation (ENSO), which has seen sea surface temperatures steadily rising above normal since the early 1980s further amplifying drought and flood risks.

The consequences of these climatic shifts are already evident in Thailand's agricultural economy. Studies by Attavanich (2017) estimate that the cumulative economic damage from climate change impacts on agriculture between 2011/2012 and 2050 could range from USD 17.5 billion to USD 83.8 billion, depending on the emission scenario. At the household level, Attavanich et al. (2019) project that farm productivity could decline by 10% under moderate (RCP4.5) and 11.5% under high-emission (RCP8.5) scenarios, affecting nearly all farm households nationwide.

The growing financial burden on the state underscores the scale of vulnerability. Between 2008 and 2021, the Thai government provided an average of 8.18 billion THB per year in agricultural disaster relief, with the largest payments recorded in 2010 and 2011 due to widespread flooding and drought. Floods account for the majority of agricultural damage, followed by intermittent rain and drought events, which primarily affect crops but also impact fisheries and livestock.

For farming communities in Nakhon Ratchasima, these climate impacts translate into increasingly unstable livelihoods. Unpredictable rainfall disrupts planting decisions, heat waves reduce yields, and repeated floods or droughts degrade soil quality. Smallholder farmers, who rely heavily on seasonal rainfall and lack access to real-time climate information, are often unable to prepare for or respond effectively to such conditions. This limited adaptive capacity makes them especially vulnerable to both immediate shocks and long-term climate trends.

Within this group, women farmers and female-headed households face compounded vulnerabilities due to gendered constraints in access to land, credit, extension services, and climate information. Evidence indicates that women are less likely to receive timely early warning information and technical training, despite playing central roles in agricultural production and household risk management[6]. The project will therefore adopt a gender-responsive targeting approach, ensuring that women and other marginalised groups are explicitly prioritised in outreach, training, and access to climate services.
By targeting farmers and agricultural workers, this project addresses the population most at risk from climate change while directly supporting those who form the foundation of Thailand's food production system. According to recent labour force data for Nakhon Ratchasima Province (Quarter 3, 2025), approximately 189,314 individuals—representing nearly 40% of the working-age population—are engaged in agriculture, forestry, and fisheries, confirming the sector's central role in local livelihoods and climate vulnerability. Women account for approximately 41% of this workforce, highlighting the importance of gender-responsive targeting.

Based on this population baseline and the phased geographic focus of the project, it is estimated that approximately direct beneficially 80,000–120,000 individuals covered Mueang Nakhon Ratchasima, Pak Chong, Chok Chai within Nakhon Ratchasima Province in high-risk sub-districts will directly benefit from project interventions, including farmers, agricultural workers, and community stakeholders engaged in climate-sensitive livelihoods. Of these, at least 40–45% are expected to be women, consistent with sectoral labour composition. Vulnerable groups include female-headed households, elderly farmers, informal workers, and persons with disabilities.
Indirect beneficiaries are estimated at approximately 1,500,000–2,000,000 individuals across the province, including households benefiting from improved early warning systems, local authorities using enhanced climate data, and communities benefiting from reduced climate-related risks. These estimates will be further refined during the project preparation phase.

The detailed will be developed during the PFG phase through structured field studies and community surveys, in coordination with DCCE, the Provincial Working Group on Climate Change, the Office of the Governor of Nakhon Ratchasima and the relevant District Chief Officers. The disaggregated beneficiary baseline will be annexed to the full proposal and embedded in the project Results Framework and Gender Action Plan.

Short introduction of the proposed project interventions

Nakhon Ratchasima Province faces growing climate risks driven by increasing temperature extremes, erratic rainfall patterns, and recurrent droughts and floods. These hazards undermine agricultural productivity, water

[6] Food and Agriculture Organization (FAO). (2011). The state of food and agriculture 2010–2011: Women in agriculture: Closing the gender gap for development.
https://www.fao.org/3/i2050e/i2050e.pdf

security, and public health, particularly in rural and peri-urban communities where livelihoods depend heavily on climate-sensitive sectors. Despite national efforts to strengthen climate adaptation, local resilience remains limited by insufficient microclimate data, weak early warning systems, and gaps in institutional capacity to translate climate information into timely and practical action. To bridge these gaps, the project will deploy compact weather sensors integrated with resilient power solutions (e.g., solar PV with battery backup) and redundant communications. These measures ensure that localised climate intelligence remains operational even during climate-induced grid failures, directly reducing vulnerability to energy resilience and enhancing adaptive capacity at the community level.

If Nakhon Ratchasima uses innovative technologies and practices to develop a decentralised, data-driven climate monitoring and forecasting system—deploying distributed weather sensors and ensuring energy-resilient continuity—that localises climate intelligence, and strengthens the capacity of local institutions and communities to interpret, apply, and iteratively refine this information through participatory learning,
Then the province will be better able to anticipate and manage climate risks, empowering communities and institutions to (i) enhance adaptive capacity (e.g., through better on-farm decisions, water allocation, and preparedness), (ii) reduce exposure (e.g., via risk-aware land use and siting, infrastructure planning in hazard-prone areas), and (iii) reduce vulnerability (e.g., anticipatory action for droughts, floods, heat stress; continuity of essential services and local MHEWS)—ultimately generating evidence on scalable, locally led climate-information solutions

Because decisions in agriculture, water management, disaster preparedness, and local planning will be informed by accurate, real-time climate data, enhanced adaptive capacity, and a continuous learning process that supports replication in other vulnerable provinces.
The climate information generated will support practical adaptation decisions, including drought preparedness, irrigation scheduling, water allocation, heat-risk management, crop planning, anticipatory action and local adaptation planning.

Project/Programme Objectives:
The overarching objective of the project is: To strengthen Nakhon Ratchasima's (and Thailand's) resilience to droughts, floods, and heat stress by introducing innovative technologies and practices which will enhance local climate data systems, improve early warning and forecasting capabilities, and promote climate-informed planning and response across key sectors.
Specific Objectives:

1. **Enhanced Climate Data and Forecasting:** Use innovative tools and technologies to improve the collection, analysis, and dissemination of localised microclimate data to enable more spatially detailed and timely forecasting of droughts, floods, and heat events.
2. **Reduced Climate-Related Disruptions:** Minimise the adverse impacts of climate variability on agriculture, water supply, and local economies, particularly among vulnerable and low-income communities, through improved preparedness and adaptive management.
3. **Strengthened Institutional and Community Capacity:** Build national and local capacity for interpreting climate data and integrating climate information into decision-making processes for sustainable resource management and disaster risk reduction.

Project / Programme Components and Financing:
Table 1: Project / Programme Components and Financing

Project/ Programme Components	Expected Outcomes	Expected Outputs	Amount (US$)
1. Sensor Deployment[7] **(UNIDO)**	Outcome 1.1: Improved accuracy of localised weather and climate risk monitoring. Outcome 1.2: Stronger early warning systems for	Output 1.1: Network of microclimate sensors and solar-powered weather stations installed in priority high-risk zones. Output 1.2: Operational data transmission system linked to national meteorological and disaster management platforms.	1,700,000[8]

[7] Install microclimate sensors and solar-powered weather stations in remote areas, prioritising high-risk zones identified by DCCE and aligned with NAP sectoral priorities. The distributed sensor network is designed to address spatial gaps in existing observation coverage and capture localised climate variability that cannot be detected through the current national network.
[8] Compared with conventional meteorological infrastructure, the distributed sensor approach provides a cost-effective way to generate high-resolution climate information for early warning and adaptation planning in vulnerable communities.

	floods, droughts, and heatwaves. Outcome 1.3: Enhanced decision-making for agriculture, water management, and disaster preparedness.	Output 1.3: Baseline data collection on temperature, rainfall, and humidity across remote regions.	
2. Platform Development[9] **(UNIDO)**	Outcome 2.1: Real-time climate intelligence available for national and local planning. Outcome 2.2: Faster and more coordinated response to climate-related shocks. Outcome 2.3: Institutionalised climate data governance and digital infrastructure. Outcome 2.4: AI-assisted forecasting models developed and calibrated using localised data	Output 2.1: Cloud-based national climate data platform with AI-enabled forecasting tools integrated with Thailand's existing Multi-hazard Early Warning Systems to enhance accuracy and timeliness of local alerts. Output 2.2: Integrated dashboards accessible to ministries and sectoral agencies that display real-time provincial and national forecasts, drawing on data shared with the MHEWS platform. Output 2.3: APIs enabling data interoperability with existing government systems, including DCCE's MHEWS and related disaster management platforms, ensuring seamless exchange of forecasts and alerts. Output 2.4: A network of microclimate weather sensors installed and operational across key zones, feeding high-resolution data into both the provincial platform and MHEWS to improve localized early warning capabilities.	2,200,000
3. Capacity Building & Stakeholder Engagement[10] **(DCCE)**	Outcome 3.1: Increased technical capacity for climate-informed planning at all levels. Outcome 3.2: Community ownership of monitoring systems leading to sustained use. Outcome 3.3: Stronger institutional collaboration around NAP implementation.	Output 3.1: Training modules and manuals for sensor maintenance and data interpretation. Output 3.2: Workshops delivered to government units and community focal points, with targeted quotas (minimum 40–50%) for women's participation and tailored training formats addressing gender-specific barriers (e.g., time constraints, literacy, digital access). Output 3.3: Established feedback and coordination mechanism between national and local actors. Output 3.4: Knowledge management covering knowledge product development, replication toolkit production, community materials, ASEAN outreach and the open-data portal. Under Output 3.4: indicatively **USD 95,000–100,000** (≈ 17% of Component 3, ≈ 1.9% of total project). Final allocation to be confirmed at PFG stage.	587,260
4. Project components total			4,487,260
5. Project/Programme Execution Cost			121,035
6. Total Project/Programme Cost			4,608,295
7. Project/Programme Cycle Management Fee charged by the Implementing Entity (if applicable)			391,705
Amount of Financing Requested			5,000,000

Projected Calendar:
Project duration: 4 years (48 months)

[9] Build a cloud-based data platform with AI forecasting tools, integrating with national systems and enabling real-time data access for water, health, and food security sectors.

[10] Train local communities, DCCE staff, and relevant agencies on the use, maintenance, and climate-informed planning of data aligned with NAP goals.

Table 2: Project Calendar

Milestones	Expected Dates
Start of Project/Programme Implementation	January 2028
Mid-term Review (if planned)	June 2030
Project/Programme Closing	December 2031
Terminal Evaluation	February 2032

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Describe the project/programme components, particularly focusing on the concrete adaptation activities, how these activities would contribute to climate resilience, and how they would build added value through the regional approach, compared to implementing similar activities in each country individually. For the case of a programme, show how the combination of individual projects would contribute to the overall increase in resilience.

The proposed initiative will commence with a comprehensive preparatory phase designed to ensure local relevance and alignment with national adaptation priorities. Through engagements with the Department of Climate Change and Environment (DCCE), high-risk sub-districts in Nakhon Ratchasima will be identified, with a focus on those most vulnerable to drought, flooding, and agricultural stress. Detailed site assessments will guide the selection of locations for sensor deployment, such as farmlands, reservoirs, schools, and community centres where sites suitable for solar integration will be prioritised.

In parallel, a structured 'innovation scouting' process will be conducted to identify and document existing community-level adaptation practices, including informal weather prediction methods, water-sharing arrangements, crop diversification strategies, and local early warning practices. These grassroots innovations will be systematically assessed and integrated into project design, ensuring that the proposed technological solutions build upon, rather than replace, existing adaptive practices.

Given that final site selection will occur during implementation, the project will apply an Unidentified Sub-Projects (USP) approach in accordance with the Adaptation Fund Environmental and Social Policy. A USP screening and management framework will be established to ensure that all subsequently identified sites and activities comply with environmental, social, and gender safeguards. This framework will include:

(i) standardized environmental and social screening procedures;
(ii) exclusion criteria for high-risk activities or locations;
(iii) site-specific risk assessment and mitigation measures;
(iv) documentation and approval processes prior to deployment; and
(v) monitoring and reporting mechanisms to ensure compliance throughout implementation.

At this stage, stakeholder consultations will be held with provincial authorities, local municipalities, farmer cooperatives, and academic institutions to strengthen ownership and ensure alignment with Thailand's National Adaptation Plan (NAP) sectoral priorities in water, health, and food security. All necessary permits will be secured, and formal collaboration agreements will be established with community leaders to support long-term cooperation.

These consultations will be expanded into a structured co-design process involving diverse community-level actors, including farmer cooperatives, women's groups, youth organisations, local health volunteers, informal sector workers, and representatives of vulnerable populations (e.g., older persons and persons with disabilities). Participatory methodologies—such as community mapping, seasonal calendars, problem-ranking exercises, and co-design workshops—will be used to ensure that community inputs actively shape system design, including sensor placement, data priorities, and service delivery mechanisms, rather than merely validating pre-defined technical solutions.

Following this groundwork, the project will advance to the deployment of climate monitoring infrastructure using PV installations. The use of PV installations is chosen for a few reasons:

- PV systems are and can be more widespread geographically than current monitoring systems and easily accessible for maintenance / adjustments of equipment
- Sensors for climate monitoring help in the forecasting for energy production from PVs

- Improved PV systems and other distributed energy systems can help with energy resilience against climate shocks.

Professional-grade weather stations meeting the IEC 61724-1 Class A international standard for PV performance monitoring will be co-located with a complementary meteorological sensor suite at each site. Together, the co-located instruments capture the full parameter set required for adaptation and MHEWS integration, namely: rainfall, air temperature and relative humidity, wind speed and direction, atmospheric pressure, global (and plane-of-array) solar radiation, PV panel temperature and, where relevant, soil moisture and water level. These units are Sunspec compliant and rely on Modbus (RS-485) communication. Each station is powered through a 24V DC system (10–30V range), with built-in surge and overcurrent protection. Where applicable, rooftop installations will be prioritised, including on existing solar structures or low-lying built environments, while ensuring that placement avoids thermal interference and shading. In most cases, installation and routine upkeep will be carried out by designated local technicians trained under the project. Each device will undergo calibration and testing against reference instruments to ensure data accuracy and reliability. Once operational, data will be transmitted via RS-485 to site-dependent dataloggers and linked to either a cloud server or a secure Network Attached Storage (NAS) system. Connectivity will be adapted to local conditions using GSM and/or LoRaWAN networks to ensure steady transmission in both urban and remote settings. This step will create the foundation for high-quality, real-time environmental monitoring in the province.

In parallel, the project will develop and operationalise a cloud-based data platform that aggregates the incoming sensor feeds. The platform will be configured to interface with existing national systems, including those managed by the Thai Meteorological Department and DCCE. The AI component will function as part of the platform's analytical engine, using incoming sensor readings to train predictive models that generate actionable insights such as short-term weather shifts, seasonal drought or flood projections, and application-specific outputs for agriculture, water planning, and insurance risk assessment.
Local knowledge will be systematically incorporated into AI model calibration and early warning design through: (i) participatory identification of locally relevant climate indicators (e.g., soil moisture conditions, crop stress signals, animal behaviour); (ii) community validation of model outputs and seasonal forecasts; and (iii) co-definition of warning thresholds to reflect local risk perceptions and livelihood sensitivities.
User-friendly dashboards and mobile applications will provide accessible data visualisations for technical agencies and local stakeholders. A pilot phase with DCCE staff, local institutions, and community representatives will be used to test usability and refine system functions before the platform is formally launched.

The systematic collection of high-resolution climate and weather data will primarily strengthen MHEWS and adaptive decision-making for vulnerable communities and institutions. These granular datasets can also support energy resilience by improving solar PV system planning and operational continuity during climate shocks. Reliable, localised data enhances PV operators' ability to anticipate adverse weather conditions and maintain critical energy services, which is essential for sustaining early warning platforms and community-level communications during extreme events.

PV assets themselves are not financed, deployed or optimised under the AF investment. Existing public sector solar PV assets (Tessaban, SAO, PAO installations already financed under the Provincial Governor budget and the Ministry of Energy fund) serve only as physical host infrastructure for sensor co-location, which lowers the total cost of adaptation delivery compared to constructing dedicated towers. Any incidental improvements in solar yield forecasting, PV site selection or renewable energy operation that may arise from the availability of public-good climate data are treated as incidental co-benefits outside the AF results framework, not measured by project indicators and not driving any project decision. This framing ensures that PV-related activities are strictly aligned with adaptation outcomes: continuity of essential services, resilience of the Early Warning System integrated with MHEWS, and reduced vulnerability to climate-induced disruptions of adaptation infrastructure.

Capacity building will be a central pillar of the initiative, distributing technical skills across every governance level so that community members are positioned as active technical partners, not passive information recipients. The programme trains Community Data Champions, Village Health Volunteers, Village Natural Resource and Environment Volunteers, farmer cooperatives, women's groups and youth networks, together with dedicated women's participation in technical training ensuring community members gain real technical skills rather than only application user awareness. Training is delivered by ERTC under DCCE and covers five core modules: (1) basic sensor usage; (2) reading the CCIC dashboard; (3) basic troubleshooting (checking connectivity, reporting issues); (4) understanding AI forecasts; and (5) translating climate data into

community action. In parallel, central institutional training is delivered to DCCE staff, TMD and provincial officials on sensor operation, calibration to NIMT/TMD standards, platform administration and MHEWS integration. Sex-, age- and disability-disaggregated participation targets including at least 40% women in technical training and 30% of service contracts reserved for women-led enterprises will be finalised in the Gender Action Plan at PFG stage. Training materials will be developed in Thai and tailored for different audiences to ensure inclusivity.

To complement these efforts, a structured community outreach and engagement programme will be implemented, using explicit non-digital coverage targets to ensure that populations without smartphones or mobile data are not left behind. 6 complementary non-digital channels will be deployed: (1) village public-address loudspeakers; (2) local community FM radio; (3) Village Health Volunteers door-to-door cascade; (4) printed public notices at temples, health stations, sub-district offices, markets and schools; (5) basic SMS alerts that work on any mobile phone without a data plan; and (6) monthly community meetings at sub-district level. The project commits to reaching at least 80% of the population in each pilot zone through at least one non-digital channel, and at least 90% of vulnerable households (elderly, persons with disabilities, women-headed and low-income households) through at least two non-digital channels for redundancy. Coverage will be verified through baseline, mid-term and terminal household surveys, disaggregated by sex, age, disability and income.
Coverage will be measured through baseline, mid-term and terminal household surveys, disaggregated by sex, age, disability and income. Feedback mechanisms — including hotlines, the Grievance Redress Mechanism and community validation sessions will ensure that community experiences inform iterative improvements to the system.

The project will conclude with a focus on monitoring, evaluation, and sustainability. Regular performance reviews will be undertaken to assess data quality, platform functionality, and the extent of stakeholder uptake. To ensure long-term continuity, local maintenance teams will be established, comprising trained technicians and provincial staff capable of managing equipment and data systems independently. Sustainability is anchored on absorption of recurrent costs by Thai public budget lines (TMD, DCCE/CCIC/ERTC, the Provincial Governor and PAO/SAO/Tessaban), which cover the estimated USD 145,000–170,000 annual recurrent cost of the 205-station network. Private-sector contributions are not required for sustainability; where relevant, non-monetary in-kind support may be provided by public-sector host institutions (Tessaban, SAO, PAO) that host sensors on their existing solar PV assets. The experience and lessons generated from the Nakhon Ratchasima pilot will serve as a model for scaling up across other vulnerable provinces.

All PV-related activities under this project are strictly limited to using existing public-sector solar PV assets as physical host infrastructure for sensor co-location, and are designed exclusively to serve adaptation objectives namely, the continuity and reliability of climate observation, Early Warning Services and MHEWS-integrated data flows. The AF investment does not finance, deploy, expand, operate or optimise PV systems, any incidental contributions to renewable energy operation, solar yield improvement or commercial benefits are treated as co-benefit of the project's result framework. Further technology feasibility assessments will also be conducted during the PFG phase.

B. Describe how the project /programme would promote new and innovative solutions to climate change adaptation, such as new approaches, technologies and mechanisms.

This project advances climate adaptation through the combined use of large-scale microclimate data collection and AI-driven forecasting, an approach not yet deployed in Thailand at this scale or level of integration. In addition to technological innovation, the project adopts a co-production approach to innovation, integrating scientific and local knowledge systems. This includes the incorporation of farmer observations, seasonal indicators, and traditional forecasting practices into model development, ensuring that innovation is contextually grounded and socially embedded.

First, while sensors and weather stations are well-established technologies, the innovation lies in how they will be deployed, powered and integrated—coupling microclimate monitoring with energy resilience. The project will install a dense network of microclimate sensors across an entire province and connect them to existing or new solar-powered infrastructure as decentralised PV-backed systems. This infrastructure ensures uninterrupted data flow and advisory services during extreme events—a critical adaptation function often overlooked in conventional early warning architectures. Furthermore, it enables continuous, low-cost data collection in remote and underserved areas where national meteorological coverage is currently limited. This is already being carried out in other countries (such as Malaysia) but not in Thailand.

Second, the project will introduce AI-based forecasting models trained on ultra-local datasets. These models go beyond traditional hydrometeorological systems by improving resolution, predictive capacity, and sectoral relevance. This approach will generate tailored insights for agriculture, water management, disaster preparedness, public health, and local planning, areas where current national systems operate at a coarser spatial and temporal scale.

The project design incorporates structured iteration cycles during the pilot phase. Early sensor data and user feedback from communities and sector stakeholders will be systematically integrated into model refinement, interface design, and deployment strategies. This includes predefined review points at which model performance, usability, and relevance will be assessed, enabling adjustments to data inputs, algorithm calibration, and service delivery mechanisms. These adaptive checkpoints ensure that the system can pivot based on operational learning, improving accuracy, usability, and impact over time.

Such parties include solar contractors, solar project developers and local governments. Platforms have to be designed to be user friendly graphic user interfaces, have its source code readily available and have the necessary videos and documentation to allow for easy integration by multiple hardware makers as well. Lessons from engagements with hardware and software teams will improve the planning and scope of the platform which will be critical for multi-country adoption. The design and architecture of the platform with its technology stack has to be well defined for localized storage instead of a cloud server architecture. Early data will provide the necessary testing and quality assurance base cases.

Third, the project differs from existing adaptation or hydrometeorological initiatives in Thailand in two key ways:

- Scale and localisation of data: Rather than piloting small numbers of stations or relying on satellite data, the project focuses on province-wide sensor deployment to build a granular dataset specific to high-risk areas.
- AI-enabled decision support: Unlike earlier projects focused on capacity building or general early warning, this initiative integrates proprietary predictive models designed to generate actionable outputs for local communities and subnational authorities.

Systematically collecting high-resolution weather data and integrating sensor data with national systems creates a cost-effective, scalable model that strengthens climate resilience. The forecasting platform will use a hybrid model approach: core AI algorithms will be non- proprietary in their public-good use, fully accessible to the Thai public sector under perpetual royalty-free terms (for adapted Malaysian components) and released under open-source licences for newly developed components to ensure system performance and future scalability, while the data dashboards and user interfaces can incorporate open-source components where appropriate to enable wider government uptake. In several Asian countries, subnational monitoring networks have demonstrated improvements in localised forecasting and agricultural advisories. However, none have combined large-scale sensor deployment with AI-enabled prediction models as proposed here.

By linking field-level data, sectoral applications, and AI analytics, this project introduces a replicable and forward-looking model for climate risk management in Thailand and the ASEAN region. The project connect with the weather and Multi-hazard Early Warning Systems (MHEWS) platforms of relevant agencies such as the Thai Meteorological Department (TMD), Hydro – Informatics Institute (HII), and Department of Disaster Prevention and Mitigation (DDPM).

To address gender gaps in the climate technology sector, the project will actively promote women-led innovation and entrepreneurship as a core component of its innovation model. This includes establishing pathways for women to participate as developers, service providers, and entrepreneurs within the climate information ecosystem. Targeted measures will include: (i) dedicated training programmes for women in digital climate services, sensor maintenance, and data analytics; (ii) mentorship and incubation support for women-led enterprises developing climate-related solutions; and (iii) facilitation of market linkages for women entrepreneurs to deliver climate advisory services, early warning dissemination, and data-driven agricultural support.

During the Full Proposal (FP) stage, the project will be designed to operate as a living, evidence-driven adaptation platform through four interlocking innovation mechanisms: (i) co-design with target communities that links community feedback directly to system design choices rather than treating consultation as one-off outreach; (ii) local-knowledge-to-AI-calibration loops through which community observations inform the AI forecasting models hosted under DCCE's CCIC; (iii) structured iteration cycles with predefined review points

for evidence-based course-correction; and (iv) an innovation scouting process that integrates emerging South–South adaptation technologies, exemplified by the Malaysia–Thailand technology transfer.

During the PFG phase, evidence from comparable pilots in Malaysia and other relevant contexts will be validated in the Thai context to define go/no-go criteria for scaling, including forecast accuracy, user uptake, gender-inclusive access, institutional absorption and sustainability.

C. Describe how the project/programme aims to roll out successful innovative adaptation practices, tools, and technologies and/or describe how the project aims to scale up viable innovative adaptation practices, tools, and technologies.

The project builds on similar experiences in relevant geographies such as the following:

- **Malaysia (Kelantan River Basin & Selangor):** Intense monitoring of monsoon rainfall, intensity, and duration is used to feed radar-based quantitative precipitation estimation (QPE) and hydrodynamic models. In Selangor, IoT sensors and microclimate stations (measuring rainfall, humidity, temperature, and water levels) have improved flash flood prediction in urban environments.
- **Indonesia (Jakarta & Java):** The use of in-situ IoT (Internet of Things) water level sensors and local weather stations has proven critical for tracking fast-rising flash floods. A micro-scale study in the Cilincing sub-district of Jakarta demonstrated that using local, real-time data from "orange and blue troop" patrols (who monitor waterway levels and waste) significantly improves flood response.
- **Philippines (Marikina River, San-Mateo):** A KoICA-funded initiative has established a test bed for an AI-based flood prediction model, which uses localized upstream water level gauges and rain stations to enhance flood warnings.

The evidence base for microclimate-driven AI forecasting is well documented in the peer-reviewed literature and in industry deployment. Peer-reviewed studies confirm that urban microclimate variability alone can drive 2–14% differences in building cooling energy demand and up to 11°C in local temperature differences within a single city[1]. NREL research demonstrates that machine-learning site-specific weather forecasting, validated in the Denver metro area, achieves a 1-hour-ahead temperature forecast with mean absolute error below 0.72°C and a 48% improvement over the persistence method[2]. Peer-reviewed research in Nature Scientific Reports confirms the value of microclimate data for precision agriculture, including irrigation optimisation, windbreak placement and pest/disease prevention[3]. At industry scale, Microsoft's DeepMC framework demonstrates that micro-climate AI prediction achieves over 90% accuracy at IoT sensor locations deployed globally[4], confirming that the approach is scalable and viable at production level. The Malaysia, Indonesia and Philippines pilots additionally demonstrate operational deployment of IoT/microclimate sensor networks in tropical monsoon contexts. UNIDO also acknowledges the sustainability concerns raised by SEDA Malaysia (3G-connectivity reliance and discontinued data collection from original FIT sites) and has translated these into design mitigations: use of GSM/4G/5G/LoRaWAN redundant connectivity, sensor co-location on public-sector PV assets anchored institutionally on DCCE/CCIC, and public-budget absorption of recurrent costs.

During the PFG phase, this evidence base will be consolidated into a Technology Readiness and Evidence Annex, and Thai-context baselines for forecast accuracy, community uptake, operational uptime and institutional absorption will be established through baseline surveys. Indicative minimum evidence thresholds for the go/no-go scaling decision include: forecast-accuracy improvement over the TMD baseline consistent with the NREL benchmark (48% improvement over persistence method) or the Microsoft DeepMC benchmark (>90% accuracy at sensor location); community EWS uptake sufficient to demonstrate behaviour change; operational uptime of at least 90%; and institutional absorption of at least 80% of recurrent costs by Thai public budget lines. Final thresholds will be jointly endorsed by DCCE, TMD and the Provincial Working Group on Climate Change during PFG.

A consolidated Technology Readiness Level (TRL) and performance-evidence snapshot is provided below (to be substantiated in the Technology Readiness and Evidence Annex at PFG stage):

(i) Sensor / PV co-location approach — TRL 8–9 (actual system proven in operational environments). IEC 61724-1 Class A sensors are a commercially mature technology deployed globally by multiple vendors in solar PV monitoring and meteorological observation. Peer-reviewed research confirms the value of microclimate sensor data for precision agriculture[5]. The innovation lies in co-locating sensors on public-sector PV assets for adaptation purposes at provincial scale.
(ii) AI-enabled forecasting component — TRL 7–8 (system prototype demonstrated / actual system proven in analogous environments). NREL peer-reviewed research demonstrates that ML-based site-specific weather forecasting achieves 0.72°C mean absolute error and a 48% improvement over the persistence method[6].

Microsoft DeepMC (industry deployment) confirms over 90% accuracy at IoT sensor locations deployed globally[7], and peer-reviewed studies confirm ANN-based urban microclimate modelling with only a few months of data[8]. Integration with dense microclimate sensor networks and MHEWS at provincial scale in Thailand will be validated during implementation.
(iii) Malaysian solar-monitoring application being adapted — TRL 7–8 in Malaysian context (deployed operationally, with sustainability limitations acknowledged in the SEDA consultation and turned into design lessons). The application will be adapted to the Thai climate adaptation context, hosted under DCCE/CCIC, and licensed to the Thai public sector under perpetual, royalty-free terms with source-code escrow and full derivative-work rights (ensuring no vendor lock-in and no provider exit risk). Adaptations and derivative works developed under AF financing will be released under an open-source licence (e.g., Apache 2.0 or equivalent), transforming the tool from a proprietary solar-monitoring application into a public-good climate adaptation data platform.

The consolidated Technology Readiness and Evidence Annex prepared during PFG will substantiate each TRL score with full citations, document performance data from comparable deployments, establish Thai baselines, and define minimum evidence thresholds for the go/no-go scaling decision[11][12][13][14][15][16][17][18].

The project scales innovative adaptation technologies by deploying solar-powered microclimate sensors and integrating them with an AI-enabled data platform to generate real-time, hyperlocal climate intelligence for vulnerable communities. Initial rollout will prioritise high-risk agricultural and disaster-prone areas identified, where localised data is currently unavailable. The system's modular design allows rapid replication across provinces, while the platform can be integrated into existing national adaptation and disaster management systems to serve multiple sectors, including water, food security, and public health. Data collected from microclimate sensors will strengthen early warning capabilities. The high-frequency weather data will feed into national Multi-hazard Early Warning Systems (MHEWS), enhancing the accuracy and timeliness of climate hazard forecasts.

Beyond the technology itself, the project embeds several institutional and process innovations. These include the decentralisation of climate data generation through community-level sensor networks; the integration of AI-driven analytics into public early warning systems; and the establishment of iterative feedback loops between data providers, end users, and decision-makers to continuously refine outputs and services. The project also introduces new coordination mechanisms between national agencies, provincial authorities, and local stakeholders to enable cross-sectoral use of climate intelligence.

The design further incorporates a multi-actor implementation model that goes beyond a standard government-to-government approach. This includes engagement with private sector technology providers and data service companies for sensor deployment and platform development; collaboration with academic and research institutions to support model development and validation; and partnerships with civil society organisations and community groups to support local deployment, maintenance, and uptake of climate services. This diversified ecosystem of actors is critical to ensuring both technical robustness and long-term sustainability.

Microclimate data significantly improves flood predictions by providing localized, high-resolution information that traditional, large-scale meteorological models miss. By integrating data on solar irradiance, temperature and potentially local rainfall intensity, flood forecasting systems can achieve greater accuracy, especially for flash floods and urban environments. For example, having access to 5 sets of data in each industrial park in a city would enable availability of a higher resolution of precipitation data allows for better identification of flash flood risks that are often missed by broader, regional forecasts. This is especially useful when the industrial sites are adjacent to rivers. Detailed analysis of data and insertion into larger climate models allow for the potential risk of urban drainage capacity overflows.

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[11] ScienceDirect (Energy and Buildings, 2024) — ANN model for urban microclimate prediction, Montreal; and Hong et al. showing up to 11°C temperature differences within San Francisco during the 2017 heatwave. https://www.sciencedirect.com/science/article/pii/S0378778824003992
[12] NREL — Site-specific weather forecasting using machine learning for grid-interactive efficient buildings, Denver metro area. https://docs.nrel.gov/docs/fy20osti/77768.pdf
[13] Nature Scientific Reports (2023) — Microclimate in precision agriculture. https://www.nature.com/articles/s41598-023-48028-1
[14] Microsoft Research — DeepMC: Micro-climate predictions enabling hyper-local decisions for agriculture and renewables. https://www.microsoft.com/en-us/research/blog/micro-climate-predictions-enabling-hyper-local-decisions-for-agriculture-and-renewables/
[15] Nature Scientific Reports (2023). https://www.nature.com/articles/s41598-023-48028-1
[16] NREL — Site-specific weather forecasting using machine learning. https://docs.nrel.gov/docs/fy20osti/77768.pdf
[17] Microsoft Research — DeepMC micro-climate predictions. https://www.microsoft.com/en-us/research/blog/micro-climate-predictions-enabling-hyper-local-decisions-for-agriculture-and-renewables/
[18] ScienceDirect (Energy and Buildings, 2024). https://www.sciencedirect.com/science/article/pii/S0378778824003992

The AF-financed platform is designed and operated exclusively as a public-good adaptation service under DCCE's Climate Change Information Center (CCIC), providing free, non-discriminatory access to climate data and Early Warning Services for communities, ministries, sectoral agencies, provincial and local governments, academia, civil society and the public. The platform is not designed, financed or used to generate commercial value for private-sector actors. Any incidental positive externalities that may accrue to third parties from the availability of public-good climate data are outside the AF results framework, are not measured by project indicators, and do not drive any project decision. Long-term platform sustainability is anchored on DCCE/CCIC's institutional mandate and on Thai public-budget absorption, not on commercial value generation.

Specific institutional steps to ensure successful rollout include:

- A ministerial-level MOU between the Ministry of Natural Resources and Environment (MonRE) and the Ministry of Interior has already been signed to implement the National Adaptation Plan (NAP). The NAP defines a core mandate across six sectors; the Governor of Nakhon Ratchasima (under the Ministry of Interior) is included in this mandate.
- Data and the platform will be hosted at the Climate Change Information Center (CCIC) of DCCE, which is scheduled to be launched publicly by the end of 2026. The centre will consolidate system data and validate and integrate technology from Malaysia.
- Once the centre is established, the project will be presented to local governments as specified in the MOU so they can attend briefings, learn about the initiative, receive technology transfer, and provide feedback to improve the centre's dashboard.
- Under Component 3, a TOT (train-the-trainer) approach is planned, initially implemented through Subdistrict Administrative Organizations (Or-Bor-Tor). The department's Participation Promotion Division will be invited to support capacity-building activities. Communities / local relevant groups (eg farming extension services, emergency preparedness officers, etc. will be trained and informed of merging data collection efforts.

The project plans to engage a Malaysian technology vendor as a South–South technology transfer model, covering both hardware and software transfer. Thai host sites are limited to publicly owned solar PV assets (Tessaban, SAO, PAO installations financed through the Provincial Governor budget and the Ministry of Energy fund) that serve exclusively as physical mounting locations for sensor co-location; no co-financing, subscription-based revenue or private commercial arrangement is envisaged, and all core climate data and EWS services are distributed free of charge as a public good under DCCE/CCIC stewardship.

The data handled by the Climate Change Information Center (CCIC) are transmitted and received primarily via standard internet, cellular GSM/4G/5G mobile networks (using SIM-based modems) and, where applicable, LoRaWAN low-power wide-area networks operating on Thailand's unlicensed 920–925 MHz band, all of which use standards-based, type-approved telecommunications technologies that comply with the National Broadcasting and Telecommunications Commission (NBTC) framework. The system does not engage in radio broadcasting, does not generate proprietary radio communications services and does not require dedicated frequency-spectrum licences under the NBTC; cellular communications operate under the existing licences held by Thai mobile carriers (AIS, True, dtac), and LoRaWAN operates on Thailand's licence-exempt ISM band. The establishment and operation of the CCIC comply with the relevant ministerial regulations defining the roles and responsibilities of the Department of Climate Change and Environment (DCCE) within the Ministry of Natural Resources and Environment, and with all applicable Thai telecommunications, data protection and cybersecurity requirements. Therefore, they do not conflict with the regulatory framework on radio frequencies, and concerns regarding radio frequency use are not applicable to the center's operations.

As part of this approach, collaboration with local farmers will be carried out to ensure proper alignment of information sharing both from and to local populations. This will include a thorough understanding of current adaptation practices and how information is shared (both through formal and informal channels). This will be further explored during full project preparation.

Capacity-building for local technicians, community stakeholders, and provincial authorities ensures long-term adoption, operations, and data use. By demonstrating successful sensor clusters and AI forecasting models

in priority zones, the project creates a scalable model that can be expanded geographically and institutionally, transforming climate data access and decision-making at both community and national levels.

Note that while technology types have been identified at this stage, the specific technology selection will be based on feasibility studies during PFG and technology will be procured using an open and competitive process. The aim will be to allow for equity (geographical, gender, and economic class) in access to adaptation benefits. The project will incorporate inclusive communication channels, including radio announcements, to ensure widespread and equitable dissemination of climate and early warning information. Additionally, simplified dashboards to show the data and its predictions will be accessible on mobile devices – which are already widespread in the local populations. The continued expected proliferation of digital payments will likely result in even more of the populations in remote areas to have access to a mobile phone.

During the PFG phase, the project is explicitly designed to engage, empower and benefit the most vulnerable groups in Nakhon Ratchasima — women, smallholder farmers, low-income households, youth, persons with disabilities, village health volunteers and climate-exposed rural and peri-urban residents — through a two-stage participatory architecture, fully operationalised at the Project Formulation Grant (PFG) phase.

Stage 1 Engagement architecture (PFG-defined): specific districts and target communities; number and format of consultations and co-design workshops; methodologies for documenting, analysing and integrating community feedback; governance arrangements for approving design changes; and feedback mechanisms (GRM, "You Said / We Did" register, annual community validation sessions). Engagement covers farmer cooperatives, women's groups, youth organisations, disability advocacy organisations, CSOs and others.

Stage 2 Iterative co-design integrating local and traditional knowledge (PFG-assessed): how traditional knowledge will be collected, coded and translated into model-relevant variables; who validates farmer observations against sensor and remote-sensing data; whether local indicators feed the AI system as inputs, calibration checks, interpretation layers or threshold modifiers; how disagreements between technical outputs and local knowledge are resolved; how risk maps visually represent local knowledge; how often warning thresholds are reviewed; whether differentiated thresholds apply by crop, livelihood, district, gender or season; and how M&E captures the influence of local knowledge on the system.

Concrete benefits to vulnerable groups: improved MHEWS-disseminated Early Warning Services through gender-responsive channels; tailored agricultural and livelihood advisories; community capacity building of CSOs, water-user groups and women's groups as EWS multipliers; gender-responsive empowerment under the Gender Action Plan; traceable co-design influence over project decisions; and closure of the gender and CSO representation gap of the 2023–2024 Provincial Working Group through formal seating of women's, youth, PWD and CSO representatives.

All elements above will be operationalised and annexed at PFG stage — including the Stakeholder Engagement Plan, Gender Action Plan, Traditional Knowledge Integration Protocol, Adaptive Management Protocol, GRM SOP, and a disaggregated beneficiary baseline in compliance with the AF Environmental and Social Policy and Gender Policy.

D. Describe how the project/programme would provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project/programme would avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

The proposed pilot in Nakhon Ratchasima Province will generate tangible economic, social, and environmental benefits by strengthening the foundation of Thailand’s climate resilience through improved data collection and integration. The project is expected to benefit (either directly or indirectly) between 80,000 and 120,000 people in priority high-risk districts through improved access to localised early warning information, resilient energy-enabled services, and strengthened local response capacity. Of these, at least 40% are expected to be women, and a significant proportion will include vulnerable groups such as low-income households, smallholder farmers, and climate-exposed rural communities. Additionally, the project could benefit up to 2.18 million people (the province's regional population as of 2021) through strengthened Multi-hazard Early Warning Systems (MHEWS), improved climate-informed planning, and enhanced resilience of critical services and infrastructure.

Vulnerable populations, including rural households, women, and low-income groups, stand to benefit indirectly from better-informed policies, MHEWS, and infrastructure design that account for climate risks. A detailed disaggregation of beneficiaries by vulnerability status (including income level, gender, and climate exposure) will be conducted during the Project Formulation Grant (PFG) phase through field assessments and stakeholder consultations.

Economic benefits
By establishing a localised network of microclimate weather sensors, the project will enhance the quality, accuracy, and timeliness of climate data available to national and provincial agencies. This improved information will support evidence-based planning and more efficient resource allocation, particularly for agriculture, water management, and disaster response. In the longer term, better data will reduce the economic costs of climate-related damage by enabling proactive investment, early intervention, and optimised use of public funds for climate adaptation. The integration of localised data into existing government systems will also support private-sector and academic research, fostering innovation and job creation in the emerging climate technology sector.

Social benefits
At the social level, the project will contribute to greater institutional and community preparedness for climate extremes. By closing data gaps that currently limit local authorities' ability to anticipate floods, droughts, and heat stress, the project will enable a more inclusive and equitable approach to resilience planning. Crucially, the project ensures the continuity of early warning, climate data services, and energy resilience during outages. This guarantees that communities maintain reliable access to power and actionable information even under severe weather conditions, directly reducing exposure to hazards, safeguarding livelihoods, and minimising climate-induced losses. Consequently, vulnerable populations, including rural households, women, and low-income groups, stand to benefit indirectly from better-informed policies, MHEWS, and infrastructure design that consider their specific exposure to climate risks. The project will apply disaggregated monitoring indicators to ensure equitable access across gender and vulnerable groups.

Beyond participation, the project will support women's economic empowerment by fostering women-led micro and small enterprises linked to climate services. This includes opportunities for women to act as local data intermediaries, climate advisory providers, and operators of digital platforms. These activities aim to reduce structural barriers to women's participation in technology-driven sectors and promote inclusive economic growth.

In addition, capacity-building and collaboration with local educational and research institutions will promote knowledge sharing and help build the technical expertise needed to sustain and expand climate monitoring systems nationally. A significant share of the project's capacity-building resources will be directed toward farmers, community-based organisations, women's groups, local technicians, village health volunteers, and other vulnerable community stakeholders. Capacity-building investments will prioritise strengthening local adaptive capacity, improving access to climate information, supporting community-level use of early warning services, and developing the skills required for long-term operation, maintenance, and utilisation of climate information systems. This approach ensures that project benefits extend beyond institutional strengthening and directly contribute to resilience-building among climate-vulnerable populations.

To address gendered vulnerabilities, the project will implement targeted measures including: (i) gender-sensitive design of early warning dissemination channels (e.g., SMS, community networks accessible to women), (ii) inclusion of women's groups and female leaders in local decision-making and feedback mechanisms, and (iii) development of training materials adapted to women's roles in agriculture, water management, and household resilience. These measures aim to enhance women's adaptive capacity and agency in climate risk management.

To mitigate the risk of excluding populations without access to mobile technology, the project incorporates inclusive communication channels, including radio announcements, to ensure widespread and equitable dissemination of climate and early warning information, thereby avoiding the reinforcement of existing inequalities.

The project will actively create pathways for women to participate as entrepreneurs, innovators, and technical leaders within the climate technology ecosystem. This includes setting minimum targets (e.g. at least 40%) for women's participation in technical training on sensor installation, maintenance, and data analytics; reserving a defined share of service contracts (e.g. 30%) for women-led enterprises or cooperatives involved

in sensor deployment and operations; and establishing a small grant or incubation window to support women-led businesses providing climate-related services (such as local data collection, advisory services for agriculture, or maintenance of monitoring equipment).

In addition, the project will partner with local universities and technical institutes to support women in STEM fields through internships, applied research opportunities, and mentorship linked to the AI platform and data systems. Women will also be prioritised for leadership roles within community-level governance structures, managing the sensor networks and data use. These measures ensure that women are not only recipients of climate information but active contributors to, and beneficiaries of, the emerging climate innovation ecosystem.

Environmental benefits
From an environmental perspective, the project will strengthen Thailand's capacity to monitor and manage climate variability with greater precision. Enhanced local data will guide sustainable land and water management, improve resource efficiency, and enable the early detection of environmental stressors such as soil degradation, drought, or heat-related crop losses. Over time, this will curb unsustainable resource use, preserve ecosystem services, and bolster the resilience of Thailand's agricultural and natural landscapes to climate change.

The climate information and improved weather forecasting generated by the project will support practical adaptation decisions, including drought preparedness, irrigation scheduling, water allocation, heat-risk management, crop planning, anticipatory action and local adaptation planning. They will also strengthen the continuity and reliability of adaptation-critical services during climate shocks by enabling public-sector operators to anticipate and mitigate disruptions to Early Warning Services, Multi-Hazard Early Warning System (MHEWS) data flows, CCIC data services and the public-sector solar infrastructure hosting the sensor network. More accurate, location-specific forecasts will support proactive maintenance, safeguard adaptation-critical assets and minimise downtime during extreme weather events. The data may also inform public-sector planning, site-risk assessments and operational-resilience considerations for the climate-resilient and efficient future deployment of renewable-energy systems. Any benefits for renewable-energy operation, grid integration, PV asset management or future deployment will remain incidental co-benefits outside the project's results framework; they will not be measured by project indicators or drive project decisions, and no Adaptation Fund resources will finance renewable-energy assets or their deployment.

In sum, the pilot project in Nakhon Ratchasima represents an important step toward a data-driven model of climate adaptation. By generating high-resolution, localised climate information and integrating it with national systems anchored under DCCE's Climate Change Information Center (CCIC), it will deliver benefits that extend beyond the province, laying the groundwork for more resilient, climate-informed development across Thailand.

E. Describe or provide an analysis of the cost-effectiveness of the proposed project/programme and explain how the regional approach would support cost-effectiveness.

The project is designed to maximise impact while minimising costs through strategic use of existing assets and scalable technologies. By integrating sensors with existing solar infrastructure, installation and maintenance expenses are significantly reduced, avoiding the need for new civil works or standalone power systems. The use of AI-driven forecasting enhances analytical capacity without relying on costly supercomputing infrastructure, lowering long-term operational costs for national agencies. In addition, the modular design of both the hardware and the data platform allows for phased expansion and targeted scaling, ensuring resources are deployed efficiently and only where demand and climate risk justify investment. This approach ensures high value for money while enabling replicability across other vulnerable provinces.

Strategic Cost Efficiency
The project avoids costly civil works by co-locating microclimate sensors on existing public-sector solar PV infrastructure (Tessaban, Sub-district Administrative Organisation and Provincial Administrative Organisation installations already financed under the Provincial Governor budget and the Ministry of Energy fund) that serve only as physical host infrastructure, rather than constructing dedicated towers. The all-in deployed cost per station is approximately USD 8,300 — composed of an IEC 61724-1 Class A weather-station head at USD 4,000, a site gateway and data logger at USD 2,500, and approximately USD 1,800 for Photovoltaic-integration kits, electrical interface, site surveys, calibration traceable to NIMT and TMD reference standards, logistics and installation contingency. This represents a substantial reduction compared to the USD 50,000 per site benchmark for conventional fully-equipped hydrometeorological stations on dedicated towers with standalone power systems and complex installations.

By leveraging the existing solar baseline as a mounting platform, the project also avoids tower, foundation and grounding costs of approximately USD 100,000–120,000 across the 205-station network, eliminates the need for stand-alone solar/battery kits at each sensor site (free electrical supply from the host system), and benefits from existing site security at municipal Photovoltaic installations. This ensures uninterrupted uptime of adaptation-critical systems during climate shocks — safeguarding Early Warning Services integrated with Thailand's Multi-hazard Early Warning System — and delivers high value per dollar compared to reactive approaches.

The PV assets themselves are not financed, deployed or optimised under the Adaptation Fund investment; any benefits accruing to renewable-energy operation are treated as incidental co-benefits outside the project's results framework. The cost-effectiveness claim is therefore substantiated by a verifiable unit-economics outcome — approximately USD 8,300 per station all-in for Nakhon Ratchasima, and approximately USD 7,600 per station for replication in other Thai provinces - anchored on a vendor bill of quantities, validated by the Thai Meteorological Department on technical specifications and aligned with the Department of Climate Change and Environment on the 205-station provincial density target.
The use of AI-driven forecasting further enhances cost-effectiveness. By relying on cloud-based analytics rather than supercomputing infrastructure, the project lowers long-term operational costs for national agencies while improving predictive accuracy and sectoral relevance.

Modular and Scalable Design
The sensor network and data platform are designed for phased deployment, leveraging modular, locally maintainable technologies for long-term sustainability. This allows resources to be allocated based on climate risk and demand. This modularity ensures that investments are targeted and adaptable, reducing the risk of underutilised infrastructure and enabling replication across other provinces.

Regional Cooperation and Shared Value
The project benefits from South–South cooperation with Malaysia, which contributes technical expertise, access to existing photovoltaic monitoring databases, and lessons learned from similar deployments. This collaboration supports:

- Bulk procurement of hardware and software components.
- Shared algorithm development, reducing duplication and enhancing model performance.
- Joint training and capacity-building, lowering per-unit training costs and fostering regional knowledge exchange.

The Malaysia partnership is expected to generate primarily non-monetary cost-effectiveness benefits through technology transfer, validation of algorithms using comparable datasets, avoidance of design errors, and accelerated learning. Any direct procurement or training-related cost savings will be assessed and quantified during full proposal preparation and are not currently counted in the project’s cost-effectiveness calculations.

Integration with Private Sector Data
The platform is designed using open-source database management systems, enabling integration with private-sector data sources such as agri-businesses, insurance companies, and energy providers provided access is granted. This feature expands the platform’s utility while reducing the need for redundant data collection, enhancing cost-effectiveness and long-term sustainability.

Avoided Losses and Economic Value
By improving Multi-hazard Early Warning Systems and climate intelligence, the project is expected to reduce economic losses from floods, droughts, and heatwaves events that have cost Thailand over USD 160 million in recent years. Enhanced forecasting and planning will help protect agricultural productivity, reduce disaster recovery costs, and improve public health outcomes, delivering substantial return on investment.

Full Cost of Adaptation Justification
The project is scoped entirely within the USD 5 million envelope requested from the Adaptation Fund. All activities from sensor deployment to platform development and capacity-building are calibrated to this budget. No co-financing is required to achieve the intended outcomes, ensuring full compliance with the Fund’s full cost of adaptation principle.

F. Describe how the project/programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist. If applicable, please refer to relevant regional plans and strategies where they exist.

Table 3: National and Sub-national Sustainable Development Strategies

Framework / Strategy	Key Objectives / Priorities	Project Alignment and Contribution
Thailand's National Adaptation Plan 2024	• Enhance climate resilience across six priority sectors: water resources, agriculture, health, tourism, natural resources, and human settlements. • Strengthen information systems, early warning, and institutional capacity for adaptation.[19]	Directly supports four NAP priority sectors: • Water Resources Management: improved climate forecasting and flood/drought risk mapping. • Public Health: supports heat stress monitoring and climate-health surveillance. • Food Security: provides localised weather data for crop and yield management. • Human Settlements: enhances early warning and risk-informed infrastructure planning. Builds institutional capacity through improved climate data integration. Directly operationalises NAP priorities related to climate information systems, localised climate services, climate risk management and evidence-based adaptation planning at provincial and community levels.
Climate Change Master Plan (2015–2050)	• Promote a low-emission and climate-resilient society. • Strengthen climate data systems, innovation, and stakeholder participation.- Integrate science-based adaptation into national planning.[20]	• Establishes a localised microclimate data network, improving the accuracy and accessibility of climate information. • Enhances the government's data-driven decision-making for adaptation planning. • Supports innovation and technology deployment in climate monitoring and forecasting.
Thailand's Nationally Determined Contribution	• Integrate adaptation in key sectors including agriculture, land use, and water management. • Advance climate-smart agriculture (CSA) and early warning systems.[21] • Improve coordination among agencies and data systems[22]	• Provides foundational data to strengthen CSA practices and inform sectoral adaptation strategies. • Aligns with national commitments to reduce climate risk and improve adaptive capacity. • Supports the development of early warning systems and reporting mechanisms identified in the NDC.
FAO-UNDP SCALA Programme (2020–2025)	• Support implementation of NAP and NDC in agriculture and land use sectors. • Address data and capacity gaps for climate-smart land management. • Strengthen institutional coordination and resource mobilisation.[23]	• Complements SCALA's goal to enhance data integration and land use information systems. • Provides a pilot model for microclimate monitoring that can be scaled nationally. • Strengthens institutional collaboration with the DCCE.
ASEAN Climate Change Strategic Action Plan (ACCSAP) 2025–2030	• Enhance regional cooperation on finance, technology, and capacity-building. • Accelerate NDC implementation through shared adaptation and mitigation actions.[24]	• Supports ASEAN objectives by piloting technology and data systems that can be replicated across the region. • Facilitates cross-border knowledge sharing on climate forecasting and risk management. **Specific ACCSAP action lines that the project aligns with:**

[19] Thailand National Adaption Plan
[20] Climate Change Master Plan
[21] Thailand CSA
[22] Thailand NDC
[23] Scaling Up Climate Ambition on Land Use and Agriculture (SCALA)
[24] ASEAN Climate Change Strategic Action Plan

		• Enhancing adaptation and resilience, including disaster risk management • Promoting cross-sectoral coordination and integration of climate into planning • Supporting evidence-based decision-making and climate information systems • Enabling multi-stakeholder collaboration (government, private sector, academia, civil society) • Creating enabling environments for long-term climate resilience and NDC implementation • Strengthening technology, data, and capacity-building for climate action
National Strategy (2018–2037)	• Achieve sustainable, resilient, and innovation-driven development while reducing economic inequalities. • Build environmental sustainability and disaster resilience across all sectors.[25]	• Contributes to strategic objectives on sustainable growth and resilience. • Advances innovation and digital transformation for climate-informed planning. • Contributes to reducing poverty by targeting vulnerable and climate-exposed communities.
Bio-Circular-Green (BCG) Economy Model (2021–2027)	• Promote sustainable agriculture, renewable energy, and circular economy principles. • Integrate innovation and technology into resource management.[26]	• Supports BCG objectives by deploying green, solar-powered, and data-driven technologies. • Encourages efficient, climate-resilient agricultural and land-use practices.
Sendai Framework for Disaster Risk Reduction (2015–2030)	• Priority 1: Understanding disaster risk. • Priority 2: Strengthening disaster risk governance. • Promote risk-informed decision-making.	• Enhances hazard data and early warning capability at provincial and national levels. • Builds institutional capacity to anticipate and reduce disaster risk.
Thailand's Technology Needs Assessment (TNA)	Identifies priority technologies, barriers and enabling conditions to strengthen climate resilience across sectors including water resources, agriculture, disaster risk management and climate information systems.	TNA's broader objectives of strengthening climate information systems, climate-risk management and evidence-based adaptation planning by improving the availability, accessibility and usability of localised climate data. While microclimate sensor networks, AI-enabled forecasting and PV-hosted climate monitoring systems are not currently identified as standalone priority technologies within the concept-stage assessment, the project supports the underlying TNA objectives of improving climate information services and adaptive decision-making. During full proposal preparation, a detailed TNA crosswalk will be undertaken to identify the specific technology priorities, barriers and enabling actions to which the project contributes.
Technology Action Plan (TAP)	Supports implementation of priority adaptation technologies through institutional strengthening, capacity-building, financing mechanisms, stakeholder coordination and enabling policy frameworks.	The project contributes to TAP implementation by strengthening institutional capacity for climate information management, supporting inter-agency coordination, demonstrating scalable deployment models, engaging academic and private-sector partners, and building technical capabilities at national, provincial and community levels. A detailed mapping between project activities and specific TAP implementation actions will be undertaken during full proposal development.
National Strategy (2018–2037) and National Economic and Social Development Plan	Promote inclusive, resilient and sustainable economic development, reduce inequalities, strengthen resilience to climate-related shocks, and support vulnerable populations.	The project contributes to national poverty reduction and resilience objectives by reducing the climate vulnerability of smallholder farmers, low-income households, women, climate-exposed rural communities, and other vulnerable groups in Nakhon Ratchasima Province. Through improved early warning services, localised climate information, enhanced adaptive planning and strengthened institutional preparedness, the project aims to reduce livelihood losses

[25] National Strategy
[26] Bio-Circular Green Economy Model

		associated with droughts, floods, heat stress and extreme weather events. These benefits are expected to improve income stability, reduce disaster-related economic losses, strengthen food and water security, and reduce the disproportionate burden of climate shocks on vulnerable populations. During full proposal preparation, poverty-disaggregated baselines, beneficiary targets and contribution pathways will be incorporated into the results framework to demonstrate alignment with national and provincial poverty reduction objectives.

It is also notable that Thailand has already made substantial progress, though there are some limitations in MHEWS. Multiple data repositories that are hosted and maintained by different national agencies. This has hindered user access and interoperability, leading to inconsistencies across data sets. Moreover, there are plans to implement the Associated Programme on Flood Management (APFM) in Thailand, alongside HydroSOS of WMO[27].

The project contributes to Thailand's national SDG targets by strengthening climate resilience, improving access to climate information, and supporting inclusive, data-driven decision-making. It directly advances SDG 13 (Climate Action) through enhanced climate monitoring and Multi-hazard Early Warning Systems (MHEWS), enabling better preparedness for floods, droughts, and heat stress. It also supports SDG 2 (Zero Hunger) and SDG 6 (Clean Water and Sanitation) by providing localised data for more resilient agriculture and improved water resource management. The use of solar-powered systems for critical services contributes to SDG 7 (Affordable and Clean Energy), while the deployment of AI and sensor technologies aligns with SDG 9 (Industry, Innovation and Infrastructure). Finally, the project promotes inclusive access to climate services and capacity-building, contributing to SDG 5 (Gender Equality), SDG 10 (Reduced Inequalities), and SDG 11 (Sustainable Cities and Communities) by ensuring that vulnerable populations benefit from improved resilience and planning – with the gender lens in particular included in various project activities.

G. Describe how the project/programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.

The project will be implemented in full compliance with relevant Thai technical, environmental, and safety standards, as well as the Environmental and Social Policy (ESP) of the Adaptation Fund. Compliance measures will be integrated throughout project preparation, implementation, and monitoring to ensure that all activities are environmentally sound, socially equitable, and technically robust.

Compliance with Thai Technical Standards

The project will adhere to all applicable national and sectoral regulations governing environmental management, infrastructure, ICT systems, and occupational safety, including:

- Environmental Assessment and Management: In accordance with the *Enhancement and Conservation of the National Environmental Quality Act (1992, updated 2018)* and related Ministry of Natural Resources and Environment (MONRE) guidelines, project sites will undergo environmental and social screening to confirm minimal or no adverse impacts.
- Construction and Building Standards: Any installation of sensor units or supporting structures will comply with the *Building Control Act (1979)* and relevant engineering and safety codes issued by the Department of Public Works and Town & Country Planning. All equipment will meet *Thai Industrial Standards* (TIS) for electrical and structural safety.
- ICT and Data Management Standards: The project's digital infrastructure and data-sharing systems will conform to the Digital Government Development Agency (DGA) and Ministry of Digital Economy and Society (MDES) regulations on data security, interoperability, and cybersecurity. Cloud-based data management will follow the information security standards and comply with Thailand's *Personal Data Protection Act (PDPA, 2019)*
- Renewable Energy Standards: Solar-powered systems will follow the *Energy Regulatory Commission (ERC)* guidelines and certified solar installation and maintenance codes to ensure safe, efficient, and sustainable operations.

[27] Global Status of MHEWS

The proposed hydro-meteorological sensor network will be designed, procured, calibrated and operated in full compliance with the technical standards and data quality framework applied by the Thai Meteorological Department (TMD) as a member of the World Meteorological Organization (WMO), and with the data architecture required by the Climate Change Information Center (CCIC) under DCCE. Specific relevant standards and how they will be adhered to are described below.

Applicable technical standards. The sensors and automatic weather stations (AWS) to be deployed will meet the technical specifications set out in the WMO Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8, CIMO Guide), the WMO Integrated Global Observing System (WIGOS) metadata standard (WMO-No. 1160), and the TMD internal equipment specifications for national observation stations. Key parameters — rainfall, air temperature, relative humidity, wind speed and direction, atmospheric pressure, solar radiation and, where relevant, soil moisture and water level will be measured with sensor accuracy classes meeting the operational measurement uncertainty requirements set out in the WMO Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8, CIMO Guide), Annex 1.B (ANNEX 1B - Operational Measurement Uncertainty Requirements and Instrument Performance), and calibrated against ISO/IEC 17025-traceable reference standards through the National Institute of Metrology Thailand (NIMT) and the Thai Meteorological Department (TMD) calibration laboratory.

Data quality and interoperability requirements. Data will be (i) time-stamped in UTC with station-level metadata aligned to WIGOS, (ii) transmitted in TMD-compatible formats (CSV/JSON over MQTT or FTPS, with BUFR encoding for integration into the WMO Global Telecommunication System where required), (iii) subjected to automated QA/QC routines covering range, step, persistence and inter-parameter consistency checks, and (iv) mirrored to both the TMD data system and the DCCE/CCIC dashboard to avoid data silos. The system will support the CCIC data model confirmed with DCCE during stakeholder consultations.

Calibration protocols and reference standards. All sensors will be factory-calibrated with certificates traceable to the International System of Units (SI) via nationally accredited laboratories (ISO/IEC 17025). Traceability in Thailand will be assured through the National Institute of Metrology Thailand (NIMT) and, where applicable, TMD's own calibration laboratory, which serves as the national reference for meteorological instruments. Field calibration and inter-comparison with the nearest reference TMD station will be conducted at commissioning and at defined intervals (typically annually for rainfall and temperature/humidity, biennially for radiation and wind), with records archived and shared with TMD and DCCE.

TMD endorsement. As recorded in Minute 3 of the Stakeholder Consultation report (annexed to this proposal), TMD has been formally engaged and has confirmed, in principle, that additional sensors funded under the AF project can be integrated into the national TMD observation network provided they meet TMD standards and that a post-project institutional owner is designated. Formal written endorsement of the detailed equipment specifications will be obtained from TMD during the full proposal development phase prior to procurement through a Technical Specifications Validation Note jointly signed by TMD, DCCE/ERTC/CCIC and UNIDO. This note will also confirm suitability for feeding into national early warning systems and will form an annex to the full proposal.

Specifically related to the end of life for the technology used, the following apply:

E-waste and End-of-Life Management: The project will comply with applicable Thai regulations governing electronic and hazardous waste management, as well as relevant international good practice, including the Basel Convention. An E-Waste and Hazardous Waste Management Plan will be developed during the PFG phase and incorporated into the ESMF. The plan will cover procurement requirements, asset tracking, maintenance, collection, recycling, disposal arrangements, and the use of licensed waste management providers to ensure environmentally sound end-of-life management of project equipment.

Certified handlers. UNIDO confirms that only DIW-licensed hazardous waste transporters and treatment facilities (including licensed e-waste recyclers and battery recyclers certified under ISO 14001 and, where applicable, R2 or equivalent responsible recycling standards) will be contracted. Selection will be made through UNIDO's competitive procurement process with mandatory environmental and social due-diligence screening, and contracts will contain explicit clauses on Basel Convention compliance, no export to non-OECD facilities without prior informed consent, and worker safety.

Occupational Health and Safety (OHS) standards:

All sensor installation, operation and maintenance activities financed by the project will comply with applicable Thai occupational health and safety legislation, relevant technical standards, and UNIDO's Environmental and Social Safeguards requirements. Contractors and service providers engaged under the project will be required to implement appropriate safety procedures, provide suitable personal protective equipment, ensure adequate worker training and certification, maintain appropriate insurance coverage, and comply with all applicable labour and workplace safety requirements.

All sensor installation, operation and maintenance activities will comply with the specific Thai occupational health and safety legislation applicable to the works involved, namely: (i) the Occupational Safety, Health and Environment Act B.E. 2554 (2011) and its implementing Ministerial Regulations; (ii) the Ministerial Regulation on Work at Heights B.E. 2564 (2021) governing rooftop and elevated installation activities; (iii) the Ministerial Regulation on Electrical Work B.E. 2558 (2015) governing electrical connection and PV-integration activities; (iv) the Labour Protection Act B.E. 2541 (1998) on working conditions, hours and welfare; and (v) the Social Security Act B.E. 2533 and Workmen's Compensation Act B.E. 2537 requiring employer registration and insurance coverage for all workers. Internationally, the project will apply IEC 62446 (grid-connected PV system inspection), IEC 62305 (lightning protection) and ISO 45001 (OHS Management Systems). Potential risks associated with electrical work, rooftop installation, work at height, heat exposure and equipment maintenance will be assessed and managed through site-specific risk assessments, standard operating procedures, contractor supervision, and regular monitoring. Contractors will be required to appoint certified Safety Officers, maintain Contractor All-Risk / Public Liability / Workers' Compensation insurance, and enforce use of appropriate personal protective equipment (PPE). Detailed OHS requirements, training provisions, contractor obligations, emergency response procedures and monitoring arrangements will be further developed during the PFG phase and incorporated into the project's ESMF, procurement documentation, and installation contracts.

Compliance with the Adaptation Fund Environmental and Social Policies
The project will apply the Adaptation Fund's Environmental and Social Policy and Gender Policy, ensuring that all activities are designed and implemented to avoid, minimise, or mitigate adverse environmental and social impacts. The implementing entity (UNIDO) will conduct an environmental and social screening during the project preparation phase to determine the risk category.

In line with Adaptation Fund guidance on Unidentified Sub-Projects (USPs), the project will establish a formal USP management procedure to govern activities where exact locations and beneficiaries are not known at approval stage. All sensor deployment sites and associated infrastructure will undergo site-specific environmental and social screening prior to implementation. Only activities classified as low or moderate risk and consistent with Category B requirements will be approved. Where minor risks are identified, appropriate mitigation measures will be applied in accordance Adaptation Fund's Environment and Social Policy (ESP). Records of screening, risk categorisation, and mitigation actions will be maintained and reported to the Adaptation Fund as part of regular monitoring.

Environmental and social risks associated with this project have been assessed as limited, site-specific and readily mitigable, and the project has been classified as Category B (moderate risk) under Adaptation Fund's updated Environmental and Social Policy (ESP). Given the AF ESP, an environmental and social assessment considering the identified risks will be developed and annexed to the full proposal at the PFG stage, covering e-waste management, occupational health and safety, gender and inclusion, stakeholder engagement and a Grievance Redress Mechanism, with implementation monitored through the project M&E framework and reported in the annual Project Performance Report to the Adaptation Fund.

Gender-specific risks have been identified, including unequal access to training, limited participation in technical roles, and potential exclusion from decision-making processes. These risks will be addressed through targeted measures, including gender-responsive outreach, participation quotas, and integration of gender considerations into monitoring and evaluation systems.

Environmental and social aspects will be monitored throughout implementation, and regular reporting to the Adaptation Fund will ensure transparency and accountability.

Grievance Redress Mechanism
It will be established in line with UNIDO and Adaptation Fund requirements to address any environmental or social concerns raised by project stakeholders. The mechanism will provide accessible, transparent, and culturally appropriate channels for individuals or communities to submit complaints or suggestions related to

project activities. All grievances will be recorded, acknowledged, and resolved in a timely and fair manner. The GRM will be publicised during community consultations and integrated into national and provincial implementation processes.

Technical Maintenance and Quality Assurance
To ensure long-term functionality and safety, all installed equipment, including weather sensors, solar systems, and communications components, will follow manufacturer-certified maintenance schedules and be covered under standard warranties. Periodic inspections will be conducted by qualified technicians in coordination with national partners such as the DCCE and the TMD. Technical guidelines and training will be provided to local institutions to ensure proper operation, calibration, and replacement procedures, ensuring compliance with both Thai standards and UNIDO's quality assurance protocols.

H. Describe if there is duplication of project/programme with other funding sources, if any

The following is a list of relevant projects and a description of how the proposed Adaptation Fund project's activities complement these projects.

Project	Funder/Authority	Description	Complementarity / description of avoidance of duplication
Royal Rainmaking Project	Royal Rainmaking and Agricultural Aviation Department (RRAA)	Utilizes cloud-seeding and atmospheric interventions to induce rainfall, thereby supporting drought mitigation and effective water management.	The Royal Rainmaking Project focuses on weather modification rather than systematic data generation. This project complements such efforts by establishing real-time microclimate data collection and predictive analytics to inform adaptation planning.
Enhancing Climate Resilience in Thailand through Effective Water Management and Sustainable Agriculture	**GCF:** UNDP / Royal Thai Government	Builds capacity for sustainable water and agricultural management in drought-prone areas through planning and community participation.	While both address resilience, the UNDP project emphasizes institutional and community capacity building. This project introduces high-frequency environmental data and AI-based forecasts to strengthen those same systems with a technical foundation for decision-making.
Strengthening Thailand's Agricultural Drought Resilience (STAR)	UK Centre for Ecology and Hydrology (UKCEH) / Thai Research Fund	Focused research on drought monitoring and response using satellite and meteorological data.	STAR relies primarily on remote sensing and modelling. This project deploys ground-based sensor networks to produce granular, real-time data feeding into predictive models, enhancing spatial accuracy and local applicability.
Urban-Act	International Climate Initiative (IKI) / GIZ / ONEP	Supports Thai cities to integrate climate adaptation into urban planning, focusing on low-carbon transport and policy frameworks.	Urban-Act targets policy integration and planning; it does not generate new datasets or predictive tools. This project provides data-driven inputs to such planning processes through AI-based microclimate forecasting.
Enhancing Resilience to future Hydro-meteorological extremes in the Mun River basin in Northeast Thailand (ENRICH)	UK Research and Innovation (UKRI)	Collaborative research on climate resilience and innovation in the energy and environmental sectors.	ENRICH is primarily research-oriented and limited to pilot demonstrations. This project operationalizes complementary insights, creating a nationally integrated, scalable data system that supports public sector adaptation efforts.
Early Warning and Drought Resilience Initiatives	Stockholm Environment Institute (SEI)	Enhances early warning systems and builds resilience to drought and climate change, especially along the Thailand–Myanmar border.	SEI's work is localized and research-driven. This project extends coverage nationally, using AI-based analysis and large-scale sensor deployment to enable real-time monitoring and forecasting across sectors. The Adaptation Fund project will: - inventory and digest SEI and other key datasets into the CCIC dashboard according to agreed data standards (metadata, formats, temporal/spatial resolution)

Project	Funder/Authority	Description	Complementarity / description of avoidance of duplication
			- deploy additional sensors to fill spatial data gaps and raise data resolution - establish automated data-exchange and update processes with SEI and other partners. - develop central standards and data-quality requirements to prevent duplication and ensure national dataset consistency.
National Hydroinformatics & Climate Data Centre (NHC)	Hydro-Informatics Institute (HII) / Ministry of Higher Education, Science, Research and Innovation	Serves as the national hub integrating hydrological and meteorological data from multiple agencies.	The NHC aggregates existing datasets. This project complements it by creating new, high-resolution microclimate data and feeding these into predictive models that can enhance the NHC's analytical capabilities.
NSTDA–DOAE Weather Data Integration Project	National Science and Technology Development Agency / Department of Agricultural Extension	Uses automatic weather stations to improve agricultural land use and planning.	While aligned in purpose, NSTDA–DOAE focuses on sector-specific agricultural data. This project provides cross-sectoral climate intelligence spanning agriculture, water, and health through AI forecasting and spatial analytics. DCCE have already taken place and DCCE and HII are already structurally interlinked through reciprocal committee membership, making them established institutional collaborators on water and climate data
Friends in Need (of "Pa") Volunteers Foundation – Disaster Warning Stations	Royal Household-supported foundation / national agencies	Installs automated telemetry and monitoring stations for disaster warnings in forest and watershed areas.	This project differs by focusing not only on alerts but also on long-term adaptation planning, linking sensor data to resource management and climate resilience strategies.
Hydrometeorological Forecasting Tools	ALICE-LAB	Provides hydrological forecasts and seasonal models to support water management.	ALICE-LAB focuses on research and hydrological modelling. This project complements it by contributing high-frequency field data that improves forecast accuracy and model calibration.
Smart Weather Station Pilot (Nakhon Ratchasima)	SEI / ONWR / RMUTI	Installed pilot weather stations with farmer groups to support climate-smart agriculture.	The Smart Weather Station Pilot in Nakhon Ratchasima was implemented by the Stockholm Environment Institute (SEI) — Asia Centre in partnership with the Office of the National Water Resources (ONWR) and Rajamangala University of Technology Isan (RMUTI) as part of SEI's climate-smart agriculture research programme in Northeast Thailand. UNIDO has undertaken a preliminary desk review of the pilot and has initiated direct outreach to SEI Asia, ONWR and RMUTI to secure detailed information ahead of full proposal development **Outcomes**: The pilot installed a small number of automatic weather stations alongside farmer field schools in selected sub-districts of Nakhon Ratchasima, generating localised rainfall, temperature and soil-moisture data to support farmer decisions on planting timing, water management and crop selection. The pilot demonstrated that farmer

Project	Funder/Authority	Description	Complementarity / description of avoidance of duplication
			engagement in weather-data interpretation is feasible when linked to concrete agricultural decisions, and produced peer-reviewed and policy-relevant research on climate-smart agriculture and local adaptation practices. **Challenges and limitations observed**: The pilot faced three main constraints that directly inform the AF project design: (i) limited spatial coverage — a small number of stations across a large province could not support province-wide EWS or MHEWS integration; (ii) short-term financing and post-project sustainability gaps — the research grant cycle did not include a long-term host institution for continued operation, maintenance, calibration or data hosting; and (iii) limited institutional integration — data was used primarily for research outputs rather than integrated into national systems (TMD, DCCE, CCIC). **Operational status**: Based on preliminary outreach, some SEI-installed stations may remain operational at RMUTI and partner farmer sites, while others have degraded due to the absence of a maintenance budget after project closure. A full station-by-station inventory (sensor condition, data continuity, host site status) will be completed during the PFG phase with SEI, ONWR and RMUTI as part of the coordination protocol. **How the SEI pilot's limitations inform the AF project design**: AF project design directly responds to each observed limitation: (i) spatial coverage, providing the province-wide coverage the SEI pilot lacked; (ii) long-term sustainability — the AF project is anchored institutionally on DCCE/CCIC with recurrent costs absorbed by Thai public budget lines, directly addressing the post-project sustainability gap experienced by SEI; (iii) institutional integration — the AF platform is designed from inception to integrate with TMD, MHEWS and CCIC, adhering to WMO/WIGOS and MDES cybersecurity standards, ensuring that data flows into national systems rather than remaining in research silos. **Integration commitment:** Any SEI stations confirmed as still operational during the PFG-stage inventory will be assimilated into the AF sensor network and CCIC data flow, subject to compatibility with IEC 61724-1 Class A / WMO CIMO Guide standards. SEI Asia, ONWR and RMUTI researchers will be formally engaged during the PFG phase to (i) complete the operational station inventory, (ii) document

Project	Funder/Authority	Description	Complementarity / description of avoidance of duplication
			detailed pilot outcomes and lessons for the AF project design annex, and (iii) advise on farmer engagement modalities and site selection methodology in Nakhon Ratchasima.
Mekong EbA South: Enhancing Climate Resilience in the Greater Mekong Sub-region through Ecosystem-based Adaptation in the Context of South-South Cooperation (Thailand, Viet Nam)	**Adaptation Fund:** International Union for Conservation of Nature (IUCN) / Ministry of Natural Resources and Environment of Vietnam / Ministry of Natural Resources and Environment of Thailand / UN Environment Programme,	Regional initiative that builds community and ecosystem resilience to droughts and floods in the Greater Mekong Subregion through climate-resilient agriculture, water management, and livelihood diversification.	This project complements the GMS initiative by strengthening the data and forecasting systems that underpin effective local adaptation. While the GMS project builds resilience through community-based and ecosystem interventions, this project enhances climate monitoring and predictive capacity, enabling more targeted drought management, improved agricultural planning, and evidence-based decision-making across the region.
Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience (Cambodia, Lao People's Democratic Republic, Thailand, Viet Nam)	**Adaptation Fund:** United Nations Educational, Scientific and Cultural Organization / Adaption Fund / Coordinating Committee for Geoscience Programmes in East and Southeast Asia–Technical Secretariat (CCOP-TS) / International Water Management Institute (IWMI) / International Groundwater Resource Assessment Centre (IGRAC)	Regional initiative to strengthen transboundary governance and institutional capacity for the sustainable management of groundwater resources across the Greater Mekong Subregion	While the groundwater project focuses on institutional collaboration and sustainable management of shared water resources, the proposed climate data and forecasting project complements it by improving the availability of localised climate and hydrological data. This enhanced data infrastructure can inform groundwater modelling, recharge assessments, and drought monitoring, supporting evidence-based water management and climate adaptation across the region.

There are also two UNIDO projects being developed currently – at Concept phase including "Building climate-resilient community-based tourism and sustainable supply chains in Chiang Rai, Thailand" and "Building Climate Resilience of Small-Scale Fisheries and Aquaculture in Southeast Asia". Where relevant, the UNIDO team will ensure complementarity and no overlap with these projects. Two other initiatives are also worth noting. While the proposed project is distinct in terms of geography, financing and scope, these initiatives provide useful lessons and opportunities for coordination and knowledge exchange.

1. ENRICH (Enhancing Resilience to future Hydro-meteorological extremes in the Mun River basin, NE Thailand): ENRICH was a 3.5-year research project (September 2018 – March 2022) jointly funded by Thailand's NRCT and the UK's NERC under the Newton Fund, implemented by the Asian Institute of Technology (AIT) and the University of Exeter. It investigated the combined impacts of climate variability, climate change and land-use change on hydro-meteorological extremes in the Mun River Basin across four work packages (land-use change, climate variability and change, hydro-meteorological extremes, and drought adaptation strategies), and generated recommended adaptation measures to improve water security. While ENRICH was not implemented at the provincial scale but through selected case-study locations within the basin, its basin footprint includes Nakhon Ratchasima, Buri Ram, Surin, Si Sa Ket and Ubon Ratchathani. The UNIDO AF project will build on ENRICH's scientific outputs — particularly the hydro-meteorological extreme analyses and drought adaptation recommendations relevant to Nakhon Ratchasima — to inform the design of the densified observation network, the Early Warning System, and the community-level adaptation measures, and UNIDO will engage AIT as a knowledge partner during the full proposal phase to avoid duplication and maximise use of ENRICH's research findings. ENRICH closed in March 2022; there is therefore no operational overlap, only leveraging of completed research.

2. GCF/UNDP Project — "Enhancing climate resilience in Thailand through effective water management and sustainable agriculture" (FP170): This US$17,533,500 GCF-financed project (approved 7 October 2021; expected completion 10 January 2027) is implemented by UNDP with the Thai Ministry of Agriculture and Cooperatives, GIZ and King Mongkut's University of Technology North Bangkok. It focuses exclusively on the Yom and Nan sub-river basins of the Greater Chao Phraya River Basin in northern Thailand (Phitsanulok, Sukhothai and Uttaradit provinces), directly benefiting 62,000 people and indirectly benefiting up to 25 million. Its three outputs address (i) climate-informed water and agriculture planning, (ii) strengthened

water infrastructure combined with Ecosystem-based Adaptation (EbA), and (iii) reduced agricultural livelihood volatility through extension, on-farm adaptation and market access. There is no geographical overlap with the UNIDO AF project, which targets the Northeastern province of Nakhon Ratchasima in the Mun/Chi basin system. There is also no thematic overlap: the GCF/UNDP project centres on grey–green water infrastructure and on-farm agricultural adaptation in northern Thailand, whereas the UNIDO AF project centres on integrated climate data, densified hydro-meteorological sensing, an Early Warning System linked to communities and public-sector solar (rooftop and ground-mounted) assets, and institutional integration with the forthcoming Climate Change Information Center (CCIC) under DCCE — a national data backbone that does not currently exist. Coordination will be ensured through DCCE as the national adaptation focal point, by engaging UNDP as a sister UN agency during full proposal development to exchange lessons on climate-informed planning, tailored climate information services, and extension-based community engagement, and by ensuring that observation data and EWS products generated by the UNIDO AF project flow into the national CCIC platform that can ultimately also serve Greater Chao Phraya basin stakeholders.

More broadly, to ensure effective coordination with existing initiatives, the project will establish a proactive, structured coordination framework throughout implementation. This will include:

- Multi-stakeholder coordination committees at national and provincial levels, bringing together relevant government agencies, NGOs, research institutions, and private sector actors to align activities, share lessons, and avoid duplication.
- Regular data and progress sharing through online dashboards and periodic technical workshops, ensuring that sensor deployments, AI models, and forecasting outputs complement rather than overlap with other initiatives.
- Designated coordination focal points within the project team responsible for liaising with other climate adaptation programs and reporting on integration opportunities.
- Joint planning and review sessions during pilot phases to incorporate lessons learned from other initiatives into deployment strategies, platform design, and community engagement approaches.

Specifically, the HII under the Ministry of Higher Education, Science, Research and Innovation and the DCEE will engage with each other as follows:

- The HII has the mandate to serve as the national water information center, responsible for collecting, processing, and providing water data.
- DCCE is the national focal point for National Adaptation Plan (NAP) which covers 6 sectors: agriculture, water, public health, natural resources, human settlements, and tourism. Water is one of the subset within the mandate of DCCE to responsible. Informal discussions on collaboration with HII, including DCCE, have already taken place and DCCE and HII are already structurally interlinked through reciprocal committee membership, making them established institutional collaborators on water and climate data rather than new counterparts. This existing relationship provides a ready-made platform for HII's involvement in the AF project's sensor data integration and flash-flood EWS, with formal coordination arrangements to be confirmed at the PFG stage.
- The CCIC led by DCCE is confirmed as the central platform for collecting climate change-related data across sectors, while HII is responsible for managing the core datasets related to water resources. As confirmed in the coordination meeting with DCCE and TMD, data are already being exchanged between the two agencies, and further integration will be achieved through progressive API-based connectivity ensuring that water-related climate data flows seamlessly between HII and CCIC without creating parallel infrastructures. Technical-level discussions between DCCE and HII have been initiated and are ongoing on the CCIC platform's data architecture and interoperability standards specifically, that HII has not raised concerns about the platform being developed alongside the NHC, as documented at Minute 10 (meeting between DCCE and HII). The AF-financed platform will therefore complement HII's existing infrastructure rather than replace it, using open interoperability standards and adhering to the Practices for Government Cybersecurity issued by the Ministry of Digital Economy and Society (MDES). During development of the full proposal, HII will be invited to join the Project Steering Committee (PSC) to provide technical input on platform architecture, data standards and interoperability, and to oversee data integration.

The project’s monitoring and evaluation framework will include specific indicators to track coordination effectiveness, such as:

- Number and frequency of coordination meetings and information exchanges with parallel initiatives
- Instances of joint data use, or shared AI model enhancements
- Early identification and mitigation of overlapping activities or gaps in coverage

This structured approach ensures that complementarity is maintained throughout implementation, maximising synergies, avoiding duplication, and strengthening the overall resilience outcomes for communities and national systems.

The project team has specifically screened potential overlap with domestic modernisation activities by TMD and DCCE, in addition to external partners. As confirmed in the coordination meeting with DCCE and TMD TMD is responsible for managing the network of weather stations that comply with the standards of the World Meteorological Organization (WMO). Expanding the weather station network in accordance with WMO standards requires substantial financial resources. Currently, they have plans to expand at a national level but not specific to NR. The proposed AF project will support in expanding this to other provinces in the country but implementing it within the scopes and budget of the CCIC mandate. Meanwhile, DCCE serves as the coordinating agency that promotes implementation at the local level. Therefore, the activities of TMD and DCCE do not overlap with this project in terms of network expansion. Instead, this project serves as a demonstration in Nakhon Ratchasima Province, with the intention of promoting replication in other provinces in line with provincial climate adaptation plans.

During full proposal development, the project team will additionally conduct a detailed review of further ongoing and planned investments by SOFF, JICA, ADB, the World Bank and other development partners in hydrometeorological observation systems, climate information services, disaster risk reduction and adaptation planning. Preliminary assessment suggests that these initiatives are largely complementary rather than duplicative, as the proposed project focuses on adaptation-oriented microclimate monitoring, AI-enabled decision support, community-centred early warning services and integration into the Climate Change Information Center (CCIC). Particular attention will be given to SOFF-supported observation investments and any hydrometeorological modernization initiatives to ensure interoperability, avoid duplication of sensor deployment, and maximise synergies with national meteorological and climate information systems.

I. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

A strong learning and knowledge management component will be embedded throughout the project to ensure that lessons learned are systematically captured, synthesised, and disseminated at local, national, and regional levels. Lessons will inform continuous improvement during implementation and promote replication in other provinces and ASEAN countries. Gender-disaggregated data and lessons on women’s participation, leadership, and entrepreneurship in climate adaptation will be systematically documented to inform scaling and replication.

A community knowledge integration framework will be established to document, validate, and feed local adaptation practices into the project’s data and learning systems. This includes the use of participatory mapping, local knowledge registries, and community-led monitoring to ensure that lived experience continuously informs system refinement. Knowledge generated through the project will be documented in accessible formats and shared through multiple channels, including the project’s online platform, workshops, academic collaborations, and ASEAN knowledge-sharing networks. The platform itself will serve as both a technical tool (for data collection and visualisation) and a learning hub, hosting open-access dashboards, technical manuals, and training resources for practitioners, policymakers, and researchers.

The project's learning and knowledge management approach is designed not only to document project outputs and lessons but also to support continuous reflection, adaptive management, and evidence-based improvement throughout implementation. Building on the structured co-design, community validation, and iterative review processes described in Sections A, B and C, the project will establish regular learning cycles through which stakeholders including communities, government agencies, technical partners, and vulnerable groups can assess whether the project's underlying assumptions, technologies, and service delivery approaches are achieving their intended adaptation outcomes. Feedback generated through community consultations, grievance redress mechanisms, user surveys, platform analytics, technical reviews, and annual validation workshops will be systematically analysed and used to inform adjustments to system design, forecast models, communication channels, training approaches, and implementation strategies. The learning framework will explicitly document both successes and challenges, including technology performance issues, data quality limitations, community adoption barriers, institutional constraints, and unforeseen contextual factors, ensuring that lessons from what does not work are captured alongside good practices. Consistent with the project's co-production approach, community-generated knowledge including farmer observations, traditional weather indicators, local risk perceptions, and experiential adaptation practices will be

systematically documented through participatory processes and integrated into the project's knowledge base, model calibration processes, and learning products alongside scientific and technical data.

1. Knowledge products to be developed will include:
   1.1. Technical manuals, hardware integration documentation, operation guides on sensor installation, calibration, and maintenance, promoted by the DCCE and the Thai Meteorological Department.
   1.2. Training curricula and e-learning modules for provincial officials, community technicians, and data users to strengthen capacity in climate data interpretation and evidence-based local planning.
   1.3. Case studies documenting pilot experiences in Nakhon Ratchasima, highlighting institutional coordination, implementation, and lessons on sustainability.
   1.4. Policy briefs and synthesis reports summarising recommendations for integrating microclimate data into national adaptation frameworks and sectoral planning processes.

2. Knowledge and lessons learned will be shared nationally and regionally through multiple mechanisms:
   2.1. National-level dissemination workshops hosted by UNIDO will present interim results, lessons learned, and best practices to ministries, provincial departments, and civil society stakeholders.
   2.2. Regional learning exchanges with ASEAN partners, beginning with Malaysia and later expanding to other member states, will promote cross-country learning, platform demonstration, and scalability.
   2.3. Online dissemination through the project’s open-access portal will feature data visualisations, publications, and multimedia summaries.
   2.4. Integration into existing ASEAN knowledge networks — particularly the ASEAN Climate Resilience Network (CRN) and the ASEAN Centre for Energy (ACE) — will ensure that project lessons inform ongoing regional dialogues, contribute to South–South knowledge exchange, and create a pathway for future regional collaboration on climate adaptation and resilient energy infrastructure. To operationalise this engagement, the project will pursue ASEAN-level outreach through the Ministry of Energy of Thailand, which serves as Thailand's institutional interface with ACE and which has expressed openness to coordination with UNIDO on the project. The Ministry of Energy will, where appropriate, also facilitate engagement with MoNRE/DCCE — Thailand's institutional interface with the ASEAN Working Group on Climate Change (AWGCC) and the broader ASEAN Climate Resilience Network ensuring that the project's adaptation lessons (climate observation densification, AI-enabled MHEWS-integrated forecasting, PV co-location, community-level EWS in three pilot zones) are channelled into the appropriate regional forum.. Note that outreach to the relevant ASEAN knowledge networks will be carried out during the full project preparation phase.
3. Monitoring, evaluation, and adaptive learning will be central to the knowledge management framework:
   3.1. A dedicated Monitoring and Evaluation and Knowledge Officer will oversee systematic learning capture and reporting.
   3.2. Reports will include a “lessons learned” section summarising challenges and adaptive responses, while mid-term and terminal evaluations will assess the effectiveness of knowledge capture and application. Beyond the formal mid-term and terminal evaluations, the project calendar includes dated review points ie inception, monthly technical meeting, quarterly meeting, 6-month data review, end-of-first-rainy-season, end-of-first-drought/heat-season and an Annual Theory of Change.
   3.3. Continuous feedback loops will be embedded in community engagement to improve the system and ensure that climate information translates into practical action. To test whether the information leads to behaviour change and improved adaptation outcomes, the project introduces a Behaviour-Change and Adaptation-Outcome Test (BCAOT) with three elements: (1) a Behavioural Indicator Panel tracking whether Early Warning System recipients act on advisories and whether relevant public-sector operators use climate information to identify risks to adaptation-critical infrastructure, including public-sector solar host sites, and undertake preventive, preparedness, emergency-response and post-disaster recovery measures, with data disaggregated by sex, age and disability where applicable; (2) an Adaptation-Outcome Panel measuring reduced climate impacts, including avoided losses, reduced health incidence, reduced damage to public-sector solar host infrastructure and improved continuity of EWS, MHEWS and CCIC data services during extreme events; and (3) an Independent Assumption Review Panel, comprising a gender specialist and representatives from civil society, communities and academia, convened annually to assess the validity of the project’s assumptions and recommend adjustments. Findings from these mechanisms will be used to refine risk communication, training materials, preparedness protocols and system design throughout implementation. These activities will focus on climate-risk identification, capacity building and operational preparedness; Adaptation Fund resources will not finance the rehabilitation, expansion or upgrading of renewable-energy assets.

3.4. Lessons learned from USP screening, risk management, and community engagement processes will be systematically documented to inform continuous improvement and replication in future scaling phases.

4. Academic and research partnerships are expected to play a key role in supporting knowledge generation and enhancing the project's long-term sustainability. In Thailand, the Climate Change and Environmental Research Centre and selected universities in Nakhon Ratchasima may collaborate to analyse field data, support curriculum development, and contribute to sensor calibration and performance studies. Where feasible, universities will be encouraged to host training sessions or integrate project learnings into academic programmes, helping to sustain capacity building and institutional knowledge beyond the project's duration.

The project will generate a replicable model for integrating distributed microclimate monitoring, AI-assisted forecasting and public-sector climate information services. Technical specifications, governance arrangements, implementation lessons and knowledge products will be documented and shared through national, regional and Adaptation Fund learning channels.

J. Describe the consultative process, including the list of stakeholders consulted, undertaken during project/programme preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

The project has been developed through a participatory and inclusive consultative process involving national, provincial, and regional stakeholders to ensure that design and implementation are fully aligned with local needs, institutional mandates, and the Adaptation Fund's Environmental and Social Policy. Particular attention has been given to engaging stakeholders representing vulnerable groups, integrating gender considerations, and ensuring that project outcomes promote equitable access to benefits.

DCCE, through its Climate Change and Environmental Research Centre, has played a central role in shaping the project concept and will continue to provide strategic oversight during implementation. DCCE has actively participated in all design discussions and has been confirmed as the Chair of the Project Steering Committee (PSC). During consultations in August and September 2025, DCCE provided key inputs on the alignment of activities with national climate priorities and requested that budget provisions be included for subcontractors to implement tasks relevant to its technical scope of work. DCCE also endorsed the decision for UNIDO to serve as the Project Management Unit (PMU), responsible for fund management and overall coordination.

Thai communities in Korat face vulnerabilities that are multi-dimensional (livelihood, food/water, health, social, knowledge, governance), demographically concentrated (women, elderly, persons with disabilities, low-income, informal workers, smallholder farmers), and place-specific (urban heat in Mueang, flash floods in Pak Chong, drought in Chok Chai)

Stakeholder engagement followed a structured and inclusive consultative process during the development of the proposed AF project concept. The process was led by UNIDO in close coordination with DCCE, Thailand's Designated Authority for the Adaptation Fund. It is formally documented in the Stakeholder Consultation Minutes (September 2025 – March 2026), which have been submitted as supporting evidence of country ownership and inclusive consultation.

During national-level consultations, preliminary discussions included gender-differentiated dimensions of climate vulnerability, particularly in relation to access to climate information, agricultural decision-making roles, and differential exposure to climate risks. While gender-focused organisations were not formally represented in all initial consultations, the project recognises this as a gap and will ensure the inclusion of organisations with a gender mandate (e.g., women's cooperatives, gender-focused NGOs, and relevant government agencies such as the Department of Women's Affairs and Family Development) during the Project Formulation Grant (PFG) phase.

The consultations engaged all key stakeholder groups necessary to ensure country ownership and an inclusive project design. These included national-level government institutions, DCCE as the Adaptation Fund Designated Authority, ERTC as the national environmental training institution under DCCE, the forthcoming CCIC, the Thai Meteorological Department (TMD) under the Ministry of Digital Economy and Society, and the Ministry of Energy.

At the provincial and local levels, engagement included the Office of the Governor of Nakhon Ratchasima, with further consultations planned during the full proposal phase involving Provincial Administrative Organizations (PAOs), Subdistrict Administrative Organizations (SAOs), and Tessaban municipalities.

Scientific and academic stakeholders were also actively involved. Members of the DCCE National Committee comprised senior officials, experts, and researchers from universities and research centres. This engagement builds on ongoing collaboration with Suranaree University of Technology, Wongchawalitkul University, and the Thammasat University Research and Consultancy Institute, drawing from the 2023–2024 Provincial Working Group on Climate Change.

In addition, the process incorporated experts engagement, including a Malaysian technical expert contributing to South–South cooperation and an external gender specialist, further strengthening the inclusiveness and technical depth of the consultations.

Consultation with vulnerable groups has been pursued through two complementary streams. First, the process builds on the 2023–2024 Provincial Adaptation Planning initiative led by ONRE Nakhon Ratchasima and Thammasat University. This initiative engaged a 42-member Provincial Working Group on Climate Change that included community-level representation, notably the Village Natural Resource and Environment Volunteer Network, and documented autonomous adaptation practices of farmers, water-user groups, and community health volunteers across 11 agency field consultations.

Second, a more in-depth community and civil society engagement programme is planned for the full proposal development phase. This will explicitly address the gender and CSO representation gaps identified in the 2023–2024 Working Group, where women's groups were not represented, through targeted consultations with women's groups, Village Health Volunteers, water-user groups, farmer associations, and national-level CSOs active in Thailand's climate adaptation sector. This phased approach is consistent with Adaptation Fund guidance, whereby early consultation with institutional stakeholders at the concept stage is complemented by deeper engagement with communities and vulnerable groups during the full proposal stage.

The project will specifically engage women-led enterprises, women's cooperatives, and female entrepreneurs in agriculture and digital services to identify opportunities for integrating women into the climate technology value chain. Their inputs will inform the design of entrepreneurship support mechanisms and innovation pathways.

Initial Gender Assessment

An initial gender assessment was undertaken based on available secondary data, relevant literature and information generated through project preparation. The assessment considered women's and men's roles in climate-sensitive livelihoods, their exposure and adaptive capacity in relation to floods, droughts and heat stress, their access to climate information and productive resources, and their potential participation in the climate technology ecosystem.

The initial gender assessment confirms that women constitute a significant share of the climate-exposed agricultural population in Nakhon Ratchasima. The assessment therefore focused on the gender-specific constraints that may affect women's access to climate information, adaptation resources, technical opportunities and project decision-making.

The evidence reviewed indicates that these roles do not necessarily translate into equal access to the resources and services needed for adaptation. Women may face constraints in accessing land, credit and other productive resources, agricultural extension and technical training, timely climate and early warning information, digital technologies, and decision-making structures. Time constraints associated with unpaid household and care responsibilities, differences in literacy and digital access, and women's underrepresentation in technical fields may further limit their ability to participate in training, operate monitoring technologies or benefit from emerging climate-service markets. These constraints could reduce women's capacity to anticipate climate hazards, adjust farming and water-management decisions, and recover from climate-related losses. They also create a risk that a technology-centred intervention could reinforce existing inequalities if access, communication and participation arrangements are not deliberately designed to address them.

The initial assessment also identified opportunities for the project to strengthen women's role. Women's existing roles position them as important users and disseminators of climate information. At the same time,

the project's sensor network, data platform and associated climate services can create new roles for women as technicians, data intermediaries, climate advisory providers, entrepreneurs, innovators and leaders in community-level climate governance.

These findings have shaped the concept in the following ways:

- Women, particularly women farmers and female-headed households, are explicitly prioritised among the project's vulnerable beneficiary groups. At least 40–45% of direct beneficiaries are expected to be women, consistent with their representation in the provincial agricultural workforce.
- Early warning information and climate advisories will be disseminated through multiple gender-responsive and locally accessible channels, including SMS, radio, community networks, women's groups and village-level intermediaries, to reduce barriers related to digital access and ensure that information reaches women in a timely and actionable form.
- Training formats, schedules and materials will be adapted to identified barriers, including time constraints, literacy and digital access. A minimum target of 40% women's participation will be applied to relevant technical training, including sensor installation and maintenance, data analytics and the use of climate information for agricultural and water-management decisions.
- Women's groups, female farmer networks and women leaders will be formally included in consultations, co-design processes, community feedback mechanisms and local governance structures. This addresses the absence of women's organisations from the 2023–2024 Provincial Working Group and helps ensure that women influence sensor siting, platform design, communication channels and the development of locally relevant climate advisories.
- The project will support women's economic participation in the climate technology value chain through mentorship, internships, technical training, incubation or small-grant support, market linkages and opportunities for women-led enterprises and cooperatives to provide climate advisory, data collection and equipment-maintenance services. The proposed full project will assess the feasibility of reserving a defined share of relevant service contracts for women-led enterprises.

A comprehensive gender assessment will be conducted during the Project Formulation Grant (PFG) phase, building on secondary data and stakeholder consultations to identify gender-specific needs, roles, constraints, and opportunities. This will include sex-disaggregated data collection; separate and mixed consultations with women and men; engagement with women's groups, female farmers, women-led enterprises and relevant government and civil-society organisations; and analysis of differentiated climate vulnerabilities, information-access patterns, livelihood roles, time use, adaptive capacities and barriers to technical and economic participation. This assessment will inform the development of a Gender Action Plan, including targeted interventions, indicators, and institutional responsibilities to ensure compliance with the Adaptation Fund Gender Policy.

The project design also draws on regional collaboration and technical exchange with Malaysia, reflecting the shared climate and energy challenges across ASEAN. Consultations were held with the Sustainable Energy Development Authority (SEDA) Malaysia, which expressed strong support for the project's data platform and offered technical cooperation. SEDA will provide access to Malaysia's existing photovoltaic (PV) monitoring database to test and validate algorithms developed under the Thai platform. SEDA also indicated readiness to support capacity-building activities and, if feasible, adapt the algorithms for potential use in their national system. During consultations, SEDA raised practical implementation issues, including data sustainability challenges associated with its current database (e.g., reliance on mobile 3G connectivity and discontinued data collection from original FIT sites). These experiences will inform Thailand's system design to ensure robustness and long-term functionality. The inclusion of Malaysian technical expertise and additional sites for data testing will strengthen the project's regional relevance and replication potential.

The project will prioritise publicly owned PV sites for sensor deployment. In Nakhon Ratchasima, the availability of suitable publicly owned solar installations is not expected to be challenging. In the event of future scaling to other provinces where suitable publicly owned solar installations may not be available, farmer cooperatives and private businesses with existing PV installations, including private PV developers, may be engaged. In such cases, the feasibility of potential co-investment and operational partnership arrangements may be explored.

At the national level, consultations with the Thai Meteorological Department (TMD) helped define the technical specifications for the microclimate sensors and data parameters required for integration into national systems. TMD's participation ensures technical compatibility, data standardisation, and compliance with Thailand's broader climate data framework.

Consultations also took place with Thailand Greenhouse Gas Management Organisation (TGO) which played an important role in identifying the Nakhon Ratchasima province as the relevant location to commence the project.

Consultations will also be held with local community representatives to identify high-risk areas within Nakhon Ratchasima province, focusing on understanding local vulnerabilities, gender dynamics, and data needs. For sites identified during implementation under the USP approach, additional site-specific consultations will be conducted with affected communities prior to deployment. The project will expand engagement with civil society organisations (CSOs) operating in Nakhon Ratchasima and nationally, including organisations working on climate adaptation, rural livelihoods, gender equality, and community development. These CSOs will play a key role in facilitating inclusive consultations, identifying vulnerable groups, and ensuring that local knowledge and social dynamics are adequately reflected in project design. These consultations will ensure that local stakeholders are informed, potential risks are identified early, and community feedback is incorporated into site selection and implementation decisions.

Feedback from these discussions will inform the siting strategy for sensor deployment, prioritising flood-prone and drought-affected villages. Consultations with local communities will focus on identifying data needs that directly support local decision-making particularly for farming schedules, water management, and disaster preparedness. To ensure inclusive and locally led design, the project will engage a diverse set of community-level actors, including: (i) farmer cooperatives and irrigation user groups; (ii) women's groups and female farmer networks; (iii) youth organisations and agri-entrepreneur groups; (iv) village health volunteers (VHVs) and local disaster response teams; (v) indigenous and local knowledge holders, particularly those with experience in traditional weather forecasting and water management; (vi) disability advocacy groups; and (vii) informal sector workers involved in climate-sensitive livelihoods.

Engagement will move beyond consultation toward co-design through structured participatory methodologies, including: (a) participatory rural appraisal (PRA), (b) co-design workshops at sub-district level, (c) citizen science approaches for data collection and validation, and (d) iterative feedback loops where community inputs directly inform system design, sensor placement, and platform functionality. These processes will ensure that community knowledge meaningfully shapes project decisions rather than validating pre-defined technical solutions.

Gender analysis will be systematically integrated into consultations through sex-disaggregated data collection, focus group discussions with women and men separately, and engagement with local women's organisations to identify gender-specific climate risks, information needs, and barriers to participation. During the PFG phase, the consultative process will be formalised through a structured stakeholder engagement plan, including: (i) targeted consultations with women's groups and gender-focused organisations; (ii) dedicated sessions with civil society actors; (iii) engagement with private sector stakeholders, including publicly owned PV developers and agri-businesses; and (iv) documentation of stakeholder inputs to ensure traceability in project design decisions.

Note that Nakhon Ratchasima (Korat) is a culturally diverse province and a historical crossroads where several communities coexist. The main local group is the Khorat Thai (Thai Doeng), especially in areas like Chok Chai, with a distinct dialect blending Central Thai and Isan. All groups are able to communicate in standard Thai. Furthermore, no differentiated needs have been identified to date and that this will be assessed as part of the PFG-stage community consultations.

K. Describe how the project/programme draws on multiple perspectives on innovation from e.g., communities that are vulnerable to climate change, research organisations, or other partners in the innovation space, in the context in which the project/programme would take place.

The project combines multiple perspectives on innovation by drawing on community perspectives documented through the 2023–2024 provincial climate-planning process, together with project-specific consultations conducted with national and provincial institutions and technical experts. Local communities and businesses, drought- and flood-affected districts, and district-level disaster response units will inform sensor placement, data needs, and the types of advisories most useful for daily decision-making. Their lived experience of rising temperatures, erratic rainfall and crop losses, as documented through the 2023–2024 provincial consultation process, has informed the project's preliminary design. Direct project-specific consultations during the PFG phase will validate these findings and further shape the platform's practical outputs. Research organisations and international partners will contribute through the development of AI-based forecasting models, calibration

methods, and data validation, building on national and regional climate science. Partnerships with technical agencies experienced in solar infrastructure and digital monitoring support technology transfer and contextual adaptation. DCCE, TMD, TGO, and provincial authorities ensure the innovations align with national adaptation priorities and can be integrated into planning, measurement, reporting, verification, and sectoral systems. By weaving together community priorities, scientific expertise, and institutional mandates, the project ensures the innovations are both context-appropriate and scalable.

L. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

The proposed project has been designed from the outset to be fully deliverable within the USD 5 million envelope requested from the Adaptation Fund. All activities, institutional arrangements, and delivery modalities are calibrated to this funding level. No co-financing is required or foreseen. The project complies with the Adaptation Fund's "full cost of adaptation" principle by addressing the incremental costs of building climate resilience in remote and vulnerable areas of Thailand, where current systems are insufficient to manage growing climate risks.

Grant funding is required to provide the means for public-sector solar host institutions (Tessaban, SAO and PAO) to participate in the scheme as physical host sites for the sensor co-location component of the AF intervention. The grant will be used to integrate sensor data into the cloud-based national climate data platform institutionally anchored under DCCE's Climate Change Information Center (CCIC), with MHEWS interoperability and standards-based integration into TMD's national observation network. Grant funding will also support the development of standards-based APIs that enable interoperability of the platform with multiple sensor vendors and Thai government systems, mitigating vendor lock-in and preserving the public-good architecture. Grant resources will further provide additional hardware where required including supplementary rain gauges, water-level sensors and microclimate sensors in the three pilot zones (Mueang Nakhon Ratchasima, Pak Chong and Chok Chai) to improve forecast resolution and Early Warning System accuracy for community-level adaptation outcomes.

Grant funding is specifically required to develop the central data platform which will be used to collect, store, validate, analyse and disseminate the climate data, including AI-enabled forecasting tools (drought-onset detection, flash-flood nowcasting, urban heat-island prediction, rainfall downscaling) and the EWS dissemination layer. Public-sector solar operators hosting the project's sensors currently generate operational data on their installations that is neither systematically shared nor analysed for adaptation purposes; the AF-financed platform will enable structured, public-good integration of climate observations co-located with these solar assets into the CCIC for weather prediction, adaptation planning and future policy work. Without a centrally hosted, AF-financed platform that serves as the public-good repository under DCCE/CCIC — with free, non-discriminatory access to core climate data and EWS services for communities, ministries, sectoral agencies, provincial and local governments, academia, civil society and the public — the data generated by the sensor network would not be accessible to the broader public sector or to vulnerable communities. AF financing is therefore strictly ring-fenced to climate adaptation infrastructure (sensors, data platform, MHEWS integration, community capacity building); the PV assets themselves are not financed, deployed or optimised under the AF investment, and any benefits accruing to renewable energy operation are treated as incidental co-benefits outside the project's results framework.

Baseline Scenario (Without AF Financing)

Under the business-as-usual scenario, Thailand's climate risk management continues to rely on a sparse network of approximately 100 national weather stations operated by the Thai Meteorological Department (TMD). These stations provide coarse-resolution data that is often outdated or too generalised to inform local decision-making. Remote and high-risk areas such as those in Nakhon Ratchasima lack real-time, localised climate information, leaving communities, farmers, and local authorities unable to anticipate or respond effectively to floods, droughts, and heatwaves. National risk maps are based on 2020 data and do not reflect current or projected microclimatic variability. Without intervention, this data gap will continue to undermine Thailand's ability to implement its National Adaptation Plan (NAP), particularly in the sectors of water, agriculture, and public health.

Adaptation Scenario Enabled by AF Financing

The Adaptation Fund grant will enable the deployment of a province-wide network of solar-powered microclimate sensors, the development of an AI-enabled forecasting platform, and the integration of real-time data into national and local planning systems. These interventions will provide granular, actionable climate intelligence for vulnerable communities and institutions. The project will also build the capacity of local

technicians, government officials, and community members to operate and maintain the system, ensuring long-term sustainability and ownership. Key adaptation benefits include:

- Improved early warning systems for floods, droughts, and heatwaves.
- Enhanced agricultural planning and water resource management.
- Reduced climate-related losses in food production, infrastructure, and livelihoods.
- Strengthened institutional capacity for climate-informed decision-making.

Full Cost Justification
The AF grant covers the full cost of adaptation by financing the incremental measures required to address climate risks that would not be addressed under the baseline scenario. These include:

- Procurement and installation of commercial-grade microclimate sensors and solar-powered weather stations.
- Development of APIs and data integration tools to ensure interoperability with national systems.
- AI model development for hyperlocal forecasting, which would not be feasible under standard hydromet budgets.
- Capacity-building programs for local and national stakeholders.
- Additional hardware (e.g., rain gauges) to improve forecast accuracy in underserved areas.

Compared to traditional hydrometeorological stations, which are expensive, centralised, and limited in coverage, the proposed system offers a cost-effective, modular, and scalable alternative. For example, the all-in cost of one **IEC 61724-1 Class A** station is approximately USD 8,300, significantly lower than the cost of conventional hydromet infrastructure, which can exceed USD 50,000 per site. Moreover, the integration of AI forecasting reduces long-term operational costs by automating analysis and enabling proactive planning.
Following technical consultations with the Malaysia-based technical partner, TMD and DCCE's explicit density target of one station per 10 km × 10 km grid for a total of 205 stations across Nakhon Ratchasima to allow density to be more accurate for adaptation measures. The USD 2,500 figure cited above represents a single hardware sub-component specifically a site gateway/logger unit and not a complete, IEC 61724-1 Class A-compliant weather station ready for integration into TMD's national observation network and the CCIC dashboard. The all-in hardware cost per fully deployed site is composed of two distinct sub-components:

(i) the IEC 61724-1 Class A weather-station head (sensor suite, housing, bracketry, internal wiring) at USD 4,000 per station, and
(ii) the corresponding site gateway and data logger at USD 2,500 per station,

The total hardware sub-total is therefore USD 6,500 per deployed site. A complete deployed station also requires a PV-integration kit (clamps, brackets, weatherproof mounts compatible with rooftop or ground-mounted solar racking, and surge protection on the sensor circuit), electrical interface to the host PV system, site surveys including structural verification of the PV host asset, calibration traceable to NIMT/TMD reference standards, transport and logistics, spare parts inventory and quality assurance. The total budget for hardware / installations is described in the table below.

Table 4: Costs for hardware installation (Component 1)

#	Cost line	Quantity / basis	Unit (USD)	Total (USD)
1	IEC 61724-1 Class A weather stations (sensor head, housing, bracketry)	205 stations	4,000	820,000
2	Site gateways and data loggers	205 units	2,500	512,500
3	Pilot demonstration densification — additional micro-climate sensors in three pilot zones (Mueang Nakhon Ratchasima, Pak Chong, Chok Chai)	Lump sum	–	150,000
4	PV-integration kits — clamps, brackets, weatherproof mounts compatible with rooftop and ground-mounted solar racking, plus surge protection on sensor circuits	205 sites	~290	60,000
5	Cabling, electrical interface with host PV system, and on-site networking	205 sites	~195	40,000
6	Site surveys, structural verification of PV host assets and georeferencing	205 sites	~145	30,000

7	Sensor calibration traceable to NIMT / TMD reference standards	Lump sum	–	20,000
8	Logistics, customs clearance and in-country transport / distribution	Lump sum	–	35,000
9	Spare parts inventory and contingency replacements during installation	Lump sum	–	22,500
10	Site coordination, MOUs/agreements with PV asset owners (Tessaban, SAO, PAO) and acceptance testing	Lump sum	–	10,000
	Total — Component 1 (sensor deployment only)			**1,700,000**

The technical solution proposed within the project is cost-effective versus the alternative of additional hydrometeorological stations. The installation or deployment of weather stations are often hampered by the complicated functionality and lack of economic returns of such hardware. Therefore, such installations to be predominantly funded by public sector budgets. Many industrial rooftop solar installations where installed capacities exceed 500 kWp will already likely have weather stations installed as part and parcel of the solar installation. These installations which are paid for by the private sector offers the aggregation of data from many sites for very little cost for public-sector users (i.e. for warning systems).

Table 5: Costs for platform development (Component 1)

Output	Platform (component 2)	Cost (USD)
2.1	Cloud-based national climate data platform with AI-enabled forecasting integrated with MHEWS	950,000
2.2	Integrated ministerial and sectoral dashboards (real-time provincial and national forecasts)	400,000
2.3	APIs enabling interoperability with DCCE's MHEWS and disaster management platforms	350,000
2.4	Microclimate sensor network operational across key zones, feeding high-resolution data into platform and MHEWS	500,000
	Total — Component 2	**2,200,000**

The table below compares **five alternative approaches** considered during concept design against the four AF-requested dimensions, demonstrating that the selected approach is not arbitrarily chosen but is the result of a structured options assessment.

Approach	Indicative CAPEX (205-station equivalent)	Annual OPEX	Cost per indirect beneficiary (1.5–2.0 M)	Sustainability	Scalability	Adaptation impact	Selected?
A. Proposed — IEC 61724-1 Class A sensors co-located on existing public-sector PV	USD 1.7 M (~USD 8,300/station all-in)	USD 145–170 k (USD 1,150/station/yr)	≈ USD 0.85–1.10	High — 90–100% absorbed by Thai public budgets (MDES/TMD, DCCE/CCIC, ERTC, Provincial Governor); 5-person team in-kind	High — replication at ≈USD 7,600/station marginal (platform already in place; PV co-location reproducible nationwide)	High — IEC Class A, WMO/WIGOS-compliant, MHEWS-integrated, community-level EWS in 3 pilot zones	**YES**
B. Traditional hydromet stations on dedicated towers	USD 10.25 M (~USD 50,000/station)	USD 615 k (~USD 3,000/station/yr)	≈ USD 5.10–6.80	High (gold standard) but cost-prohibitive for absorption	Low — replication cost-prohibitive at sub-national scale	High but disproportionate to adaptation need at sub-provincial resolution	**No — 6× higher CAPEX, 4× higher OPEX**
C. Satellite-based remote	USD 0.3–0.5 M (data	USD 50–100 k/yr	≈ USD 0.20–0.30	Medium — depends on third-party	High geographically, but no	Low–Medium — typical 1–10 km	**No — insufficient**

sensing only (no ground sensors)	subscription / pre-processing only)			satellite provider continuity and licensing renewals	micro-climate ground truth	resolution; no real-time sub-kilometre data; cannot validate community-level EWS or feed MHEWS as primary source	**resolution and ground-truth for community EWS**
D. Crowdsourced / citizen-science consumer-grade stations	USD 0.1–0.15 M (~USD 200–500/station)	Minimal cash, volunteer-dependent	≈ USD 0.05–0.10	Low — calibration drift, volunteer turnover, no IEC/WIGOS compliance	High in volume, but not interoperable with national systems	Low — not accepted by TMD for MHEWS integration; data quality unsuitable for AI forecasting or insurance/policy use	**No — not MHEWS-compatible; safeguards and quality gaps**
E. Software-only AI forecasting using existing TMD data (no new sensors)	USD 0.5 M (platform only)	USD 50 k/yr	≈ USD 0.25–0.35	High institutionally but constrained by data input gap	High software-wise, but adds no observational coverage	Low–Medium — only 3 TMD stations across 20,493 km² (≈1 per 6,800 km²); AI cannot compensate for missing micro-climate observations	**No — fails to close the underlying observation-density gap identified by DCCE**

Why AF Grant Funding Is Essential

Grant funding from the AF is essential to catalyse this innovation. The project involves public goods such as open-access climate data and early warning systems that do not generate immediate financial returns and are therefore unattractive to investors. Domestic budgets are constrained and typically prioritise infrastructure recovery over anticipatory adaptation. The AF grant provides the necessary risk capital to:

- Mobilise solar developers and data providers to participate in the platform.
- Develop the foundational digital infrastructure (e.g., APIs) that allows future integration of hardware from multiple vendors.
- Demonstrate the viability of AI-enabled forecasting in a real-world, high-risk setting.

Without this catalytic investment, Thailand's adaptation efforts will remain constrained by outdated data systems and limited local capacity, leaving vulnerable communities exposed to escalating climate risks.

M. Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project/programme.

Sustainability has been a core consideration throughout the project design, ensuring that outcomes remain effective, locally owned, and institutionally embedded beyond the project's duration. The project promotes sustainability through three key pillars: community engagement, institutional integration, and regional scalability.

At the local level, strong community engagement will underpin long-term ownership and maintenance of deployed sensors and data systems. Local technicians and community representatives will be trained in installation, calibration, and troubleshooting, ensuring the development of in-province technical capacity. This participatory approach encourages local stewardship, reduces reliance on external support, and ensures that equipment remains functional, and data continues to flow after project completion. Regular awareness and capacity-building sessions will also strengthen understanding of how climate and environmental data can inform local planning and early warning systems, fostering behavioural change and demand for continued data-driven decision-making.

The platform will be maintained as a public climate adaptation asset under DCCE/CCIC. Long-term sustainability will be ensured through institutional integration, public budget allocations, technical capacity-building and partnerships with relevant public institutions. Once the AF-financed platform is operational in Nakhon Ratchasima, DCCE exercising its institutional mandate over CCIC will be responsible for replicating and expanding the platform model nationwide, integrating sensor data from additional provinces and from additional public-sector and (where applicable) private-sector data sources into the CCIC repository, so that CCIC progressively achieves its mandated role as the single national platform for climate data across Thailand.

Based on the product specifications, the sensor stations to be deployed meet the **IEC 61724-1 Class A** international standard and are designed with durable, UV-inhibited, weather-resistant materials intended for long-term outdoor operation. While the specific numerical lifespan is not explicitly stated in the datasheet, typical industry standards for this type of industrial-grade, durable sensor array suggest a functional life of 3 to 10 years, depending on the environment, maintenance, and calibration frequency.

To secure replacement parts and manufacturer technical support over the network's expected 10–15 year operational horizon, the project's procurement specifications will include the following mandatory contractual clauses with sensor and hardware manufacturers: (i) minimum 10-year parts availability commitment from delivery date, with liquidated damages for non-performance; (ii) 3–5 year manufacturer warranty covering sensor heads, gateways/data loggers, and communications modules; (iii) 24-month advance end-of-life notification allowing structured migration to successor products; (iv) technical support (documentation, firmware updates, engineering support) for the same period; and (v) compliance with open communication protocols (Modbus, RS-485, MQTT, WMO/WIGOS metadata standards) to ensure that successor products from any qualified manufacturer remain integrable. Because the sensor network is specified to the multi-vendor IEC 61724-1 Class A international standard, replacement parts and successor products are procurable from multiple qualified manufacturers throughout the network's lifetime — the network is not tied to any single supplier. A structured refresh cycle (batteries every 3–5 years; sensor heads and communications modules every 8–10 years; platform hardware every 5–7 years) is built into the recurrent-cost envelope absorbed by CCIC/DCCE public budget lines, thereby covering the at-least-one replacement cycle referenced above.
To avoid platform-level vendor lock-in distinct from the algorithm-level safeguards, the cloud hosting arrangement will be structured to permit migration to alternative providers at any time. The hosting contract will include the following mandatory provisions: (i) data portability requirements — all data stored in open, non-proprietary formats (SQL/PostgreSQL/PostGIS, CSV, JSON, NetCDF, BUFR and WMO/WIGOS-compliant metadata) with full export capability; (ii) open APIs (RESTful, OGC standards) enabling seamless data extraction and re-hosting; (iii) exit provisions guaranteeing DCCE/CCIC full rights to extract all data, configurations, source code and database schemas at any time and at no additional cost; (iv) source-code escrow for all custom-developed platform components; (v) mandatory documentation of platform architecture, dependencies and deployment procedures sufficient to enable re-hosting by an alternative provider or by DCCE/CCIC directly; and (vi) transition-support obligations of at least six months at contract termination. Combined with the open-source back-end software (database, dashboards, APIs, ingestion pipelines) and the modular architecture that allows any component to be replaced without rebuilding the platform, these provisions guarantee that Thailand retains full legal and technical control to operate, modify, migrate or replace the platform independently of any commercial cloud provider.

Regarding data sharing and analysis, all algorithms and derivative works developed or substantially adapted under AF financing are owned by the Thai public sector named DCCE through the CCIC and are released under open-source licences, enabling free reuse and replication; while Malaysian-derived components will be available under perpetual, royalty-free terms with source-code escrow and full derivative-work rights. The Thai public sector holds this IP specifically as a safeguard to protect the public-good, open-source licensing and to prevent any provider from restricting future access after project closure, not as a proprietary or restrictive ownership arrangement. Any incidental use of climate data by non-government actors will remain outside the project results framework and does not drive any project decision. The primary purpose of the platform is to provide public-good climate information for adaptation, Early Warning Services and resilience planning under DCCE/CCIC stewardship.

Once the Nakhon Ratchasima pilot is successfully demonstrated, scale-up to other Thai provinces will be led by the Ministry of Natural Resources and Environment (MoNRE) through DCCE — as the AF Designated Authority and as the institutional owner of the National Adaptation Plan (NAP) and the Climate Change Information Center (CCIC) in partnership with the Ministry of Digital Economy and Society through the Thai

Meteorological Department (TMD) for technical observation-network integration, the Ministry of Energy for replicating the PV co-location model and channelling provincial/ministerial solar funding streams to host sites, and the Ministry of Interior for engaging Provincial Governors, PAOs, SAOs and Tessaban as the local replication interface.

The Ministry of Higher Education, Science, Research and Innovation (through ERTC and partner universities) will support the replication training curriculum, while the Ministry of Agriculture and Cooperatives and the Ministry of Public Health will be associated where the EWS extends into agricultural advisory and heat/health surveillance services. This multi-Ministry replication architecture ensures that nationwide scale-up is not contingent on continued AF financing but is anchored in standing Thai public-sector mandates and budget lines.

During the full project preparation phase, a comparative assessment will be developed of potential interventions to examine the cost-effectiveness of this technology in terms of adaptation outcomes per dollar invested. This will include upfront capital costs, long-term operations and maintenance costs, institutional feasibility, and the breadth and equity of adaptation benefits delivered.

At the institutional level, the project is fully aligned with national and provincial strategies. Integration with existing government systems and digital platforms will ensure data interoperability and long-term relevance. Collaboration with line ministries, provincial offices, and the local governor will ensure that the sensor network and platform are managed in accordance with existing regulatory frameworks and that responsibilities for maintenance, data sharing, and policy integration are clearly defined. This alignment strengthens institutional ownership and facilitates resource mobilisation from public budgets once donor support concludes.

An MoU has been signed with the Ministry of Interior covering the National Adaptation Plan (NAP). This MoU will provide a nationwide framework and engagement with all regions and local governments. The project will prioritize solar systems installed at government sites especially within the responsible especially those owned by subdistrict administrative organizations (SAOs) in Nakhon Ratchasima province. Sensors will be added to existing government solar installations to monitor performance and support adaptation/resilience measures. Preliminary consultations have been held with the provincial environment office (under the Governor) and the provincial energy office. Both indicate high feasibility for implementation in Nakhon Ratchasima due to widespread government solar installations and high risk from adaptation.

Long-term operational sustainability is anchored on the Climate Change Information Center (CCIC) under DCCE, which holds the institutional mandate to operate the national climate data center within the Ministry of Natural Resources and Environment, ensuring that the project's outputs remain within a standing public-sector function rather than relying on time-bound project arrangements. During implementation, the project will aim for the Thai Meteorological Department (TMD), together with CCIC, to take on joint operational management of the monitoring system covering the 205-station observation network, calibration to NIMT/TMD reference standards, sensor maintenance and data flows into MHEWS. If TMD declines to assume formal responsibility at full proposal stage, CCIC under DCCE will assume sole responsibility to continue managing and maintaining the equipment, hosting the data platform and sustaining the recurrent operations beyond project closure. This will be formalised through written commitments from MDES/TMD and MoNRE/DCCE-CCIC annexed to the full proposal at the PFG stage.

Annual post-project recurrent costs are estimated at USD 145,000–170,000 per year for the full 205-station network composed of:

- USD 600 in network-wide calibration travel costs (with the 5-person field team absorbed in-kind by the Nakorn Rachasrima Governor’s umbrella)
- USD 112,750 for platform maintenance (USD 550 × 205 stations), and
- Approximately USD 30,000–55,000 for training, coordination and contingency to be absorbed approximately 90–100% by Thai public budget lines (CCIC, under DCCE).

This arrangement is structured to preserve free public-good, non-discriminatory access to climate data and community EWS for all users. No user fees, subscription streams or willingness-to-pay mechanisms form part of the project's sustainability model; recurrent costs are absorbed in full by Thai public budget lines under CCIC/DCCE.
At project completion, the monitoring equipment will be transferred to the responsible department so it can include maintenance in its annual budget.

Further, the project is designed with replication and regional scalability in mind. Nakhon Ratchasima province will serve as a demonstration site, where operational experience, stakeholder engagement models, and lessons learned will inform the adaptation of similar systems in other provinces. The design emphasises low-cost, modular technology and open-data architecture, allowing replication with moderate additional investment. By establishing a robust model for climate and environmental data management, the project will also generate regional learning for other ASEAN countries pursuing climate resilience and digital adaptation solutions.

Together, these measures ensure that the project will not only deliver high-level benefits but also establish a self-sustaining system that continues to operate, expand, and inform policy long after the initial implementation phase.

Note that regarding environmental sustainability, the project will not install new solar panels; instead, it will use the existing government-owned solar systems (and potentially privately-owned systems). The only additional equipment to be provided is batteries, which have a service life of 3-10 years. When replaced, spent batteries will be sent to certified industrial and hazardous-waste disposal facilities in accordance with Thai regulatory standards under the Ministry of Industry.

Long-term institutional sustainability of the platform is anchored on DCCE's standing mandate, through the Climate Change Information Center (CCIC), to consolidate, host and disseminate climate-related data from across Thailand as a national public good. Once the AF-financed platform is operational in Nakhon Ratchasima, DCCE — exercising its institutional mandate over CCIC — will be responsible for replicating and expanding the platform model nationwide, integrating sensor data from additional provinces and from additional public-sector and (where applicable) private-sector data sources into the CCIC repository, so that CCIC progressively achieves its mandated role as the single national platform for climate data across Thailand

As the consultation with DCCE, the ownership will be Government related, the government allocates as common practice budgets for domestic waste management and currently contracts out segregated waste disposal services.

N. Provide an overview of the environmental and social impacts and risks identified as being relevant to the project/programme.

Table 6: Environmental and Social Impacts and Risks

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law		*Level*: Low *Risk to outcomes*: Non-compliance with national or provincial regulations on electronic waste disposal or data governance could delay implementation or risk regulatory sanctions. *Mitigation*: All activities will comply with Thai environmental, ICT, and data protection laws. The project is being implemented in close coordination with relevant government agencies and in consultation with the provincial governor's office to ensure alignment with local regulations and procedures. Provincial waste management guidelines will be followed for end-of-life disposal and recycling of all equipment.
Access and Equity		*Level*: Medium *Risk to outcomes:* Certain communities, particularly remote or underserved areas, may not benefit equally from the sensor network. *Mitigation*: Site selection will ensure broad and inclusive coverage across Nakhon Ratchasima, with no exclusion of populations based on geography, income, or demographic characteristics.
Marginalised and Vulnerable Groups		*Level*: Medium *Risk to outcomes*: Vulnerable or marginalised groups could be excluded from participation or data benefits. *Mitigation*: Stakeholder engagement and community outreach will prioritise representation from all groups, ensuring equitable access to project benefits and capacity-building activities.
Human Rights		*Level*: Low *Risk to outcomes*: Mishandling of data could compromise individuals' privacy or rights.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
		Mitigation: The project will adhere to national data protection frameworks and human rights standards.
Gender Equity and Women's Empowerment		*Level*: Medium *Risk to outcomes:* Women may have limited participation in training or decision-making processes related to sensor deployment and maintenance. *Mitigation:* Gender-inclusive approaches will be adopted, with active outreach to ensure equal opportunities for women in technical training and stakeholder consultations.
Core Labour Rights		*Level*: Low *Risk to outcomes*: Field technicians may face unsafe working conditions or lack proper labour protections. *Mitigation*: Contractors and local partners will adhere to national labour laws. Training and safety equipment will be provided to ensure occupational health and safety.
Indigenous Peoples		*Level*: Low *Risk to outcomes*: Potential conflict if project activities overlap with indigenous or culturally sensitive lands. *Mitigation*: No impacts are anticipated as installations will occur in existing public or government-managed facilities.
Involuntary Resettlement		*Level*: Low *Risk to outcomes:* Installation activities could require land acquisition or restrict land use. *Mitigation:* The project will use existing government or community facilities; no land acquisition or resettlement will be required.
Protection of Natural Habitats		*Level*: Low *Risk to outcomes*: Installation in ecologically sensitive areas could disturb local ecosystems. *Mitigation*: Sites will be screened to avoid protected areas and biodiversity hotspots. Installation will use minimal land footprint.
Conservation of Biological Diversity		*Level*: Low *Risk to outcomes*: A poor site could affect local flora and fauna. *Mitigation*: Environmental screening and consultation with local authorities will ensure biodiversity considerations are integrated in site selection.
Climate Change		*Level*: Medium *Risk to outcomes:* Extreme weather events (floods, storms, heat) could damage sensors and solar units, interrupting data collection. *Mitigation*: Equipment is specifically designed to be climate-resilient, with rapid-response maintenance protocols. Vulnerability mapping will inform placement of sensors to minimize exposure.
Pollution Prevention and Resource Efficiency		*Level*: Low *Risk to outcomes:* Improper disposal of sensors, batteries, or solar components could cause environmental harm. *Mitigation*: End-of-life disposal and recycling will follow Nakhon Ratchasima's provincial regulations, aligning with SDG 12 and the Provincial Development Plan (2023-2027).
Public Health		*Level*: Low *Risk to outcomes*: Malfunctioning or damaged equipment could pose physical hazards to nearby communities. *Mitigation*: Routine inspection and maintenance will be carried out, and damaged units will be promptly removed or repaired.
Physical and Cultural Heritage		*Level*: Low *Risk to outcomes*: Installation near culturally significant sites could cause unintended disturbance. *Mitigation*: Site selection will exclude heritage or religious sites, in consultation with local authorities and communities.
Lands and Soil Conservation		*Level*: Low *Risk to outcomes*: Improper installation of poles or foundations for sensors could cause minor soil disturbance or erosion. *Mitigation*: Installation will use non-invasive mounting techniques that minimise ground disturbance.

PART III: IMPLEMENTATION ARRANGEMENTS

A. Describe the arrangements for project/programme management at the regional and national level, including coordination arrangements within countries and among them. Describe how the potential to partner with national institutions, and when possible, national implementing entities (NIEs), has been considered, and included in the management arrangements.

Implementing Entity (IE): UNIDO will serve as the Implementing Entity (IE), responsible for fiduciary oversight, supervision of project delivery, quality assurance of environmental, social and gender standards, and compliance with AF policies. UNIDO will approve annual work plans and budgets, monitor implementation progress, and ensure that reporting, M&E, and safeguards requirements are met. In line with AF and UNIDO policies, any execution functions undertaken by UNIDO will be carried out independently and under separate management arrangements from its IE functions.

Executing Entities: The Department of Climate Change and Environment (DCCE) under MONRE will act as the primary Executing Entity for Component 3, responsible for day-to-day implementation, coordination with provincial authorities, engagement with communities and farmer groups, and the operational management of project activities in Nakhon Ratchasima. DCCE will also lead coordination with national institutions on data integration and alignment with national systems.

Government Partner: The Ministry of Natural Resources and Environment (MONRE), through DCCE, will provide government leadership and strategic oversight, ensure alignment with national adaptation frameworks, and facilitate cooperation with relevant line ministries and agencies
Role of UNIDO in Execution (as applicable): UNIDO will undertake limited execution functions only where specifically justified, focusing on specialized technical support, capacity development, and knowledge dissemination for Components 1 and 2. Any execution roles carried out by UNIDO will remain fully distinct and non-overlapping with its IE responsibilities.

The above mentioned implementation arrangements can further be supported using the executing entity fee calculator.

2. If IE act as EE, or act the part of EE(s)

Step3: Fill out the amount (USD) and Choose EE Type in green cells

Project/Program Activity Cost: A	Amount (USD)	EE type	Error Check
Component 1	1700000	IE executes as E	
Component 2	2200000	IE executes as E	
Component 3	587260	Non-IE executes	
Component 4			
Component 5			
Component 6			
Component 7			
Component 8			
Total Component :A	4.487.260		

Step4: Fill out the amount (USD) in green cells and adjust the figures until no error messges pop up

	Amount (USD)		Error Check
	Proposed figure	Cap	
Total Component :A	4.487.260		
Fees for IE acting as part of EE(s)	59.390	$59.390	
Fees for Non-IE acting as EE(s)	61.646	$61.646	
Total EE fee: B	121.036		
Total Program Cost : A+B	4.608.296		
IE fee: C	391.705		
Total Request: A+B+C	5.000.001		

The Kingdom of Thailand agrees to apply to the present project, mutatis mutandis, the provisions of the Revised Standard Technical Assistance Agreement concluded between the United Nations and the Specialized Agencies and the Government on 4 June 1960.

B. Describe the measures for financial and project/programme risk management.

N/A at this stage.

C. Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy of the Adaptation Fund.

N/A at this stage.

D. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

N/A at this stage.

E. Include a results framework for the project / programme proposal, including milestones, targets, and indicators

N/A at this stage.

F. Demonstrate how the project/programme aligns with the Results Framework of the Adaptation Fund

Note that the below targets for the indicators and budgets for each Indicator have not yet been fully defined, and will be finalised during full project preparation.

Project Outcomes	Project Outcome Indicator(s)	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
Outcome 1.1: Improved accuracy of localised weather and climate risk monitoring.	Number of microclimate sensors and weather stations installed and operational; % improvement in forecast accuracy vs. TMD baseline. Baseline and targets to be finalised at PFG stage.	Outcome 8: Innovation for effective, long-term adaptation to climate change accelerated, encouraged, and enabled to scale up	Indicator 8A: Innovations successfully reaching scale up that demonstrate local innovation participation and/or local innovation benefit [# of innovations]	1,200,000
Outcome 1.2: Stronger early warning systems for floods, droughts, and heatwaves.	% of priority high-risk zones covered by the sensor and early warning network; number of EWS alerts issued. Baseline and targets to be finalised at PFG stage.	Outcome 1: Reduced exposure to climate-related hazards and threats	Indicator 1: People using climate-related threat and hazard information [# of people, by sex, by sector, and by hazard]	150,000
Outcome 1.3: Enhanced decision-making for agriculture, water management, and disaster preparedness.	Volume of data transmitted to national platforms; number of local agencies using climate data in planning decisions. Targets to be finalised at PFG.	Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets	Indicator 4 (Core Indicator 3): Physical assets improved or constructed to withstand climate variability and change [by km of linear infrastructure and # of point infrastructure, and by sector]	350,000
Outcome 2.1: Real-time climate intelligence available for national and local planning.	Platform operational and accessible to target ministries/agencies (Y/N); number of ministries with active platform access. Targets to be finalised at PFG.	Outcome 8: Innovation for effective, long-term adaptation to climate change accelerated, encouraged, and enabled to scale up	Indicator 8A: Innovations successfully reaching scale up	950,000
Outcome 2.2: Faster and more coordinated response to climate-related shocks.	Number of forecasts/advisories generated per month; % reduction in average response time. Baseline and	Outcome 1: Reduced exposure to climate-related hazards and threats	Indicator 1: People using climate-related threat and hazard information	400,000

	targets to be finalised at PFG.			
Outcome 2.3: Institutionalised climate data governance and digital infrastructure.	Number of API integrations with government systems; % of decision-makers using platform outputs. Targets to be finalised at PFG.	Outcome 7: Improved policies and regulations that promote and enforce resilience measures	Indicator 7: Policies, strategies, and/or plans adopted, implemented, and/or enforced that integrate climate risk and resilience considerations	350,000
Outcome 2.4: AI-assisted forecasting models developed and calibrated using localised data.	Number of AI-assisted forecasting models developed, tested and operationalised; accuracy of AI forecasts vs. observed conditions. Baseline and targets to be finalised at PFG.	Outcome 8: Innovation for effective, long-term adaptation to climate change accelerated, encouraged, and enabled to scale up	Indicator 8A: Innovations successfully reaching scale up	500,000
Outcome 3.1: Increased technical capacity for climate-informed planning at all levels.	Number of government, technical and community personnel trained (sex-disaggregated); % of trained personnel actively applying skills. Baseline and targets to be finalised at PFG.	Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses	Indicator 2: Institutions with strengthened capacity to understand and better address climate risks and resilience [# of institutions, by scale, by sector, and by type of institution]	165,000
Outcome 3.2: Community ownership of monitoring systems leading to sustained use.	Number of community members trained (sex-, age-, disability-disaggregated); number of local actors using climate data for planning. Baseline and targets to be finalised at PFG.	Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes	Indicator 3A: People with strengthened awareness of climate change risks and how to better address them [# of people, by sex, by vulnerable groups, and by sector]	195,000
Outcome 3.3: Stronger institutional collaboration around NAP implementation.	Frequency of coordination meetings held; number of KM products developed and disseminated (national and ASEAN). Targets to be finalised at PFG.	Outcome 7: Improved policies and regulations that promote and enforce resilience measures	Indicator 7: Policies, strategies, and/or plans adopted, implemented, and/or enforced that integrate climate risk and resilience considerations	227,260
Total outcome level grant amount				**4,487,260**

Project Outcome	Project Output(s)	Project Output Indicator(s)	Fund Output	Fund Output Indicator	Grant Amount (USD)
Outcome 1.1	Output 1.1: Network of microclimate sensors and solar-powered weather stations installed in priority high-risk zones.	Number of stations installed and operational (target: 205 stations at DCCE-endorsed	Output 8.1: Innovations identified and piloted that collectively	Indicator 8.1A: Innovations identified that demonstrate local innovation participation and/or	1,200,000

		10 km × 10 km density).	enhance local innovation capacity	local innovation benefit [# of innovations]	
Outcome 1.2	Output 1.2: Operational data transmission system linked to national meteorological and disaster management platforms.	Data transmission system operational and integrated with TMD/MHEWS (Y/N); % operational uptime.	Output 1.2: Targeted population groups covered by warning and advisory services for climate-related hazards and threats	Indicator 1.2A (Core Indicator 2): Early warning systems established or improved [# of systems, disaggregated by hazard and by scale]	150,000
Outcome 1.3	Output 1.3: Baseline data collection on temperature, rainfall, and humidity across remote regions.	Baseline dataset established and validated (Y/N); number of climatic parameters monitored.	Output 4.1: Vulnerable development sector services and infrastructure assets strengthened	Indicator 4.1: Development sector services strengthened to respond to climate variability and change [# of sector services, by sector and scale]	350,000
Outcome 2.1	Output 2.1: Cloud-based national climate data platform with AI-enabled forecasting tools integrated with Thailand's existing Multi-hazard Early Warning Systems.	Platform deployed, operational under CCIC/DCCE and MHEWS-integrated (Y/N).	Output 8.1: Innovations identified and piloted that collectively enhance local innovation capacity	Indicator 8.1B: Innovations piloted that demonstrate local innovation participation and/or local innovation benefit [# of innovations]	950,000
Outcome 2.2	Output 2.2: Integrated dashboards accessible to ministries and sectoral agencies displaying real-time provincial and national forecasts.	Number of dashboards deployed and operational; number of ministerial/sectoral users.	Output 1.2: Targeted population groups covered by warning and advisory services	Indicator 1.2B: People covered by new or improved early warning systems [# of people, disaggregated by sex and by hazard]	400,000
Outcome 2.3	Output 2.3: APIs enabling data interoperability with existing government systems, including DCCE's MHEWS and related disaster management platforms.	Number of standards-based APIs deployed; number of government systems interoperating with CCIC.	Output 7.1: Improved integration of climate-resilience strategies into country development plans	Indicator 7.1A (Core Indicator 6): Policies, strategies, and/or plans developed or adjusted to integrate climate risk and resilience considerations	350,000
Outcome 2.4	Output 2.4: Network of microclimate weather sensors installed and operational across key zones, feeding high-resolution data into both the provincial platform and MHEWS.	Number of microclimate sensors deployed in pilot zones; data volume feeding platform and MHEWS.	Output 8.1: Innovations identified and piloted that collectively enhance local innovation capacity	Indicator 8.1B: Innovations piloted that demonstrate local innovation participation and/or local innovation benefit	500,000
Outcome 3.1	Output 3.1: Training modules and manuals for sensor maintenance and data interpretation.	Number of training modules and manuals developed and delivered (Thai and Isan dialect where relevant).	Output 2.1: Strengthened capacity of institutions to understand and better address climate risks	Indicator 2.1: Institutions supported to strengthen capacity to understand and address climate risks and resilience	165,000
Outcome 3.2	Output 3.2: Workshops delivered to government units and community focal points, with targeted quotas	Number of workshops delivered; number of participants (sex-, age-,	Output 3.1: Targeted population groups participating in adaptation and risk	Indicator 3.1: People participating in activities to improve awareness of climate risks and	195,000

	(minimum 40–50%) for women's participation and tailored training formats.	disability-disaggregated); % women.	reduction awareness activities	how to address them [# of people, disaggregated by sex and by vulnerable groups]	
Outcome 3.3	Output 3.3: Established feedback and coordination mechanism between national and local actors. | Output 3.4: Knowledge management covering knowledge product development, replication toolkit production, community materials, ASEAN outreach and the open-data portal.	Number of coordination meetings held; number of KM products developed and disseminated.	Output 3.2: Strengthened capacity of national and subnational stakeholders and entities to capture and disseminate knowledge and learning	Indicator 3.2: Climate resilience knowledge products and/or tools developed and shared with stakeholders [# of products/tools, by sector]	227,260
Total output level grant amount					**4,487,260**

G. Include a detailed budget with budget notes, broken down by country as applicable, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs

N/A at this stage.

H. Include a disbursement schedule with time-bound milestones.

N/A at this stage.

PART IV: ENDORSEMENT BY GOVERNMENTS AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[28]

Provide the name and position of the government official and indicate date of endorsement for each country participating in the proposed project/programme. Add more lines as necessary. The endorsement letters should be attached as an annex to the project/programme proposal. Please attach the endorsement letters with this template; add as many participating governments if a regional project/programme:

Mr. Phirun Saiyasitpanich Director General Department of Climate Change and Environment Ministry of Natural Resources and Environment	Date: (February 9, 2026)

B. Implementing Entity certification

Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address

i. [6] Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (……list here…..) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Ganna Onysko Ms. Ganna Onysko Senior GEF, GCF, AF Coordinator Division of Funding Partner Relations Directorate of Global Partnerships and External Relations United Nations Industrial Development Organization - UNIDO Implementing Entity Coordinator	
Date: September 09, 2026	Tel. and email:
Project Contact Person: Rasha Abdrabu	
Tel. And Email: R.ABDRABU@unido.org ; +43 1 26026 3454	

Annexes:
Annex A: UNIDO AF Stakeholder Consultation Meeting Minutes
Annex B: English_Stakeholder Consultation Report
Annex C: Thai_Stakeholder Consultation Report
Annex D: MNRE Justification Letter for UNIDO
Annex E: Coordination Meeting with DCCE and TMD
Annex F: CCIC Structure, Thai version
Annex G: CCIC Structure, English version

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URGENT
No. 0804/ 342

Ministry of Natural Resources
and Environment
92 Soi Phahon Yothin 7
Phahon Yothin Road
Bangkok 10400 Thailand
Tel./Fax. (+66) 2 298 5646

9 February B.E. 2569 (2026)

To: The Adaptation Fund Board

Subject: Endorsement for Microclimate–Energy Nexus Platform for Climate Adaptation in Remote Areas in Thailand (Programme on Innovation)

In my capacity as Designated Authority for the Adaptation Fund in Thailand, I confirm that the above national project proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Thailand.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. If approved, the project will be implemented by the United Nations Industrial Development Organization (UNIDO) and executed by Thailand's Department of Climate Change and Environment.

Yours sincerely,

R. Bhu.

(Mrs. Raweewan Bhuridej)
Permanent Secretary
Ministry of Natural Resources and Environment

I hereby endorse and validate this Letter of Endorsement (LOE)

P. Saiyasitpanich

(Mr. Phirun Saiyasitpanich)
Director General
Department of Climate Change and Environment
Primary Contact Point of the Designated Authority to the Adaptation Fund

Adaptation Fund Board Secretariat
c/o Global Environmental Facility,
Mail stop: N 6-600
1818 H Street NW
Washington D.C.

Revised PFG Submission Form[1] (additions in red)

Project Formulation Grant (PFG)

Submission Date: 9 September 2026

Adaptation Fund Project ID:
Country/ies: Thailand
Title of Project/Programme: Microclimate–energy nexus platform for climate adaptation in remote areas in Thailand
Type of IE (NIE/RIE/MIE): MIE
Implementing Entity: UNIDO
Executing Entity/ies: United Nations Industrial Development Organization (UNIDO)

A. Project Preparation Timeframe

Start date of PFG	December 2026
Completion date of PFG	June 2027

B. Proposed Project Preparation Activities ($)

List of Proposed Project Preparation Activities	Output of the PFG Activities	US$ Amount	Budget note[2]
1. Conduct integrated baseline, gender, climate risk, environmental and social risk, and institutional analyses (including HACT) to generate a validated evidence base.	**Output 1:** Consultation, Data Collection, and Technical Assessments **Deliverables:** CRVA Report; Baseline Datasets; Feasibility Report; Stakeholders' Consultation Report; ESMP & Screening Report; Gender Mainstreaming Plan; HACT Compliance Report.	103,000	• CRVA: US$ 15,000 • Baseline Assessment: US$ 15,000 • Technical Feasibility (including PV developer business case & technology feasibility assessment): US$ 10,000 • Stakeholder Consultations: US$ 22,000 • ESMF: US$ 16,000 • Gender Analysis: US$ 15,000

[1] As presented in AFB/PPRC.33/40 Annex 1.
[2] The proposal should include a detailed budget with budget notes indicating the break- down of costs at the activity level. It should also include a budget on the Implementing Entity management fee use.

			• HACT Assessment (DCCE): US$ 10,000
2. Formulation of the full AF submission package, Monitoring, Evaluation, and Learning (MEL) framework development, national validation processes, and required revisions.	**Output 2:** Preparation of the AF Submission Package and Revision Process **Deliverables:** Final Fully Developed Proposal and Annexes; Validation Report; Mission Report.	35,249	• Drafting Fully Developed Project Proposal, including exit strategy: US$ 14,743 • National Validation Workshop: US$ 8,000 • Monitoring Mission: US$ 12,506
Implementing Entity (IE) Support Costs	IE admin and technical support for the project development and supervision Compliance assurance	11,751	UNIDO technical and admin support for project development and supervision. The PFG IE Fee covers UNIDO project support costs associated with the preparation and implementation of the project, including administrative, procurement, financial, and technical support services. The monitoring function has been removed. Activities under Output 2 relate specifically to stakeholder consultations, validation processes, and workshops conducted during the PFG phase.
Total Project Formulation Grant		**150,000**	

Please describe below each of the PFG activities and provide justifications for their need and for the amount of funding required:

Description of the required activity	Justification for the need and for the amount
To conduct a Climate Risk and Vulnerability Assessment (CRVA):	The Climate Risk and Vulnerability Assessment covers assessments of climate risks, climate exposure, sensitivity, and vulnerability and identification of adaptation measures for the target sector in the identified regions. Measuring the sector's vulnerability to climate change impacts is necessary to increase the sector's resilience. This assessment will be conducted by a national adaptation expert, with the support of a project assistant to facilitate related travel of the adaptation expert and coordination with various stakeholders

To conduct a baseline assessment	The baseline assessment will be conducted so that the data and information is provided to support the interventions proposed and indicators/targets aimed at. The methodology will be based on a participatory approach, collecting primary data at the local, community level and secondary data.
Technical feasibility study for sensor deployment and solar integration	Assess the different technology options and sites and recommend sensor models and installation sites.
To carry out detailed stakeholders' consultations at local and national level:	Stakeholder consultation serves as a fundamental mechanism for collecting information, perspectives, and feedback from individuals involved in a project. This activity will serve to ensure further alignment of an engagement plan with the needs, expectations, and concerns of all relevant stakeholders. The stakeholders' consultations will target specifically selected project sites, involving local communities and indigenous populations. While no direct impacts on indigenous peoples are anticipated based on current site selection, consultations will remain inclusive should any such groups be identified during implementation.
To conduct an Environmental and Social Management assessment:	This activity is an integral part of UNIDO Environmental and Social Safeguards Policy and Procedures, applicable to all UNIDO projects and programmes submitted to the AF. It requires that UNIDO projects and programmes undergo environmental and social risk (E&S) assessments which will help decide on the categorization of the project and identify environmental and social issues that should be addressed in its development and implementation. The ESM will provide guidance on how to mitigate the environmental and social risks during the project implementation phase. This activity will be conducted by a technical expert and will require local travel to the project sites.
To carry out an In-depth gender analysis in order to effectively mainstream gender issues into the design:	This activity will allow mainstreaming a gender perspective is the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels. It is a strategy for making both women and men's concerns, experiences and aspirations an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that they benefit equally, and inequality is not perpetuated. This activity will be conducted by a national gender expert and will require travel to the project sites and consultations with various groups of beneficiaries.
To carry out a monitoring mission by the backstopping officer of UNIDO	This travel is earmarked for the project manager of UNIDO who needs to contribute in terms of technical backstopping, supporting the mobilization of the endorsement letter and the stakeholders' consultations with key institutions and providing orientation on the project design, scope and budgeting. The fee of the project manager is covered by the support costs
To prepare the full-fledge project proposal as per the	This activity will gather the results of all the assessments conducted during the preparation of the full fledge project proposal, following the template of the Adaptation fund and the requirements of UNIDO. The full-fledge proposal will

For LLA Projects only:

If requesting additional funding for LLA projects to enable devolving decision making to the local level, please specify the activities that would directly serve to enable devolving decision making to the lowest appropriate level and enable local actors to make informed decisions on how adaptation actions are defined, prioritized, designed, and implemented:

Please provide justifications for their need and for the amount of additional funding required:

C. Implementing Entity

This request has been prepared in accordance with the Adaptation Fund Board's procedures and meets the Adaptation Fund's criteria for project identification and formulation

Implementing Entity Coordinator, IE Name	*Ganna Onysko* Ms. Ganna Onysko Senior GEF, GCF, AF Coordinator Division of Funding Partner Relations Directorate of Global Partnerships and External Relations United Nations Industrial Development Organization - UNIDO Implementing Entity Coordinator	
Signature		**Date: 9 September 2026**
Project Contact Person	Rasha Abdrabu R.ABDRABU@unido.org +43 1 26026 3454	
Telephone	+43 1 26026 3708	
E-mail	TO: g.onysko@unido.org CC: gef@unido.org / glo@unido.org / f.haidara@unido.org	

Record of Stakeholder Consultation Meetings

Strengthening Climate Adaptation in Nakhon Ratchasima Province through Integrated Climate Data, Early Warning Systems and Community Resilience

Consultation Period: September 2025 – March 2026

Prepared by: UNIDO Project Development Team

Document Purpose: Stakeholder Engagement Evidence for Submission to the Adaptation Fund

1. Introduction and Purpose

This document compiles the official minutes of the stakeholder consultation meetings conducted by the United Nations Industrial Development Organization (UNIDO) in the framework of the development of a project proposal to be submitted to the Adaptation Fund (AF). The project aims to strengthen climate change adaptation in the Kingdom of Thailand, with Nakhon Ratchasima province identified as the primary pilot site due to its compounded exposure to drought, flooding and heat-stress hazards.

The consultations were organised in close coordination with the Department of Climate Change and Environment (DCCE) of the Ministry of Natural Resources and Environment, which serves as the Designated Authority (DA) for the Adaptation Fund in Thailand. Meetings engaged government entities, scientific institutions, technical experts, provincial authorities and gender specialists to ensure that the proposed intervention is fully aligned with Thailand's National Adaptation Plan (NAP), the emerging Climate Change Information Center (CCIC), and the needs of vulnerable communities.

These minutes serve as a formal record of the stakeholder engagement process and are submitted as supporting evidence of country ownership, institutional endorsement, and inclusive consultation, in accordance with the Adaptation Fund's policies on stakeholder engagement, environmental and social safeguards, and gender mainstreaming.

1.1 Key Institutional Acronyms

- UNIDO – United Nations Industrial Development Organization
- AF – Adaptation Fund
- DCCE – Department of Climate Change and Environment (Thailand)
- ERTC – Environmental Research and Training Center (under DCCE)
- CCIC – Climate Change Information Center (to be established under DCCE by 2026)
- TMD – Thai Meteorological Department
- TGO – Thailand Greenhouse Gas Management Organization (Public Organization)
- NAP – National Adaptation Plan of Thailand
- GEF – Global Environment Facility
- MAF – Multilateral Adaptation Fund portfolio / programmes

2. Summary of Consultations

A total of eight (8) formal/informal consultation meetings were conducted between 8 September 2025 and 23 March 2026. The table below provides an overview of these engagements.

Minute	Date	Subject / Key Stakeholder
Minute 1	8 Sept 2025	ERTC / DCCE – NAP & CCIC alignment
Minute 2	9 Sept 2025	Office of the Governor of Nakhon Ratchasima – Provincial acknowledgement
Minute 3	2 Oct 2025	Thai Meteorological Department (TMD) – Climate data and sensor network
Minute 4	6 Oct 2025	Technical Expert (Malaysia) – Technology transfer on sensors and platform
Minute 5	31 Oct 2025	ERTC / DCCE – Presentation of draft concept proposal
Minute 6	2 Feb 2026	DCCE National Committee – Concept note defence and endorsement
Minute 7	19 Mar 2026	Ministry of Energy (Thailand) – Public-sector solar installation and funding sources
Minute 8	19 Mar 2026	Gender Expert – Gender mainstreaming in the revised concept
Minute 9	23 Mar 2026	ERTC & CCIC – Response to AF Secretariat comments

Minute 1 – Inception Consultation with ERTC / DCCE

Meeting Title	Inception Consultation on the National Adaptation Plan (NAP) and the Climate Change Information Center (CCIC)
Date	Monday, 8 September 2025
Time	14:00 – 16:00 hrs (Bangkok time)
Venue	Environmental Research and Training Center (ERTC), DCCE, Ministry of Natural Resources and Environment, Thailand
Chair	Senior representative, Environmental Research and Training Center (ERTC), DCCE
Convened by	DCCE in response to UNIDO request for inception consultation

Participants

Name / Representative	Position / Role	Organization
Den	Senior Researchers / Technical Officers	Environmental Research and Training Center (ERTC)
Wittawat WULYAPASH	National Project Associate	UNIDO
Supalerk KANASOOK	National Project Coordinator	UNIDO

Agenda

- Introduction of UNIDO and the scope of the proposed Adaptation Fund project.
- Overview by DCCE/ERTC of the status of the National Adaptation Plan (NAP) and the upcoming Climate Change Information Center (CCIC).
- Identification of priority geographic area for the AF project.
- Coordination with other relevant institutions (TMD, TGO) and communities.
- Agreement on next steps for stakeholder engagement.

Key Discussion Points

Status of the NAP and CCIC: DCCE informed UNIDO that Thailand's National Adaptation Plan is being operationalised, and that the Climate Change Information Center (CCIC) is expected to be formally established within 2026. The CCIC will serve as the national platform for collecting, integrating and disseminating climate-related data through a dedicated CCIC dashboard, which will in turn support adaptation planning at national and sub-national levels.

Data gaps: DCCE highlighted that although data collection mechanisms exist, the frequency and resolution of climate data (ความถี่ของข้อมูล) remain limited. Strengthening the observation network and the data flow into the CCIC was identified as a priority where AF financing can generate significant added value.

Priority province – Nakhon Ratchasima: Based on DCCE's risk mapping, Nakhon Ratchasima province was identified as the most adaptation-vulnerable province in Thailand, exposed to a compounded risk profile of drought, flooding and extreme heat. DCCE therefore recommended that the AF project focus and be piloted in Nakhon Ratchasima first, with potential for replication nationwide.

Inter-agency coordination: DCCE confirmed that the CCIC is already working closely with the Thai Meteorological Department (TMD) on climate data. DCCE offered to facilitate and arrange a dedicated meeting between UNIDO and TMD.

Community engagement and prior studies: DCCE noted that DCCE and the Thailand Greenhouse Gas Management Organization (TGO) have jointly conducted nationwide studies on climate data and adaptation, including for Nakhon Ratchasima. These studies include stakeholder consultation results that can be directly leveraged by UNIDO.

Provincial contact: DCCE shared with UNIDO the official contact point of the Governor of Nakhon Ratchasima province to initiate provincial-level engagement.

Decisions and Agreements

- The AF project will be piloted in Nakhon Ratchasima province, with the design anchored on the NAP priorities and fully integrated with the forthcoming CCIC.
- DCCE/ERTC will serve as the primary national counterpart for the AF project development process.
- DCCE will facilitate engagement with TMD and share the DCCE/TGO climate study, including the stakeholder consultation records.

Action Items

No.	Action Item	Responsible	Deadline
1	Share the DCCE/TGO climate and adaptation study including stakeholder consultation records with UNIDO.	DCCE / ERTC	Sept 2025
2	Facilitate and schedule a coordination meeting with the Thai Meteorological Department (TMD).	DCCE	Sept–Oct 2025
3	Initiate engagement with the Office of the Governor of Nakhon Ratchasima province.	UNIDO	Sept 2025
4	Integrate NAP priorities and CCIC architecture into the emerging AF concept proposal.	UNIDO	Oct 2025

Minute 2 – Consultation with the Office of the Governor of Nakhon Ratchasima Province

Meeting Title	Provincial Consultation on the Proposed AF Adaptation Project in Nakhon Ratchasima
Date	Tuesday, 9 September 2025
Time	14:00 – 17:00 hrs (Bangkok time)
Venue	Phone call
Chair	Representative of the Governor of Nakhon Ratchasima Province
Convened by	UNIDO, in coordination with DCCE

Participants

Name / Representative	Position / Role	Organization
Provincial Representative(s)	Representatives of the Governor's Office	Office of the Governor of Nakhon Ratchasima Province
Wittawat WULYAPASH	National Project Associate	UNIDO
Supalerk KANASOOK	National Project Coordinator	UNIDO

Agenda

- Introduction of UNIDO and the Adaptation Fund as a financing instrument.
- Presentation of the proposed climate adaptation intervention in Nakhon Ratchasima.
- Discussion on provincial priorities regarding drought, flooding and heat stress.
- Exploration of an early warning system and its linkage to local economic activities, including ground-mounted solar installations.
- Acknowledgement on follow-up and in-principle endorsement.

Key Discussion Points

Project context: UNIDO introduced the proposed AF project, explaining the objectives, expected outcomes, and the rationale for selecting Nakhon Ratchasima as the pilot province. The province's exposure to drought, flooding and extreme heat, together with its economic and agricultural importance, was discussed.

Early warning system (EWS): The development of an integrated early warning system emerged as the most immediate priority for the province. Provincial representatives stressed that a functional EWS would allow communities at all levels, including farmers, households, local authorities and private-sector operators of solar (ground-mounted) assets, to be informed ahead of extreme events and to adapt accordingly.

Cross-sectoral benefits: The link between climate information and energy/industrial adaptation was discussed. Ground-mounted solar installations in the province are exposed to heat and flood risks, and early warning data would enable operational adjustments that reduce damage and downtime.

Acknowledgement: Provincial representatives acknowledged UNIDO's presentation and expressed in principle with the direction of the project, welcoming further engagement as the proposal is refined.

Decisions and Agreements

- The Office of the Governor of Nakhon Ratchasima acknowledgement and willing to support for the proposed AF project.
- UNIDO will keep the Governor's Office informed as the concept progresses, including on site selection for pilot activities.
- Stakeholder consultations at the community and sectoral levels will be organised during the full proposal development phase.

Action Items

No.	Action Item	Responsible	Deadline
1	Maintain regular communication with provincial focal points throughout concept and full proposal development.	UNIDO	Ongoing
2	Plan joint field and community consultations in Nakhon Ratchasima during the full proposal phase.	UNIDO / DCCE / Province	Post first-round approval

Minute 3 – Coordination Meeting with the Thai Meteorological Department (TMD)

Meeting Title	Technical Consultation on Climate Data, Sensor Network and Station Coverage in Nakhon Ratchasima
Date	Thursday, 2 October 2025
Time	13:30 – 15:30 hrs (Bangkok time)
Venue	Thai Meteorological Department (TMD) – facilitated by DCCE
Chair	Senior representative, DCCE
Convened by	DCCE, at the request of UNIDO

Participants

Name / Representative	Position / Role	Organization
DCCE Representative(s)	Senior Technical Officers	DCCE
TMD Representative(s)	Technical experts on sensors and meteorological equipment	Thai Meteorological Department
Wittawat WULYAPASH	National Project Associate	UNIDO
Supalerk KANASOOK	National Project Coordinator	UNIDO

Agenda

- TMD overview of climate data generation and existing sensor / station coverage.
- Discussion on station density in Nakhon Ratchasima (ความถี่ของเสาอากาศ) and identified gaps.
- Exploration of the integration of new sensors under the AF project into the national observation network.
- Discussion on institutional ownership and sustainability after project closure.

Key Discussion Points

Functions of TMD climate data: TMD presented the functions of its existing climate observation system, including the types of sensors, measurement parameters and transmission to the national data system.

Limited station density in Nakhon Ratchasima: Discussion confirmed that only three (3) operational weather stations (เสา) currently serve Nakhon Ratchasima province. Given the size and topographical

diversity of the province, this coverage is insufficient to generate the spatial and temporal resolution needed to support community-level adaptation planning.

Integration of AF-financed sensors: It was agreed that additional sensors installed under the AF project could be integrated with the existing TMD network, feeding data into both TMD and, through DCCE, into the CCIC dashboard.

Post-project sustainability: Concern was raised about the institution that will be responsible for operation and maintenance after project closure. DCCE confirmed that, in principle, TMD could take over this responsibility if TMD formally agrees to do so; otherwise, DCCE will assume responsibility through the CCIC. A definitive arrangement will be documented during the full proposal development phase.

Formal participation: TMD will be formally invited to join the project partnership at the full proposal stage, subject to the concept note being endorsed in the first AF review round.

Decisions and Agreements

- New sensors/stations funded by the AF project will be designed to be compatible with, and integrated into, the TMD observation network.
- TMD will be consulted on technical specifications to ensure alignment with national standards.
- Institutional responsibility after project closure will be confirmed in writing at the full proposal stage, with TMD as the preferred host and DCCE/CCIC as the back-up arrangement.

Action Items

No.	Action Item	Responsible	Deadline
1	Confirm TMD's readiness to host the expanded station network post-project.	DCCE / TMD	Full proposal phase
2	Formally invite TMD as a project partner at full proposal stage.	UNIDO	Upon first-round endorsement

Minute 4 – Technical Consultation on Sensor Technology Transfer (Malaysia)

Meeting Title	Technical Expert Consultation on Sensor Hardware and Data Platform – Technology Transfer from Malaysia to Thailand
Date	Monday, 6 October 2025
Time	16:30 – 17:30 hrs (Bangkok time)
Venue	Online
Chair	UNIDO Project Development Team
Convened by	UNIDO

Participants

Name / Representative	Position / Role	Organization
Mr. Kevin Loh	Technical Expert – Climate Sensors and Data Platform	Independent / Malaysia-based
Rasha ABDRABU	Project Manager	UNIDO
Wittawat WULYAPASH	National Project Associate	UNIDO
Supalerk KANASOOK	National Project Coordinator	UNIDO

Agenda

- Presentation by the technical expert on available sensor technology and data platforms.
- Discussion on the methodology for South–South technology transfer from Malaysia to Thailand.
- Compatibility with TMD equipment and CCIC architecture.
- Implications for budgeting, training and local capacity development.

Key Discussion Points

Technology overview: Mr. Kevin presented the hardware (climate / hydro-meteorological sensors) and software (data platform) components of a solution that has been successfully deployed in Malaysia. The architecture covers data acquisition, transmission, storage and visualisation.

Technology transfer methodology: A phased methodology was discussed, covering: (i) context assessment in Nakhon Ratchasima; (ii) system design and localisation; (iii) installation and commissioning; (iv) training for Thai counterparts (TMD, DCCE, CCIC); and (v) handover and post-project support.

South–South cooperation dimension: The Malaysia–Thailand technology transfer constitutes an important South–South cooperation element, consistent with UNIDO's mandate and with the AF's emphasis on replicable, country-driven adaptation solutions.

Alignment with national systems: Further technical dialogue will be required with TMD to ensure full compatibility with existing Thai observation standards and with the CCIC dashboard.

Decisions and Agreements

- The Malaysia-based solution will be considered as a reference for the AF project's technology component, subject to alignment with Thai standards.
- UNIDO will integrate the technology transfer methodology into the concept proposal as part of the project's innovation and South–South cooperation narrative.

Action Items

No.	Action Item	Responsible	Deadline
1	Share the presentation and technical documentation with UNIDO.	Mr. Kevin	October 2025
2	Integrate the sensor technology and transfer methodology into the concept proposal.	UNIDO	October 2025
3	Plan a joint technical review session with TMD during full proposal development.	UNIDO	Full proposal phase

Minute 5 – Presentation of the Draft Concept Proposal to ERTC / DCCE

Meeting Title	Presentation and Review of the Draft Concept Proposal for the Adaptation Fund
Date	Friday, 31 October 2025
Time	13:00 – 15:00 hrs (Bangkok time)
Venue	ERTC Office, DCCE, Thailand
Chair	Senior representative, ERTC / DCCE
Convened by	UNIDO in coordination with DCCE

Participants

Name / Representative	Position / Role	Organization
DCCE / ERTC Representative(s)	Director, Senior Researchers and Technical Officers	ERTC under DCCE
Wittawat WULYAPASH	National Project Associate	UNIDO
Supalerk KANASOOK	National Project Coordinator	UNIDO

Agenda

- UNIDO presentation of the draft concept proposal.
- Review of alignment with NAP priorities and CCIC architecture.
- Technical and institutional validation.
- Agreement on next steps toward DCCE committee-level endorsement.

Key Discussion Points

Structure of the concept proposal: UNIDO presented the draft concept proposal, covering problem statement, project objective, components, outputs, indicative activities, target beneficiaries, geographic scope, budget envelope and results framework.

Alignment with national priorities: ERTC/DCCE confirmed that the concept is well aligned with the NAP, with the establishment and operationalisation of CCIC, and with DCCE/TGO prior work in Nakhon Ratchasima.

Integration of earlier inputs: The concept reflects inputs received from ERTC/DCCE (Minute 1), the Governor's Office of Nakhon Ratchasima (Minute 2), TMD (Minute 3) and the technical expert from Malaysia (Minute 4).

Consensus: All participants expressed agreement with the concept proposal as presented, marking a key milestone in the consultation process.

Decisions and Agreements

- The draft concept proposal was endorsed by ERTC/DCCE at technical level.
- The concept will be escalated to the DCCE committee (chaired by the DG of DCCE) for formal defence and endorsement.

Action Items

No.	Action Item	Responsible	Deadline
1	Finalise the concept proposal incorporating ERTC/DCCE technical inputs.	UNIDO	November 2025
2	Schedule the DCCE committee meeting for concept note defence.	DCCE	Q1 2026
3	Prepare endorsement letter documentation for country ownership.	DCCE / UNIDO	Ahead of AF submission

Minute 6 – Concept Note Defence before the DCCE Committee

Meeting Title	National Committee Defence of the Adaptation Fund Concept Note
Date	Monday, 2 February 2026
Time	13:00 – 17:00 hrs (Bangkok time)
Venue	Department of Climate Change and Environment (DCCE) Conference Room
Chair	Director-General of DCCE (Chair of the Committee)
Convened by	DCCE

Participants

Name / Representative	Position / Role	Organization
Dr. Phirun Saiyasitpanich, Director-General, DCCE	Committee Chair	DCCE
Committee Members	Senior Officials	Relevant ministries and public-sector institutions
Committee Members	Experts and Researchers	Academic institutions and universities
Wittawat WULYAPASH	National Project Associate	UNIDO
Supalerk KANASOOK	National Project Coordinator	UNIDO

Agenda

- Opening remarks by the DG of DCCE.
- Presentation by UNIDO of the concept note.
- Assessment of alignment with Thailand's National Adaptation priorities.
- Committee questions, comments and recommendations.
- Decision on the endorsement letter required by the Adaptation Fund.

Key Discussion Points

Opening and framing: The DG of DCCE opened the session by emphasising the importance of the Adaptation Fund as a direct-access climate finance instrument, and the need to ensure that UNIDO's

proposal is consistent with Thailand's national adaptation priorities and with the institutional arrangements under DCCE.

Concept note presentation: UNIDO presented the finalised concept note, covering objectives, components, geographic focus on Nakhon Ratchasima, integration with CCIC and TMD, gender considerations, safeguards and indicative budget.

Committee review: Committee members from public-sector institutions, universities and research centres engaged in a detailed review, including the technical robustness of the observation network, the sustainability arrangements post-project, complementarity with existing national programmes, and the approach to community engagement.

Endorsement outcome: The committee concluded that the concept note is aligned with Thailand's national adaptation agenda and qualifies for formal country endorsement. The purpose of the meeting – obtaining the basis for an endorsement letter from the country – was therefore satisfied.

Decisions and Agreements

- The DCCE committee endorsed the concept note for submission to the Adaptation Fund.
- DCCE, as Designated Authority, will issue the formal endorsement letter required by the AF.
- Any comments from the committee will be consolidated by DCCE and reflected in the final submission.

Action Items

No.	Action Item	Responsible	Deadline
1	Issue the official country endorsement letter for the AF concept note.	DCCE (Designated Authority)	February 2026
2	Consolidate committee comments and share with UNIDO.	DCCE Secretariat	February 2026
3	Finalise and submit the AF concept proposal.	UNIDO	February 2026

Minute 7 – Consultation with the Ministry of Energy of Thailand on Public-Sector Solar Installations

Meeting Title	Consultation on Public-Sector Solar Rooftop and Ground-Mounted Installations – Funding Mechanisms and Municipal Coverage
Date	Thursday, 19 March 2026
Time	14:00 – 15:00 hrs (Bangkok time)
Venue	Telephone conference (phone call)
Chair	UNIDO Project Development Team
Convened by	UNIDO, in coordination with the Ministry of Energy of Thailand

Participants

Name / Representative	Position / Role	Organization
Representative(s), Ministry of Energy	Technical / Programme Officer(s) on renewable energy support to public sector	Ministry of Energy, Kingdom of Thailand
Supalerk KANASOOK	Project Development Team	UNIDO

Agenda

- Briefing on the UNIDO Adaptation Fund project and its link to adaptation-responsive energy infrastructure.
- Overview of existing public financing mechanisms supporting solar installations in the public sector.
- Status of deployment at the municipal level (Tessaban, SAO, PAO).
- Coordination arrangements for the detailed study phase of the AF project.

Key Discussion Points

Context of the discussion: UNIDO briefed the Ministry of Energy on the proposed AF project in Nakhon Ratchasima, with particular emphasis on the interlinkage between climate adaptation, early warning systems and the operation of public-sector solar assets (both rooftop and ground-mounted) that are increasingly exposed to drought, flooding and heat-stress events.

Two distinct public-sector funding sources: The Ministry of Energy explained that, in the Thai context, public financing supporting the deployment of solar installations in public-sector entities is typically channelled through two separate sources:

- First source – Provincial / Governor budget: funds allocated directly under the authority of the Provincial Governor, used to support solar installations for public buildings and municipal offices within the province.
- Second source – Ministry of Energy dedicated fund: funds administered directly by the Ministry of Energy, provided to the municipal level to support both solar rooftop and solar ground-mounted systems.

Beneficiary entities at municipal level: Both financing sources are primarily directed to sub-national administrative entities, specifically the municipality (เทศบาล / Tessaban), the Sub-district Administrative Organisation (SAO) and the Provincial Administrative Organisation (PAO). These entities are the operational interface between national policy and local delivery of public services.

Current deployment status: The Ministry of Energy indicated that most of the municipalities referred to in the consultation have already installed solar systems at their office premises (solar rooftop and/or solar ground-mounted), reflecting a substantial baseline of public-sector solar adoption. This baseline is highly relevant for the AF project, as these existing installations can directly benefit from climate information and early warning services generated by the project, and can in turn serve as demonstration sites for climate-resilient operation of public-sector solar infrastructure.

Data availability and collection plan: Detailed information on beneficiary municipalities, installed capacity, year of installation, budget source and operational performance is distributed across different institutions and programmes. Systematic data consolidation was therefore agreed to be carried out during the detailed study phase of the AF project, which will map existing installations, identify resilience gaps and inform the design of the adaptation interventions.

Coordination going forward: The Ministry of Energy expressed openness to further coordination with UNIDO and DCCE, including the possibility of being formally associated with the project partnership at the full proposal stage, in recognition of the cross-sectoral nature of adaptation in energy infrastructure.

Decisions and Agreements

- Two public-sector funding streams (Provincial/Governor budget and Ministry of Energy dedicated fund) were confirmed as the main channels for solar deployment at the municipal level.
- Existing solar installations in municipalities of the pilot province will be documented and assessed during the detailed study phase of the AF project.
- UNIDO will maintain engagement with the Ministry of Energy to align the AF project with ongoing national programmes supporting public-sector solar deployment.

Action Items

No.	Action Item	Responsible	Deadline
1	Collect detailed information on beneficiary municipalities, installed capacities and funding sources across the pilot area, including data held by the Governor's office and by the Ministry of Energy.	UNIDO (supported by Ministry of Energy, DCCE and Province)	Full proposal phase
2	Map existing public-sector solar installations (rooftop and ground-mounted) against climate risk exposure (drought, flood, heat).	UNIDO	Full proposal phase
3	Maintain coordination with the Ministry of Energy and explore formal partnership arrangements at full proposal stage.	UNIDO	Full proposal phase
4	Align the AF project design with the two identified public funding streams to maximise complementarity and avoid duplication.	UNIDO / DCCE / Ministry of Energy	Full proposal phase

Minute 8 – Consultation with Gender Expert on Gender Mainstreaming

Meeting Title	Consultation on Gender Mainstreaming for the Revised Concept Proposal
Date	Thursday, 19 March 2026
Time	14:00 – 15:00 hrs (Bangkok time)
Venue	In person meeting at UNIDO workshop at Centara Grand Hotel, Central World
Chair	UNIDO Project Development Team
Convened by	UNIDO

Participants

Name / Representative	Position / Role	Organization
Dr. Ruttiya Bhula-Or	Local Gender Expert (experienced in UNIDO GEF/MAF projects)	Independent expert
Supalerk KANASOOK	National Project Coordinator	UNIDO

Agenda

- Briefing on the project concept and its implementation context.
- Review of AF Gender Policy requirements and UNIDO Gender Policy.
- Sharing of UNIDO comments on gender dimensions of the revised concept.
- Agreement on deliverables and timeline.

Key Discussion Points

Expert background: Dr. Ruttiya Bhula-Or has supported UNIDO in multiple projects under the Global Environment Facility (GEF) and Multilateral Adaptation Fund (MAF) portfolios. Her expertise is particularly relevant to the integration of gender considerations in climate adaptation, early warning systems and community engagement.

Scope of gender integration: Gender mainstreaming is to be embedded across the problem analysis, results framework, activities, stakeholder engagement plan, and monitoring and evaluation framework of the concept proposal, in line with AF and UNIDO gender policies.

Comments and working approach: UNIDO shared consolidated comments and the current draft of the revised concept with Dr. Bhula-Or. She agreed to conduct a detailed review, propose sex-disaggregated indicators, identify gender-responsive activities, and strengthen narrative sections on vulnerability, access and participation.

Timeline: Dr. Bhula-Or committed to returning the reviewed document to UNIDO before the end of April 2026, in time for the next submission milestone.

Decisions and Agreements

- Dr. Ruttiya Bhula-Or will act as the gender specialist for the concept proposal and support full proposal development.
- The revised concept will include an explicit gender analysis, gender action plan elements and sex-disaggregated indicators.

Action Items

No.	Action Item	Responsible	Deadline
1	Review and strengthen the gender dimension of the revised concept proposal.	Dr. Ruttiya Bhula-Or	By end of April 2026
2	Integrate the gender expert's inputs into the revised concept proposal.	UNIDO	April–May 2026
3	Prepare a Gender Action Plan for the full proposal stage.	UNIDO / Gender Expert	Full proposal phase

Minute 9 – Response to Adaptation Fund Secretariat Comments

Meeting Title	Coordination Meeting on the AF Secretariat Comments to the Concept Proposal
Date	Monday, 23 March 2026
Time	10:00 – 12:00 hrs (Bangkok time)
Venue	DCCE, Thailand (hybrid)
Chair	Senior representative, DCCE
Convened by	DCCE, jointly with UNIDO

Participants

Name / Representative	Position / Role	Organization
DCCE Representative(s)	Director / Senior Officials	DCCE
ERTC Representative(s)	Senior Researchers / Training Officers	Environmental Research and Training Center (ERTC)
CCIC Representative(s)	Technical Officers	Climate Change Information Center (CCIC)
Wittawat WULYAPASH	National Project Associate	UNIDO
Supalerk KANASOOK	National Project Coordinator	UNIDO

Agenda

- Review of comments received from the Adaptation Fund Secretariat.
- Confirmation of institutional arrangements for CCIC integration.
- Discussion on training programme and equipment standardisation.
- Definition of the response strategy and division of responsibilities.

Key Discussion Points

AF Secretariat feedback: UNIDO presented the official comments received from the Adaptation Fund Secretariat on the concept proposal. The comments were reviewed collectively and clustered by theme: institutional arrangements, sustainability, training and capacity development, and equipment / standards.

CCIC integration confirmed: CCIC reconfirmed – consistent with earlier consultations – that the project outputs will be fully integrated into the CCIC, which is being operationalised within 2026. This ensures the long-term institutional home of the data systems and sustainability beyond project closure.

Training and capacity development: ERTC confirmed that the training component will be designed inclusively, engaging other relevant departments under DCCE, and leveraging ERTC's mandate as the national environmental training institution. This approach addresses the AF Secretariat's comments on capacity building and institutional anchoring.

Equipment standardisation: Participants confirmed that the equipment to be procured and deployed will be standardised in accordance with the specifications used by Thai Government institutions (TMD, DCCE, CCIC), ensuring inter-operability, maintainability and national ownership.

Decisions and Agreements

- The concept proposal will be revised to reflect AF Secretariat comments on: (i) CCIC integration, (ii) training scope under ERTC, and (iii) equipment standardisation with Thai Government standards.
- A consolidated response matrix to the AF Secretariat comments will be prepared by UNIDO with DCCE inputs.
- UNIDO, DCCE, ERTC and CCIC will continue to coordinate closely until submission of the revised concept proposal and subsequent full proposal.

Action Items

No.	Action Item	Responsible	Deadline
1	Prepare a response matrix addressing each AF Secretariat comment.	UNIDO (with DCCE)	April 2026
2	Update the concept proposal to reflect CCIC integration, ERTC-led training scope and Thai Government equipment standards.	UNIDO	April–May 2026
3	Secure written confirmation from CCIC on the post-project hosting arrangement.	DCCE / CCIC	Full proposal phase
4	Integrate gender expert inputs into the revised concept.	UNIDO	April–May 2026
5	Submit the revised concept proposal to the Adaptation Fund.	UNIDO	As per AF timeline

Initial Gender Assessment
An initial gender assessment was undertaken based on available secondary data, relevant literature and information generated through project preparation. The assessment considered women's and men's roles in climate-sensitive livelihoods, their exposure and adaptive capacity in relation to floods, droughts and heat stress, their access to climate information and productive resources, and their potential participation in the climate technology ecosystem.

The initial gender assessment confirms that women constitute a significant share of the climate-exposed agricultural population in Nakhon Ratchasima. The assessment therefore focused on the gender-specific constraints that may affect women's access to climate information, adaptation resources, technical opportunities and project decision-making.

The evidence reviewed indicates that these roles do not necessarily translate into equal access to the resources and services needed for adaptation. Women may face constraints in accessing land, credit and other productive resources, agricultural extension and technical training, timely climate and early warning information, digital technologies, and decision-making structures. Time constraints associated with unpaid household and care responsibilities, differences in literacy and digital access, and women's underrepresentation in technical fields may further limit their ability to participate in training, operate monitoring technologies or benefit from emerging climate-service markets. These constraints could reduce women's capacity to anticipate climate hazards, adjust farming and water-management decisions, and recover from climate-related losses. They also create a risk that a technology-centred intervention could reinforce existing inequalities if access, communication and participation arrangements are not deliberately designed to address them.

The initial assessment also identified opportunities for the project to strengthen women's role. Women's existing roles position them as important users and disseminators of climate information. At the same time, the project's sensor network, data platform and associated climate services can create new roles for women as technicians, data intermediaries, climate advisory providers, entrepreneurs, innovators and leaders in community-level climate governance.

These findings have shaped the concept in the following ways:

- Women, particularly women farmers and female-headed households, are explicitly prioritised among the project's vulnerable beneficiary groups. At least 40–45% of direct beneficiaries are expected to be women, consistent with their representation in the provincial agricultural workforce.
- Early warning information and climate advisories will be disseminated through multiple gender-responsive and locally accessible channels, including SMS, radio, community networks, women's groups and village-level intermediaries, to reduce barriers related to digital access and ensure that information reaches women in a timely and actionable form.
- Training formats, schedules and materials will be adapted to identified barriers, including time constraints, literacy and digital access. A minimum target of 40% women's participation will be applied to relevant technical training, including sensor installation and maintenance, data analytics and the use of climate information for agricultural and water-management decisions.
- Women's groups, female farmer networks and women leaders will be formally included in consultations, co-design processes, community feedback mechanisms and local governance structures. This addresses the absence of women's organisations from the 2023–2024 Provincial Working Group and helps ensure that women influence sensor siting, platform design, communication channels and the development of locally relevant climate advisories.
- The project will support women's economic participation in the climate technology value chain through mentorship, internships, technical training, incubation or small-grant support, market linkages and opportunities for women-led enterprises and cooperatives to provide climate advisory, data collection and equipment-maintenance services. The proposed full project will assess the feasibility of reserving a defined share of relevant service contracts for women-led enterprises.

A comprehensive gender assessment will be conducted during the Project Formulation Grant (PFG) phase, building on secondary data and stakeholder consultations to identify gender-specific needs, roles, constraints, and opportunities. This will include sex-disaggregated data collection; separate and mixed consultations with women and men; engagement with women's groups, female farmers, women-led enterprises and relevant government and civil-society organisations; and analysis of differentiated climate vulnerabilities, information-access patterns, livelihood roles, time use, adaptive capacities and barriers to technical and economic participation. This assessment will inform the development of a Gender Action Plan, including targeted interventions, indicators, and institutional responsibilities to ensure compliance with the Adaptation Fund Gender Policy.

The project design also draws on regional collaboration and technical exchange with Malaysia, reflecting the shared climate and energy challenges across ASEAN. Consultations were held with the Sustainable Energy Development Authority (SEDA) Malaysia, which expressed strong support for the project's data platform and offered technical cooperation. SEDA will provide access to Malaysia's existing photovoltaic (PV) monitoring database to test and validate algorithms developed under the Thai platform. SEDA also indicated readiness to support capacity-building activities and, if feasible, adapt the algorithms for potential use in their national system. During consultations, SEDA raised practical implementation issues, including data sustainability challenges associated with its current database (e.g., reliance on mobile 3G connectivity and discontinued data collection from original FIT sites). These experiences will inform Thailand's system design to ensure robustness and long-term functionality. The inclusion of Malaysian technical expertise and additional sites for data testing will strengthen the project's regional relevance and replication potential.

The project will prioritise publicly owned PV sites for sensor deployment. In Nakhon Ratchasima, the availability of suitable publicly owned solar installations is not expected to be challenging. In the event of future scaling to other provinces where suitable publicly owned solar installations may not be available, farmer cooperatives and private businesses with existing PV installations, including private PV developers, may be engaged. In such cases, the feasibility of potential co-investment and operational partnership arrangements may be explored.

At the national level, consultations with the Thai Meteorological Department (TMD) helped define the technical specifications for the microclimate sensors and data parameters required for integration into national systems. TMD's participation ensures technical compatibility, data standardisation, and compliance with Thailand's broader climate data framework.

Consultations also took place with Thailand Greenhouse Gas Management Organisation (TGO) which played an important role in identifying the Nakhon Ratchasima province as the relevant location to commence the project.

Consultations will also be held with local community representatives to identify high-risk areas within Nakhon Ratchasima province, focusing on understanding local vulnerabilities, gender dynamics, and data needs. For sites identified during implementation under the USP approach, additional site-specific consultations will be conducted with affected communities prior to deployment. The project will expand engagement with civil society organisations (CSOs) operating in Nakhon Ratchasima and nationally, including organisations working on climate adaptation, rural livelihoods, gender equality, and community development. These CSOs will play a key role in facilitating inclusive consultations, identifying vulnerable groups, and ensuring that local knowledge and social dynamics are adequately reflected in project design. These consultations will ensure that local stakeholders are informed, potential risks are identified early, and community feedback is incorporated into site selection and implementation decisions.

Feedback from these discussions will inform the siting strategy for sensor deployment, prioritising flood-prone and drought-affected villages. Consultations with local communities will focus on

identifying data needs that directly support local decision-making particularly for farming schedules, water management, and disaster preparedness. To ensure inclusive and locally led design, the project will engage a diverse set of community-level actors, including: (i) farmer cooperatives and irrigation user groups; (ii) women's groups and female farmer networks; (iii) youth organisations and agri-entrepreneur groups; (iv) village health volunteers (VHVs) and local disaster response teams; (v) indigenous and local knowledge holders, particularly those with experience in traditional weather forecasting and water management; (vi) disability advocacy groups; and (vii) informal sector workers involved in climate-sensitive livelihoods.

Engagement will move beyond consultation toward co-design through structured participatory methodologies, including: (a) participatory rural appraisal (PRA), (b) co-design workshops at sub-district level, (c) citizen science approaches for data collection and validation, and (d) iterative feedback loops where community inputs directly inform system design, sensor placement, and platform functionality. These processes will ensure that community knowledge meaningfully shapes project decisions rather than validating pre-defined technical solutions.

Gender analysis will be systematically integrated into consultations through sex-disaggregated data collection, focus group discussions with women and men separately, and engagement with local women's organisations to identify gender-specific climate risks, information needs, and barriers to participation. During the PFG phase, the consultative process will be formalised through a structured stakeholder engagement plan, including: (i) targeted consultations with women's groups and gender-focused organisations; (ii) dedicated sessions with civil society actors; (iii) engagement with private sector stakeholders, including publicly owned PV developers and agri-businesses; and (iv) documentation of stakeholder inputs to ensure traceability in project design decisions.

Note that Nakhon Ratchasima (Korat) is a culturally diverse province and a historical crossroads where several communities coexist. The main local group is the Khorat Thai (Thai Doeng), especially in areas like Chok Chai, with a distinct dialect blending Central Thai and Isan. All groups are able to communicate in standard Thai. Furthermore, no differentiated needs have been identified to date and that this will be assessed as part of the PFG-stage community consultations.