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[1]: 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

Project Formulation Grant Request: Yes ☒ No ☐

Amount of Requested financing for PFG: 150,000 (in U.S Dollars Equivalent)

Letters of Endorsement (LOE) signed for all countries: Yes ☒ No ☐

Stage of Submission:

☐This proposal has been submitted before including at a different stage (pre-concept, concept)

☒ This is the first submission ever of the proposal at any stage

Please note that concept note documents should not exceed 50 pages, including annexes.

[1] 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 Additionally, Thailand's national risk maps are based on low-resolution and outdated data from 2020, limiting their utility for local adaptation planning.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 solar infrastructure in remote and vulnerable areas of Nakhon Ratchasima province. This initiative combines distributed weather sensors with decentralised renewable energy systems, framed under an energy resilience narrative. By integrating sensors with resilient solar infrastructure, the project ensures uninterrupted monitoring and data transmission during climate shocks, reduces vulnerability to climate-induced power disruptions, and thereby safeguards adaptive functions such as early warning systems. These sensors will feed into a cloud-based platform that supports AI-driven forecasting, risk mapping, and climate resilience planning. The platform will be hosted in Thailand and developed with technical support from Malaysian experts, leveraging South–South cooperation.

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 the 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 set forth 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. [2]

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

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

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 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[3]. 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.[4]

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 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.

[3] See publication https://www.sciencedirect.com/science/article/pii/S2949911924000443
[4] All relevant statistics and information in this section are from the Climate Change Action Plan for the Agricultural Sector

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.

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.

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 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.

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:

Project/ Programme Components	Expected Outcomes	Expected Outputs	Amount (US$)
1. Sensor Deployment[5] **(UNIDO)**	Outcome 1.1: Improved accuracy of localised weather and climate risk monitoring.	Output 1.1: Network of microclimate sensors and solar-powered weather	1,700,000

[5] Install microclimate sensors and solar-powered weather stations in remote areas, prioritising high-risk zones identified by DCCE and aligned with NAP sectoral priorities.

Project/ Programme Components	Expected Outcomes	Expected Outputs	Amount (US$)
	Outcome 1.2: Stronger early warning systems for floods, droughts, and heatwaves. Outcome 1.3: Enhanced decision-making for agriculture, water management, and disaster preparedness.	stations installed in priority high-risk zones. Output 1.2: Operational data transmission system linked to national meteorological and disaster management platforms. Output 1.3: Baseline data collection on temperature, rainfall, and humidity across remote regions.	
2. Platform Development[6] **(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[7] **(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.	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.	587,260

[6] 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.

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

Project/ Programme Components	Expected Outcomes	Expected Outputs	Amount (US$)
	Outcome 3.3: Stronger institutional collaboration around NAP implementation.	Output 3.3: Established feedback and coordination mechanism between national and local actors.	
4. Project/Programme Execution Cost			121,035
5. Total Project/Programme Cost			4,608,295
6. 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)

Milestones	Expected Dates
Start of Project/Programme Implementation	May 2027
Mid-term Review (if planned)	October 2029
Project/Programme Closing	April 2031
Terminal Evaluation	June 2031

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. 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.

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

Compact professional-grade weather stations such as the PVMET-75 model will be used to capture real-time data on ambient temperature, PV panel temperature, and global or plane-of-array irradiance. 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. 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.

While PV technology offers scalability and low-levelized costs of electricity (LCOE), its inclusion in this project is justified only insofar as it contributes to energy resilience for adaptation functions—not for commercial optimisation. Any improvements in solar yield forecasting or site selection will be treated as ancillary benefits, and the details for these co-benefits will be examined during the full proposal stage. This framing ensures that PV-related activities remain fully consistent with adaptation scope by linking them directly to adaptation outcomes, such as the continuity of essential services, the resilience of early warning systems, and reduced vulnerability to climate-induced power disruptions.

Capacity building will be a central pillar of the initiative, designed to ensure sustained use and impact of the new systems. Technical training programs will be delivered for DCCE staff and provincial officials to strengthen their expertise in sensor operation, maintenance, and troubleshooting. Sector-specific trainings will target agencies in agriculture, water, and health to build their capacity for interpreting forecasts and applying data to climate-informed planning processes. Training materials will be developed in Thai and tailored for different audiences to ensure inclusivity. In parallel, targeted community workshops will equip farmer groups, schools, and health volunteers with the knowledge and skills to use SMS alerts, mobile applications, and local climate data in their daily decision-making.

To complement these efforts, a structured community outreach and engagement program will be implemented to foster broad-based awareness and ownership. Outreach campaigns will employ diverse communication channels, including community meetings, radio programs, and temple-based information sessions, to disseminate knowledge about climate risks and adaptive responses. Special attention will be given to youth engagement to encourage innovative applications of climate information in agriculture and water conservation. Feedback mechanisms, including hotlines and digital surveys, will be established to 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 will also be supported through the development of cost-sharing models that engage provincial governments, farmer cooperatives, and private businesses. Finally, the experience and lessons generated from the Nakhon Ratchasima pilot will serve as a model for scaling up across other vulnerable provinces.

As a side benefit to the project – and important for the business case of ongoing sustainability of the interventions – the systematic collection of high-resolution climate and weather data can also provide significant added value for solar PV developers and operators. Beyond supporting early warning functions, such data can substantially improve the accuracy of solar yield forecasting and site selection across the country. Reliable, granular data are essential inputs for simulation and performance optimisation software used in PV system design and operation. The project will provide first-mover support to these PV developers, which will benefit local communities by improving early warning systems / overall resilience, while at the same time providing benefits to the PV developers. The exit strategy of the project will include a winding down of the grants for sensor implementation (or alternatively, will involve policies to provide ongoing support).

Further assessments of technology feasibility assessment – including further elaborating the business case and project exit strategy - 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.

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.

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

- 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 remain proprietary 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 countries in Asia, 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 connects 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).

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 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.

As a side benefit, for renewable energy developers, the data can improve solar resource assessment, yield forecasting, and system design, supporting more efficient and resilient PV deployment.

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.

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.

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. 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.

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.

In parallel, improved weather forecasting will reinforce energy system resilience by helping producers and grid operators anticipate and mitigate climate-related disruptions. More accurate forecasts will support optimal generation planning, safeguard assets, and minimise downtime during extreme weather events. For renewable energy – particularly solar and wind – this enhanced foresight will facilitate smoother grid integration, ensure more reliable supply, and promote proactive maintenance, thereby strengthening the stability and adaptability of the national energy system. Furthermore, the enhanced production forecasts could be expected to allow for increased PV installations, which in turn improve the resilience of the system since distributed energy sources can act as a backup when storms and disruptions occur in the broader, more centralised system. This will be further examined in the preparation of the full proposal.

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, 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 integrating microclimate sensors with existing solar infrastructure. Each PVmet weather station—including supply and installation—costs approximately USD 2,500, excluding extensive cabling. This approach significantly reduces capital expenditure compared to traditional hydrometeorological stations, which often require standalone power systems and complex installations. Furthermore, integrating PV for resilience avoids costly service interruptions. By ensuring the uptime of adaptation-critical systems, these measures deliver high value per dollar compared to reactive approaches.

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.

These measures reduce implementation costs and accelerate learning, making the project more efficient and regionally relevant.

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 flood, drought, and heatwave 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.

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	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.

Framework / Strategy	Key Objectives / Priorities	Project Alignment and Contribution
	institutional capacity for adaptation.[8]	• Human Settlements: enhances early warning and risk-informed infrastructure planning. Builds institutional capacity through improved climate data integration.
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.[9]	• 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.[10] • Improve coordination among agencies and data systems[11]	• 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.[12]	• 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.[13]	• 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.

[8] Thailand National Adaption Plan
[9] Climate Change Master Plan
[10] Thailand CSA
[11] Thailand NDC
[12] Scaling Up Climate Ambition on Land Use and Agriculture (SCALA)
[13] ASEAN Climate Change Strategic Action Plan

Framework / Strategy	Key Objectives / Priorities	Project Alignment and Contribution
National Strategy (2018–2037)	• Achieve sustainable, resilient, and innovation-driven development. • Build environmental sustainability and disaster resilience across all sectors.[14]	• Contributes to strategic objectives on sustainable growth and resilience. • Advances innovation and digital transformation for climate-informed planning.
Bio-Circular-Green (BCG) Economy Model (2021–2027)	• Promote sustainable agriculture, renewable energy, and circular economy principles. • Integrate innovation and technology into resource management.[15]	• 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.

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[16].

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:

[14] National Strategy
[15] Bio-Circular Green Economy Model
[16] Global Status of MHEWS

- 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.

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.

Environmental and social risks associated with this project have been assessed as minimal, and the project has been classified as Category C under UNIDO's Environmental and Social Safeguards Policy and Procedures (ESSPP). As such, a detailed Environmental and Social Management Plan (ESMP) is not required. Nonetheless, precautionary measures will be integrated into project implementation to manage minor risks, including provisions for e-waste management, occupational health and safety, gender and inclusion, and stakeholder engagement. 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	UK Centre for Ecology and Hydrology	Focused research on drought monitoring and	STAR relies primarily on remote sensing and modelling. This project

Project	Funder/Authority	Description	Complementarity/ description of avoidance of duplication
Agricultural Drought Resilience (STAR)	(UKCEH) / Thai Research Fund	response using satellite and meteorological data.	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.
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.

Project	Funder/Authority	Description	Complementarity/ description of avoidance of duplication
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.
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 SEI pilot is small-scale and experimental. This project aims to scale up sensor deployment across multiple provinces, integrate AI prediction models, and build a national data and training platform for long-term application.
Mekong EbA South: Enhancing Climate Resilience in the Greater Mekong Sub-region through Ecosystem-based Adaptation in the Context of South-	**Adaptation Fund:** International Union for Conservation of Nature (IUCN) / Ministry of Natural Resources and	Regional initiative that builds community and ecosystem resilience to droughts and floods in the Greater Mekong Subregion through climate-	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

Project	Funder/Authority	Description	Complementarity/ description of avoidance of duplication
South Cooperation (Thailand, Viet Nam)	Environment of Vietnam / Ministry of Natural Resources and Environment of Thailand / UN Environment Programme,	resilient agriculture, water management, and livelihood diversification.	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.

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. 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.

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, such as the ASEAN Climate Resilience Network (CRN) and ASEAN Centre for Energy (ACE), will ensure lessons inform ongoing regional dialogues and future collaboration.

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 final evaluations will assess the effectiveness of knowledge capture and application.

   3.3. Continuous feedback loops will be embedded in community engagement activities, ensuring that local users, technicians, and government stakeholders contribute insights to improve the system and training materials.

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.

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.

The 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.

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.

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. 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. Gender considerations will be integrated by ensuring the active participation of both women and men, recognising their distinct roles in agricultural and household decision-making.

Through this inclusive and iterative consultative process, the project will ensure that institutional partners, local authorities, and community groups all have clearly defined roles in implementation, monitoring, and knowledge sharing.

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 engaging climate-vulnerable communities, technical agencies, and research partners throughout design and implementation. Local communities and businesses, drought- and flood-affected districts, and district-level disaster response units 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 helps shape the platform's practical outputs. Research organisations and international partners 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 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 initial impetus for solar developers to participate in the scheme by mobilising additional resources to integrate the data into a database. Grant funding helps develop the APIs which allow for future integration of hardware by multiple vendors. Grant money can provide additional hardware, such as rain gauges at certain locations, to improve the forecast.

Baseline Scenario (Without AF Financing)

Under the business-as-usual scenario, Thailand's climate risk management relies on a sparse network of approximately 100 national weather stations operated by the Thai Meteorological Department (TMD). In Nakhon Ratchasima specifically, this coverage is

critically insufficient. The province, with an area of 20,493 km², is served by only 3 main stations, resulting in a density of approximately 6,800 km² per station. This falls significantly below the World Meteorological Organization (WMO-No. 8) recommendations of 600–900 km²/station for tropical flatlands.

Consequently, current data is too coarse and generalised to inform local decision-making. National risk maps rely on outdated data (c. 2020) and fail to capture the real-time microclimatic variability required to anticipate floods, droughts, and heatwaves. Remote communities and farmers lack actionable intelligence, directly undermining Thailand's ability to implement its National Adaptation Plan (NAP), particularly in the priority sectors of water, agriculture, and public health.

Comparing this to regions with robust early warning systems highlights a structural gap. For instance, Taiwan (36,197 km²) has a density of 260 km² per station (139 automatic stations). The disparity between 6,800 km² per station and international standards demonstrates that merely reinforcing existing central capacities is insufficient. A dedicated, high-density sensor network is a necessary new investment to close this data gap.

With the proposed AF financing, the project will bridge this gap by installing over 100 sensor points across the province. This will significantly increase coverage density to approximately 200 km² per station (averaging 3 stations per district). This represents a significant and necessary upgrade to the existing infrastructure, supporting and enhancing weather forecasting and climate projection downscaling, ensuring accurate, localised early-warning capabilities to protect vulnerable communities.

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 cost of a PVmet station is approximately USD 2,500, 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.

Why AF Grant Funding Is Essential

Grant funding from the Adaptation Fund 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 private 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.

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.

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.

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

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		*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	✓	*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	✓	*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		*Risk to outcomes*: Mishandling of data could compromise individuals' privacy or rights. *Mitigation*: No data is foreseen to be collected related to individuals. The project will also adhere to national data protection frameworks and human rights standards.
Gender Equity and Women's Empowerment	✓	*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		*Risk to outcomes*: Field technicians may face unsafe working conditions or lack proper labour protections.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
		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	✓	*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	✓	*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	✓	*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	✓	*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	✓	*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	✓	*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	✓	*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.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Physical and Cultural Heritage	✓	*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	✓	*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, 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. Any execution roles carried out by UNIDO will remain fully distinct and non-overlapping with its IE responsibilities.

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 yet not been fully defined, and will be defined during full project preparation.

Project Objective(s)[17]	Project Objective Indicator(s)	Adaptation Fund Outcome	Adaptation Fund Outcome Indicator	Grant Amount (USD)
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.				5,000,000
Sub-Objectives, indicators, outcomes and associated budgets				
Objective 1: Enhanced climate resilience to climate variability through improved microclimate data collection and forecasting.	• Number of microclimate sensors and weather stations installed and operational • Percentage of high-risk zones covered by sensors • Accuracy of AI-based localised climate forecasts	Outcome 8: Support the development and diffusion of innovative adaptation practices, tools and technologies	8. Innovative adaptation practices are rolled out, scaled up, encouraged and/or accelerated at the regional, national and/or subnational level	3,100,000
Objective 2: Reduce climate-related disruptions in agriculture, water supply, and local economies, particularly in vulnerable communities	• Number of climate advisories issued to communities • Reduction in crop, water, or economic losses reported in pilot districts • Number of households or farmers accessing and using climate data	Outcome 1: Reduced exposure to climate-related hazards and threats Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at the local level Outcome 7: Improved policies and regulations that promote and enforce resilience measures	1. Relevant threat and hazard information generated and disseminated to stakeholders on a timely basis 3.1. Percentage of the targeted population aware of the predicted adverse impacts of climate change, and of appropriate responses 3.2. Percentage of targeted population 7. Climate change priorities are integrated into the national development strategy	1,500,000
Objective 3: Development of national and local capacity for data	• Number of trainings / workshops	Outcome 2: Strengthened institutional capacity to reduce risks	2 The capacity of staff to respond to, and mitigate impacts of, climate-related	400,000

[17] The AF utilised OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

Project Objective(s)[17]	Project Objective Indicator(s)	Adaptation Fund Outcome	Adaptation Fund Outcome Indicator	Grant Amount (USD)
interpretation and climate-informed decision-making	conducted for government staff and communities • Number of trained personnel actively using data in planning Feedback from participants on improved decision-making capacity	associated with climate-induced socioeconomic and environmental losses Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets	events from targeted institutions increased 4.1. Responsiveness of development sector services to evolving needs from changing and variable climate 4.2. Physical infrastructure improved to withstand climate change and variability-induced stress	
Total outcome level grant amount				5,000,000

Project Outcome(s)	Project Outcome Indicator(s)	Adaptation Fund Output	Adaptation Fund Output Indicator	Grant Amount (USD)
Outcome 1.1: Improved accuracy of localised weather and climate risk monitoring. Outcome 1.2: Stronger early warning systems for floods, droughts, and heatwaves. Outcome 1.3: Enhanced decision-making for agriculture, water management, and disaster preparedness.	• X of microclimate sensors and weather stations installed and operational • X% of priority high-risk zones covered • X Volume of data transmitted to national platforms • Accuracy of localised forecasts improved • Percentage of targeted sub-districts with up-to-date, localised climate risk and vulnerability assessments produced by the platform	Output 1.1: Risk and vulnerability assessments conducted and updated	1.1. No. of projects / programmes that conduct and update risk and vulnerability assessments (by sector and scale)	300,000
			1.2 No. of early warning systems (by scale) and no. of beneficiaries covered	1,400,000
Outcome 2.1: Real-time climate intelligence available for national and local planning. Outcome 2.2:	• Platform operational and accessible to target ministries/agencies • X of API integrations with government systems	Output 7: Improved integration of climate-resilience strategies into country	7.1. No. of policies introduced or adjusted to address climate change risks (by sector)	500,000

Project Outcome(s)	Project Outcome Indicator(s)	Adaptation Fund Output	Adaptation Fund Output Indicator	Grant Amount (USD)
Faster and more coordinated response to climate-related shocks. Outcome 2.3: Institutionalised climate data governance and digital infrastructure.	• X of forecasts/advisories generated per month • X% of decision-makers using platform outputs	development plans	7.2. No. of targeted development strategies with incorporated climate change priorities enforced	700,000
Outcome 3.1: AI-assisted forecasting models developed and calibrated using localised data	• Number of pilot sites operational • Accuracy of AI forecasts compared to observed conditions • Number of local decisions informed by pilot data	Output 4: Vulnerable development sector services and infrastructure assets strengthened in response to climate change impacts, including variability	4.1.1. No. and type of development sector services modified to respond to new conditions resulting from climate variability and change (by sector and scale)	250,000
			4.1.2. No. of physical assets strengthened or constructed to withstand conditions resulting from climate variability and change (by sector and scale)	750,000
Outcome 4.1: Increased technical capacity for climate-informed planning at all levels. Outcome 4.2: Community ownership of monitoring systems leading to sustained use. Outcome 4.3: Stronger institutional collaboration	• Number of trainings conducted • Number of participants trained (by gender, stakeholder type) • Number of local actors using climate data for planning • Frequency of coordination meetings held	Output 2.1: Strengthened the capacity of national and sub-national centers and networks to respond rapidly to extreme weather events	2.1.1. No. of staff trained to respond to, and mitigate impacts of, climate-related events (by gender)	100,000
			2.1.2 No. of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale)	150,000

Project Outcome(s)	Project Outcome Indicator(s)	Adaptation Fund Output	Adaptation Fund Output Indicator	Grant Amount (USD)
around NAP implementation.		Output 2.2: Increased readiness and capacity of national and sub-national entities to directly access and program adaptation finance	2.2.1 No. of targeted institutions benefitting from the direct access and enhanced direct access modality	237,260
Total output level grant amount				4,387,260

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[18]

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: 9 February 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 certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plan 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: February 9, 2026	Tel. and email: +43 1 26026 3647 g.onysko@unido.org
Project Contact Person: Rasha Abdrabu	
Tel. And Email: R.ABDRABU@unido.org ; +43 1 26026 3454	

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.