MID-TERM REVIEW

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I. Overview

A. Description

Project name	
Applications of Industry-urban Symbiosis and Green Chemistry for Low Emission and Persistent Organic Pollutants (POPs)-Free Industrial Development in Thailand	
Country	
Thailand	
GEF ID	Implementing Agency
9219	UNIDO
Executing Entity	
Multilateral	
Trust Fund	Project Type
GET	FSP
Objective	
To reduce greenhouse gas emissions, as well as releases of persistent organic pollutants and other harmful chemicals from industries and urban centers through the application of industry-urban symbiosis and green chemistry technology	

B. Key Dates

CEO Endorsement/Approval	Agency Approval
4/3/2019	7/16/2019
Implementation Start	First Disbursement
7/24/2019	1/29/2020
Expected MTR	MTR Submission
12/12/2022	3/17/2025
Actual MTR	Expected Completion
2/2/2023	6/30/2026

II. PROGRESS STATUS AND ISSUES

A. Main MTR Findings

3.1. Project Design Assessment

This section provides the MTR's in-depth assessment of the project's design and results framework.

3.1.1. Project Design

A review of the project design document revealed that the project has been designed in accordance with UNIDO-GEF principles. In particular, the project design was based on extensive assessment and consultations to understand the root causes and barriers to RECP, Green Chemistry, POPs, and Eco-Industrial Town development. The MTR found that the most relevant stakeholders were engaged in the project design, including government agencies, private sector, and academia. This has resulted in a project that is aligned with the government priorities and also has significant buy in from stakeholders.

Furthermore, the design was based on the outcomes and lessons learned from relevant previous GEF-UNIDO projects implemented in Thailand, including the: Industrial Energy Efficiency in Thailand (IEE), CleanTech in Thailand, Greening Industry through Low Carbon Technology Application for SMEs in Thailand (GI), Greening the Scrap Metal Value Chain through Promotion of BAT/BEP to Reduce U-POPs Releases from Recycling Facilities, and Enabling Activities to Review and Update the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants, UNIDO. Similarly, as this was the second GEF project supporting a transition towards more sustainable industrial zones, the design was built on the experiences from the predecessor project in Vietnam, entitled: Eco-industrial Estate/park Initiative for Sustainable Industrial Zones in Vietnam (2014-2019). In addition, UNIDO has also implemented projects focused on POPs, including the 'Regional Plan for Introduction of BAT/BEP Strategies to Industrial Source Categories of Stockholm Convention Annex C of Article 5 in ESEA Region', and 'Demonstration of BAT and BEP in Fossil Fuel-fired Utility and Industrial Boilers in Response to the Stockholm Convention on POP'.

The MTR found that the project strategy has been well-elaborated in the design document, accompanied by clear guidance on implementation arrangements and roles and responsibilities of respective stakeholders in project implementation, monitoring and evaluation guidelines, budgetary resources, and risk analysis, with proposed mitigation measures. The design has also been based on a comprehensive approach, including focus on policy, research, awareness and capacity building, demonstration, and financial support linkages (for businesses). Similarly, the project implementation approach was designed according to multiple tiers of stakeholders, including national, industrial estate/park, enterprise, and community levels, with a detailed assessment of the situation of the three selected provinces. Taking into consideration learning from past projects, the design also incorporated enhanced activities, such as bolstering RECP assessments by technical and financial feasibility studies to promote uptake by private sector, etc. Furthermore, with respect to the development support being provided by international development sector in Thailand, MTR interviews with local stakeholders revealed that the project's focus on POPs and industry symbiosis/industry urban symbiosis to be a unique contribution as few other development stakeholders have considered providing support to these areas.

At the same time, the MTR found that the project's focus on three inter-related yet distinct areas, namely RECP, POPs, and symbiosis, is somewhat ambitious. This is specifically so as the baseline capacities and practices in the country are very limited with respect to POPs and Symbiosis. Similarly, the project's target for demonstrating RECP in 50 projects is rather ambitious, considering the project's geographic scope being limited to only three provinces as well as the businesses' limited access to finance to adopt RECP measures,

in general. Similarly, a key challenge for the demonstration of an e-waste management and its dismantling recycling plant is the heavy involvement of informal sector in this value chain, which can be highly averse to working with a public sector-led project. A major gap in the project's training strategy was the explicit inclusion of learning from international examples through exchange visits and trainings abroad, especially as some technical areas addressed by the project are unique with limited baseline capacity in the country.

It is also to be noted that in the case of POPs, the project had to make informed assumptions about baselines, since the baseline National Inventory Project had faced implementation delays and its results did not become available until 2020/21. Consequently, during the course of implementation, the project has had to make the decision to modify its initial product-based approach to a national approach to POPs, as elaborated in the section on Effectiveness.

Furthermore, the MTR determined that the outcome level targets provided in the Project Results Framework are highly ambitious, especially those at the objective level. In particular, the targeted direct GHG reduction of 1,305,761 tons of CO2eq is likely not attainable only by implementing RECP in 50 factories, most of which are likely to be SMEs. In fact, the attainment of this goal can be possible only if significant action is taken by the project's large private sector partners, i.e. PTT Group and Saha Pathana Inter-holding across businesses in their portfolio. Similarly, while the objective-level target is disposal of 620 tons of POPs, the recent assessment by the National Inventory Project (NIP) determined that this amount is roughly equivalent to one quarter of the POPs present in the country which the project is focusing on. Moreover, at the Outcome-level, it is unclear how the target numbers of training participants under Outcome 2 and RECP assessments under Outcome 3 have been determined.
In line with GEF 6 targets, the project set a target of at least 30 women's participation in project's activities. In particular, Gender considerations in the design were informed by a gender equality assessment undertaken in 2018 as part of the CEO Endorsement document and its preliminary recommendations on gender mainstreaming. Accordingly, targets for women's participation in project activities were set in accordance with the baseline representation of women at different levels. For instance, while the target for women inclusion in managerial trainings is set at 50%, that for factory workers is set at 30%. Nevertheless, the MTR found that Gender targets have only been established for training-related activities under Outputs 2.1 and 2.3, whereas, there is no explicit mention of Gender focus or mainstreaming in other planned project activities, such as the policy improvements or piloting of RECP, etc.

Design Rating – In summary, the MTR determined that the design was developed using a consultative approach and provides clarity of implementation strategy, detailed assessment of root causes/barriers, as well as Gender considerations. However, the design's focus on three distinct yet inter-related technical areas of RECP, POPs, and symbiosis is somewhat ambitious. Moreover, the objective level targets are highly ambitious and unlikely to be achieved in the project's current implementation context. Hence, the overall the design is rated **Moderately Satisfactory.**

3.1.2. Project Results Framework/Logframe

The MTR determined that the project's Results Framework has been developed based on the principles of Results Based Management (RBM). Accordingly, the Framework includes the standard results hierarchy of objectives, outcomes, outputs, indicators, and targets, and also provides gender-segregated targets. Moreover, the Framework provides baseline status for all outcomes and outputs except Output 1.1. In addition, while the Results Framework provides end-of-project (EOP) targets, it does not provide mid-term targets against which the project's progress could be reviewed at MTR. Nevertheless, the overall Results Framework was found to be well aligned with the project strategy detailed in the project document and has provided a sound guideline to measure the project's progress.

Results Framework Rating – The Results Framework has been developed on the principles of RBA, and all but one of the indicators/targets are SMART. Accordingly, the MTR rated the Project's Results Framework as **Satisfactory.**

4. Project Performance and Progress Towards Results

4.1. Relevance

The MTR assessed the relevance of the project to the priorities of key institutions and stakeholders, including the Government of Thailand, UN, private sector, and communities in industrial areas.

The project was found to be well aligned with the major priorities of the Government of Thailand in the areas of environment and climate change. Specifically, Thailand being the world's 22nd largest emitter of carbon dioxide, releasing 271 million tons of CO2 in 2016, sustainable industrial development has been a key priority of the Government. However, Thailand aims to achieve carbon neutrality by 2050 and net-zero GHG emissions by 2065. Accordingly, the country's 20-year National Strategy (2017- 2036) has listed 'Environment-friendly Growth' as one of its six strategies. In fact, the support to Eco-industrial town Development is explicitly stated in this strategy. Moreover, since 2014, the Department of Industrial Works (DIW) has promoted the eco-industrial town development, an activity also promoted by the Industrial Estate Authority of Thailand (IEAT).
Also, corresponding to the National Strategy is the 5-year 12th National Economic and Social Development Plan 2017 - 2021 (NESDP), which includes the concept of Eco-industrial Town Development under its Strategy 3, while resource efficiency, low carbon technology application, sound chemical management is highlighted under strategy 4. Similarly, the Green Growth Strategy (2014 – 2018) was introduced to promote sustainable production and services as well as to increase the scope of industry-urban symbiosis. Importantly, at present, the Government of Thailand has conceptualized a model 'Bio Circular Green Economy (BCG)'5, which aims to integrate bio-economy, circular economy, and green economy, to support Pillar 4 of the Thailand 4.0 strategy. Furthermore, interviews revealed that the DIW also plans to develop and strengthen policy framework for waste utilization.

The project is also supported by key Thai legislation, including the Factory Act B.E. 2535, Hazardous Substance Act B.E. 2535, Enhancement and Conservation of Environmental Quality Act B.E. 2535, and Energy Conservation Promotion Act B.E. 2535. Furthermore, Thailand is also a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and the Stockholm Convention. In fact, the two key government partners, i.e. the Department of Industrial Works (DIW) and the Pollution Control Department (PCD) are directly involved in the development, implementation, and monitoring of most of these policies, plans, and legislations.
Moreover, the project is well aligned with the global development agenda by being compliant with SDGs 7, 8, 9, and 12, which are also reflected in the United Nations Partnership Framework, as well as the GEF Focal Areas of Climate Change Mitigation (CCM) and Chemicals and Waste (CW). The project is also relevant to the programming strategy of UNIDO, as since the mid-1990s, UNIDO and the United Nations Environment Programme (UNEP) have collaborated to foster the global uptake of RECP under the joint flagship RECP Programme, sponsored primarily by the Government of Switzerland. Under the Programme, UNIDO and UNEP have assisted SMEs, governments, civil society, research institutions, and related stakeholders, in over 60 countries.

Furthermore, MTR interviews with businesses and industry experts determined that businesses are increasingly interested in implementing RECP due to their cost saving potential, while export-oriented businesses are also keen to improve their production practices in order to comply with trade regulations of high paying countries. For instance, PTT Global, the project's private sector partner has been pursuing a Climate Change Management Strategy since 2018 as part of its corporate plan. Similarly, interviews with

communities revealed concerns about the pollution caused by industrial waste in the nearby industrial estates, adversely affecting the quality of residents' water, air, and soil.

In conclusion, the MTR determined that the **project is Highly Relevant** to the development priorities of the government of Thailand and United Nations, while also being responsive to the emerging needs to the industrial community in the country.

4.2. Effectiveness and progress towards results

This section provides the MTR's component and output-wise detailed assessment of the extent to which the project's objectives have been achieved as well as the potential for the project to achieve its remaining activities that were planned at the time of design.

Outcome A: GHG emissions and releases of POPs reduced through industry-urban symbiosis by transferring low carbon and green chemistry technologies, improving capacity, enhancing infrastructure, promoting innovative business models and raising awareness.

Outcome A pertains to GHG emissions and releases of POPs reduced through industry-urban symbiosis by transferring low carbon and green chemistry technologies, improving capacity, enhancing infrastructure, promoting innovative business models, and raising awareness. Under Outcome A, there are four Components, including Component 1: Policy Development; Component 2: National capacity building and awareness raising on industry-urban symbiosis and POPs; Component 3: Pilot demonstration of cleaner production, new POPs management and industry-urban symbiosis; and Component 4: Development of National Eco-Industrial Town Framework and its supporting system.

Component 1: Policy Development

Under Component 1, the project aims to recommend policies which will promote the development and adoption of resource efficient and cleaner production (RECP), green chemistry, and industry-urban symbiosis. Component 1 pertains to only one output: Necessary legislative and policy measures on industry urban symbiosis principles, management of new POPs and market-based instruments enhanced (Output 1.1).

Under Output 1.1, the project was to develop policy recommendations on RECP and POPs, to be endorsed by key stakeholders. As of MTR, the draft RECP policy recommendations had been developed with the final document expected to be available in early 2023. The MTR through its assessment learned that the process of developing these policy recommendations was initiated in 2021 by selecting a service provider through open bidding. Furthermore, the recommendations have been developed based on research and extensive consultations with project partners and other stakeholders, including businesses, academia, and community, etc. As of June 20227, the project had undertaken 17 in-person and virtual sessions with 623 participants, of which 50% were female. Moreover, the draft policy and recommendations were planned to be validated in a second round of stakeholder meetings in the second half of 2022.

While some aspects of these recommendations were reported to be ambitious for the context of Thailand, e.g., those regarding the need for digitization, overall, due to their potential to guide the Government of Thailand's Bio Circular Green Economy (BCG) model concept, the MTR found widespread support for the RECP policy recommendations among key stakeholders. Furthermore, the Department of Industrial Works (DIW) plans to embark on policy development for industrial waste utilization and therefore anticipates the recommendations to provide useful guidance. This support was further ensured by the inclusion of various partners and stakeholders in developing the recommendations. Moreover, timely completion of the RECP policy recommendations will provide the project a chance to pilot some of these when demonstrating RECP projects under Output 3.1.

On the other hand, while discussions on POPs were initiated with the PCD in July 2021, the project has faced significant delays in its work on development of POP recommendations. As elaborated in the section on Efficiency, these delays were caused mostly due to the prolonged deliberation by PCD management to make the decision on project execution modality as well as because of COVID-19. Consequently, the work on POPs started in early 2022, once the execution modality was agreed. The development of policy recommendations for POPs is now pending the completion of planned surveys on POPs under Component 2. However, as the surveys are planned to be completed in August 2023, it is anticipated that development of POPs policy recommendations is not likely to be completed before the project's planned closure. Consequently, the project would likely require additional time to complete its activities.

Component 2: National capacity building and awareness raising on industry-urban symbiosis and POPs

Component 2 relates to national capacity building and awareness raising on industry-urban symbiosis and POPs. This is to be achieved by preparing a national inventory of new POPs to be used to support the national policy and plan to manage such new POPs. Under Component 2, there are three outputs, including, Output 2.1: Inventory of new POPs and intervention plan developed for the three selected provinces; Output 2.2: Opportunities for industry-urban symbiosis elaborated through material and waste stream analysis; and Output 2.3: Increased capacity and awareness on risks of new POPs and the benefits of RECP, green chemistry, and industry-urban symbiosis. As per project design, activities under Component 2 were to inform the development of policy recommendations under Component 1.

Under Output 2.1, the project aimed to i) develop an inventory of new POPs in the three target provinces; and ii) improve the limited knowledge and technical capacity in the country on measurement and analysis of POPs.

The MTR learned that while the project's initial focus was to assess POPs in the three target provinces. However, as the results of the National Inventory Project (NIP) that became available in 2020 revealed, most of the industrial POPs were in use and end-of-life phase, instead of production phase, as was anticipated at the time of project design. As a result, the Project determined that POPs were not confined to the three provinces, therefore making invalid the area based implementation, as envisioned under Output 2.1. This led the TWG assigned by the PSC to adjust the activities to study new industrial POPs and adopt a substance-based approach as opposed to a location based, which effectually led to expanding the scope from three provinces to the national level. This modification in scope also resulted in the change in focus from undertaking a POPs inventory to identification and registration of POPs last users, followed by the development of a roadmap and action plan at the national level, with the aim of covering 50% of the inventory. This led to the selection sub-contracting the survey and registration of HBCD8 and PFOS9 in October 2022, albeit with significant delay, and are anticipated to be completed in August 2023. The final results of these surveys will be used to develop policy recommendations for POPs (Output 1.1) and POPs roadmap and action plan (Output 2.1).

Furthermore, to overcome the challenges of limited capacity in the country on sampling, data collection, and analysis on POPs, the project aimed to develop and deliver training to at least 30 technical experts, e.g. from the public and private sectors as well as academia. These trainings were included in the TORs for data collection on PFOs and HBCD, are now planned to be delivered by mid 2023.

Overall, the MTR determined that at the time of the MTR, the Project had shown only limited progress under Output 2.1. Nevertheless, the re-adjustment of the intervention approach to POPs based on newly obtained baseline information has the potential to positively contribute to the overall Project's effectiveness moving forward. That being said, it is expected that the Project would require additional time to complete Output 2.1,

as work on Intervention Plans and Monitoring Reports is pending the results of the survey of new POP and is expected to start in late 2023/ early 2024.

Under Output 2.2, at the time of the MTR the Project has successfully identified four industrial symbiosis (IS) and industry symbiosis opportunities (against a target of 3). These include: i) Using cassava pulp for sweetener production; ii) Using fly ashes and dregs ingredients in concrete; iii) Using scrap rubber for carbon black production; and iv) Using wastewater for biogas production. Similarly, three potential industry-urban symbiosis (IUS) applications were identified, including: i) Using rags, textile scraps, and fibre scraps for bedding industry production; ii) Using industrial residues for fertilizer production, and iii) Using pineapple leaves for natural fibre production.

The MTR determined that the Kasetsart University (KU) Team, as the executing entity for Output 2.2, identified these opportunities by preparing the material flow analysis (MFA) using data from Department of Alternate Energy Development and Efficiency (DAEDE), DIW, and PCD, as well as the development of waste generation, energy consumption, and emission profiles. In addition, KU worked with the PTT Global, the project's private sector partner, to identify hot spots for energy efficiency/optimization and GHG emissions reduction/utilization. The analysis of the MFA by using STAN (subSTance flow ANalysis) to simulate and calculate the material flow contributed directly to identification of the symbiosis and industry symbiosis opportunities. For instance, by focusing on processes such as assessing the possibility of separating CO2 from natural gas for dry ice manufacturing, and separation of ethane and propane from natural gas to be used as material in nearby petrochemical plants, etc.

Going forward, the TWG plans to shortlist applications to be demonstrated under Output 3.1. However, considering the specific requirements of IS and IUS, the identification of factories/facilities that have the willingness and compatibility to be included in the symbiosis model may prove to be challenging. Other challenges reported by private sector partners include development cost, scalability, technology, and know how, etc.
Furthermore, in 2021 following a series of consultative meetings with the Federation of Thai Industries (FTI) and Industrial Estate Authority of Thailand (IEAT), a draft ToR for the development of an online waste exchange database was developed. As of the MTR, the project was in the process of upgrading the Circular Material Hub (CMH), which is the industry waste exchange platform that was initially developed by the Federation of Thai Industries (FTI). This process has included four consultative meetings with stakeholders that saw participation from 151 individuals (55% female). The updated CMH is planned to be launched in early 2023. Moreover, the PMU aims to document at least five case studies on waste exchange through the CMH platform.

However, the MTR found that regulations on waste management are a major challenge for waste exchange. Having said that, there are legal provisions allowing waste exchange between recycling and treatment facilities. In addition, the Director of DIW can also give permission to companies on case by case basis for waste exchange to happen. Although, these may not be ideal solutions in the long-term, these provisions can facilitate the project's pilots under Component 3. Nevertheless, considering its planned focus on improved waste utilization, the Government of Thailand is likely to update/modify these regulations in the coming years.

Under Output 2.3, only one of the 10 targeted leaflets were produced, thereby meeting only 10% of the target. This limited progress was partly due to the delayed start of POPs activity. The leaflet has been disseminated to various stakeholders during the project's consultation events, meetings, seminars, and trainings, etc. In addition, as of 2021, the project website was created to disseminate news about the project and promote awareness seminars/workshops and organize training events. The PMU now plans to develop and disseminate the remaining nine leaflets during the remaining project duration.

Furthermore, as of MTR, 1,130 participants (F 695, M 435), i.e. 45% of target (61% female participants) from factory, industrial zone/estate and government agency, consultant, supplier and service provider, and other relevant stakeholders attended one-day awareness raising seminars. Whereas, 629 participants (F 425, M 204), (i.e. 68% female participants) from community, local authority, wastes collector and recycle facility attended the awareness raising event/seminar/workshop, generally spanning one day, thereby surpassing the target of 500 participants. Also, 797 participants (F 361, M 436), i.e. 32% of target (45% female participants) attended user trainings of 1-2 days duration, and 61 participants (F 26, M35) attended intensive trainings. The PMU expects to meet the end of project training targets during the remaining duration.

In addition, a training on Thermal Optimization and Steam Optimization was delivered in November 2022 by international experts. This was the first international training provided by the project, as COVID-19 restrictions eased. However, it is to be noted that no trainings of POPs have been initiated yet and are expected to commence in 2023.

The MTR found that all training and learning activities delivered under the project have been free of cost. The training content has been obtained from various sources, including KU as well as modified from previous UNIDO-GEF projects, such as the Industrial Energy Efficiency Project (GEF 4) and Greening Industry for SME (GEF 5), thereby allowing the project to build off past lessons learnt and best practices. Moreover, while FTI has led the training activities, being responsible for scheduling, management, and pre and post assessment; trainers have included representatives from various relevant technical organizations, including universities, government departments, and FTI itself.

MTR interviews with trainees revealed an overall positive learning experience. In particular, technical experts currently working in the sector reported the most positive feedback. They shared that the learning activities organized by the project helped them gain or strengthen practical knowledge on technical matters regarding GHG reduction and associated policy and regulation, which has helped them in serving their industry/clients better. The feedback for the international training was especially encouraging, as it facilitated learning on topics that have little or no expertise in the country. Additional benefits of training have been the extensive training material provided for continuous learning and networking opportunities among stakeholders. However, a major feedback with regards to trainings have been the need for more hands on training and additional international training.

The MTR noted that major challenges faced by FTI as the training organizer have been COVID-19, audience selection, and business interest. When selecting trainees, within factories, the trainings may only be applicable to a particular category of workers. Moreover, despite the fact that the trainings were provided free of cost, SMEs have been generally reluctant to spare staff to undergo trainings. To mitigate this and ensure high participation, the Project invested in highlighting the importance of RECP and tapped personal contacts to encourage SME’s to depute staff for the trainings. Also, the Project faced significant challenges in meeting training targets due to COVID-19 restrictions.

Moreover, against a target of 3 academic courses, one course on RECP has been developed, one is close to being finalized, and a third one is under development. The finalized course can be used in several degrees/diplomas on environmental sciences and was reported to be hands on and based on workshop approach. The target of three academic courses on RECP should be reached in early of 2024. Furthermore, against a target of one online training course, five training courses are now available for stakeholders. Based on interviews held with trainees, they reported that course material has been in accordance with the industry needs.

Component 3: Pilot demonstration of cleaner production, new POPs management and industry-urban symbiosis

Component 3 relates to pilot demonstrations of cleaner production, new POPs management, and industry-urban symbiosis. Under this component, the innovative approaches promoted by this project were to be demonstrated at pilot scale. Under component 3, there is only one output: Industry urban symbiosis implemented through the demonstration of low carbon and green chemistry systems in selected enterprises, industrial zones, and neighboring urban settlements (Output 3.1).

Under Output 3.1, the Project had planned to undertake a series of activities and demonstrations of low carbon and green chemistry systems in selected enterprises, industrial zones and neighboring urban settlements. This would entail undertaking RECP assessments of 200 companies, of which 100 selected facilities would be provided technical and financial feasibility studies. Whereas, 50 of the 100 companies were to be supported in the implementation of RECP, low carbon technologies, and green chemistry or BAT/BEP, etc.

However, the MTR learned that the project's progress has been rather slow on this component, as against a target of 200 company assessments, only 66 had been conducted thus far, including 45 completed assessments and 21 in-process. These assessments have been conducted using the FTI's 14 established criteria for eco-industry development. Following this, versus an end of project target of 100 completed feasibility studies, only 9 companies have been engaged thus far, with all nine feasibilities being in process. Consequently, the project has not been able to support implementation in any of the targeted 50 facilities in order to contribute to its objective-level target on GHG reduction.

In particular, COVID-19 has proven to be a major hurdle for the project to reach its targets under this activity thus far, as access to companies has been restricted or limited during pandemic lockdowns and restrictive measures. Resultantly, the project's technical experts have had to rely on the less ideal option of remote data collection.

Furthermore, interest from both SMEs and large businesses in such investment has been declining due to the economic impacts of COVID and Ukraine war. For instance, interviews with the project's private sector partners, PTT Group and SPI, which are expected to make the significant part of contribution to the project's target of GHG reductions, revealed that while they remain committed to their climate change goals, COVID-19's economic impact has forced their priorities to somewhat shift and may cause implementation delays. Also, SMEs specifically are reluctant to adopt such new technologies due to their resource requirements and limited technical understanding. However, the MTR observed that the project's approach to feasibility studies, including both technical and financial guidance, is likely to facilitate adoption of the recommended technologies.

An additional challenge to meet targets has also been the geographic scope of the project being restricted to only three provinces which are already a part of the designated economic zones and are therefore well served by multiple government agencies and other service providers.
Consequently, the project will require additional time to meet its targets for demonstration. Particularly, while the assessments of 200 companies may be completed in 2023 and feasibility studies in 2024, the implementation of such projects in 50 facilities is a time consuming process and will need time beyond the project completion in 2024. Furthermore, success of the RECP component relies on incentives from the Thai Government, awareness on climate change issues, and knowledge on cost cutting contributions of RECP. While the project is working on awareness raising and capacity building, there is no universal government incentive scheme in place yet.

The project also planned to carry out 3 demonstration projects on industrial symbiosis between the companies/estate and communities, one demonstration project for waste management and waste-to-energy, and one demonstration project for e-waste management and its dismantling and recycling plan. Against these targets, the project plans to short-list for implementation the IS and IUS opportunities that have already been identified under Component 2. A major anticipated challenge in the identification of companies for IS/IUS is

ensuring the willingness and technical match between the two entities. In this regard, some discussions have taken place with provincial offices of DIW and Industrial Waste Bureau and expects to have a realistic assessment of company selection by mid 2023.

Similarly, the project plans to start activities towards the demonstration of a waste management and waste-to-energy plant. However, a major anticipated challenge that was also faced by the Government of Thailand's previous scheme of one district – one waste to energy project, is the availability of a site that is willing to implement good practices recommended by the project. Likewise, the project also aims to start work on the demonstration project for e-waste management in 2023, but foresees limited cooperation from the informal/unregistered sector, which is the main stakeholder in this value chain, due to the latter's hesitation of working with a government-led initiative, as has been experienced by recent such schemes implemented by the PCD in the past.

Component 4: Development of National Eco-Industrial Town Framework and its supporting system

Component 4 relates to development of national Eco-Industrial Town Framework and its supporting system. The Project aims to develop the national Eco-Industrial Town Framework by incorporating the innovative approaches promoted by the project and streamline the various standards relevant to the eco industrial town in Thailand. Under component 4, there is one output, Continuous improvement and sustaining the industry urban symbiosis (Output 4.1).

Under Output 4.1, the project aimed to into support the Eco Industrial Town plan through the development of an integrated framework, encompassing the guidelines for Eco Industrial Town, Eco-Industrial Park, and Eco Factory. As of 2022, the government of Thailand had designated 54 areas in 39 provinces as eco-industrial towns. While the country has an Eco Industrial Town framework, this existing framework has not been recognized by all stakeholders.

To resolve these issues, the Project adopted an extensive consultative process to develop an integrated National Eco-Industrial Town Framework that will serve as a standard and will be relevant across various areas, e.g. rural, urban, and semi-urban, etc. The framework is being developed in line with international guidelines and will also lead to a harmonized system in the country, such as a standardized auditing system. At the time of the MTR, the Framework has been developed in consultation and feedback of multiple stakeholders and expected to be finalized in Q1 2023. Overall, five sessions were held with a total of 257 participants (140 female and 117 male). This consultative approach has significantly improved the chances of adoption of the framework by multiple entities, including DIW, IEAT, and FTI. Whereas, the supporting system of the Framework is expected to be developed in 2024.

Component 5: Monitoring and Evaluation

The MTR found that the project's work planning, monitoring, and reporting have been conducted at multiple levels, with the participation of the UNIDO HQ, PMU, Project Partners, and Sub-Contractors. The PSC and PMU have been the primary entities responsible for planning and monitoring. In particular, the PSC has been engaged in review and approval of annual work plans and providing course correction and facilitation, where needed. However, it is important to note that the PSC did not meet in 2021 due to COVID-19.

Furthermore, the PMU being responsible for the day-to-day monitoring receives monthly, 6-monthly, and annual progress reports from the implementing partners and sub-contractors. Whereas, a Monthly Project Management report is submitted to the UNIDO HQ by the PMU. Monitoring data reported through the year is used to develop the annual Project Implementation Report (PIR) that is submitted to GEF. In addition, the TWGs on POPs and RECP have also been involved in the review of technical inputs by project partners and sub-contractors.

In terms of reporting, it was determined that as most entities reporting to the project are organizations with prior experience in donor projects, there have been no major issues faced in this aspect. Furthermore, the MTR found the intensive reporting schedules put in place by the PMU have been assisting the project management in staying abreast of the project progress and needs. Whereas, the project's PIRs are also detailed and provide a clear picture of the project's implementation progress, opportunities, and challenges, etc. Hence, the MTR determined that the project's work planning, monitoring, and reporting has been in accordance with UNIDO-GEF project guidelines as well as the M&E plan in the project design. Furthermore, the participation of PSC and TWGs in these activities ensure collaborative decision making by project stakeholders. Accordingly, the project's work planning, monitoring, and reporting were found to be Satisfactory.

Effectiveness Rating: The MTR determined that the project has made significant progress on the development of RECP policy recommendations and National Eco-Industrial Town Framework. Furthermore, training activities are on track and baseline MFAs have also been conducted. However, the bulk of project activities, related to POPs and demonstration are significantly behind schedule due to COVID-19 and other issues, and are not likely to be completed by the planned project close date. Hence, the project's Effectiveness and Progress Towards Results is rated **Moderately Unsatisfactory.**

4.3. Efficiency

As elaborated in the section on Effectiveness, several activities have faced implementation delays, mostly due to COVID-19 and slow response from relevant stakeholders. Major activities that the progress has lagged on include: all activities related to POPs under Component 1 and Component 2; and activities related to RECP assessment, feasibility studies, and pilot project implementation under Component 3.

As the project start coincided with the peak of COVID-19 pandemic, the project has had to face significant challenges and delays. Since 2020, Thailand has seen multiple waves of COVID-19, considerably impacting activities. The challenge has in fact persisted even through 2022 and affected the MTR mission, as elaborated in the section on Challenges. Hence, activities requiring face-to-face interaction and travel have been affected throughout the project. For instance, the project's planned inception activities, which included a 200 person event in Bangkok and soft openings in the three provinces, had to be postponed several times and eventually did not take place. Similarly, the project was not able to organize a training by international experts until November 2022, and the MTR also had to be postponed from 2021 to November/December 2022. Further, most notably, the project's activity on POPs were not initiated until early 2022 and first TWG on POPs meeting was held in May 2022, leading to work on HBCD and PFOS survey and registration in October 2022 to be completed in August 2023. While the remaining work on POPs, e.g. policy recommendations is now planned to be started in 2023 after completion of the surveys, and is unlikely to be completed during the planned project closure by 2024.

Whereas, due to limited access to factories, RECP assessments and feasibility studies have lagged behind, while no RECP demonstration projects have been designed or implemented yet. In particular, site visits to factories to conduct RECP assessments had to be put on hold until May 2022 due to lockdowns and/or factories prohibiting access to outsiders, and instead data provided by companies had to be relied upon, which posed significant limitations for experts. Similarly, technical support to the project's private partners, e.g. PTT and Saha Pathana was delayed. Moreover, it was also reported that most businesses have had to slow down their investments due to the economic uncertainty caused by COVID-19 and the eventual global economic adversity following the Ukraine conflict.

Nevertheless, the MTR observed that for seminars, trainings, and meetings, the project had adopted alternative interaction measures using internet tools accompanied by face-to-face activities, where possible.

Accordingly, while training numbers lagged earlier in the project, activities were expedited in late 2022, as COVID-19 somewhat eased, to meet the mid-term targets.

Overall, the MTR determined that a major impact of these delays has been the project's inability to contribute to its targets on GHG reductions and POPs management, as of the MTR. Consequently, the project's efficiency in terms of timeliness, mostly affected by exogenous factors, was found to be **Moderately Unsatisfactory.**

4.4. Project Implementation & Management

This section provides an in-depth assessment of the project's implementation management, including: project management arrangements; work planning, monitoring and evaluation systems, reporting; financial management and co-finance; and stakeholder engagement and communication.

4.4.1. Project Management

UNIDO as the GEF Implementing Agency maintains oversight of the project implementation, manages overall budget, supports the procurement of goods and services, and recruitment of technical experts.

The project is being implemented by a project team in Thailand with guidance from a Project Manager based in UNIDO HQ in Vienna, who has in turn been assisted by two Project Associates. The PMU is led by the National Project Coordinator (NPC) and also comprises of a Project Assistant, a Gender Expert, and an Eco-Industrial Town Expert. While the PMU is responsible for project planning, coordination, and monitoring day to day activities, it receives strategic support and guidance on technical and operational issues from the UNIDO HQ on issues such as finance, procurement, and technical project aspects.

The PMU is located at the Department of Industrial Works (DIW), the lead executing agency. In addition to the DIW, the project is also supported by four key project partners, including:
i) Pollution Control Department (PCD) under the Ministry of Natural Resources and Environment provide strategic guidance and direction to the PMU on POPs related issues;
ii) Industrial Estate Authority of Thailand (IEAT) under the Ministry of Industry to help the project to reach their industrial estates and the industries located in those industrial estates;
iii) Federation of Thai Industries (FTI) to build collaboration with the private sector and reaching out to factories; and
iv) Kasetsart University (KU) to provide technical expertise on green chemistry, cleaner production, eco-factory and industry-urban symbiosis.
In addition, the FTI and KU also work as sub-contractors, with FTI contributing to Outputs 2.3 and 3.1; whereas, KU provides technical expertise for Outputs 2.2, 2.3, 3.1, and 4.1.

A review of the Project Management Team revealed that the project team has remained with the project since its start, while some team members were also involved in the project's design. It was further ascertained that the project is sufficiently staffed by individuals with experience in UNIDO programming on similar projects. However, the departure of one Project Associate at the HQ in June 2022 has created a gap to be covered by the remaining team members at HQ and in Thailand. Similarly, key technical staff among the project partner organizations have remained associated with the project either since the design or project inception. The only major exception to this has been a change in the DG at PCD and DIW.
The PMU further receives technical guidance and planning support from the Project Steering Committee (PSC) and two Technical Working Groups (TWGs). These include the TWG on RECP led by the Deputy Director General (DDG) of DIW and the TWG on POPs led by the DDG of PCD.

The Project Steering Committee (PSC), appointed by Order of the Ministry of Industry (No. 212/2020, dated 30 July 2020), comprises 19 members and is co-chaired by DIW and PCD. While the PSC is scheduled to meet once a year, it did not meet in 2021 due to the pandemic. The PSC approves key decisions, such as the change in geographic scope for POPs, as elaborated in the section on Effectiveness. Furthermore, the PSC brings a variety of stakeholders onboard to ensure consultative decision making.

Similarly, TWG members comprise of representatives from all project partners. This help in making collaborative decisions and giving technical advice and also ensure that the proposed activities are aligned with government policy. The TWG on RECP reviews technical input from consultants and sub-contractors and provides guidance accordingly. On the other hand, due to the highly technical nature of POPs and in view of limited capacity on the subject in Thailand, the TWG on POPs has been involved in review of consultant TORs; while a sub-working group designated by the TWG on POPs is also involved in the selection of consultants as well as review of inputs.

In summary, the MTR found the project management mechanisms to be in line with UNIDO-GEF project implementation modalities and also sufficient to ensure efficient implementation. Hence, the project's management was found **Satisfactory.**

4.4.2. Financial management and co-finance

At the time of design, the project was provided USD 8.966 Million from GEF funding, while USD 120.06 Million was committed as co-financing from various stakeholders, including UNIDO, Government of Thailand, Kasetsart University, and private sector partners, as detailed in the following table. The UNIDO HQ is responsible for the disbursement of GEF funds in accordance with approved work plans. Of the total allocated GEF funds, USD 3.3 Million (37%) were spent by 30 November 2022.

As show in the table below (Table 11), of the total GEF fund, the highest spending was 139% against component 5 (Monitoring and Evaluation). This overspend is due to additional resources drawn from the project management budget as only 6% of the allotted budget against project management has been spent. Also, among the project activities, 49% of the budget allotted for Component 2 has been spent, representing the highest allocation. Since POPs as a major element under this Component has seen limited progress, this budgetary expenditure mostly reflects achievements for training activities. Conversely, due to the slow progress on RECP assessment, feasibility, and demonstration, only 22% of the USD 3.77 million have been spent against Component 3.

Analysis of the project's Annual Delivery Rate (ADR) also revealed that the budget allocated in the project's Annual Work Plans has been ambitious. In particular, the project was able to spend only 37% of the planned resources in Year 2 while the highest spend was in Year 3 at 61%. It is however important to note that the low underspend has been a direct consequence of uncertainty and delays caused by COVID-19.

Furthermore, of the Government co-financing, the largest contribution was made by IEAT, equaling more than three times the committed amount. On the other hand, 1% of the private-sector co-financing came through from KU and FTI contributions, while Saha Pathana Inter-
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Holding have also provided nearly 50% of the committed co-financing of USD 24.65 Million. In addition, the other private sector partners have also contributed resources during their cooperation with the project for implementation of activities such as the MFA10. Whereas, the remaining contribution from private sector will be mostly subject to the implementation of pilot demonstration projects under Component 3.

Overall, the TE mission found the project's financial management and reporting mechanisms to be **Satisfactory.**

4.5. Sustainability

Sustainability of the project's outputs and outcomes delivered as of the MTR were assessed by analyzing the prospects of financial, technical, socio-economic, and governance support beyond the EOP.

The MTR determined that multiple measures of sustainability were incorporated into the project design, including policy development, consultative mechanisms, and knowledge generation. Under Component 1, the RECP policy is in line with the priorities of the Government of Thailand and has a high likelihood of being adopted by relevant government ministries and departments. Similarly, under Component 2, the project is working on the development of a registration system, which is expected to contribute to the Government of Thailand's capacity to monitor the presence of POPs in the country. Nevertheless, the continued use of this system will depend on availability of financial resources as well as technical capacity available in the country. Similarly, although technical assistance provided under the project has led to the identification of hot spots and opportunities for symbiosis, etc., their adoption will be subject to the willingness and ability of private sector partners, and will require solutions related to funding availability, scalability, technology, and knowhow, etc.

Furthermore, the planned demonstration on RECP in factories under Component 3 will depend upon access to finance as well as availability of incentives by the Government of Thailand and the market for adopting RECP measures. Whereas, the National Eco-Industrial Town Framework under Component 4 has also been developed with input from multiple stakeholders and is therefore anticipated to be accepted by relevant entities as a guidance document. Having said that, implementation of the Framework will require close collaboration between public and private sectors as well as the communities in the industrial areas.

Furthermore, the Project has undertaken the training activities under Component 2 in close collaboration of the Federation of Thai Industries (FTI). The training content itself is closely aligned with several public sector policies and strategies focusing on shared topics and also received positive reviews by trainees employed in technical roles. As the FTI has its own training center, which provides training regularly, the course content introduced by the project can be used by the center for future trainings. At the same time, working with KU on development and piloting of curriculum will ensure sustainability, as KU intends to incorporate the course content into some of its programs on environmental sciences. Similarly, the project's website and learning platform are available to the public and can be used by relevant interested entities after the project end.

In conclusion, the project has support from key stakeholders in the government and policy-level outputs are likely to be sustainable. Similarly, technical trainings provided by the project are highly appreciated. The MTR also determined that at this time there are no mentionable environmental risks to the project's sustainability. However, the adoption/implementation of symbiosis opportunities identified will depend on the availability of legislation, finance, technology, and know-how, etc. Similarly, scale-up of symbiosis-related activities will be subject to change in government regulations, which are likely to occur due to the planned GoT's focus on improved utilization of industrial waste. Also, scale-up of RECP demonstrations will be subject to government and market incentives. Hence, the project's sustainability is rated **Moderately Likely.**

5. Conclusions, Recommendations, and Follow-up Plan

5.1. Conclusions

Based on a detailed assessment of the project design, effectiveness, management, stakeholder performance, sustainability, and safeguards, the MTR concluded that:

Conclusion 1: The project's implementation management has been in line with UNIDO-GEF guidelines and has facilitated achievement of results. Key enabling factors of the management arrangements have been a PMU staffed by experienced experts and close collaboration among key stakeholders.

Conclusion 2: The project has made significant progress towards its targets related to training activities. In particular, the technical trainings delivered by the project have received positive feedback. However, the opportunity for international trainings and exchange visits have been limited due to COVID-19.

Conclusion 3: However, the project is well behind on achieving targets for piloting RECP, green chemistry, and symbiosis activities, mostly due to COVID-19 caused delays. Also, the uptake of these activities can be expedited by introducing policy incentives. Whereas, the activities on POPs started significantly late due to issues of implementation arrangements. Consequently, the project has not made any significant progress towards achieving its objective-level targets of GHG reduction and POPs management.

Conclusion 4: Consequently, the project will need additional time, approximately 18 months, to complete all planned activities.

Conclusion 5: The project has mainstreamed Gender in most activities. Whereas, the activities undertaken thus far have posed no environmental risks.

Conclusion 6: The sustainability of project activities and outputs is subject to effective collaboration between all relevant stakeholders and a conducive policy environment.

B. Stakeholder Engagement

4.4.3. Stakeholder Engagement and Communication

The PMU has engaged multiple project stakeholders, including government organizations, communities, academia, and private sector. The project's partners and sub-contractors have been involved in planning and monitoring activities through their participation in the PSC and TWGs. Furthermore, key project activities, such as the development of the National Eco-Industrial Town Framework and RECP Policy Recommendations involved the participation of multiple stakeholders in addition to the four key project partners, such as local authorities, communities, industries, waste transporters, and recycle facilities, etc. For instance, stakeholder consultations with regards to RECP policy recommendations entailed 17 sessions attended by 623 participants, whereas, the discussions on National Eco-Industrial Town Framework involved 5 sessions with participation of 257 participants, etc. In addition, the project has engaged private sector and community through training, awareness raising, and RECP-related activities.

However, COVID-19 has affected the project's efforts at collaboration and a number of interactions and trainings have therefore had to be conducted online. While others, such as the project's inception workshops, have had to be cancelled.

Generally, during MTR interviews, partners and stakeholders expressed appreciation for the project's efforts at promoting inter-stakeholder collaboration and building consensus for development of key guiding documents, such as the Framework. Similarly, the partnership between DIW and PCD has reported to have improved data sharing and information exchange. Also, the MTR found that the project stakeholders are well aware of the project's objectives and their respective roles and responsibilities. Consequently, stakeholder engagement and communication were found Satisfactory.

Project Implementation and Management Rating: The PMU is well staffed by experienced individuals, while having sufficient oversight from the PSC. Moreover, the project has the benefit of access to technical support through the multi-stakeholder TWG. Also, planning, monitoring, and reporting is carried out at various levels and processes are in line with UNIDO-GEF guidelines. Furthermore, major stakeholders are well aware of their roles and responsibilities and the project has facilitated interaction with a wide range of stakeholders towards achieving results. Consequently, the project's Implementation Management is rated **Satisfactory.**

4.7. Performance of Partners

4.7.1. UNIDO

UNIDO has implemented the project through its Project Manager based at its headquarters in Vienna and PMU in Bangkok. The agency has been responsible for overall management of funds, project planning, implementation oversight, and stakeholder coordination. In addition, UNIDO has provided technical guidance to the project through its HQs as well as by recruiting international technical expertise for implementation and evaluation.

The MTR determined that UNIDO has delivered its role in accordance with the agreed roles and responsibilities outlined in the project document. Interviews also revealed that stakeholders are generally appreciative of UNIDO's technical guidance and facilitating collaboration among various entities. However, some stakeholders, such as government agencies, expressed the need for technical training of their staff and international exposure visits to learn from experiences of other countries in the implementation of recommendations related to Eco-Industrial Town Development, Symbiosis, and POPs management, etc.

The MTR determined that UNIDO has delivered its role in accordance with the agreed roles and responsibilities outlined in the project document. Interviews also revealed that stakeholders are generally appreciative of UNIDO's technical guidance and facilitating collaboration among various entities. However, some stakeholders, such as government agencies, expressed the need for technical training of their staff and international exposure visits to learn from experiences of other countries in the implementation of recommendations related to Eco-Industrial Town Development, Symbiosis, and POPs management, etc.

4.7.2. Government

Key government stakeholders include the DIW, IEAT, and PCD. As elaborated in the section on design, key project concepts have been in line with the Government of Thailand's priorities for sustainable industrial development. Accordingly, government partners have been supportive of the project and actively engaged in implementation through participation in PSC, TWGs, reviews, and consultations, etc. Moreover, the project's PMU is based at the DIW.
Having said that, the project has faced significant delays in the implementation of the POPs activities due to delays in agreement on implementation modalities by the PCD. However, as those issues have now been resolved, it is expected that the POP activities will have support of the PCD going forward.

4.7.3. Private Sector

The project's private sector partners include companies from the PTT Group and Saha Pathana Inter-holding. These entities have extended their support to the project by providing in-kind and cash co-financing as well as cooperating with the project's partners and sub-contractors in conducting Material Flow Analysis (MFA), etc. However, interviews with sub-contractors revealed that high staff turnovers and low prioritization of the project's activities by the private sector partners proved to be challenging when working with them. Furthermore, the MTR determined that as the results of the MFAs are finalized, the implementation of RECP

and symbiosis activities towards GHG reduction will be contingent upon cooperation from these companies in the second half of the project. In summary, UNIDO has provided adequate technical and management support, while the project public and private sector partners have also been actively involved in implementation support. However, delays caused by PCD have resulted in significant lapse in the initiation of POPs activities.

Consequently, the MTR found the **performance of partners Moderately Satisfactory.**

C. Gender Equality

4.6. Gender Mainstreaming and Environmental Safeguards

4.6.1. Gender

The MTR determined that in line with the project design, Gender has been mainstreamed in the implementation of project activities. Encouragingly, most of the senior and mid-level staff of UNIDO and partners associated with the project were found to be women. Furthermore, to guide the project's work on Gender, a Gender Expert was engaged during the project design. This Expert was eventually retained to support the PMU in implementation and has been associated with the project since its start.

Accordingly, Gender sensitization of partners is undertaken at the start of each major activity, and Gender-specific targets have been included in all project activities conducted thus far. The MTR determined that the project has thus far exceeded its target of average 30% participation of female training participants, with women representing 61.5% in the professional-level awareness raising seminars, 67.5% in the community-level awareness raising events, 45% in user trainings, and 43% in the intensive trainings organized by the project, as of November 30, 2022. Similarly, Gender concerns have been reportedly incorporated in the training modules developed by the KU.

Furthermore, in addition to project activities having mainstreamed Gender in line with the project design considerations by including Gender-specific targets in training and awareness raising, some other project activities have also considered Gender aspects. For instance, reportedly, the RECP assessments also have an element related to Gender, while any monitoring reports of stakeholder consultations on various project aspects, e.g., eco-industrial framework development, also track the number of women participants. Similarly, the draft policy and framework documents developed by the project, including the RECP Policy Recommendations or Eco-Industrial Town Framework also have a Gender focus.
In terms of stakeholders' approach to Gender, the MTR observed that business partners of the project (PPT and Saha Pathana) have non-discrimination and gender support policies in place.

Moreover, a number of public sector partners reported having a gender neutral approach to their work. However, as revealed by MTR interview with the Gender Expert, a major challenge with regard to Gender mainstreaming, especially when dealing with SMEs, has been the mindsets and understanding among technical experts and businesses for Gender mainstreaming. Accordingly, the PMU has used the expertise of the Gender Expert for awareness raising and capacity building for project partners and sub-contractors as well as collection and reporting on sex disaggregated monitoring data.

D. Knowledge Management

Knowledge management activities at the time of the MTR can be also found in PIR 2023, and cited below:

- *The project leaflet has been disseminated to the stakeholders during the seminar, training, and factory visits. The additional leaflets on HBCD and PFAS were disseminated to the relevant stakeholders during the seminar and training.*
- *The project's website is available for public (in Thai and English language). The brief information about project and news have been published on the project website.*
- *The project's online learning platform is available for public. Four courses and one webinar record are available on the platform.*
- *9714_Project leaflet*
- *9714_Leaflet – HBCD basic information, risk and management*
- *9714_Leaflet – PFAS basic information, risk and management*
- *9714_Project's website: https://industry-urban-symbiosis-project.com*
- *9714_Project's online learning platform: https://learning.industry-urban-symbiosis-project.com*

III. Core Indicators

Indicator 6 Greenhouse Gas Emissions Mitigated

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)	0	1305761	0	0
Expected metric tons of CO_2e (indirect)	0	5765426	0	0

Indicator 6.1 Carbon Sequestered or Emissions Avoided in the AFOLU (Agriculture, Forestry and Other Land Use) sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)				
Expected metric tons of CO_2e (indirect)				
Anticipated start year of accounting				
Duration of accounting				

Indicator 6.2 Emissions Avoided Outside AFOLU (Agriculture, Forestry and Other Land Use) Sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)		1305761	0	
Expected metric tons of CO_2e (indirect)		5765426	0	
Anticipated start year of accounting		2020	2020	
Duration of accounting			10	

Indicator 6.3 Energy Saved (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Total Target Benefit	Energy (MJ) (At PIF)	Energy (MJ) (At CEO Endorsement)	Energy (MJ) (Achieved at MTR)	Energy (MJ) (Achieved at TE)
Target Energy Saved (MJ)				

Indicator 6.4 Increase in Installed Renewable Energy Capacity per Technology (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Technology	Capacity (MW) (Expected at PIF)	Capacity (MW) (Expected at CEO Endorsement)	Capacity (MW) (Achieved at MTR)	Capacity (MW) (Achieved at TE)

Indicator 9 Chemicals of global concern and their waste reduced

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)
0.00	625.34	0.00	0.00

Indicator 9.1 Solid and liquid Persistent Organic Pollutants (POPs) removed or disposed (POPs type)

POPs type	Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)
Pentachlorobenzene		0.00	0.00	
Polychlorinated dibenzo-p-dioxins (PCDD)		0.00	0.00	
Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride		27.54	0.00	
Tetrabromodiphenyl ether and pentabromodiphenyl ether		597.80	0.00	
Hexachlorobenzene (HCB)		0.00	0.00	

Indicator 9.2 Quantity of mercury reduced (metric tons)

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)

Indicator 9.3 Hydrochloroflurocarbons (HCFC) Reduced/Phased out (metric tons)

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)

Indicator 9.4 Number of countries with legislation and policy implemented to control chemicals and waste (Use this sub-indicator in addition to one of the sub-indicators 9.1, 9.2 and 9.3 if applicable)

Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)

Indicator 9.5 Number of low-chemical/non-chemical systems implemented, particularly in food production, manufacturing and cities (Use this sub-indicator in addition to one of the sub-indicators 9.1, 9.2 and 9.3 if applicable)

Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)

Indicator 9.6 POPs/Mercury containing materials and products directly avoided

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)

Indicator 9.7 Highly Hazardous Pesticides eliminated

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)

Indicator 9.8 Avoided residual plastic waste

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)

Indicator 10 Persistent organic pollutants to air reduced

Grams of toxic equivalent gTEQ (Expected at PIF)	Grams of toxic equivalent gTEQ (Expected at CEO Endorsement)	Grams of toxic equivalent gTEQ (Achieved at MTR)	Grams of toxic equivalent gTEQ (Achieved at TE)
	12.59	0.00	

Indicator 10.1 Number of countries with legislation and policy implemented to control emissions of POPs to air (Use this sub-indicator in addition to Core Indicator 10 if applicable)

Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)

Indicator 10.2 Number of emission control technologies/practices implemented (Use this sub-indicator in addition to Core Indicator 10 if applicable)

Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)

Indicator 11 People benefiting from GEF-financed investments

	Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)

Female		3,510	1,507	
Male		8,190	1,110	
Total	**0**	**11,700**	2,617	**0**

IV: Co Financing

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Anticipated at CEO($)	Materialized at MTR($)
Recipient Country Government	Department of Industrial Works DIW	In-kind	Recurrent expenditures		1966393.5
Recipient Country Government	Ministry of Natural Resources and Environment (MONRE)	In-kind	Recurrent expenditures		11154.8
Recipient Country Government	Industrial Estate Authority of Thailand (IEAT)	In-kind	Recurrent expenditures		4135970.5
Private Sector	The Federation of Thai Industries	In-kind	Recurrent expenditures		147139.9
Private Sector	Kasetsart University (KU)	In-kind	Recurrent expenditures		26847.1
Private Sector	PTT Public Company Limited	Grant	Investment mobilized		
Private Sector	PTT LNG	Grant	Investment mobilized		
Private Sector	PTT Global Chemical	Grant	Investment mobilized		
Private Sector	Saha Pathana	Grant	Investment mobilized		12201073.7
Private Sector	Inter-Holding	Grant	Investment mobilized		11820332
Total Co-financing				**0.00**	**24,021,405.70**

Comments

The actual monetary value of contributions by other private sector partners was not readily available at the time of the MTR and is therefore not reported here. Interh-Holding mobilized 400 mil THB (1 USD=33.84 THB) in 2020.

V: ENVIRONMENTAL AND SOCIAL SAFEGUARDS

Overall Project/Program Risk Classification

PIF	CEO Endorsement/Approval	MTR	TE
		High or Substantial	

Measures to address identified risks and impacts

The risk level identified in the PIR 2023 was Moderate risk, while the MTR assessed the project with High risk on the criteria Project design and results framework, Effectiveness and Progress Towards Results, Efficiency and Remaining barriers to achieving the programme/project expected results,

The implementation of RECP measures by the factories participating in the activities under Component 3 contributed to a reduction of 64,512 tons CO_{2eq}/year. On POPs, assessments are currently being conducted to verify the baseline and the committed GEBs.

The project has sped up the capacity building activities including awareness raising seminars and technical trainings. The project has already achieved the target of awareness workshop with community and waste management stakeholders (623 participants from a target of 500 participants). Although the start of activities related to new industrial POPs management was delayed, the project has proceeded with the survey to confirm the amount of HBCD in SE-grade EPS and PFAS in firefighting foam (output 2.1), which will be the basis for the policy and plan recommendation (output 1.1) and demonstration projects (output 3.1) in FY24.

The project is still facing the moderate risk from the economic impact after the COVID-19 situation, which caused the delay of the investment in RECP project. The election in May 23 has transpired but the new cabinet has not been set yet, which may reflect the moderate risk on political uncertainty.

For more risk mitigation measure, please also refer to PIR 2023

5.2. Recommendations

Based on the above conclusions, the MTR presents the following recommendations to the project's key stakeholders, including PMU, UNIDO, and Government organizations.

5.2.1. PMU

1) Based on the findings of this MTR, it is recommended that the PMU, in collaboration with all key stakeholder organizations, undertake an assessment of the time it will require to complete its planned activities. Accordingly, a request for a no-cost extension is to be submitted to the GEF. (Linked to Conclusion # 4)

2) In order to achieve the targets for demonstrating RECP and green chemistry projects, it is recommended that the project extends its geographic scope to at least one additional province. While making a decision on province selection, the TWG/PSC are advised to consider underserved provinces, i.e. with limited support

available from government agencies on such activities, such as a designated Eco-industrial town that is in early phases of development. (Linked to Conclusion # 3)

3) It is also recommended that the RECP feasibility studies and MFA's undertaken by the project are disseminated broadly in order to facilitate uptake by a broader range of stakeholders. (Linked to Conclusion # 3)

4) In response to the high demand from the project stakeholders, it is recommended that the project organizes technical trainings in Thailand by international stakeholders. Furthermore, there is a need to organize exchange visits for public and private sector stakeholders to improve their understanding of policy and practices with respect to POPs, Eco-Industrial Framework, and Symbiosis, etc. Also, in view of the high demand for and utility of international trainings, it is advised that the project links these to a modest fee structure to ensure that only those with genuine interest are able to access this limited opportunity. Furthermore, the provision of TOTs under the project is highly recommended under all training categories, as this will promote efficiency and sustainability. (Linked to Conclusion # 2)

5) Similarly, it is recommended that to ensure sustainable utilization of the newly developed National Eco-industrial Town Framework and RECP policy recommendations, the project provides trainings to staff of relevant agencies in their implementation. (Linked to Conclusion # 3)

6) While the project has not undertaken any activities yet with adverse environmental implications, it is recommended that to mainstream Environmental Safeguards, the RECP assessments also include environmental safeguards, going forward. (Linked to Conclusion # 5)

5.2.2. Government of Thailand

1) In view of the late start on the POP-related activities, it is recommended that PCD prioritizes the project's activities and closely monitors progress to ensure compliance with work plans for the remainder of the project. (Linked to Conclusion # 3)

2) To ensure uptake of RECP measures by SMEs, it will be critical to provide policy support. It is therefore recommended that the Government of Thailand introduce supportive measures such as financial incentives for implementation of RECP projects, such as tax incentives and attractive financing, etc. Similarly, there is a need to harmonize the various eco certification mechanisms available through the various government agencies and link it to tangible incentives. (Linked to Conclusion # 6)

3) To ensure effective implementation of the National Eco-Industrial Framework, it is recommended that various agencies of the government collaborate when implementing the framework. (Linked to Conclusion # 6)

5.2.3. UNIDO

1) In order to facilitate an objective assessment of project progress at MTR, it is recommended that the UNIDO include mid-term targets in the Results Frameworks for future projects. (Linked to Conclusion # 1)

5.2.4. GEF

1. It is recommended that the project is provided a no-cost extension to allow it to overcome the implementation delays caused by COVID-19 and complete its planned activities. (Linked to Conclusion # 4)

5.3. Follow-Up Plan

The MTR presents the follow-up plan on Pages 54-55 of MTR, to be reviewed and agreed by the Project Management team.

VI. ANNEX

Uploaded Document

Document Category	Title
M and E Document	FINAL MTR Report - UNIDO Thailand_9219