



GEF-6 REQUEST FOR PROJECT ENDORSEMENT/APPROVAL

PROJECT TYPE: Full-sized Project

TYPE OF TRUST FUND: GEF Trust Fund

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PART I: PROJECT INFORMATION

Project Title: Climate change mitigation through methane recovery and reuse from industrial wastewater treatment in Myanmar			
Country(ies):	Myanmar	GEF Project ID: ¹	9830
GEF Agency(ies):	UNIDO (select) (select)	GEF Agency Project ID:	150011
Other Executing Partner(s):	Main Executing Partner: - Department of Urban Housing and Development Department (DUHD), Ministry of Construction Supporting Executing Partners: - Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation - Directorate of Industrial Supervision and Inspection (DISI) under the Ministry of Planning, Finance and Industry - Department of Research and Innovation (DRI), Ministry of Education Yangon City Development Committee (YCDC) Mandalay City Development Committee (MCDC) Myanmar Industries Association (MIA)	Submission Date:	
GEF Focal Area (s):	Climate Change	Project Duration (Months)	60
Integrated Approach Pilot	IAP-Cities <input type="checkbox"/> IAP-Commodities <input type="checkbox"/> IAP-Food Security <input type="checkbox"/> Corporate Program: SGP <input type="checkbox"/>		
Name of Parent Program	[if applicable]	Agency Fee (\$)	378,536

A. FOCAL AREA STRATEGY FRAMEWORK AND OTHER PROGRAM STRATEGIES²

Focal Area Objectives/Programs	Focal Area Outcomes	Trust Fund	(in \$)	
			GEF Project Financing	Co-financing
(select) CCM-1 Program 1 (select)	Outcome A. Accelerated adoption of innovative technologies and management practices for GHG emission reduction and carbon sequestration.	GEFTF	1,793,065	14,099,686
(select) CCM-2 Program 3 (select)	Outcome B. Policy, planning and regulatory frameworks foster accelerated low GHG development and emissions mitigation.	GEFTF	2,191,524	10,655,636
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
Total project costs			3,984,589	24,755,322

B. PROJECT DESCRIPTION SUMMARY

¹ Project ID number remains the same as the assigned PIF number.

² When completing Table A, refer to the excerpts on [GEF 6 Results Frameworks for GETF, LDCF and SCCF](#).

Project Objective: Reducing GHG emissions through the application of integrated low-emission wastewater treatment and the Transfer of Environmentally Sound Technologies (TEST) to strengthen Myanmar's efforts toward climate change mitigation.

Project Components/ Programs	Financing Type[1]	Project Outcomes	Project Outputs	Trust Fund	(in \$)	
					GEF Project Financing	Confirmed Co-financing
Component 1 -Policy framework and national capacity for water quality and wastewater management improved	TA	Outcome 1.1: National capacity for promoting greenhouse gas emission reduction strengthened by an improved institutional and policy framework on water quality and wastewater management;	Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened;	GEFTF	180,000	548,310
			Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane harnessing technology strengthened by TEST capacity building program		319,200	1,782,006
			Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented		200,000	411,232
			Subtotal		699,200	2,741,548
Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach	TA	Outcome 2.1: Greenhouse gas emissions from industrial effluent discharges reduced through pilots at company and industrial park levels implementing TEST approach and WWTP and biogas technologies	Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions	GEFTF	742,720	5,899,198
			Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants		2,152,927	13,745,511
			Subtotal		2,895,647	19,645,709
Component 3: Monitoring and Evaluation	TA	Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation	Output 3.1.1: M&E mechanism developed and applied.	GEFTF	200,000	1,458,065
Subtotal					3,794,847	18,245,322

Project Management Cost (PMC) ^[2]	189,742.00	910,000
Total project costs	3,984,589	24,755,322

C. CONFIRMED SOURCES OF CO-FINANCING FOR THE PROJECT BY NAME AND BY TYPE

Please include evidence for co-financing for the project with this form.

Sources of Co-financing	Name of Co-financier	Type of Cofinancing	Amount (\$)
Recipient Government	DUHD	In-kind	2,000,000
Recipient Government	ECD	In-kind	1,000,000
Recipient Government	DRI	In-kind	1,500,000
Recipient Government	DISI	In-kind	1,820,322
Recipient Government	MCDC	In-kind	1,500,000
Recipient Government	MCDC	Equity	4,000,000
Recipient Government	YCDC	In-kind	895,000
Donor Agency	FMO	Loan	5,600,000 ³
Private Sector	MIA	In-kind	1,000,000
Private Sector	Shwe Pyi Tha Industrial Zone (2,3,4)	In-kind	1,000,000
Private Sector	Shwe Pyi Tha Industrial Zone (2,3,4)	Equity	4,000,000
Private Sector	Pylonechantha Trading co.ltd	Equity	300,000
Private Sector	Daw Wai Wai Paper Mill	Equity	30,000
Private Sector	High Win International Co., Ltd	Equity	30,000
Private Sector	Sein Than Agro Industry Co., Ltd	Equity	30,000
GEF Agency	UNIDO	Grants	40,000
GEF Agency	UNIDO	In-kind	10,000
Total Co-financing			24,755,322

A supporting letter from the KBZ Bank is also attached in Annex O, whereby the bank confirms its commitment to provide green finance mechanisms to support project's activities.

D. TRUST FUND RESOURCES REQUESTED BY AGENCY(IES), COUNTRY(IES) AND THE PROGRAMMING OF FUNDS

GEF Agency	Trust Fund	Country Name/Global	Focal Area	Programming of Funds	(in \$)		
					GEF Project Financing (a)	Agency Fee ^{a)} (b) ²	Total (c)=a+b
UNIDO	GEF TF	Myanmar	Climate Change	(select as applicable)	3,984,589	378,536	4,363,125
Total Grant Resources					3,984,589	378,536	4,363,125

a) Refer to the Fee Policy for GEF Partner Agencies

³ As the attached co-financing letter is expressed in Euros, an exchange rate of 1.12 USD/Euro is used.

E. PROJECT'S TARGET CONTRIBUTIONS TO GEF 6 CORE INDICATORS

Update the relevant sub-indicator values for this project using the methodologies indicated in the Core Indicator Worksheet (as used in GEF 7 Endorsement template – Annex E) and aggregating them in the table below. Progress in programming against these targets is updated at mid-term evaluation and at terminal evaluation. Achieved targets will be aggregated and reported any time during the replenishment period. There is no need to complete this table for climate adaptation projects financed solely through LDCF and SCCCf.

Project Core Indicators		Expected at CEO Endorsement
1	Terrestrial protected areas created or under improved management for conservation and sustainable use (Hectares)	
2	Marine protected areas created or under improved management for conservation and sustainable use (Hectares)	
3	Area of land restored (Hectares)	
4	Area of landscapes under improved practices (excluding protected areas)(Hectares)	
5	Area of marine habitat under improved practices (excluding protected areas) (Hectares)	
	Total area under improved management (Hectares)	
6	Greenhouse Gas Emissions Mitigated (metric tons of CO ₂ e)	282,494 metric tons (direct) and 847,481 – 1,345,363 (indirect)
7	Number of shared water ecosystems (fresh or marine) under new or improved cooperative management	
8	Globally over-exploited marine fisheries moved to more sustainable levels (metric tons)	
9	Reduction , disposal/destruction, phase out, elimination and avoidance of chemicals of global concern and their waste in the environment and in processes, materials and products (metric tons of toxic chemicals reduced)	
10	Reduction, avoidance of emissions of POPs to air from point and non-point sources (grams of toxic equivalent gTEQ)	
11	Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment	3,722 males (63%); 2,163 females (37%) TOTAL: 5,885

Provide additional explanation on targets, other methodologies used, and other focal area specifics (i.e., Aichi targets in BD) including justification where core indicator targets are not provided.

F. PROJECT TAXONOMY

Please update the table below for the taxonomic information provided at PIF stage. Use the GEF Taxonomy Worksheet provided in Annex F to find the most relevant keywords/topics/themes that best describe the project.

Level 1	Level 2	Level 3	Level 4
Influencing Models	(multiple selection)	(multiple selection)	(multiple selection)
Stakeholders	(multiple selection)	(multiple selection)	(multiple selection)
Capacity, Knowledge and Research	(multiple selection)	(multiple selection)	(multiple selection)
Gender Equality	(multiple selection)	(multiple selection)	(multiple selection)
Focal Area/Theme	(multiple selection)	(multiple selection)	(multiple selection)
Rio Markers	(multiple selection)		

Please see annex F for the GEF Taxonomy Worksheet applied to this project.

PART II: PROJECT JUSTIFICATION

A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN WITH THE ORIGINAL PIF

Work carried out during the PPG was aimed at complementing information and validating the assumptions underlying the Project Identification Form (PIF), as well as strengthening engagement with project counterparts and stakeholder dialogue. Some adjustments were made to the original project strategy outlined in the PIF to respond to the national context, and to adequately address the identified barriers and needs. Targeted overall GHG emission reductions in the PIF were estimated based on similar initiatives. During the PPG, a screening process was developed to identify potential sites for the wastewater treatment plants (WWTP), including yield and harness of biogas in selected industrial zones. Calculation of expected global environmental benefits was updated based on data collection through a survey to companies in the target area of the project, wastewater quality analysis and secondary data provided by the “Pollution Source Survey Report 2018” prepared by JICA. Please refer to the below table for an overview of the changes incurred between the CEO submission and the original PIF.

Table 1: Comparison PIF to CEO Endorsement Stage GHG Emissions

GHG Emissions Mitigated (metric tons of CO ₂ e)	PIF Stage	CEO Endorsement Stage	Comments / Rational for changes
Direct	140,000 (14,000 ton/year)	282,494 (14,124 ton/year)	The calculation undertaken during the CEO stage shows almost exact amount of GHG emissions mitigated as in the PIF stage. The difference is in the lifetime of investment. The PIF stage based its calculation on the 10-year investment lifetime period. However, the technology identified during the PPG phase, has a lifetime of 20 years. This adjustment was made taking into account the GEF Manual for calculating GHG benefits for energy efficiency and renewable energy projects ⁴ .

⁴ Manual for Calculating GHG Benefits of GEF Projects: Energy Efficiency and Renewable Energy Projects. GEF/C.33/Inf.18. April 16, 2008

			<p>It is important to note that the calculations also account for the power production over the full expected lifetime of the renewable energy units.</p> <p>Calculations during the PPG phase were based on an improved understanding of local context through observational field trips, surveys, water assessments and quality analysis in companies from relevant industrial sectors. Local technical capacity assisted the development of data feeding into the refined GHG calculations.</p>
Indirect	56,000 – 210,000	847,481 – 1,345,363	<p>Difference in the range of indirect metric tons of CO2e is based on refined and more accurate GHG calculations and assumptions at the PPG Phase. Supporting this, the market potential was estimated as well as better understanding of the impact level due to comprehensive feasibility undertaken in the PPG phase. Compared to PIF stage, the lifetime of investment is 20 years in the CEO stage, while PIF stage took 10 years potential as basis. Furthermore, the replication factor 3 was used as it was assumed, based on the expert's inputs, that the project will have twice as much of replication potential when compared to PIF stage.</p> <p>Indirect GHG emissions reduction has vastly increased in realization of marginalized displaced fossil fuel dependence (grid electricity and diesel) through renewable energy consumption from methane harnessing technologies, in addition to reducing dependence on wood deforested from the local area.</p>

It is understood that greater direct GHG emissions reduction can be achieved due to understanding the fuller avoided potential through resource efficiency/cleaner production inputs.

Table 2 Comparison PIF to CEO Endorsement Stage

Changes in Project's Strategic Results Framework between PIF and CEO ER				
Components at PIF stage	Outcomes and Outputs - location at PIF stage	Components at CEO Endorsement stage	Outcomes and Outputs - location at CEO Endorsement	Comments / Rational for changes
1. Legal framework and national capacity improved as well as pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach	Outcome 1.1: Greenhouse gas emissions from industrial effluent discharges reduced through improved and integrated wastewater management and technologies, supported by an strengthened policy framework and increased capacity.	1. Policy framework and national capacity for water quality and wastewater management improved	Outcome 1.1: National capacity for promoting greenhouse gas emission reduction strengthened by an improved institutional and policy framework on water quality and wastewater management;	Considering the expected outcome established in the PIF and feedback from national stakeholders, UNIDO identified the need for strengthening support in both national capacities and policy framework to generate a long-term improvement in wastewater management. While pilot projects will provide the basis for greenhouse emission reduction, they also will boost the demand of the selected technology and increase the need for an appropriate policy framework. Therefore, component 1 was reformulated from a single component in two, increasing the relevance of efforts toward national capacity strengthening as a hand-in-hand strategy with pilot projects to be developed under the new component 2. This new approach also provides better empowerment of the public sector in leading the support process to promote the adoption of new technologies that reduce greenhouse gas emissions. On the other hand, it facilitates administration of GEF grant resources and monitoring of indicators and results.
	Output 1.1.1: Wastewater regulatory framework reviewed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened		Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened;	In line with the above, Output 1.1.1 was reoriented toward the strengthening of policy and regulatory framework to incorporate low-carbon concepts and tools. This framework will be assessed to identify gaps and develop at least one proposal tailored to the national context. Activities related to wastewater monitoring with on-site measures in industrial zones were relocated to component 2, as one of the crucial initial steps to develop pilot projects and generate

				<p>lessons for further development of a monitoring system in the country. The role of the private sector in this output will be addressed as an integral part of the policy framework, to generate different business models to promote private sector's participation in the improvement of the national wastewater management. Therefore, activities defined in the PIF on this subject were consolidated under this approach. Finally, an activity related to access to investment opportunities for SME was reformulated as part of a comprehensive strategy under the TEST methodology promotion in component 2. This change considered the existing baseline during the PPG which gathered information about other initiatives that are supporting the financial sector for green credit opportunities. The final result of these adjustments is an output 1.1.1 focused on policy and regulatory framework.</p>
	<p>Output 1.1.2: Industrial parks and companies with TEST integrated approach assessed and pilot low-emission technologies demonstrated.</p>		<p>Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane harnessing technology strengthened by TEST capacity building program</p>	<p>The content of Output 1.1.2 in the PIF was defined as the basis for component 2 aiming at pilot projects development (see adjustments to the initial output in the new component below). Therefore, outputs 1.1.3 and 1.1.4 in the PIF were renumbered as outputs 1.1.2 and 1.1.3 in this CEO endorsement document.</p> <p>Output 1.1.2 of the CEO endorsement document makes a clearer distinction between capacity building program in the UNIDO TEST methodology and specific training on low-cost industry wastewater treatment and methane recovery technology. Therefore, both subjects will have specific training activities. Findings during PPG led to outline the TEST train-the-trainer program to also be an opportunity to identify various potential technical partners. The PPG also helped to confirm</p>

				the relevance of capacity building activities in subjects such as EMA, EMS, wastewater management, and planning for climate change, all supported by the framework of the recently developed Myanmar Climate Change Policy and Myanmar Climate Change Strategy & Action Plan (MCCSAP) 2017-2030
	Output 1.1.3.: National capacity increased on low-cost industry wastewater treatment and methane harnessing technology through TEST training delivery.		Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented	Output 1.1.3 of the CEO endorsement document keeps goals and activities of output 1.1.4 as outlined in the PIF.
	Output 1.1.4: Awareness programs on sound wastewater management developed and implemented	2. Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach	Outcome 2.1: Greenhouse gas emissions from industrial effluent discharges reduced through pilots at company and industrial park levels implementing TEST approach and WWTP and biogas technologies	Component 2 of the CEO endorsement document contains and reinforces targets and activities outlined in the output 1.1.2 of the PIF. Its outcome aims at reducing greenhouse gas emission through the application of environmentally sound technology and practices. The TEST integrated approach and the adoption of low-carbon wastewater treatment technology are the innovative approaches to be deployed by a number of pilot projects. Through a separate component for pilot projects development, the project will allocate better efforts towards the private sector under a specific strategy. This strategy is defined by two intervention lines: at the company level to create capacity in the adoption of the TEST methodology to improve the environmental performance (output 2.1.1), and at industrial zones level to improve wastewater management by the adoption of low-carbon wastewater treatment technology (output 2.1.2).
2. Monitoring and	Outcome 2.1: Project objective achieved on		Output 2.1.1: Companies located within industrial zones assessed	This new output takes the original target of 50 companies in the original PIF for implementing

Evaluation	time through effective monitoring and evaluation		with the TEST integrated approach to improve their environmental performance and reduce GHG emissions	TEST tools. However, as a new output, a systematic process has been outlined based on UNIDO experience implementing TEST projects, in order to ensure a successful capacity building process for a more sustained adoption of TEST tools in companies. This output also provides assistance to companies to improve their access to financial mechanisms for investment in RECP measures, recovering initiatives drafted in output 1.1.1 of the PIF. This strengthened approach will provide a more comprehensive support for successful case studies in Myanmar's private sector.
	Output 2.1.1: M&E mechanism developed and applied		Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants	The second output of component 2 comprises all activities related to pilot projects on WWTP and biogas technology established in the original output 1.1.2 of the PIF; hence, it has the highest resource allocation. The strategy was also strengthened based on the screening process carried out during the PPG to select potential pilot sites and providing a more comprehensive process. Due to its relevance, activities under this output are outlined to ensure a smooth but technically strong process of final selection of these pilot sites which in turn will generate experience and lesson learned to promote the adoption of the selected technology in an emerging market.
		3: Monitoring and Evaluation	Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation	Both outcome and output related to monitoring and evaluation remain as it was outlined in the PIF. The numbering was adjusted to the new structure.
			Output 3.1.1: M&E mechanism developed and applied.	

A.1. *Project Description*. Elaborate on: 1) the global environmental and/or adaptation problems, root causes and barriers that need to be addressed; 2) the baseline scenario or any associated baseline projects, 3) the proposed alternative scenario, GEF focal area⁵ strategies, with a brief description of expected outcomes and components of the project, 4) [incremental/additional cost reasoning](#) and expected contributions from the baseline, the GEFTF, LDCF, SCCF, and [co-financing](#); 5) [global environmental benefits](#) (GEFTF) and/or [adaptation benefits](#) (LDCF/SCCF); and 6) innovativeness, sustainability and potential for scaling up.

1) The global environmental and/or adaptation problems, root causes and barriers that need to be addressed;⁶

According to the *2017 UN World Water Development Report, Wastewater: the untapped resource*, “In all but the most highly developed countries, the vast majority of wastewater is released directly in to the environment without adequate treatment, with detrimental impacts on human health, economic productivity, the quality of ambient freshwater resources, and ecosystems...”. The immediate impacts, including the degradation of aquatic ecosystems and waterborne illness from contaminated freshwater supplies, have far-reaching implications on the wellbeing of communities and peoples’ livelihoods.

While the water sector has to manage the impacts on climate change, it is also a contributor. This is particularly the case with regards to wastewater, causing high levels of nitrous oxides and methane emissions, which have much larger multiplier effects on global warming. On a global scale, 80% of all wastewater is released untreated into the environment representing three times the greenhouse gas (GHG) emissions of conventional wastewater treatment. As such, the expansion of wastewater treatment combined with energy-saving and renewable energy producing measures, can lead towards utilities achieving carbon-neutrality.

According to the *Global Climate Risk Index 2018*, Myanmar is considered to be the third most affected country by climate change-related extreme weather events, as demonstrated during the 20-year period from 1997 to 2016, Myanmar’s overall climate vulnerability factor to 2030 is classified as acute. As such, the increase of GHG emissions and its considerable contribution to climate change has been recognized as a serious threat to the country. This is evidenced by the World Resource Institute Study (2013), which breaks down the increase in GHG emission’s release by sector.

An often-overlooked significant contribution to GHG emissions is stemming from discharged untreated effluents, a pervasive practice in Myanmar. In 2013, it was estimated that only 1 in 10 Myanmar factories treat industrial effluents properly before releasing them into various waterways⁷. More specifically, agricultural industries and food producers are hereby singled out as the worst water polluters due to their generation of significant amounts of wastewater containing high organic content causing serious depletion of oxygen levels. As such, organic matter is broken down by microorganisms in a process that (i) consumes large quantities of oxygen negatively contributing to oxygen depletion in water bodies and (ii) releases GHGs, such as methane (CH₄) and carbon dioxide (CO₂), into the atmosphere. This is an alarming situation since methane causes as much as 23 times global warming potential than CO₂.

Although water resources in Myanmar are mostly abundant, localized pollution threatens to render water resources unsuitable for downstream use. The reason can be attributed to the virtual absence of any form of treatment of household and industrial wastewater. Besides the increase of the GHG emissions released into the atmosphere from industrial wastewater, these effluents also cause serious socio-economic impacts on poor communities that cannot afford to dig deep wells. Excessive water consumption combined with under investment in preventative health care, drainage and sanitation

⁵ For biodiversity projects, in addition to explaining the project’s consistency with the biodiversity focal area strategy, objectives and programs, please also describe which [Aichi Target\(s\)](#) the project will directly contribute to achieving..

⁶ For questions A.1 –A.7 in Part II, if there are no changes since PIF , no need to respond, please enter “NA” after the respective question.

⁷ Source: <https://www.mmtimes.com/national-news/mandalay-upper-myanmar/8244-a-rare-victory-in-the-battle-over-industrial-water-pollution.html>

services have resulted in severe health threats causing widespread water-related vector borne diseases, such as malaria, dengue fever and chikungunya virus.

As a consequence of unsustainable industrial development in particular insufficient wastewater treatment, the corresponding high levels of GHG emissions greatly impact on climate change as well as on the degradation of human health and the environment.

(i) Root causes

The root causes of identified wastewater management problems deriving from industries within the area of Yangon and Mandalay is summarized below. These root causes are systemic issues and thus need to be addressed at the (i) policy and planning; and (ii) industrial zone and company levels.

- **Weak environmental impact assessment regulations and poor monitoring and regulatory framework;** the modernization process of environmental quality and wastewater management systems and frameworks under which companies must conform are relatively new within Myanmar's regulatory framework. As such, national capacities of enforcement, monitoring and promotion of pollution prevention remain weak. The Environmental Conservation law of 2012 gave the context to start this by introducing the environmental impact assessment system, technical guidelines, and environmental quality standards that are still in process to be defined. (e.g. EIA system was emitted by the end 2015/beginning of 2016). As regulations are not enforced, wastewater management in the private sector has not been a priority. With the exception of a few large breweries and distilleries (which are the first tranche now required to meet the National Environmental Quality Emission Guidelines (NEQEG, 2015)), there is no systematic keeping of records, monitoring and surveillance of data for water quality control of companies. Compounding a relatively new regulatory framework with weak monitoring and enforcement, the Japanese International Cooperation Agency (JICA) (2016) study shows that only 11% of the companies have an Environmental Management Plan in the Yangon area and 4% in Mandalay area; 77% of the companies are not aware of the NEQEG (2015) in the Yangon area and 71% in Mandalay⁸.
- **Rapid economic expansion;** a rapidly changing development landscape fostered by Myanmar's political and economic reforms has seen an upsurge in Foreign Direct Investment (FDI). This has resulted in a revitalization of national businesses in a relatively short space of time seeing gross domestic product rise from 5.14% in 2009 to 8% in 2014⁹. In the absence of well-developed and enforced policies and regulations around the environment, land reform, infrastructure and foreign investment, such rapid economic growth challenges a sustainable development model where economic, environmental and social imperatives are considered in a more balanced approach.
- **Poor industrial zone use planning and enforcement of industrial zone zoning rules;** Presently, management at the various industrial zones in Yangon and Mandalay are often not standardised and are instead conducted on an ad-hoc basis. The use of industrial zone planning to foster industry sector clusters within industrial zones has largely been ignored overtime. Companies have bought and sold facilities that do not conform to the standards set by the zone use rules. As such different industry sector type business are now clustered together in most industrial zones, making it extremely difficult for centralised WWTPs that require similar constituents in wastewater. A national law governing industrial zone use planning and ensuring on-going enforcement of these rules is needed to hold the industrial zones accountable. The Ministry of Industry has said it is aware of the challenges and that discussions to prescribe an industrial zone law are currently in place.
- **Absence of environmentally sound combined treatment of domestic and compatible industrial effluents; and inefficient urban planning and provision of infrastructure to support companies in terms of water**

⁸ Source: *Pollution Source Survey Report, March 2017*. Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union Of Myanmar. JICA.

⁹ Source: <https://tradingeconomics.com/myanmar/gdp-growth-annual>

as well as sewers and sewage treatment systems; As noted in the report *‘Myanmar - Urban Development and Water Sector: Assessment, Strategy, and Road Map (ADB, 2013)*, there has been a ‘chronic underinvestment in urban infrastructure—including in water supply, sanitation, drainage, wastewater, and solid waste management—has resulted in seriously deficient urban services throughout Myanmar. Large resettlement areas in Yangon and Mandalay have urban services that are well below acceptable levels, and the situation is worse in the poor regions and states of the country. Better urban planning would allow taking advantage of the technology to provide solutions for domestic wastewater including suitable industrial effluents.

- **Lack of policy incentives for company management to promote a more sustainable production model, e.g. to install the equipment required for wastewater treatment, causing severe underinvestment in infrastructure and services;** There is a lack of effective policy, institutional, and regulatory framework. There are also unclear guidance and delineation of responsibilities in planning, regulating, and managing urban and infrastructure services as well as inefficient and overlapping institutional setup for these services. Consequently, there is a lack of policy incentives for company management causing industries to miss out on understanding and capitalizing on the advantages for productivity and competitiveness that resource efficiency strategies and environmentally sound technologies can provide. Incentives are needed to promote a more sustainable production model that includes wastewater treatment.
- **Scarcity of knowledge and skills of local engineers and companies to tackle the issue of wastewater treatment;** Shortages of staff, skills, and data are obstacles to growth of the urban infrastructure and water sector, including for wastewater treatment. As such, capacity development is of specific importance and relevance for Myanmar, especially middle management and operational staff—has had little or no exposure to international best practices (ADB, 2013). To achieve the effectiveness and long-term sustainability of technology transfer, capacities of local engineers, technical service providers and universities need to be strengthened in Myanmar. This is a needed requirement to successfully promote technology markets.

(ii) Barriers

Reducing GHG emissions stemming from water services presents a significant contribution for Myanmar's CO₂eq reduction targets under the Paris Climate Agreement. Despite the government's recognition of the urgency to integrate climate change considerations in policies, strategies, plans and operations, structural barriers remain. This is particularly the case with regards to the use of natural resources in industrial activities and treatment of industrial wastewater as one of the most important environmental impacts, whereby Myanmar will not be able to decrease its GHG emissions if the following structural barriers remain unaddressed.

- **Policy:** Gaps in political and legislative frameworks (i) to support inclusive and sustainable industrial development through industry-urban symbiosis, which refers to the collaboration, exchange of resources and sharing of infrastructure between companies and their use of by-products (wastes) from urban areas as alternative raw materials and energy sources in industrial operations, and (ii) to provide policy incentives such as market-based instruments to encourage investment in resource efficient and cleaner production (RECP). Furthermore, an ineffective legal framework as a result of insufficient, inappropriate or overlapping laws, acts and regulations in terms of water resource management, or lack of active enforcement of existing wastewater policy, impede sustainable development. This scenario can result in unclear guidance and delineation of responsibilities in planning, regulating and managing industrial zone infrastructure. Policies need to be strengthened to enforce unified wastewater management to ensure improved coordination and monitoring systems.
- **Economy:** A lack of economic incentives and pricing strategy for the private sector to be actively engaging in the funding and construction of industrial wastewater treatment projects is evident. Additionally, economic incentives are not in place to promote a more sustainable production model and perceived competing interest between productivity and environmental considerations among companies. Lack of investment incentive mechanisms and difficulties in accessing financial resources from commercial banks due to insufficient information and cumbersome processes in loan applications for SMEs. As such only 3-7% of SMEs had their applications approved and gained access to credit based on experiences in 2012 by the SME Development Bank

and the SME Centre of Yangon. Overall, this results in inadequate financial resources for investments in clean and low carbon technology.

- **Monitoring and enforcement:** lack of enforcement towards industries by the respective government agencies regarding (i) illegal dumping of wastewater in suburban areas; (ii) weak management of industrial effluents; and (iii) weak regulation of large-amount wastewater generators. Additionally, there is no regular training of Yangon City Development Committee (YCDC) and Mandalay City Development Committee (MCDC) personnel on wastewater management issues. Lack of raw data for baseline understanding, and data collection methodology also result in inability to develop consistent monitoring and evaluation, as well as enforcement systems.
- **Technology:** Supply chains for wastewater treatment and energy efficient technology are inadequate due to low demand for such technologies. Furthermore, no technical assistance in particular for wastewater treatment processes in industrial zones is available or offered on an institutional macro level. There is a general lack of knowledge and financial means regarding green chemistry and RECP, impeding their adoption. A lack in existing local infrastructure integrating wastewater treatment facilities results in lack of technical know-how on the ground.
- **Capacity:** Lack of institutional capacity to implement the concept of industry-urban symbiosis and resource (energy, water and raw material) efficiency principles, as well as a lack of inventory and data on sources and emissions in industrial zones. There is a lack of capacity in particular for small and medium sized enterprises (SMEs) to install effective wastewater treatment systems for effluent discharged in terms of knowledge, concepts and financial access through loan application processes.
- **Awareness:** There is little recognition of the advantages that environmentally sound production models such as the UNIDO Transfer of Environmentally Sound Technology (TEST), Resource Efficiency and Cleaner Production (RECP) approach and industrial symbiosis, add to companies in the international markets. In terms of sustainable production, there is a wide gap in awareness between academia/large industrial conglomerates and the vast majority of SMEs. Across the community and within industrial zones, especially factory owners, there is low awareness in general on the principles and benefits of sustainable development as well as the risks of increased water contamination to human and environmental health contributed by industrial wastewater discharges pre-treatment. Lack of both resources and exposure to international best practices, as well as limited knowledge on climate change in general and where GHG emissions originate, in addition to impact.
- **Financial:** The industry sector in Myanmar is extremely cash constrained with very limited resources to invest in infrastructure. Cash flow based financing is a relatively new concept in Myanmar with banks very averse to risks of project developers. Furthermore, a lack of equity of local project developers during the project start-up phase is also an issue. As there are few examples of privately funded WWTPs and wastewater biogas plants in Myanmar and limited experience with biogas plants in general, the local commercial banking sector is not familiar with this type of project. Consequently, financial institutions are reluctant to provide financing for these investments and a considerable amount of paperwork and research is required before offering a loan. Wastewater treatment is a cost incurring activity, whilst sources of potential wastewater for power production were identified, in order to realize this level of potential, private sector investment in combination with leveraged finance from financial institutions would be necessary.

In order to assist Myanmar to address the above outlined structural barriers and underlying root causes, the project provides technical and financial assistance via the identified project outputs and activities outlined in section 3.

2) The baseline scenario or any associated baseline projects;

2a) Baseline scenario;

- Economic, environmental and social impact of industry in Myanmar.

Myanmar's industry is geared largely to the processing of agricultural, mineral, and forest products. More than half of Myanmar industrial production is accounted for by the public sector. Principal industrial products are cement, steel, bricks and tiles, fertilizers, and processed foods. Consumer goods that were imported before 1962 and are now manufactured

domestically include blankets, paper, glass products, bicycles, and water pumps. Other major consumer manufactures are aluminium ware, jute and cotton cloth, pharmaceuticals, beverages, matches, and cigarettes. There is also a growing segment engaged in the assembly of television sets and motor vehicles¹⁰.

Based on 2016 estimates, industry accounts for 27.5% of Myanmar's GDP¹¹. Economic growth is expected to be rapid, GDP growth is expected to average 7.2% a year in 2018-22¹². According to the Economist Intelligence Unit, Industry is expected to contribute 9.1 % GDP growth in 2018 and 8.6% in 2019¹³.

The economy is predominantly agriculture based, with rice being the main crop and staple food. The agriculture sector accounts for 60% to 70% of total employment and 38% of GDP, down from 57% in 2001. In contrast, the share of GDP accounted for by the industry sector more than doubled during this period, to 25%. Liberalization of the economy and opening up to foreign direct investment has prompted rapid growth of the industry sector. While the agriculture, fisheries, and resource industries have considerable potential for expansion, Myanmar will need to broaden the economic base beyond primary industries (ADB, 2013).

In Myanmar, the first industrial zones were established in the mid-1990s. For years industrial zones have been criticized for a lack of infrastructure, investment, regulation, and efficiency. A lack of sufficient infrastructure and, more precisely, of stable electricity supply have been identified, in particular, as major problems in related literature (Min and Kudo 2013; Robertson and Taung 2015). These power shortages mainly stem from high electricity demand in the densely populated areas around Mandalay and Yangon, where the majority of industrial zones are also located (Myanmar Micro, Small and Medium Enterprise Survey 2017, Central Statistical Organization Ministry of Planning and Finance and UNU-WIDER, May 2018)¹⁴.

The Figure below gives an overview of the shares of firms in industrial zones, by township. Two areas with high concentrations of industrial zones can be identified: Yangon Region and the western area around Mandalay Region.

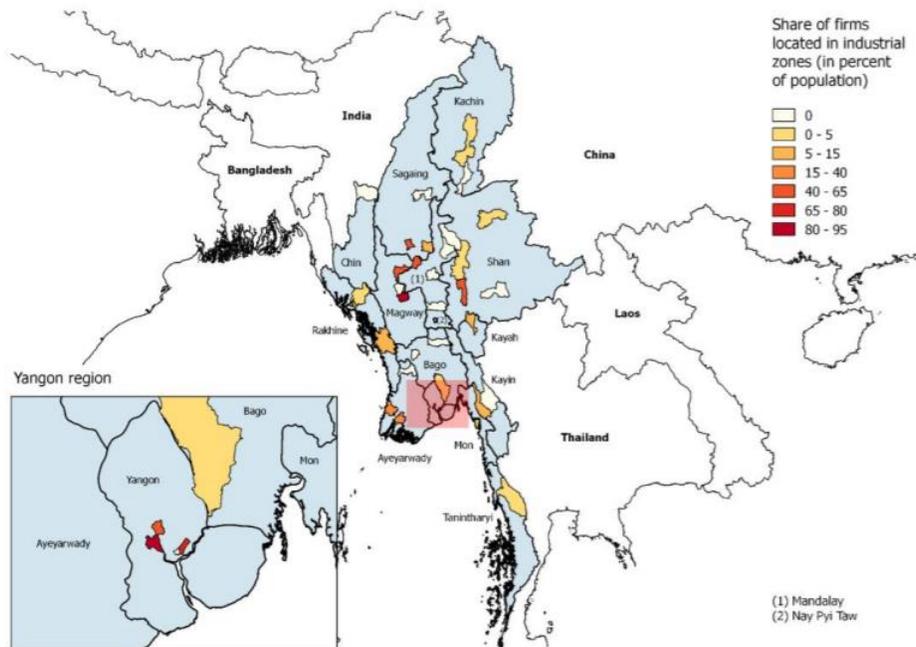
¹⁰ See: <http://www.nationsencyclopedia.com/Asia-and-Oceania/Myanmar-INDUSTRY.html>

¹¹ See: <https://www.gfmag.com/global-data/country-data/myanmar-gdp-country-report>

¹² See: <http://country.eiu.com/Myanmar>

¹³ See: <http://country.eiu.com/Myanmar>

¹⁴ See: <https://www.wider.unu.edu/sites/default/files/Publications/Report/PDF/Myanmar-MSME-survey-2017.pdf>



Source: Authors' illustration based on Myanmar MSME 2017 data.

Figure 1 Share of firms located in industrial zones

There are currently 25 industrial zones in Myanmar with 6,800 factories¹⁵ employing approximately 187,885 people. The physical proximity of industries to rivers intensifies the potential of environmental degradation in the country as many companies illegally discharge their wastewater into the nearby river as a common practice. The food processing industry is well established in Myanmar accounting for around 64% of industrial activity mostly consisting of registered SMEs in the industrial zones of Yangon and Mandalay.¹⁶ These producers generate large quantities of effluents with a high organic load. During the degradation of these organic substances, significant quantities of GHG are emitted. During government inspections at various industrial zones in the region of Yangon, it was found that the discharge of wastewater from food processing industries and textile factories without prior treatment is a widespread practice. According to the YCDC, 207 out of 3,264 factories within Yangon's industrial zones release wastewater into the Hlaing and Pan Hlaing rivers with only 109 ensuring proper treatment. It was reported that more than 1.2 million gallons (equivalent to 4542 m³) of industrial wastewater passes by the urban settlements of Hlaing Township. Reports from dwellers express that the wastewater is commonly dark and generate chemical odours; among the complaints, it is thought that chemical odours influence air pollution causing damage in walls and roofs in the surrounding areas.

The situation of industrial wastewater pollution is similar in the region of Mandalay. The industrial wastewater treatment and disposal system put in place in Pyi Gyi Tagon consists of a stabilization pond with 400 acres (equivalent to 1.6 km²). However, this system is highly inefficient and not utilized by the company owners, which was evidenced during an inspection visit with the effluent water from textile-dyeing factories and the factory workers' hostels being discharged into nearby waterways. As such, increased industrial wastewater pollution along the Dokehtawaddy River bank by the Mandalay Industrial Zone is reported to cause diarrhoea and skin diseases affecting the nearby urban settlements. Additionally, residents complain regarding the depletion of the fish populations as a result of the pollution as well as

¹⁵ Source: Ministry of Industry, Directorate of Industrial Supervision and Inspection. <http://www.industry.gov.mm/en/content/industrial-supervision-and-registration-sector>

¹⁶ Source: Ministry of Industry (1), Directorate of Industrial Supervision and Inspection.

regarding a toxic odour from the discharged wastewater. This unsustainable situation has sparked widespread protests demanding immediate action from the government if regional authorities continue to fail to ban these wastewater discharge sites.

These examples highlight the urgency for the project to introduce appropriate wastewater management policy tools as well as to demonstrate the positive environmental and socio-economic benefits of integrated low-emission wastewater technology systems at company and industrial park levels.

A survey conducted by a JICA Project focused on developing the basic water and environmental management in Myanmar¹⁷. The survey area includes 6 Industrial Zones in Yangon (Hlaing Tharyar, Shwe Linban, Shwe Pyi Thar, Wataya, Shwe Than Lwin and Ngwe Pinal) and 1 Industrial Zone in Mandalay (Pyi Gyee Tagon). The survey, which strived to provide an overview for industries in industrial zones through a sample of the most representative enterprises, revealed that the current status of wastewater management at factories in Yangon and Mandalay is as follows:

- 53% of the factories analysed in Industrial Zones in Yangon and 46% in Mandalay have wastewater treatment facilities. Most facilities are rudimentary primary treatment facilities such as screens and settling basins to remove large particles and solid waste.
- Roughly, only about 5% of factories in Yangon and Mandalay are equipped with modern secondary treatment facilities to remove biodegradable organic matter, such as activated sludge and Up Flow Anaerobic Sludge Blanket (UASB). Oil separators are available at around 10% of factories in Yangon and none are present in Mandalay. Essentially none of the factories are equipped with treatment facilities specifically designed to remove nutrients such as Total Nitrogen (TN) and Total Phosphorus (TP). Similarly, most factories are not controlling other pollutants, such as coliform bacteria.
- Only 10% of the factories in Yangon and 2% of factories in Mandalay have flow meters to monitor water usage, and only 4% of factories in Yangon and 2% in Mandalay have flow meters to monitor wastewater flow rate. The majority of factories (92% in Yangon and 100% in Mandalay) are using groundwater (rather than supplied water) as the sources of water, providing little incentive to optimize water usage and wastewater discharge by monitoring.

The JICA survey also compared factories against the effluent concentrations and requirements of the NEQEG (2015) of the Ministry of Natural Resources and Environmental Conservation (MONREC). These guidelines provide the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes of protection of human and ecosystem health¹⁸. Currently, the NEQEG (2015) is not legally mandated or enforced upon most existing factories. Not surprisingly, most of the factories are not equipped with adequate wastewater treatment facilities and many of them are not meeting the effluent guideline values of NEQEG (2015). The findings concluded the following features in regard to the studied factories:

Water quality parameters according to NEQEG

- 70 to 85% of the factories are not meeting the NEQEG (2015) requirements for Total Suspended Solids (TSS)¹⁹ in Yangon and Mandalay.

¹⁷ Information based on the results of a pollution source survey implemented in industrial zones in Yangon and Mandalay in August – October 2016 as part of (JICA) “Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar”

¹⁸ National Environmental Quality (Emission) Guidelines. English version (unofficial). <http://www.gms-eoc.org/resources/myanmar-safeguards-2012-onwards->

¹⁹ Total Suspended Solids (TSS) are solids in water that can be trapped by a filter. TSS can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage. High concentrations of suspended solids can cause many problems for stream health and aquatic life.

- Roughly half of factories in Yangon, and over 90% of the factories in Mandalay are not meeting the requirements with respect to Biochemical Oxygen Demand (BOD)²⁰ and Chemical Oxygen Demand (COD)²¹.
- 33% of factories in Yangon and 71% of the factories in Mandalay are not meeting the requirement for TP. Data for TN were not deemed reliable, and no evaluation was made. 90% of factories in Yangon and 42% of factories in Mandalay did not meet the requirement for oil and grease.
- All factories (100%) in both Yangon and Mandalay are not meeting the requirement for total coliform bacteria.
- There are factories that are satisfying NEQEG (2015) requirements for many parameters. However, most of them are able to achieve this only because their raw wastewater flow and BOD and COD levels are rather weak (e.g., some of the cold storage factories in Yangon), and not because they are actively and efficiently removing pollutants. Those sectors that discharge highly concentrated organic wastewater, such as distilleries, are expected to face serious difficulties in meeting the requirements, if the requirements are imposed. In fact, around 5 distilleries in Mandalay have reportedly ceased production until they can establish sufficient wastewater treatment facilities in order to meet NEQEG (2015) requirements.
- Effluent concentrations of heavy metals and organic chemicals were generally low, and except a few cases, the concentrations were below NEQEG (2015) requirements. For these substances, the numbers of data were too limited to evaluate the situation, and more investigation is needed.

Sizes of Factories, Environmental Impacts and Capacity of Factory to Improve Environmental Performance:

- According to Myanmar's Directorate of Industrial Supervision and Inspection (DISI)'s classification, most of the industries sampled in the JICA survey are considered Large, however, despite DISI's classification, in reality they are SMEs.
- Though effluents of many of the studied factories do not satisfy the concentration-based requirements of NEQEG (2015), only a small fraction of factories are responsible for the large part of industrial pollution load analysed in the survey's sample. In Yangon, three factories are responsible for 92% of BOD load, and in Mandalay only one factory is responsible for 92% of BOD load. The situation is expected to be similar in other pollutants typically associated with food and beverage industries, such as COD, TN and TP.

Awareness about Environmental Requirements:

- Essentially all of the respondents believe environmental performance of their factories is satisfactory and their products are environmentally friendly as they are produced with low environmental impacts. On the other hand, the survey revealed that 77% of factory managers in Yangon and 71% in Mandalay were not aware of the newly introduced NEQEG (2015).
- While many of the factory managers probably did not want to give answers that could attract attention of local authorities, it seems there is a significant gap in expectation of modern environmental management, as represented by NEQEG (2015), and awareness of many factory managers.

Issues in Improving Environmental Performance

- If factories are required to improve environmental performance and satisfy requirements of NEQEG (2015), they might face various difficulties in technical, financial and organizational aspects. One overarching issue is the lack of zoning enforcement means that different types of industries are located together making it difficult to combine similar effluents thereby complicating treatment.
- The survey identified the following main difficulties for installing wastewater treatment plants by the factories' owners:
 - High cost of technology and wastewater treatment facilities.
 - Limited land for developing the needed infrastructure. The problem is especially acute in small-scaled factories whose land area is often smaller than 0.5 acre (0.2 ha).
 - Lack of technical and financial expertise (in-house and external) to put in place the best suitable technology.
 - Unrealistic regulation: many factories may not be able to satisfy the NEQEG (2015) requirements.

²⁰ Biochemical Oxygen Demand (BOD, also called Biological Oxygen Demand) is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period.

²¹ COD or Chemical Oxygen Demand is the total measurement of all chemicals in the water that can be oxidized.

- Most factory managers believe installation of a wastewater treatment facility, as an end-of-pipe measure, would be sufficient to meet effluent guidelines. However, these factories need to meet much broader environmental requirements, including air pollution control, noise control, waste management, hazardous substance management, resource conservation, emergency response, etc. To deal with such broad issues, an end-of-pipe approach is not sufficient. They have to go more strategic, adopt an environmental management system, and explore various technology and financing options.

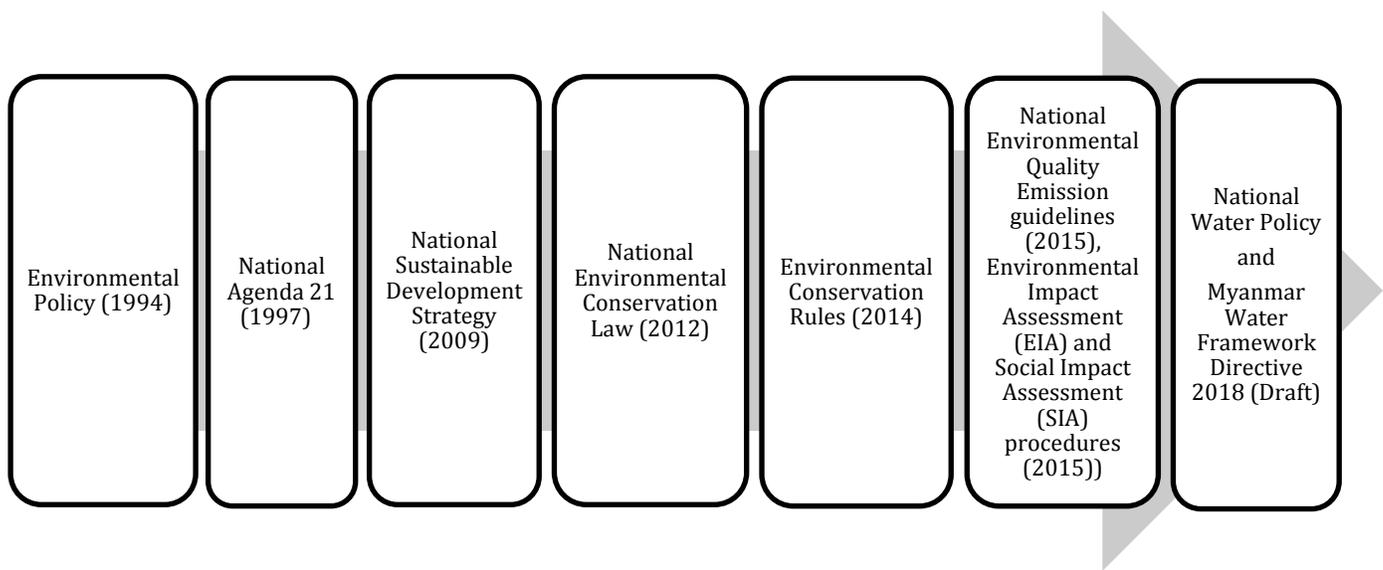
– Regulatory environment

The importance of environmental protection in Myanmar is recognized in national and local policy (see Table 3), which is in part due to the country being a signatory of various multilateral environmental treaties and agreements. Myanmar’s National Environmental Policy of 1994 instituted environmental regulations on the utilization, conservation, and prevention of environmental degradation including water, land, forest, mineral, marine resources, and other natural resources. Following the development of this national policy, the country drafted its Agenda 21 commitment (1997) to implement integrated management of natural resources which provides a blueprint for achieving specific targets on environmentally sustainable development. In 2009, the country’s National Sustainable Development Strategy (NSDS) was prepared, marking an important step for Myanmar as this guiding document aims to ensure development remains in harmony with the three main pillars of sustainability: environment, economy and society.

National Environmental Policies and Laws

On a policy level, Myanmar has enforced a number of policy guidelines for the promotion of environmental conservation and water management in order to reduce air and water pollution across the country. Currently the government seeks to combine economic development with sustainable environmental conservation practices under the current Environmental Conservation Law (2012) (See Figure 2).

Figure 2: National Environmental Policies and Laws



The **National Environmental Conservation Law** and the Environmental Conservation Department (ECD) were established in 2012 as an enforcement mechanism to protect and conserve nature. The establishment of the ECD is an initial step towards the current process for improving the regulatory system. According to this law, companies are required at point source of pollution to treat, emit, discharge and deposit pollutants in accordance with environmental quality standards. For that purpose, companies need to install or use controlling equipment and contribute cash or in-kind to

wastewater treatment facilities. Additionally, the government seeks to establish environmental and effluent standards with regards to water quality based on the existing regulations under the Myanmar Agenda 21 from 2002.

The **National Environmental Quality Emission Guidelines (NEQEG)** is a first attempt to achieve future binding standards. However, in practice actual implementation and proper enforcement of these environmental regulations has lagged behind general policy proclamations. Therefore, it is not legally mandated or enforced too most existing factories. The JICA (2016) report reveals that most factories are not equipped with adequate wastewater treatment facilities and many of them are not meeting the effluent guideline values of NEQEG. In addition, consultation with stakeholders reveals the NEQEG was based upon existing regulation in other countries and in this regard many stakeholders consulted reported that the guidelines may not be fit for purpose. In order to sufficiently address the myriad of issues surrounding effluent discharges in Myanmar the NEQEG should be periodically updated.

In 2016, Myanmar also passed new **Environmental Quality Standards (EQS), Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) procedures**. New conditions may be attached to existing investments, in order for them to comply with Myanmar’s evolving environmental regulations. Importantly, all companies operating on physical premises in Myanmar are now required to submit an Environmental Management Plan (EMP) to the Ministry of Environmental Conservation and Natural Resources (MONREC) by December 2018. An EMP is a project document to be prepared according to the requirements and guidance of MOECA, outlining how the company will refrain from, protect against, mitigate and monitor adverse impacts caused by the design, construction, implementation, operation, maintenance, termination, or closure of a project or business or activity; or after its closure, or by any other related cause. An EMP should include programs to manage and implement activities, and monitor changes to the environmental context.

The Myanmar National Water Resources Committee (NWRC) aims to draw up and implement an integrated water management system, develop a national integrated water management strategy, a national water resources policy, a water framework directive and a water law. The **National Water Policy and Myanmar Water Framework Directive** have been drafted by the Advisory Group of NWRC and published in 2014. Cabinet approved the National Water Policy in 2015. Currently the NWRC Advisory Group is drafting the National Water Policy and public consultation meetings are in progress.

In parallel to these environmental policy tools, the **Myanmar Climate Change Strategy and Action Plan (MCCSAP)** 2017-2030 has been drafted; it presents a roadmap to guide Myanmar’s strategic responses to address climate related risks and opportunities over the next 15 years and beyond. The Strategy and Action Plan aims to support key actors in their decision making at the national and local level to respond to the challenges and opportunities associated with climate change. MCCSAP prioritises reduced GHG emissions and environmentally sound technologies and good management practices to improve and maintain water systems.

City and township policies and bylaws

In addition, City and Township Development Committees have promulgated a number of local policies and bylaws establishing a legal basis for action at local level (See Table 3).

Table 3: Local environmental policies and laws

Mandalay City Development Committee (MCDC)	Yangon City Development Committee (YCDC)	Nay Pyi Taw City Development Committee (NCDC)
<ul style="list-style-type: none"> ▪ MCDC Law 2015 (Jan 12) ▪ MCDC Environmental Conservation and Cleansing bylaws 2015 	<ul style="list-style-type: none"> ▪ The Yangon Water work Act 1885 ▪ The City of Yangon Municipal Act 1922 ▪ The Water Power Act 1927 ▪ The Underground Water Act 1930 	<ul style="list-style-type: none"> ▪ NDC Pollution Control and Cleansing Department bylaws ▪ NDC Water and Sanitation Department bylaws

<ul style="list-style-type: none"> ▪ The City of Mandalay Development Law 2002 	<ul style="list-style-type: none"> ▪ The City of Yangon Development Law 1990 ▪ The Yangon Civil Development Law 2013 	<ul style="list-style-type: none"> ▪ The Nay Pyi Taw Development Law 2009
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Small and Medium Enterprises regulatory environment

The Myanmar government has established a number of initiatives and organisations to support SMEs in their general development. Multiple parallel ministries regulate the business sector in the country yet lack co-ordination amongst themselves (ARTNet 2014).

The governmental organisations that were created to support SMEs have formed an elaborate bureaucratic structure. The Central Committee for Development of SMEs was established under the Ministry of Industry (MoI), which is now restructured to Ministry of Planning, Finance and Industry (MoPFI), in 2013. The committee with its 27 members is chaired by the president and tasked with laying down policies that promote development and offer guidance to SMEs on all fronts (Sustainable Business Myanmar n.d.; The Republic of the Union of Myanmar 2015). The committee also provides guidance on energy production and effective and efficient use of energy and technology to conserve energy. The MoPFI also set up the SME Development Service Centre that is responsible for data collection, recording SME history, financial management, marketing advisory, and to serve as a credit guarantee corporation.

The SME Development Law is a recent addition – it was promulgated in April 2015 (The Republic of the Union of Myanmar 2015). The law aims to make access to information easier, enhance competitiveness of SMEs, increase employment opportunities, and reduce the obstacles faced by SMEs in their operations. It encourages SMEs to manage resources in a sustainable manner and minimise negative impacts on the natural environment and society. The law also promotes the use of advanced technology and facilities for production and distribution.

The government of Myanmar recognises that SMEs are responsible for environmental degradation and their contribution to climate change, however, at present SMEs are generally not the target of environmental and climate change policies and where included enforcement is weak. There are few restrictions on SMEs or plans for their relocation due to polluting activities, partly due to a low level of environmental law enforcement and the informal operations of the majority of SMEs. So far there are no strategies, policies or guidelines that include sustainable consumption and production (SCP).

– Green investments in industry

The banking and financial sector in Myanmar provides negligible financial support to industry, particularly for SMEs. Financial coverage in general is very poor with only 5%²² of the population having access to bank accounts. Cash-flow/working capital based loans are a relatively new concept in Myanmar with only a few of the largest banks instituting processes and offering loans to business. According to a KPMG survey in 2012, loans extended by local banks accounted for only 0.6% of GDP (the lowest figure across all Asian countries)²³. Considering the lack of SME financing in general, it is not surprising that there are currently no green financing opportunities to support industrial wastewater or energy and resource efficiency projects in the country.²⁴

²² See: <https://www.mmtimes.com/business/10446-building-up-a-banked-people.html>

²³ See: <https://assets.kpmg.com/content/dam/kpmg/pdf/2015/06/investing-in-myanmar.pdf>

²⁴ See: <http://myanmar-waterenvironment.com/index.php/en/>

2b) Baseline projects;

The baseline project consists of international organisation initiatives which are carried out jointly with the national government to strengthen national capacities and the national environmental management system in the country. The following are the most relevant projects that provide a baseline to activities of this project:

UNIDO: UNIDO implemented a pilot program for a national RECP program in Myanmar funded by the State Secretariat for Economic Affairs (SECO), Government of Switzerland. The program aimed at improving resource efficiency and environmental performance of enterprises, in particular SMEs, through the adaptation and adoption of internationally proven RECP methods and techniques. Specific outputs pertained to enable multi-stakeholder dialogues; technical capacity building for RECP service delivery; and pilot industry demonstrations. The pilot program operated in two regions, Yangon and Mandalay.

The project will draw on UNIDO's experience with regards to the Transfer of Environmentally Sound Technologies (TEST) application in the region. UNIDO previously implemented (2011 - 2013) the TEST methodologies in Phnom Penh and Kandal provinces in order to reduce the environmental footprint of Cambodian industries, while increasing their competitiveness. The project was developed in cooperation with the Ministry of Industry, Mines and Energy (MIME) of Cambodia and with the financial support of the Korea International Cooperation Agency (KOICA). During this initial project, a number of new management tools were introduced in selected enterprises, including RECP, Environmental Management Accounting (EMA), based on ISO 14051; Environmental Management System (EMS), based on the principles of ISO 14001; and Corporate Social Responsibility (CSR), based on the first steps of ISO 26000.

In 2009 under the framework of the “Strategic Partnership for the Mediterranean Large Marine Ecosystem (LME)²⁵” of UNEP/MAP (MedPartnership), UNIDO launched the MED TEST initiative with the financial support of the GEF and the Italian government. The aim was to promote the transfer and adoption of best available technologies in industries of the Southern Mediterranean Region. The MED TEST project addressed pollution from land-based sources of priority industrial hot spots in three selected geographical areas of Mediterranean coast within three pilot countries: Egypt, Tunisia and Morocco. The MedPartnership mid-term evaluation identified MED TEST as one of the most valuable initiatives within the UNEP/MAP MedPartnership replication strategy and was recommended for scale up to cover other geographical areas within the Southern Mediterranean Region. Therefore, MED TEST II was developed as part of the SwitchMed initiative, a regional multi-component programme funded by the EU and implemented through collaborative efforts by UNIDO, UNEP/MAP²⁶ -SCP/RAC²⁷ and UNEP-DTIE²⁸ during the years 2014 - 2018. The European Neighbourhood & Partnership Instrument (ENPI) countries have been beneficiaries, namely Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine, and Tunisia. The overall objective of SwitchMed is to facilitate the shift toward Sustainable Consumption and Production (SCP) in the Southern Mediterranean region by demonstrating successful examples of how this can be done. Under MED TEST II component, the objective was to increase the demand and supply of sustainable production services to industry, including providing direct TEST technical assistance to a pool of industries.

MED TEST II worked in 125 demonstration companies. By the end of the project the recommended TEST measures summed up to annual savings of 3.5 million m³ of water; 707 GWh of energy; 33,623 t of raw material and avoidance of 197,525 tons of CO₂ emissions, as well as 41.7 million euros of economic savings. The project helped the industries identify and approach existing mechanisms to finance clean technologies and upgrades in their operations. In this sense, the results achieved from MED TEST II are conclusive as they confirm the relevance and effectiveness of the TEST

²⁵ UNEP/MAP initiative <http://www.medpartnership.org/>

²⁶ Mediterranean Action Plan for the Barcelona Convention

²⁷ Regional Activity Centre for sustainable consumption and production – linked to UNEP/MAP

²⁸ Division of technology, industry and economics, now Economy Division

methodology as an instrument for industries that wish to overcome challenges related to a sustainable production, resource efficiency and pollution prevention.

UN-Habitat has already undergone extensive cooperation with Myanmar on climate change mitigation and technology transfer as well as its current implementation efforts of the Myanmar Climate Change Alliance Program (MCCA). MCCA is a EUR 4 million, 4-year program implemented by UN-Habitat and UNEP, funded by the European Union under the Global Climate Change Alliance window. MCCA is an important baseline to this project because it seeks to develop a guiding framework, in the form of a National Climate Change Strategy, and raises awareness among the general population including the private sector about measures to mitigate climate change. The project will be able to build on the three following result areas (i) raise awareness in society as a whole on the threat of climate change and potential ways for mitigation; (ii) build capacity of the government, including the development of a National Climate Change Strategy and sector action plans; and (iii) demonstrate measures that support climate change mitigation in the central dry-zone (CDZ) and the coastal/delta region.

The Japan Fund for Poverty Reduction (JFPR) is currently implementing a project in selected underserved areas of Yangon and Mandalay, which seeks to reduce environmental related diseases and provide access to basic services, such as water and sanitation facilities. Priority is given to safe and regular water supplies as well as the removal of solid and liquid waste in two selected townships in Yangon and Mandalay with 3,000 target households. Capacity building and awareness raising activities are also a key component of the JFPR's project. Specifically, key local government institutions, such as YCDC and MCDC and other relevant township development committees that are responsible for the provision and maintenance of essential urban infrastructure and services are involved.

The Japan International Cooperation Agency is developing the project for "Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar", working closely with the Ministry of Natural Resources and Environmental conservation. This project is a bilateral technical cooperation project between Myanmar and Japan that aims to support and enhance capacities of the Ministry of Natural Resources and Environmental Conservation (MONREC) and other organisations. The focus of capacities enhancement is based on environmental management of water assets and to implement environmental impact assessment (EIA) reviews. Activities of the water environment management component of the project are being implemented in three cities in Myanmar, namely Yangon, Mandalay and Nay Pyi Taw. The water quality component has two target areas, Hlaing River basin in Yangon and Doke Hta Waddy River basin in Mandalay. These areas were selected to investigate the impact of industrial effluent from industrial zones on water quality of rivers. The project is being implemented based on the Record of Discussions (R/D) signed on 23 December 2014, between then MOECA and Japan International Cooperation Agency (JICA). Project activities in Myanmar commenced in June 2015 and were finalised May 2018.²⁹

The Asian Development Bank (ADB) and other international partners have been supporting Myanmar to build an Environmental Impact Assessment (EIA) system to safeguard the country from the adverse environmental effects of economic development. The ADB led-Greater Mekong Sub region (GMS) Core Environment Program (CEP) has been at the forefront of international support to Myanmar's Environmental Conservation Department (ECD) to put together other pieces of the regulatory puzzle. These included EIA procedures, technical guidelines, and environmental quality guidelines. Throughout 2013 and 2014, CEP and partners such as the World Bank and JICA brought in international EIA expertise to support ECD, ensuring international best practice informs Myanmar's emerging system. CEP and ECD facilitated a series of awareness raising and consultation workshops to ensure all EIA stakeholders – sector ministries,

²⁹Source: <http://myanmar-waterenvironment.com/index.php/en/project/>

business, international organizations, and civil society – understand the value and requirements of EIA and have their say on how the system can best be tailored to the Myanmar context.³⁰

ADB is currently implementing a project with the objective to increase agricultural value added by improving irrigation and strengthening agricultural value chains in three regions of Myanmar's CDZ. It supports the modernization of irrigation systems in Magway district of the Magway region, Shwebo district of the Sagaing region, and Meiktila and Yamethin districts in the Mandalay region during a 7-year implementation period. The irrigation system rehabilitation and modernization component cover about 20,000 hectares (equivalent to 200 km²) and benefit around 24,000 households in addition to the agricultural sector. The UNIDO-GEF project will work with ADB to identify important lessons learned, particularly for water quality monitoring and management.

The World Bank is developing the Ayeyarwady Integrated River Basin Management Project for Myanmar; the objective is to strengthen integrated, climate resilient management and development of the Ayeyarwady River Basin and national water resources. The project focuses on a number of interrelated areas including: water resource management institutions, decision support systems and capacity building, hydro-meteorological observation and information systems modernization including institutional and regulatory strengthening, capacity building and implementation support, modernization of observation infrastructure, data management systems and forecasting, enhancement of Hydromet service delivery systems and water quality monitoring. The UNIDO-GEF project will seek collaboration with the World Bank to ensure synergies in institutional and regulatory strengthening and capacity building activities as well as exploring linkages for data sharing.³¹

The Dutch Development Bank – FMO is promoting banking for development in Myanmar. Water risk has been identified as an urgent problem that is becoming worse affecting the country capacity for development. As part of their market development in this country, the bank has identified the need of increasing private investment in sustainable water projects to improve water security, support economic growth and enhance the health of Myanmar's rivers basins. A major barrier is lack of viable, sustainable bankable water projects for companies and financial institutions to invest in, rather than a lack of private sector funds. Based on this, in 2019 FMO has joined efforts with WWF to implement the project: Development of Wastewater Treatment projects in Irrawaddy river (Ayeyarwady in Burmese) basin. The initiative seeks to provide seed funding to WWF to promote green technologies for industrial wastewater treatment, identify innovative investment options, and develop bankable wastewater treatment projects that contribute to reduce pollutant discharge in the Irrawaddy river basin. Through this innovative partnership, a pipeline of bankable projects with solid financial returns on investment will be created. The project has potential for collaboration with this GEF-UNIDO project in order to develop pilot experiences including low carbon technology.

³⁰ <http://www.gms-eoc.org/news/safeguarding-myanmar-s-future-environmental-impact-assessment>

³¹ <http://projects.worldbank.org/P146482/?lang=en&tab=overview>

The EU and WWF began implementation of Tha Bar Wa Project in 2018 (with a 48-month implementation period). The project aims to create and demonstrate an enabling environment for cleaner production. As a result of policies, business support structures, increased capacity and improved access to finance, SMEs in the Food & Beverages (F&B) sector in Myanmar are enabled to adopt sustainable energy and water management practices by 2021. The project aims to create an enabling environment for SMEs to profitably invest in green technologies, reducing both ecological footprint and cost of doing business in their supply chain. In particular, the project will provide training to 200 SMEs in the F&B processing industries in Yangon and Mandalay region to implement sustainable energy and water management practices through supporting policies and business structures, increased capacity and improved access to finance. The F&B industries, of which 66% are SMEs, are some of the largest water and energy consumers and polluters in the country. Therefore, ensuring future sustainability of SMEs in this sector is critical for long-term economic prosperity, environmental sustainability and food security in the country.

In order to achieve this, the project focuses on four components, namely, policy, capacity and markets, green finance, and replication of project results, as outlined below.

1. Policy - 2 policies and 2 sector-wide guidelines for sustainable energy and water management

- Roadmap for implementing Emission Guideline (2015) on waste water discharge
- Environmental Management Plan (EMP) guidelines for F&B sector
- SME Promotion Policy Programme for energy efficiency
- Code of conduct for investors in the F&B sector

2. Capacity and markets - 200 SMEs of the F&B sector and associated business intermediaries have gained knowledge and capacity to implement sustainable water and energy management practices

- Awareness workshops on water and energy management for SMEs in F&B sector
- In-depth trainings and assessments on waste water treatment, energy efficiency and renewable energy for SMEs
- A pool of local trainers and experts on water and energy management
- Testing laboratory and capacity of MFPEA to provide improved services on cleaner production to its members

3. Green finance - Three financial institutions have enhanced capacity and organisational structures to assess and increase green SME lending

- Trainings for loan officers: (1) Refreshment trainings on risk based SME lending and (2) Green finance trainings
- Trainings for SMEs on loan application and procedures
- Innovative green/ cleaner production financing schemes

4. Replication - The cleaner production model is replicated in other regions and lessons are shared across Southeast Asia

- A compendium of energy efficiency improvement opportunities for the F&B industries
- Integration of training content on energy and water management into curricula of educational institutions
- An online tool/ information sharing portal for waste water management.

3) *The proposed alternative scenario, GEF focal area strategies, with a brief description of expected outcomes and components of the project;*

(i) Contribution to GEF programs long-term solutions

This project contributes to **GEF program CCM 1 - Promote Innovation, Technology Transfer, and Supportive Policies and Strategies, and it's Program 1 - Outcome A: Accelerate adoption of innovative technologies and management practices for GHG emission reductions and carbon sequestration.** The project is focused on the transfer of environmentally sound technologies and practices as a means to reduce, or slow the growth in, GHG emissions, and to stabilize their concentrations and contribute towards Myanmar meeting its climate change mitigation goals. The proposed technology and application is innovative within Myanmar's industrial development landscape and will serve to strengthen Myanmar's foundation for development and economic growth, helping to create or expand markets for greener industrial products and services, and indirectly support green jobs following a transition to sustainable and greener industrial development.

The project also contributes to **CCM2 – Demonstrate Systemic Impacts of Mitigation Options, and it's Program 3 – Outcome B: Policy, planning and regulatory frameworks foster accelerated low GHG development and emissions mitigation.** Through component one of this project, support will be provided to create an appropriate enabling environment for sound industrial wastewater treatment by strengthening relevant policies, the regulatory framework, institutional and industrial sector awareness raising and capacity building to catalyse and ensure the sustainability of the transfer of innovative technologies for climate change mitigation.

As the industrial sector of Myanmar is expanding, this project seeks to support innovation and technology transfer at an earlier stage than is possible compared to, waiting and hoping for Myanmar to overcome the barriers to implementation of environmentally sound technologies. Through component 2 the project will help address elevated risks associated with innovation and mitigate the barriers of technology transfer and to pilot a promising approach to wastewater treatment and energy generation. The proposed technology will reduce the global warming potential (GWP) of industrial activities and demonstrate the transformational potential that are not yet fully commercial and market ready in Myanmar.

(ii) Development objective and project strategy

Myanmar has a growing economy and industrial sector. However, if economic productivity is not decoupled from environmental pollution, degradation and resource depletion, Myanmar will face extreme negative environmental and socio-economic impacts, threatening the prosperous development of its people and ability to withstand the intensifying impacts of climate change. As such, the development objective of this project is to support Myanmar with its transition from a linear industrial development model to a sustainable industrial development model. This project will address one of many of Myanmar's industrial development challenges – low-emission and cleaner wastewater treatment.

This project was conceptualized and put forward as a result of on-going projects by UNIDO. It was realized that the unique expertise of the private sector, its capacity to innovate and produce new technologies and its financial leverage can form an important part of the multi-sectoral partnership that is required between governmental, private and non-governmental actors to mitigate climate change. In particular, the unknown issue concerning methane released from untreated wastewater in open ponds requires urgent attention. If properly quantified, the methane emission from open ponds around the country pushes the carbon dioxide emission per capita of the country to even higher level.

Over the last decade, UNIDO has developed and implemented TEST programs to address water pollution caused by productive activities. A more detailed description of the TEST Methodology is provided in Annex P. This integrated approach aims to initiate a cycle of continuous improvements in industries ensuring that preventive strategies to reduce

environmental pollution from the generation sources, adoption of good practices, and environmentally sound technology transfer are part of the growth strategy and business model in industries. The UNIDO TEST approach is summarized in the illustration below:

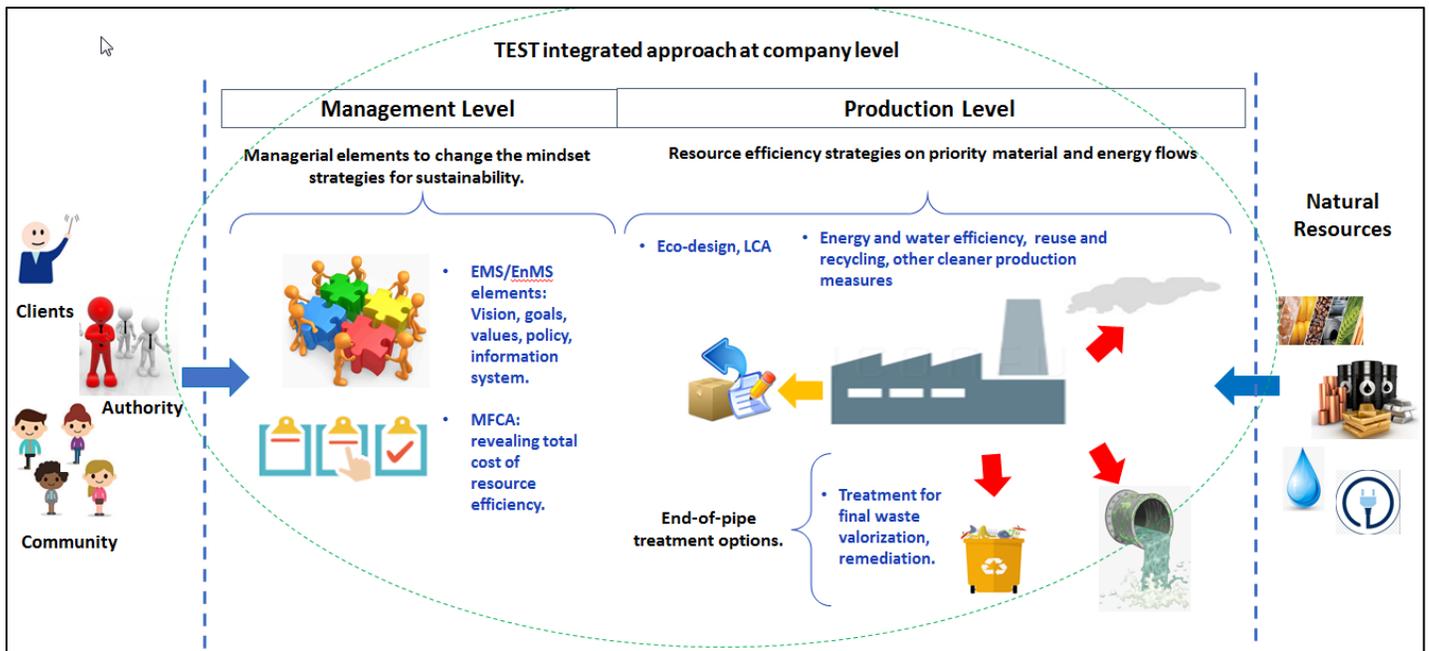


Figure 3: TEST Integrated Approach at Company Level

The TEST integrated approach in a company combines a set of strategies from different sustainable production tools. At the management level, it fosters a more in-depth knowledge of sustainable strategies and a strong commitment to using them. This approach enables managers to harness new market opportunities and enhance the relationship with relevant stakeholders. At the core of the production process, optimization measures by cleaner production and eco-design principles are used to minimize resource consumption and reduce emissions from generation sources. After waste streams have been reduced, installation and operational costs of waste treatment plants also decrease. Finally, the selection of the final treatment technology considers recovering the last potential value from waste as well as complying with more demanding standards in environmental regulation. The integrated approach used in this project seeks to optimize the use of wastewater treatment technology including biogas recovery for energy generation (heat or electricity) and take advantage of the opportunities for collaboration provided by industries located in industrial zones. Hence, TEST implementation will entail GHG emission reduction opportunities by resource efficiency in production processes and wastewater treatment technology with energy recovery potential, to be analysed as part of a comprehensive improvement process of industrial environmental performance.

The introduction of TEST by this project brings together (i) extensive capacity building and (ii) pilots in industrial parks and companies. The project will also build upon UNIDO’s previous capacity building activities in Myanmar by introducing necessary policies, economic incentives and awareness raising initiatives to encourage low-carbon industrial development in Mandalay and Yangon. In addition, effluents discharges will be monitored and technical assistance provided throughout the project.

Under the UNIDO RECP Pilot Programme funded by SECO, key project stakeholders and members of the project steering committee meeting, endorsed such initiatives as valuable, timely, and appropriate for the country and recognized the need for capacity building and technical assistance in this regard. Key barriers were highlighted including, lack of availability of wastewater treatment facility and wastewater management in industrial zones; limited access to information, technologies and finance, and policy regulatory uncertainty. In this regard, government officials will benefit from the project through strengthened capacity to lead the reduction of industrial polluted discharges and GHG emissions through sound wastewater management. Additionally, the project will target industrial zone developers, industrial park authorities and company representatives through their involvement in demonstrating technologies and practices in managing organic sludge in such a way that it has a positive impact on GHG emissions by generating biogas for electricity consumption. In return, the methane generated by the sludge and the electricity acquired through biogas can substitute the demand of electricity otherwise produced from fossil fuels, thereby reducing Myanmar's overall GHG emissions. The below scheme illustrates the targeted intervention areas under this project.

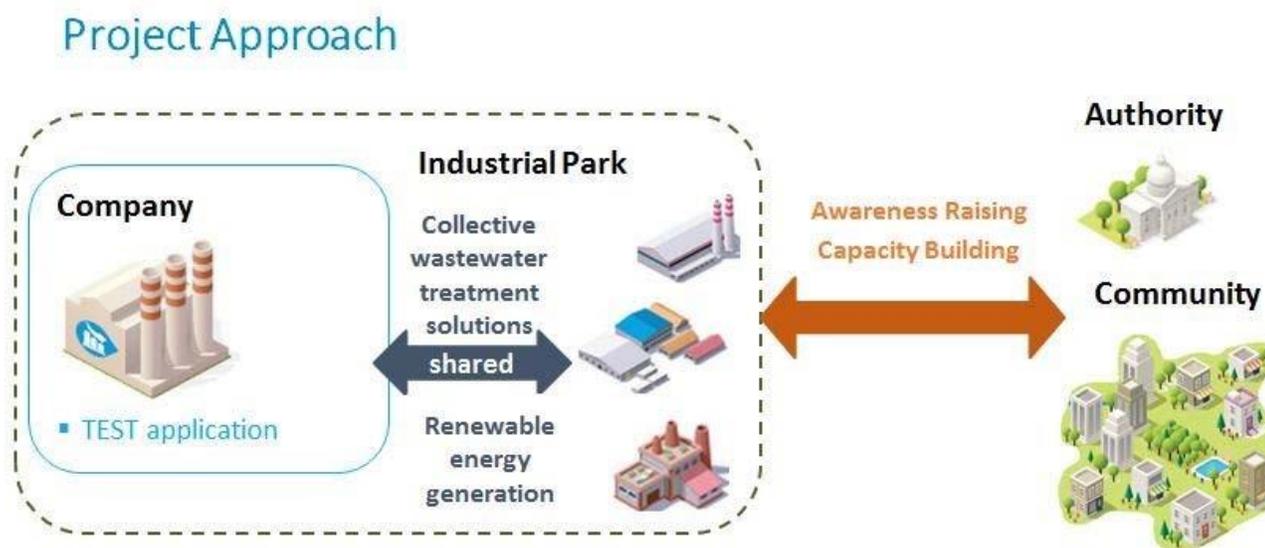


Figure 4: Project Approach

Selected industrial zones for potential pilot sites

The industrial sector in Myanmar is characterized by a high representation of the Food & Beverage sector, followed by the sectors of construction materials, clothing & wearing apparel, and mineral production (see table 2). 87 % of the registered companies are SME and 13 % are large companies. By 2016 industrial zones host approximately 15 % of the total registered industries (6800 registered units). The number of active businesses in the zones has declined in recent years due to the lack of an optimal business operating environment³². However, industrial zones development is still a core strategy for industrialization in Myanmar with a threefold objective³³: to generate employment, expedite the process of industrialization, and increase the efficiency and competitiveness with which the industrial sector operates.

Table 4: Registered Industries in Myanmar 2015³⁴ by subsector and size

³² Source: Industrial zone in Myanmar: Diagnostic, review and political recommendations. Bart Robertson, and Maureen Seng Taung. Friedrich Naumann STIFTUNG. July, 2015

³³ Source: Private Industrial Enterprise Law of 1990. Myanmar.

³⁴ Source: Ministry of Industry (2015)

No	Industry	Large	Medium	Small	Total	(%)
1	Food and beverages	2856	4677	19580	27113	60.93%
2	Clothing and apparel	502	616	1140	2258	5.07%
3	Construction material	718	933	1980	3631	8.16%
4	Personal goods	507	456	361	1324	2.98%
5	Consumer goods	140	84	70	294	0.66%
6	Literature and arts	50	145	150	345	0.78%
7	Raw goods production	184	181	182	547	1.23%
8	Metal and mineral production	322	520	1510	2352	5.29%
9	Agriculture machinery	13	25	35	73	0.16%
10	Industrial tools/equipment production	22	35	38	95	0.21%
11	Automobiles	103	38	23	164	0.37%
12	Electrical equipment	55	18	26	99	0.22%
13	Miscellaneous	225	862	5114	6201	13.94%
Total		5,697	8,590	30,209	44,496	
Composition by size		Large	Small	Medium	Total	
%		13%	19%	68%	100%	

Even though industrial zones face strong challenges related to infrastructure, management, and lack of incentives, they provide more favourable business conditions. The Myanmar Micro, Small, Medium Enterprise Survey 2017 found that those firms located inside an industrial zone make almost double the amount of revenue per employee than firms outside of industrial zones and that more productive firms choose to locate in industrial zones. The project will be addressing barriers related to the planning process for improving industrial zones potential to provide more integral and sustainable services in wastewater management, as well as access to technology and technical assistance to bring solutions on this subject.

The selection process of the industrial zones to carry out the project's activities is described in **annex N**. Industrial zones were selected based upon a number of objective criteria which broadly included: i) previous initiatives and strategies developed by local stakeholders to raise awareness in wastewater management challenges; ii) size of industrial zones in regards to both physical land area and number and size of factories; iii) physical characteristics of the sites, use of water sources, availability of land for wastewater treatment plants, general absence of wastewater treatment and scale of the wastewater related environmental issues; and iv) wastewater effluent attributes such as quality and quantity and suitability for methane capture and use.

The Project for "Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar" developed by JICA (2015- 2018) in close coordination with MCDC, YCDC and ECD³⁵, provided an important background creating national capacities related to water environmental management. Among the project's activities, a database of wastewater quality from main industries in 7 industrial zones was developed. Taking this context into account and the criteria mentioned above, 4 industrial zones are selected as priority for this project:

- Yangon region:
 - o 1) Hlaing Thar Yar, 2) Shwe Pyi Thar and 3) Shwe Lin Ban.

³⁵ MCDC: Mandalay City Development Committee; YCDC: Yangon City Development Committee; ECD: Environmental Conservation Department of the Ministry of Natural Resources and Environmental Conservation.

- Total of industries (for 3 IZs): 1,140
- Mandalay region:
 - 1) Pyi Gyi Tagon
 - Total of industries: 1,384

The food and beverages industry accounts for around 61% of the industrial activity in Myanmar and due to its high level of pollution and the organic material contained in untreated wastewater, the food processing industry is considered as one of the principal targets of the project. In addition to food processing industries, textile-dyeing, pulp & paper, and leather/tannery industries are also considered. Other sectors such as distilleries and sugar mills account for important wastewater flows and organic loads; however most companies of these sectors were recently closed down, with no clear prospect of their future operation. Companies of these two sectors have the potential of installing on-site wastewater treatment facilities. Therefore, the involvements of distilleries or sugar mills will be further analysed in case the operations restart during the course of the project.

In order to target the most suitable pilot sites for WWTP using biogas and companies for TEST demonstration projects, a team in Myanmar circulated questionnaires and collected water quality data from companies within the selected industrial zones. The selection criteria included identification of companies that have wastewater discharges that could contribute to a potential WWTP pilot site, and companies that could achieve high environmental benefits by the adoption of TEST practices (savings potential from raw materials, energy and water use).

Based on the data collected, a range of options for wastewater treatment were developed (as explained in annex N and annex G). The project will support the development of **1) options for medium to large scale closed system anaerobic digester technologies (centralised waste water treatment with potential for biogas) where applicable;** and **2) options for small scale on site treatment where applicable.**

Selected industrial zones in Yangon

Yangon sites include Shwe Lin Ban Industrial Zone, Shwe Pyi Thar industrial zone (2,3,4) and Hlaing Tharyar Industrial Zone (1,2,3,4); identified in the map below.

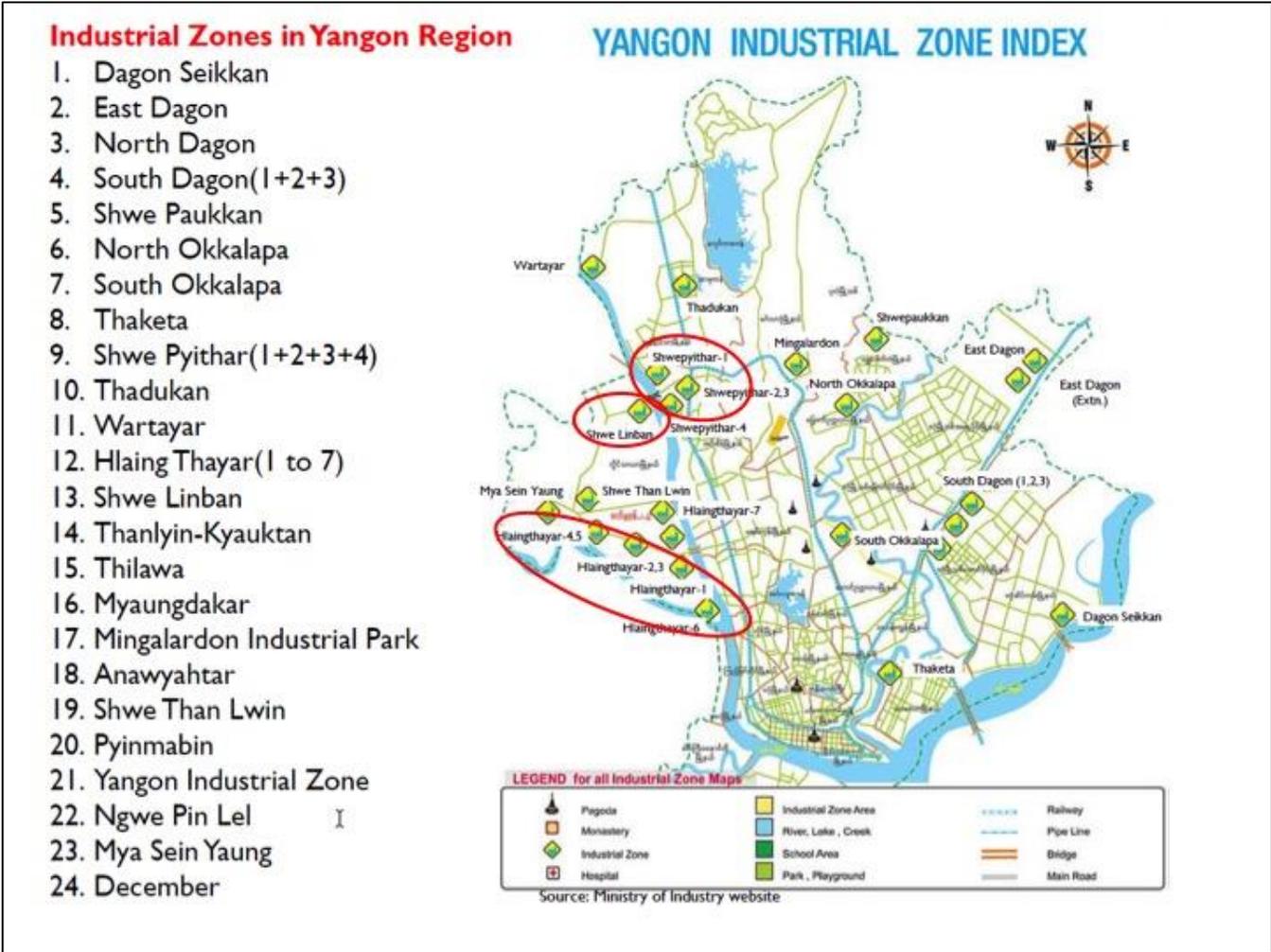


Figure 5: Map showing location of proposed Yangon industrial zones

➤ **Shwe Lin Ban Industrial Zone**

Shwe Lin Ban Industrial Zone, the fourth largest industrial zone in greater Yangon, has been identified as a potential site for the pilot demonstrations. Shwe Lin Ban has been in operation since 2002 and is currently hosting 297 factories mainly producing food and beverages, textile and household goods. Some factories treat their wastewater before discharge with very basic treatment systems; however the majority release their effluents without any treatment. All wastewater is left for natural treatment in one stabilization pond and subsequently discharged into Hlaing River. The distribution of companies per sector is shown in the pie chart below.



Figure 8a: Map of Shwe Pyi Thar Industrial Zone (2,3,4)

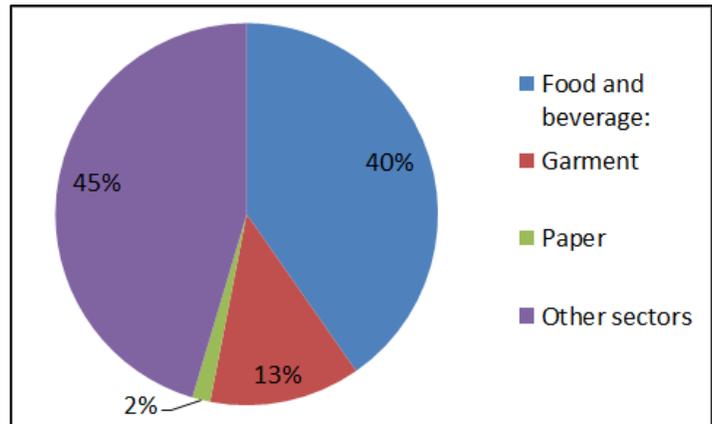


Figure 7b: Industry Sector and number of companies in Shwe Pyi Thar Industrial Zone

➤ Hlaing Tharyar Industrial Zone (1,2,3,4)

Hlaing Tharyar Industrial Zone (1, 2, 3, 4) was established in 1995. These industrial zones are bounded by Hlaing River in the east, Shwe Than Lwin Industrial Zone in the west, Pan Hlaing River in the South, Yangon Patheingyi Road in the north. The total land area is 1,401.98 acres in which the factories occupy 1,087.98 acres. There are 707 factories operating in Hlaing Tharyar Industrial Zone (1, 2, 3, 4). The factories mainly produce food and beverage, and garments. The sectors in Hlaing Tharyar industrial zone (1, 2, 3 and 4) are shown in the graph below.



Figure 8: Map of Hlaing Tharyar Industrial Zone (1,2,3,4)

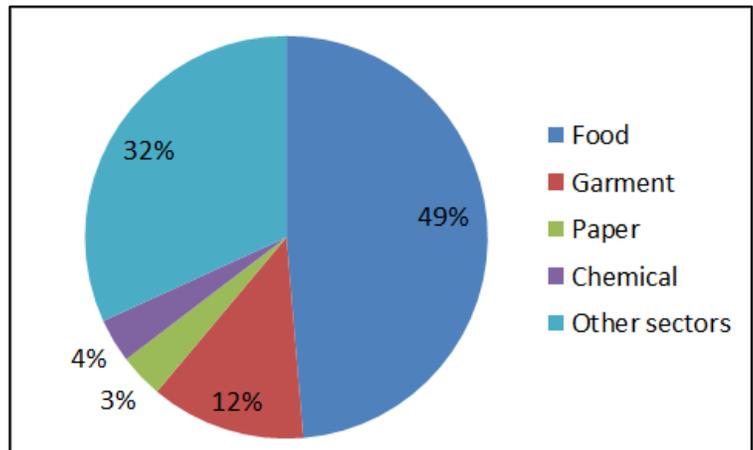


Figure 9: Industry Sector and number of companies in Hlaing Tharyar Industrial Zone (1,2,3,4)

Selected industrial zones in Mandalay

➤ **Pyi Gyi Tagon Industrial Zone**

In the area of Mandalay, the industrial zone Pyi Gyi Tagon was selected for the pilot sites of the project. It is comparable in size with the total size of industrial zones in Yangon. The current wastewater treatment facility consists of one pipeline that collects a portion of the wastewater discharges, one stabilization pond, as well as other individual discharging points. Pyi Gyi Tagon industrial zone is shown in red in the map below.

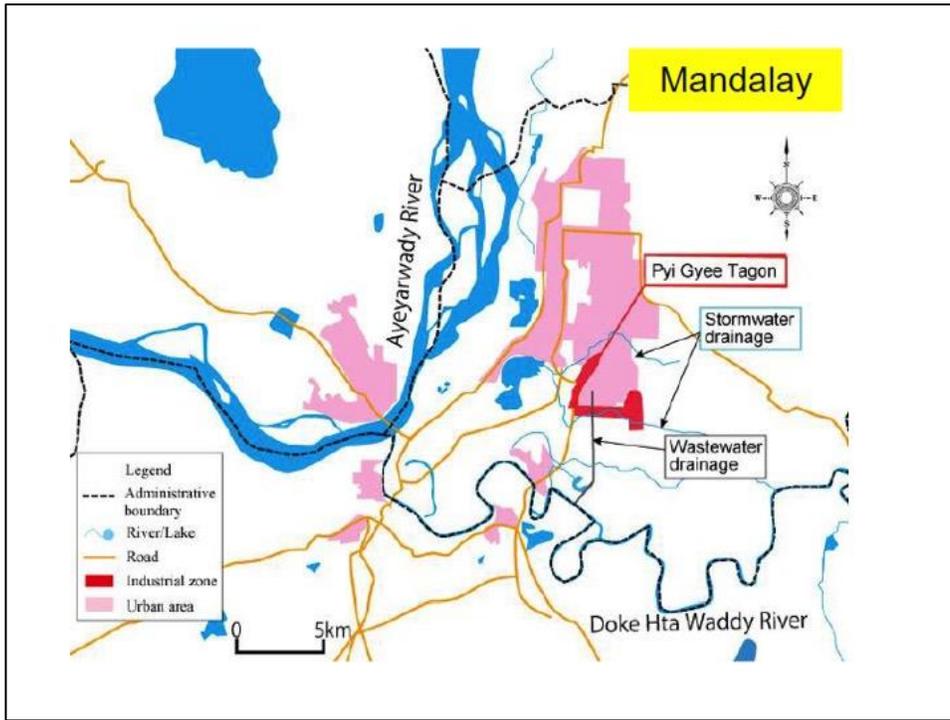


Figure 10: Map showing the location of Pyi Gyi Tagon industrial zone in Mandalay

The factories mainly consist of domestic materials or other industries with a small number of food and beverage, tannery, garment and paper shown in the graph below.

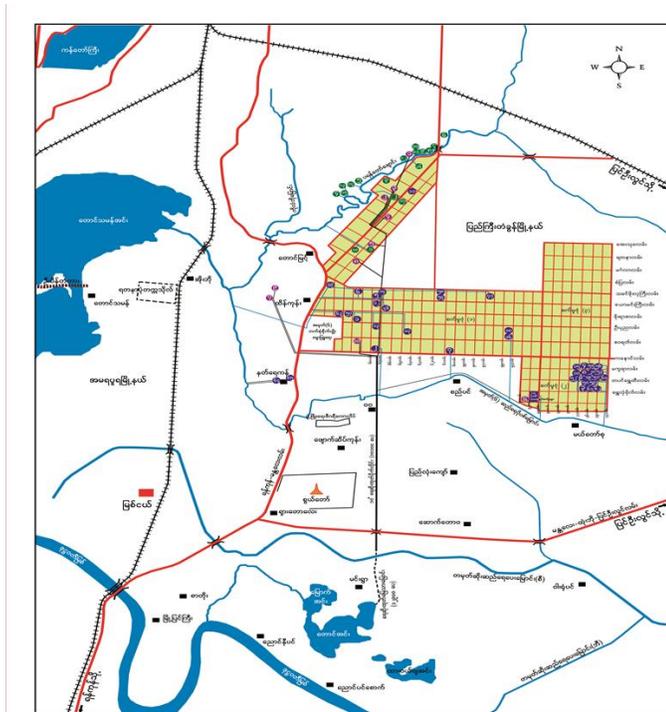


Figure 11: Map of Pyi Gyi Tagon industrial zone

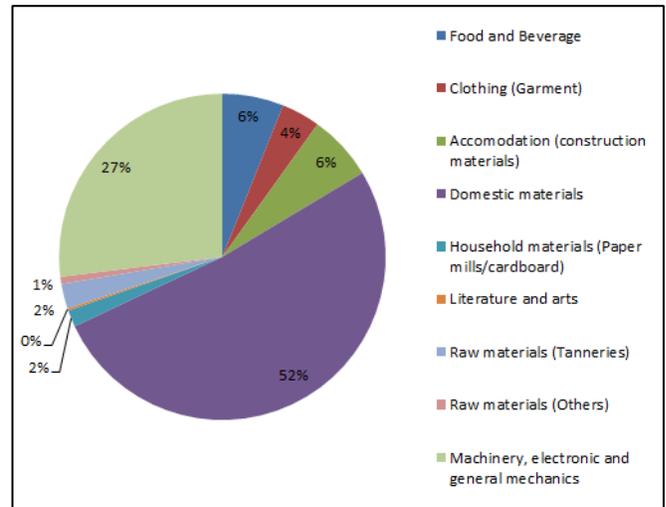


Figure 12: Industry sector and number of companies in Pyi Gyi Tagon industrial zone

(iii) Project components

Considering the development objective and project strategy outlined, the project is comprised of three interrelated technical assistance and investment components outlined below.

Component 1 -Policy framework and national capacity for water quality and wastewater management improved	Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach	Component 3: Monitoring and Evaluation
<p>Outcome 1.1: National capacity for promoting greenhouse gas emission reduction strengthened by an improved institutional and policy framework on water quality and wastewater management.</p> <ul style="list-style-type: none"> • Output 1.1.1: Wastewater regulatory framework reviewed, policy tools identified and introduced, and institutional capacity on sound wastewater management strengthened; • Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane recovery power generation technology strengthened by TEST capacity building program. • Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented 	<p>Outcome 2.1: Greenhouse gas emissions from industrial effluent discharges reduced through demonstrated pilots at company and industrial park levels implementing TEST approach and procured WWTP and biogas technologies</p> <ul style="list-style-type: none"> • Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions. • Output 2.1.2: Demonstration and investment in integrated wastewater treatment and biogas plants, including the delivery of procurement and monitoring support 	<p>Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation.</p> <ul style="list-style-type: none"> • Output 3.1.1: M&E mechanism developed and applied.

Figure 13: Project Components

Component 1 - Policy framework and national capacity for water quality and wastewater management improved.

Outcome 1.1: National capacity for promoting greenhouse gas emission reduction strengthened by an improved institutional and policy framework on water quality and wastewater management.

Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened.

Myanmar has already established a comprehensive legislative framework in particular under the before mentioned Environmental Conservation Law with Section 15 & Section 16, Rules 42 (a) and (b) focusing on wastewater management. Since the law was only passed in 2012, Myanmar lacks an adequate monitoring system as well as regulatory framework. The project seeks to streamline and strengthen relevant existing policies to ensure low carbon growth. Under the broad umbrella of resource efficiency, existing policies and legal provisions will be assessed and policy assistance will be provided in the area of wastewater regulation, as well as by identifying regulatory measures that can be developed in the context of: i) Cleaner production as a tool to reduce raw material use, GHG emissions and pollution loaded effluent discharges; ii) Chemical management and pollution prevention; iii) Waste minimization through the reduction, reuse and recycling of raw material, energy and water.

As such, this output will strengthen the regulatory framework and institutional capacity of the Ministry of Natural Resource and Environment Conservation. MoNREC, through the Environmental Conservation Department (ECD) will act as the Project Execution Entity of this output. Furthermore, the project will engage with the Ministry of Construction

and the Ministry of Industry to raise awareness on the national legal framework provisions and international good practice examples of sound wastewater management as well as develop and implement regulatory measures and tools that are needed.

In addition to wastewater and water management related policies, principles of differential pricing may have to be explored based on the economic context. Cost-recovery from users, especially in industrial zones, is an important mechanism for financing water resource management. The recycling and reuse of water after its treatment process should hereby meet specific quality standards and could also be incentivized through a properly planned tariff system.

Integration of gender considerations and guidelines in the development process plays an important role in outlining gender in every aspect. In line with Myanmar National Climate Change Policy, Strategy & Action Plan (NCCP and MCCSAP 2017-2030) activities, the MoNREC has to produce policies and strategies with a gender perspective. The project will include gender aspects in national policies and strategies to be promoted, and will engage women participation in technical meetings and consultation workshops that will be required during activities under this component. The expected woman share for these activities is 34 % considering women representation in industry and public administration³⁶.

To achieve output 1.1.1, the following activities are planned:

Activity 1.1.1.1 Assessment of current industrial legal and regulatory measures, urban planning processes and policy frameworks on water quality and wastewater management;

This involves a detailed analysis of policies and regulations affecting water and wastewater management from the industrial sector, including urban planning processes needed, to identify gaps and improvement opportunities. This activity will be executed by ECD in close coordination with other relevant ministries and departments (national and municipal level). The project will provide technical assistance to review and make recommendations on areas for strengthening industrial legal and regulatory measures, urban planning processes and policy frameworks on these subjects. In coordination with existing support provided by WWF and JICA to ECD, the project may also support the review of the regulatory enforcement framework for wastewater effluent discharge. The analysis will also include identification of possible regulations to introduce user-pay and polluter-pay principles in terms of wastewater treatment, as well as the introduction of resource efficiency promotion policies and/or regulations.

Working alongside the Ministry of Planning, Finance and Industry, private and public financial institutions, and relevant ongoing initiatives such as WWF's Tha Bar Wa project and GIZ's Banking and Financial System Development project, the analysis will also explore pertinent barriers to accessing finance for wastewater and biogas plants and provide recommendations for financial sector reform. The recommendations may also include possible financial incentives for technology transfer such as tax incentives and financial support for biogas operations. Assessments on policies and regulations affecting water and wastewater management from the industrial sector will address gender concerns by incorporating gender analysis, to strengthen gender approach in policy.

Activity 1.1.1.2 Strengthen regulations on sound wastewater management and identify policy tools needed on a national and municipal level;

Based on the previous assessment, a draft roadmap proposal for strengthening identified and prioritised regulations on sound wastewater management will be developed. ECD's project team will select one policy tool or regulation to be improved based on international best practice experiences customized to the Myanmar context. The project will develop a proposal to be drafted and consulted for submission to the government. The selection will emphasize enforcement

³⁶ Source: Annual Labour Force Survey 2017, MOLIP. Men and women representation in employment, Industry and Public administration and defense categories.

framework strengthening and the potential introduction of regulations for user-pay and polluter-pay principles in terms of wastewater treatment. Particular emphasis will be given to incorporate gender mainstreaming in the development of the proposals. All working groups/ committees established to contribute, supervise and monitor the roadmap development will target a participation of at least 30% of women.

Activity 1.1.1.3 Assessment of alternatives for public-private business models for construction and maintenance of wastewater infrastructure development;

Through private sector engagement and participation, alternative models for the construction and maintenance of wastewater infrastructure will be developed with a view to reduce GHG emissions. The suggested alternative models from private sector collaborators would be assessed based upon robust criteria. Results of the assessment would be communicated in consultations facilitated by the Myanmar Industries Association (MIA). The MIA would play a critical role in promoting and coordinating the opportunity to submit alternative models for the construction and maintenance of wastewater infrastructure supporting GHG reductions from industrial zones in Myanmar. The assessment will identify opportunities for SMEs and entrepreneurs, placing emphasis on equal representation of women. The public-private business models will also address the necessity to reduce exposure to harmful wastewater effluent in order to reduce negative externalities on workers and affected populations, particularly marginalized groups.

Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane harnessing technology strengthened by TEST capacity building program.

This output will build on national and international experiences to provide a capacity building program addressed toward public and private sectors, to strengthen national capacities for attending the urgent needs of resource efficiency and wastewater management. By tackling this subject under the TEST approach, the capacity building program will facilitate the adoption of a more sustained decision-making process to improve environmental performance in the long term. Activities under this output will be developed in parallel and close coordination with activities under output 1.1.1 and output 2.1.1 and liaise with other initiatives. A set of training materials will be developed. Training under this component will be provided to two key groups:

- **Training of governmental officials:** Creating capacity among public institutions representatives will support the introduction of sustainable industrial development principles in policies and regulations tools to be developed under output 1.1.1, as well as provide technical know-how on wastewater treatment alternatives and management options to be promoted by public instruments.
- **Training of service providers and industry:** Creating capacity among private sector organizations, industrial sectors, industrial zone administrators, and service suppliers, expects to motivate the adoption of better practices and technologies, generating a critical mass of knowledge that drives demand of these options.

This output will be executed by the DUHD of the Ministry of Construction as Project Executing Entity. DUHD will liaise with the Directorate of Industrial Supervision and Inspection (DISI) of the Ministry of Planning, Finance and Industry. DUDH, in close coordination with DISI, will identify other technical partners that can contribute with the following activities, and promote an alliance with Myanmar Industrial Association (MIA) to facilitate collaboration with industries. DUDH, as project execution entity, will ensure the recruitment of international or national experts to provide specialized training. Women empowerment will play a role in Output 1.1.2. The project will engage women participation in all training activities, which expect to reach approximately 400 direct participants with an overall 30% of women representation. More specific gender share per activity was adjusted to the main audience of each activity and regions based on the Gender Assessment Report (annex R). The activities under this output are as follows:

Activity 1.1.2.1 *Prepare capacity building program material on TEST and train a pool of national consultants and Government officials*

This activity aims to create a critical mass of human resources to provide technical service on the TEST methodology to industry and support public initiatives. A group of national experts (internal or external to an entity selected as technical service provider) will be engaged, giving priority to the fields of engineering, environmental management, and wastewater services, among others that can be strengthened by the capacity building program. A second selection will be made from this pool of professionals to obtain a more specific group of national consultants that can provide technical assistance to industries in TEST demonstration projects under the output 2.1.1. The project will promote professional women participation targeting at least 30 % of this pool of national experts.

One training-of-trainers (ToT) course on the TEST methodology will be delivered to the pool of national experts. DUHD, in coordination with UNIDO's project manager, will recruit an international expert to deliver the course. As RECP is at the core of the technical identification and evaluation of more effective measures to reduce the negative environmental impacts, emphasis will be given to the RECP component during the training. The training will have a theoretical part delivered in face-to-face training workshops accompanied by pilot in-plant-assessment in selected companies where the national consultants will implement the knowledge acquired with support from the international expert.

Taking advantage of the ToT, the technical service provider will collect all materials and adapt them to prepare a consolidated set of tools to be used in the project's activities. This action will include: i) general guidelines to apply TEST in Myanmar industries; ii) selected presentations and case studies for training sessions; iii) set of recommended tools to be applied during in-plant-assessments on demonstration factories and its reports; and, guidelines on different impacts of wastewater by gender and vulnerable groups concerns. A dedicated section of the ToT course should include training materials that raise awareness and deliver strategic information to address gender challenges in industry. This material package will be available in English and Burmese and will be used as a reference for the rest of training activities and technical assistance in TEST demonstration projects.

Governmental officials from DUHD, DISI, DRI and ECD will be invited to participate in the ToT (theoretical part). Their participation will be part of the capacity-building program for the public sector and will engage them in the promotion of preventive strategies in national and local policies and incentives.

Activity 1.1.2.2 *Deliver general training on introduction of the TEST integrated approach and RECP to industry and key stakeholders.*

This activity will deliver training workshops targeting the manufacturing sector to increase know-how on RECP methodology and provide an introduction of the TEST integrated approach. Training will be extended to participants from the city development committees, and other relevant public officers from DISI, DRI, representatives from business associations, industrial zones administrations, financiers, and related local professionals. The objective of this training will be: i) provide technical background to motivate the adoption of these methodologies by industry; ii) create capacity at local level to disseminate the relevance and benefits of this approach; iii) promote collaborative efforts to find joint solutions to wastewater issues and other relevant environmental impacts from industry; and iv) provide knowledge on different impacts of wastewater including gender and vulnerable groups concerns, and good practices.

These training actions will build on national capacities created through activity 1.1.2.1, taking advantage of the adapted material and the pool of consultants trained by the executing partner. The workshops will serve to encourage the participation of companies in the TEST pilot projects (output 2.1.1) and will serve as a kick-off event to launch the technical assistance by regions. The female gender share of the participants is targeted at 30 %.

Activity 1.1.2.3 *Deliver a general training on low-cost industry wastewater treatment, methane recovery technology for energy generation and wastewater management on industrial zones.*

This activity will strengthen public and private capacities to tackle wastewater management issues of industrial zones and industry in general. The training will target government officials from relevant Ministries, city development committees, industrial organizations, technical suppliers, industrial zone managers and industries from priority industrial zones.

Training modules will be delivered covering the following subjects: i) planning on spatial zoning, infrastructure and utility services to improve wastewater management in industrial zones; and ii) best available technology for wastewater treatment and methane harnessing for heating or electricity considering the primary sectors in Myanmar and the energy potential of their wastewater flows.

Technology options to be addressed in this training will be adapted to the primary sectors and industrial zones context by region. A specialist team will deliver this activity; the specialists will conduct an initial revision of the local context to adapt the training to the national and regional background.

The female gender share of the participants in the training is targeted at at least 20%. The training venue will be organized in collaboration with the Industrial Zone Management committee of each industrial zone.

Activity 1.1.2.4 *Conduct trainings on Environmental Management Accounting (EMA) and Environmental Management System (EMS);*

This activity will provide a complementary capacity to the private sector (and other relevant stakeholders identified in activity 1.1.2.2) for continuous improvement of its path toward a more sustainable industrial development under the TEST approach. A selected technical service provider will design training on EMS and EMA with support from national or international experts, as needed. Each subject will be delivered in separate training program addressed to participating industries in TEST pilot projects (output 2.1.1) and other relevant professionals from public and private sectors. These training workshops will be delivered per each batch of companies applying TEST projects to enhance the sustainability of their actions beyond the project. The project targets a 20% participation rate from women in the trainings.

Activity 1.1.2.5 *Conduct training on planning for climate change for government officials from YCDC and MCDC*

As administrative bodies with wide-ranging responsibilities including city planning, land administration and urban development, the city development committees of Mandalay and Yangon play a fundamental role in the implementation of the sectoral action plans of the recently developed Myanmar Climate Change Policy and Myanmar Climate Change Strategy & Action Plan (MCCSAP) 2017-2030. Therefore, this activity aims at carrying out a set of training sessions to strengthen the local capacity to conduct action plans to tackle climate change mitigation and adaptation goals.

The detailed technical scope of training will be defined during the first year of the project in consultation with Yangon City Development Committee (YCDC) and Mandalay City Development Committee (MCDC). Considering the project's objectives, the training will likely include the following subjects related to planning process for climate change and management of industrial zones wastewater discharges:

- Integration of low carbon technology and climate resilient urban development options into legal and policy framework for urban planning and management at local level.
- Methodologies and tools to support the planning process and decarbonization of industrial zones understanding the specific needs of industries to operate efficiently as a basis for designing of infrastructure and logistics to ensure adequate utility services (freshwater resources, energy supply, and wastewater treatment and management).

- Vulnerability and risk evaluations as well as gender mainstreaming into city and industrial zone development plans for facing climate change.
- Different impacts of wastewater/ climate changes by gender and vulnerable groups, and good practices of climate-change.

For this activity, DUHD will liaise with the Myanmar Climate Change Alliance and the Ministry of Natural Resources and Environment Conservation to integrate this action in the regional efforts for implementing the MCCSAP 2017 – 2030.

Training materials will build capacity around the integration of gender mainstreaming into climate change mitigation and resilient programmes and project cycles. The DUHD engages in providing training to all relevant ministries to raise awareness on how to integrate gender into climate change-resilient programmes and project cycles. Therefore, the developed materials may highlight the contribution of wastewater management to the GHG reduction and transfer them as case study for the Ministry of Education and or relevant ministries. The gender share of participants is targeted at 50% or as close to as possible.

Activity 1.1.2.6 Carry out capacity building activities for local government to better tackle issues connected with wastewater treatment, including water supply and sanitation.

Local Government representatives play a key role in jurisdictional decision-making, project planning, implementation and maintenance of systems infrastructure. They also contribute knowledge and support that facilitate project outcomes. In parallel, knowledge and technical gaps at the local government level as they relate specifically to integrated wastewater treatment options, compromise the project outcome. To address this capacity gap, customized training will be developed to strengthen skills and knowledge in wastewater treatment systems in the context of securing GHG reduced emissions.

The capacity building will be delivered to officials of local Government of Yangon and Mandalay. The project will consult with the local governments to plan the trainings according to priority areas.

Key focal areas for training may include but are not limited to: climate change, industrial zoning and planning permissions, best practice and Business As Usual (BAU) scenario discussions, water supply, use and sanitation, river and public health, up and downstream river hydrology, properties of water, safe and unsafe thresholds, integrated wastewater treatment costs and avoided costs, environmental management systems, quantitative and qualitative data collection, industrial product substitution (i.e. using less harmful, less oxygen demanding chemicals in process), complementary carbon sequestration, closed loop on-site systems, end-of-pipe solutions, centralized wastewater treatment facilities, inflow and out-flow meter reading, smart metering and live readings, maintenance, sustainability (optimal performance over how many years), systems monitoring, reporting and continual improvement.

Capacity building is developed with a view to enable local governments to plan and manage wastewater much more effectively and by doing so, deliver positive knock-on impacts to women, local economic prosperity, environmental wellbeing and improved river water quality, and public health improvements. In addition, if a successful model is demonstrated, the integrated wastewater management solution would be taken up by many other districts and municipalities in the country.

In addition, as stipulated in the MCCSAP, the MoNREC (ECD) has to develop local-level institutional mechanisms to integrate climate change within the sub-national and local plan and activities. As such, the capacity building activities will include discussion on how to develop such mechanisms in a view of improved industrial wastewater management. Discussions will also include how to identify and address the links between gender and climate change in a sustainable manner under a local-level context. The gender share of participants is targeted to be at least 30% female.

Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented.

This output is designed to tackle the lack of knowledge on water pollution and resource efficiency by organizing advocacy and awareness raising campaigns, and will be executed by the ECD of MoNREC. As a result of the identified barriers in terms of low awareness of key stakeholder groups, the understanding of wastewater management needs to be increased in order to enable stakeholders to incorporate wastewater management into city planning and industrial processes. Furthermore, awareness raising of resource efficiency is also needed to support the prevention of GHG emissions and waste generation. These actions will integrate information on the consequences that a poor wastewater management generate for more vulnerable groups and gender concerns, incentivising women involvement. As in the previous component, an overall women share of 30 % is targeted for the dissemination and awareness raising events.

The activities planned under this output are:

Activity 1.1.3.1 *Conduct awareness-raising activities for industries, policy makers and civil society, to improve their understanding of wastewater management and the consequences of water pollution.*

A campaign and simple brand for engagement would be developed to support visual identification and traction. Informational material with key messages for each target group will be developed citing what industry, urban and policy sectors can do to avoid further degradation of river systems while also citing solutions for each that can greatly improve river health and its link with public health and future climate change contributions through GHG emissions. The material would be distributed across the industrial zone and other key locations. They will also address different short-term and long-term impacts by gender and by vulnerable group.

Awareness raising content will focus on water pollution and impacts locally, BAU and improved trajectories, sound water management for healthy communities, local economic, environmental, and social gains, sustainable development, climate change and resilience measures.

The project will identify and select a small group of industries, policy makers and civil society representatives to become champions in facilitating discussion and opportunities to collaborate on improving wastewater treatment and reducing impact on river health through behavioural change. Good practice for this Project will highlight the benefits of inclusiveness by ensuring champions diversity in gender, educational background and socio-economic status.

Activity 1.1.3.2 *Lessons learned and best practices will be disseminated through events, publications and outreach/educational materials.*

The project's interventions will result in a wealth of information and knowledge on approaches for resource efficiency and effective wastewater treatment of mixed industrial zones in Myanmar.

A communication strategy will be developed during the inception phase. It will include the development of a website and other material where project information and lessons learned will be disseminated. This activity will be conducted alongside activities of various ministries including MoNREC who is responsible under the MCCSAP to develop mass communication and dissemination strategy for communicating climate change to local communities with a gender-sensitive communications approach.

The types of lessons learned that may be of interest include: adopted processes, project rollout and time considerations, allocated budget and co-financing journey, available and applied technologies, data findings, stakeholder engagement, immediate results and expected benefits in the future and longer-term sustainability. Perceived and real barriers and project surprises will also be captured as value-added project lessons to share.

Lessons learned will be captured through an agreed mechanism for the duration of the project and consequently shared through a variety of means, including but not limited to: focus groups/meetings, reports, web links, photos, videos, case studies, dissemination events etc.

Materials for dissemination will be targeted at relevant local, national and international events, industry networks, policy working groups and academic conferences. Outreach and educational opportunities may focus on cultural or community events, in addition to school climate and wastewater programs.

Activity 1.1.3.3 *Develop awareness raising material on the integrated TEST approach, and a training manual on sound wastewater management for use in relevant vocational training centers and institutes*

Training material will be developed to focus on fostering a shift towards effective and integrated wastewater management. Project beneficiaries and beyond, may develop an interest and career aspirations to work in the wastewater sector based on visibility and profile of the project and associated results. General awareness raising on the TEST approach, supported by a manual on sound wastewater management delivered through vocational training centers or institutes, would be beneficial in capturing a variety of professionals and interested parties along the water management spectrum. ECD, as executing entity of this output, will coordinate this activity with DUHD in order to establish a coordinated strategy to integrate the TEST approach and the industrial sector context in this material.

The project will encourage the partners, especially the industrial zone management committees, to develop training linkages with vocational training centres or institutes. All training conducted at the industrial zone will consider the participation of teachers/lecturers of vocational training centres or institutes or universities in the area. Besides the benefits in increasing interest and career aspirations in the wastewater sector based, the inclusion of this group will also reduce possible labour shortage in this field in the near future. Further collaboration between the private sector and the vocational training centres or institutes can be further developed for their students with the technical support by the project. Female teachers/ lecturers are particularly encouraged to join.

Transfer of Environmentally Sound Technologies (TEST) is an area of expertise that can be made accessible to all those interested in resource efficiency and effective management of wastewater, through awareness raising material. The material would be generic and accessible, reflecting various TEST solutions and settings for applicability. The TEST awareness raising material would offer basic insight into various technologies and contexts, in addition to relevant material around cost, pros and cons, and how to adapt a TEST project focusing on wastewater prevention and management.

A training manual on sound water management would serve the needs of those industry experts and new entrants seeking to understand the holistic and integrated facets of wastewater prevention, reuse, mitigation and treatment. Emphasis will also be placed on gender and marginalized groups concerns. These facets combined with the costs, governance, programming, available smart technologies, future possibilities, and the multiple co-benefits, would be incorporated to deepen expertise. The manual could also include real life case studies made from practical observations in addition to theory and summaries from experts.

Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach

Outcome 2.1: Greenhouse gas emissions from industrial effluent discharges reduced through demonstrated pilots at company and industrial park levels implementing TEST approach, and WWTP and biogas technologies

Under this component, the innovative approaches promoted by the project will be demonstrated at pilot scale at (i) company level and (ii) industrial park level implemented in selected sites located in Mandalay and Yangon. The Transfer

of Environmentally Sound Technology (TEST) integrated approach will assist enterprises to increase their environmental and economic performance. The technical and management improvements undertaken by these companies will then be used as examples during the dissemination campaign as part of the awareness raising activities outlined under Component 1. On the industrial park level, the project will assess existing or planned central wastewater treatment infrastructure and carry out feasibility studies for the application of low-emission technology and the use of the produced biogas for electricity and/or heat energy (either at the individual company level or multiple companies where feasible). This also delivers multiple co-benefits such as renewable energy and displacement of fossil fuels, odour control, and reduced chemicals in treated water allowing for safer discharge. DUHD of MoC, as the main partner of the project, is the project executing entity of activities outlined under component 2.

Company level intervention: The TEST approach combines management tools targeting various areas of intervention within industries, from the production process to the accounting and quality departments, and finally the strategic level. The combination of the management tools aims at initiating a cycle of continuous improvement where the top management of a company recognizes the importance of searching for resource efficiency and sustainable development, for the company benefit, but also for social and environmental benefits and realizing that these interests are not competing with each other. Industrial wastewater pre-treatment could be a further important contribution to reducing the strain on the centralized wastewater treatment facilities used in the industrial zone. Since the majority of companies do not treat their effluent before discharge, the industrial pre-treatment technology would result in a direct improvement to the quality of water.

Industrial zone level intervention: Several different anaerobic technologies exist and the identification of the most effective technology depends on the organic loading rate and operating conditions; technologies that could be assessed include: aerobic biological, physical-chemical and anaerobic biological treatment. The technology that could be applied for the pilot is a **closed type anaerobic reactor**, which was already successfully introduced in other food and agricultural processing industries, such as in Thailand. This offers energy efficient treatment of industrial wastewater characterized by low energy use, a small reactor surface area, lower chemical usage and reduced sludge handling costs.

Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions

Under output 2.1.1, activities include the identification and selection of the participating industries, and the assessment of pilot companies to improve their overall energy and environmental performance and reduce GHG emissions through the application of the TEST approach. The project will work with a representative group of companies that can generate successful case studies of the TEST benefits to be shared around the industrial zone to motivate other industries. According to administration committees of the selected industrial zones, there are 619 companies of industrial sectors with relevant wastewater discharges out of 1,384 enterprises in the 4 industrial zones³⁷. The project will endeavour to ideally cover between 5 and 15 % of these companies in each industrial zone; therefore, it is estimated that 10 companies will be selected in each zone in Yangon (three IZ) and 20 companies in Mandalay (one IZ) for a total of **50 pilot projects** of TEST application. The final distribution between industrial zones may vary based on the response and availability from the different companies during the implementation phase.

Along with the technical assistance to industries it is necessary to support access to financing of the TEST measures recommended for performance improvement. The project will work with a variety of local partners, including SME

³⁷ See more details in annex N, section 2.

Development Bank, SME Centers, local banks, Myanmar Industries Association and the Industrial Development Committee, along with other financial actors, in order to facilitate access to financial mechanisms available in the country.

Activity 2.1.1.1 Carry out an initial assessment phase to select a target group of 50 companies to be assessed on the TEST integrated approach as pilot projects.

The survey carried out during the project preparation phase gathered information to make a preliminary evaluation and identification of a group of sector and companies with high potential to implement low-emission technology related with wastewater and other resources. Activity 2.1.1.1 will build on these results to assess the final selection of companies that will implement an integrated strategy to improve their overall environmental performance by using the TEST methodology. As part of the efforts to select the participating companies, outreach activities will be conducted to inform a large group of companies about the project activities and raise interest for their participation. DUHD, in close collaboration with ECD, YCDC and MCDC³⁸, will work to link the selection of companies participating in TEST activities with the sites selected for the wastewater treatment demonstrations done under output 2.1.2. The target group of companies will be made up by those which: i) come from sectors with high representation of the manufacturing industry; ii) have confirmed high commitment from the upper management, iii) have large wastewater discharges; and iv) have potential to harness biogas recovered from wastewater treatment plants (centralized, partially centralized or small-scale systems).

Technical visits will be carried out in the companies that indicate their interest in participating in the project to identify their improvement potential for reducing costs and increasing resource efficiency, as well as determine the management priorities that can be supported by the TEST approach. The results of the initial assessments will be reported and presented to the top management to motivate their commitment to be part of the TEST pilot projects. At the same time, initial assessment reports will provide an overview of those companies with higher potential of success. National experts trained through activity 1.1.2.1 and coordinated by an executing partner will carry out the initial assessments. The PMU and the executing partner will promote an alliance with MIA and other industrial associations to help to contact potential companies. The result of this activity will be the final selection of 50 companies to implement TEST pilot projects and obtaining a formal commitment (for example through a participation agreement) from the top management of each company for their participation in the project.

The management of gender concerns in this activity will be done by gender data collection during the initial assessment, in order to gather a specific baseline on gender context in the potential companies. This information will be crucial for tailoring training components on gender issues during the capacity building and technical assistance process in industry.

Activity 2.1.1.2 Provide technical assistance to implement TEST tools at 50 selected companies as pilot projects, to improve their environmental performance and reduce GHG emissions.

This activity aims to provide technical assistance to industries to implement the TEST methodology and demonstrate its benefits. The implementation strategy for this assistance is made up of three key elements:

1. Assignment of external advisors to guide each company in the implementation of the TEST methodology. The advisors provide technical support and develop a comprehensive diagnosis of the enterprise and processes using the TEST tools.
2. Establish an internal team and designate a team leader in each company to be closely trained by the external advisors. The company team is the leading actor in the diagnosis process providing information, data collection and providing feedback into the improvement plan.

³⁸ DUHD (Department of Urban and Human Development, under the Ministry of Construction); ECD (Environmental Conservation Department of the Ministry of Natural Resources and Environmental Conservation); YCDC (Yangon City Development Committee).

3. A combined process of training and coaching activities in the company, alternating with implementation periods, to put in place all evaluation techniques and methods by the company team.

The project will provide the technical assistance through national experts trained in the first phase of the project (activity 1.1.2.1). Company teams will receive workshops on a set of TEST tools to be used in the following months with support from the external experts. The workshops will be designed following guidelines of the UNIDO TEST toolkit making the needed adaptation to meet national context conditions. As part of the TEST tools, the Material Flow Cost Accounting (MFCA) tool will be applied, and an RECP assessment will be developed emphasizing in the primary material flows in each company, to in turn identify measures to reduce the use of energy, water, and relevant raw and operational materials. Other tools from Environmental Management Systems (EMS) or Environmental Management Accounting elements will be introduced for upgrading the company commitment toward a more sustainable business. Results of the technical assistance will consist of the following products per company:

1. Proposal for incorporating TEST principles in the business policies.
2. Prioritization of the relevant material flows by the MFCA tool application.
3. RECP assessment for root-causes and inefficiency analysis.
4. Saving measures catalogue-identifying options for reducing solid and liquid waste generation and GHG emissions.
5. Monitoring system recommendations.
6. Roadmap for implementing EMS or EMA as the next upgrading step of the company performance.
7. Integrated action plan approved by the high management.

During the RECP assessment measures identified to reduce the GHG emission and improve water usage and wastewater treatment possibilities will be further studied through feasibility studies under activity 2.1.1.3. Companies will receive capacity building support through the specialized trainings to be delivered by activities 1.1.2.3 and 1.1.2.4, to increase their capabilities to continue with the improvements beyond the scope of the project. Companies will be also encouraged to develop a plan to promote gender equality; this subject will be also included during training session.

This activity will be implemented in batches of 10-20 companies organized according to the industrial zone distribution and technical capacities availability. This activity will also identify suitable company level interventions including end of pipe/in-situ wastewater treatment technologies. Under Activity 2.1.1.3, technical assistance will be provided to support access to finance for these technologies.

Importantly during implementation of TEST, the project expert team will monitor and evaluate the outcomes of the application of TEST methodology to identify potential pilot sites for wastewater treatment plants. Technical and financial feasibility of selected potential pilot sites will be conducted under Activity 2.1.2.2 prioritizing those with higher impact at the industrial zone levels.

Activity 2.1.1.3 Assistance to companies to access finance for RECP investments.

As described in Annex J, the financial sector in Myanmar is still under-developed. However, there are important opportunities for strengthening in the near future in alliance with international financial institutions and focusing on the SME sector. The project will liaise with new financial initiatives that look for development of green credit lines to support investment related to sustainable consumption and production. As a result of the TEST application, a portfolio of investments in environmentally sound technologies will be identified in the targeted industries (activity 2.1.1.2) generating new demand for credits. Taking this opportunity into account, KBZ has been invited as one financial institution that can benefit from the project activities. As it is mentioned in their letter (see Annex O), this bank is developing mechanisms to support green finance that can be used for companies under this project including loans and supporting initial process steps to access other components of green finance.

Therefore, this activity will provide technical assistance to companies to access existing streams of finance or financial products such as credits, grants and guarantees. The project will provide advisors to support companies in the development of feasibility studies for selected medium or high cost measures identified during the TEST technical assistance and preparing loan applications for financial institutions. Feasibility studies are relevant documentation to support the investment in technology and facilities that support operational changes in industries. The assistance will consist of the elaboration of critical elements regarding the technical viability and requirements to put in place the measure (or group of measures) that reduces environmental impacts in a cost-effective way. The feasibility study will analyse the alternative options for success, costs, and revenues, as well as its performance in a defined return on investment and the effectiveness of the financing. Advisors will support the companies in the elaboration of these detailed studies and facilitate approaching financial institutions to submit loan applications.

Provided its technical and economic potential, this activity will give priority to those investments at company level on suitable low-carbon WWT projects including biogas recovery for energy production that could be identified under Activity 2.1.1.2, to support its access to financing mechanisms.

This activity will take lessons learned from and be implemented in close coordination with similar activities being implemented by Tha Bar Wa project. The project will seek to liaise efforts with financial institutions strengthened by Tha Bar Wa project in regard to green financing, as the primary (but not only) potential partners.

Business cases, lesson learned, barriers will be collected and documented from this experience, in order to analyse needs, improvement potentials and recommendations to continue improving the access to financial mechanisms for environmentally sound technologies in Myanmar.

Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants

This output involves the implementation of integrated wastewater treatment, including biogas recovery plants to:

- Demonstrate the productive use of organic components of industrial wastewater streams.
- Demonstrate the technical maturity and sustainability of the chosen technical or business models.
- Generate operational experiences for further optimization and as input for policy development and scaling up.

Output 2.1.2 encompasses the specification, procurement and construction of wastewater treatment and biogas equipment and auxiliary systems for at least one pilot site. GEF grant funding will be used as co-investment to improve the financial return on investment (where applicable) and reduce the risk profile of the pilots. Procurement of systems under a potential public-private partnership (PPP) will be done through a competitive tender conducted by DUHD. The contract modality

for WWT and biogas systems construction will be decided prior to each tender; preference will be given to modalities that minimize the technical risks for the Project, such as turn-key delivery.

During the implementation, the project's PMU will monitor and evaluate the outcomes of the application of TEST methodology by an expert team. As much as theoretically possible, the project team will try to identify TEST pilot companies that will also participate in the pilot WWT and biogas plants at industrial zone level. However, depending on the progress of TEST implementation and the companies chosen, some companies participating in the WWT and biogas plant pilots may not be implementing TEST.

Biogas plants will result in energy generation by methane capture and the integration of a biogas purification system and power generation unit. This energy is expected to be used for onsite consumption (off-grid electricity and heat utilisation as thermal energy). It is estimated from the GHG calculations within Annex I, that 83.6 MWh electricity and 87.78 MWh of thermal energy can be produced over the lifetime of the Project (20-year period). Onsite and off-grid consumption of electricity and heat produced from methane harnessed technology could have several uses at the final selected Industrial Zones based on agreements at the specific site. Scenarios for use of the electricity or heat may include but not be limited to: contribution to driving the WWT plant, consumption by relevant clusters (specifically those contributing to high organic loads in wastewater), or to company/household sale and distribution. According to national regulations, there is no possibility for the Industrial Zone to sell or return this renewable energy back to the national grid within the current context of Myanmar. The Ministry of Electricity and Energy (MOEE) has prohibited such actions based on a lack of stable and consistent electricity distribution systems.

While Myanmar's regulations related to distribution or selling of renewable energy on-grid is yet to develop, a number of scenarios can be analysed. For example, if one company seeks to sell to another company, it is incumbent upon the two companies to form a mutual agreement. However, if one entity (Industrial Zone or a company) seeks to sell the off-grid energy to another entity (group of companies or households), the seller must get permission from the regional government or from the MOE; regional or national level for this permission will depend on the generation capacity. The project will facilitate the submission of financial and investment related documents that are part of this process. Upon approval by the regional government or the Ministry, off grid renewable energy fees may be determined which is crucial for final financial evaluation. All of these aspects are part of a required dialogue at project implementation given the innovative nature of the Project and the lack of policy and procedures that normally facilitate such arrangements. In this regard, the project will build an important learning process that will contribute to the strengthening of the national regulatory framework.

On the other hand, the project will also facilitate cooperation with technology providers on wastewater treatment and biogas plants. Contractors shall include a training programme for operators in their offers, as well as extensive after-sales services and provisions for technical failure.

The contractor will add value to the project grants providing a number of technical assistance activities aligned with the investments as described below.

Relevant organizations of the private sector, such as the Myanmar Industries Association, will be engaged in various activities under this output including contributing to assessment, prefeasibility studies, selection of activities (sites, actors, PPP partners) and business model development.

The project will take a gender-sensitive approach during the design, procurement, construction and operation of the demonstration plants. In particular, the project will take a gender-sensitive approach in respect to the impact of the project on neighbouring people and formal or informal workers in the waste sector (in particular potential adverse impacts on women, children and marginalized communities).

By the time of project closure, it is expected that: (i) at least one pilot WWTPs and biogas harnessing systems will be in operation and technically reliable; (ii) a pipeline of additional WWTP and biogas projects has been identified, with technical support provided and investment capital mobilized; and (iii) lessons learned from pilots have been documented and disseminated.

The activities are as follows:

Activity 2.1.2.1 *Develop a wastewater quality monitoring system, including on-site measures;*

This activity aims to carry out wastewater quality monitoring in a two-staged approach. Firstly, to determine the final sites for the wastewater treatment demonstrations. In order to do this, monitoring of main discharges points from the industrial zone will help identify or strengthen future plans for wastewater treatment. Secondly to carry out wastewater quality monitoring of the selected companies that will participate as pilots in the projects.

The first stage will include developing a wastewater effluent data collection and monitoring system at the industrial zone level installing automatic samplers at the selected locations after the preparatory works, which permit their installations, and laboratory testing measuring the physical parameters such as pH, conductivity, turbidity and Oxidation-Reduction Potential (ORP). Wastewater influent and effluent data collection and monitoring will be established at industrial zone level and selected sites to develop WWT and biogas plant demonstration projects.

Sample parameters will be analyzed in selected laboratory or public institutions, such as the Department of Research and Innovation (DRI). Specific institutions will be selected as recipients of training, based upon criteria including capacity needs assessment to inform training activities outlined below. Monitoring of the qualities of industrial wastewater includes common parameters such as: pH, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Total Dissolved Solids (TDS) and Total Suspended Solids (TSS). The wastewater quality monitoring will also take into consideration the location and level of risk exposure to different gender and different groups of people.

Water quality monitoring conducted at IZ level will inform activities involving wastewater policy review under Activity 1.1.1.1 and inform evidence-based policy recommendations made under Activity 1.1.1.2 to strengthen regulations on sound wastewater management and identify policy tools needed on a national and municipal level. The second stage of wastewater quality monitoring will be integrated into Activity 1.1.2.3 and Activity 1.1.2.6 through the capacity building programs on low-cost industry wastewater treatment and wastewater management in industrial zones.

Activity 2.1.2.2 *Develop technical and financial feasibility studies of the selected pilot projects for wastewater treatment applying biogas harnessing technology;*

Under this activity the technical and financial feasibility of potential pilot sites will be conducted. The project team will select a number of potential participating factories and technical options based on the monitoring conducted under 2.1.2.1 and other evaluations conducted during the implementation of the TEST methodology and other activities of the project. A specialist firm will then be contracted to conduct all relevant pre-investment studies in order to confirm investment values and all technical requirements to implement the pilot WWT and biogas plants for 3 or 4 specific sites. Based on the final investment required, the technical feasibility and the co-financing provided by local partners, DUHD, as partner executing entity of this component, will propose the final pilot sites at industrial zone level and define whether relevant factory-level demonstration wastewater treatment plants could be also considered. Approximately three or four industrial zone level interventions will be assessed, most likely consisting of centralized wastewater treatment plants for clusters of factories of the same industry type e.g. food and beverage, textile etc. or those with suitable wastewater for biogas recovery with similar wastewater qualities suitable for combined treatment. The majority of finance necessary for construction of the pilot sites will be covered by project developer equity (leveraged with loans) and GEF investment grants for the

procurement of WWTP and biogas equipment. However, where additional finance is required the project will assist project developers to access finance. This may include facilitating the sharing of information with local financial institutions (FIs) or IFIs and working in partnership with Tha Bar Wa project and financial institutions. The project will also provide assistance to access other sources of grant funding or guarantees offered by other development partners.

Reduction of N₂O emissions from wastewater treatment systems can be increased through improved plant design and operation. In order to target N₂O emissions from the wastewater treatment process, the project will endeavour to ensure international best practice (suitable for Myanmar application) is employed to reduce N₂O emissions from the wastewater treatment plants.

Activity 2.1.2.3 Investment in the selected wastewater treatment and biogas pilot plant(s).

Based on the technical and feasibility studies prepared in Activity 2.1.2.2 at least one pilot project for wastewater treatment applying biogas harnessing technology will be selected. Prior to construction of the pilot plant, the project will facilitate assistance for agreeing on a feasible business model among the partners to operate the selected pilot plant(s) (such as public-private partnership, PPP), and developing the administrative arrangements needed to put in place the procurement and construction phase. In addition, an operational guideline for using the project's funds will be developed taking into account the UNIDO and GEF rules, in order to clarify the responsibilities and procedures to manage the project grant disbursements and reports. The investment costs and technical parameters for two potential WWTP with Biogas are provided in Annex G.

A competitive tender will be put in place for the system construction by DUHD. Terms of Reference, tender specification and technical evaluation for contracting of an engineering firm to design and construct the plants will be prepared for the bidding process. A committee, consisting of the investment partners, DUHD and UNIDO, will be established to approve the tender specifications and will take part of the technical evaluation for selecting the engineering firm. Prior to the construction phase, the committee will define a monitoring mechanism to verify the progress of the construction in line with the work and investment plan.

Additionally, the project will also provide technical assistance for a) the development of an Environment Impact Assessment (EIA) and other required permitting procedures and b) the supervision of the work plan and fieldwork for installation and setting up of wastewater treatment technology.

Activity 2.1.2.4 Provide technical assistance to support the implementation of the selected wastewater treatment and biogas pilot plants.

During the project preparation phase a lack of exposure to wastewater treatment and high-tech, large-scale biogas technology was identified. The project preparation phase also identified the need for technical capacity among staff assigned to wastewater treatment and biogas harnessing.

This activity will provide technical assistance to optimize the operation of the pilot plants, training to plant staff and monitoring performance of the plant with regards to energy production and GHG emission reductions.

The project will offer training to pilot project staff for operation, monitoring and optimization as well as ensuring social and environmental safeguards of the installed pilot systems. Ad-hoc/when needed technical assistance will also be provided by the expert team throughout the project period.

GEF funds will be used to provide training to maintenance and technical staff. This training will be included as part of the contract for construction of the biogas plants (under Activity 2.1.2.3). Manuals and procedures for operation will be developed as part of this activity. The programme of training activities will include:

- Training of technical staff on process monitoring and operation;
- Optimization of WWT and biogas production;
- Monitoring of wastewater and feedstock composition for treatment and/or biodigesters;
- Control and optimization of process parameters for WWT and biodigesters;
- Storage and safety of biogas and biomethane installations;
- Planning and execution of maintenance and repair activities; and
- Social and environmental safeguards training including the gender concerns and different impacts of wastewater and climate change on women and men.

Activity 2.1.2.5 *Design a model for sound wastewater management and methane harnessing for energy use, based on principles of eco-industrial parks;*

In the final stage of project implementation and as part of an exit strategy approach, this activity will assess the current situation of wastewater treatment facilities in the participating industrial zones with the aim of evaluating opportunities to improve wastewater service management and develop strategies to strengthen the application of low-emission technologies (biogas) under the concept of eco-industrial parks model.

Based on the assessment, a master plan or strategic roadmap for improving the wastewater management at industrial zone level will be developed. The idea forms part of a Project exit package in terms of developing a model for further uptake and promotion and /or as a scaling up activity by other industrial zones. The master plan or roadmap will also address concerns on gender and proposes a set of gender-segregate indicators for monitoring and targeting purposes.

Component 3: Monitoring and Evaluation

Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation

Output 3.1.1: M&E mechanism developed and applied.

To ensure effective monitoring and evaluation, the project will include periodic progress reports on the impact status for each of the components of the project. M&E will assist the project to achieve objectives on time. The annual reports will be technical focusing on each of the project outputs, which will serve as a base for the mid-term and final evaluations. The activities of this component are as follows:

Activity 3.1.1.1 *Develop a monitoring system to track progress against indicators*

This activity covers design and regular update of an annual implementation work plan and a detailed monitoring and evaluation plan defining roles and responsibilities of implementing partners, reporting protocols and progress indicators to achieve the project's targets. Organization of an inception workshop and establishment of a Project Steering Committee (PSC) and Technical Advisory Group (TAG) are part of this activity. Gender aspects will be considered in order to facilitate gender mainstreaming throughout project implementation. The following activities will be implemented: (i) organization of inception workshop; (ii) design of monitoring plan and tools for data collection and recording, taking into consideration the GHG emission reduction targets, (iii) annual meeting of the steering committee, and (iv) periodic meetings of the TAG.

Activity 3.1.1.2 *Annual implementation reports*

Through annual reports, monitoring of project progress and compliance with UNIDO and GEF guidelines and safeguards will be ensured. This activity together with endeavours under activity 3.1.1.1, aim at complying with indicators and targets, as well as social, economic and environment safeguards. The activities implemented will be to validate project

progress and identify key issues, through regular monitoring and site visits by the PMU as well as follow up on environmental and social issues.

Activity 3.1.1.3 Mid-term review (MTR)

This activity encompasses the implementation of a mid-term review. The mid-term review (MTR) will be carried out after approximately 24 months of the project implementation. The MTR has the purpose of providing a systematic and external assessment of achievements and progress of the project at midterm of project, to propose corrective measures, changes and/or recommendations on how to improve implementation of the second half of the project to achieve the expected results.

Activity 3.1.1.4 Independent Terminal Evaluation (TE)

The TE will be implemented approximately six months before operational project termination. Independent international and national consultants contracted by UNIDO will carry out the TE evaluation. The terminal evaluation (TE) will cover the whole duration of the project from its starting date up to the date of the evaluation.

The TE aims at collecting lessons learned and developing recommendations for UNIDO, the Government, Donors, project stakeholders and local partners that may help improving the selection, enhancing the design and implementation of similar future projects and activities in the country and on a global scale upon project completion.

4) Incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, and co-financing;

The incremental project remains largely the same as described in the PIF. Following data gathering and analysis during the project preparation phase, some outputs have been added and others adjusted based on a greater understanding of the project baseline (particularly the regulatory environment and the needs of industry) as well as to establish linkages with other national and international initiatives.

Incremental cost reasoning:

Component 1:

Industries and SMEs in Myanmar are aware of the negative impact of polluted discharges and GHG emissions on the environment and are ready to invest in low carbon technologies with especially the government convinced of the importance of low carbon industrial development. However, the country lacks technical capacity and knowledge as well as institutional and policy framework to prevent industrial pollution. While Myanmar has already established a comprehensive legislative framework in particular under the Environmental Conservation Law, the country lacks an adequate monitoring system as well as regulatory framework.

Under component 1, the project will cover the incremental cost required to streamline and strengthen relevant existing policies to ensure low carbon growth. Under the broad umbrella of resource efficiency, existing policies and legal provisions will be reviewed and policy assistance will be provided in the area of wastewater regulation. As such, the incremental costs from the baseline under activities of

Output 1.1.1 will strengthen the regulatory framework and institutional capacity of the Ministry of Natural Resource and Environmental Conservation. In line with regulatory and institutional strengthening, the project will raise awareness on the national legal framework provisions and international good practice examples of sound wastewater management as

well as develop and implement regulatory measures and tools that have been identified in the baseline. In addition to wastewater and water management related policies, principles of differential pricing and cost recovery will be explored based on the economic context. In addition to cost-recovery and tariffs, financial mechanisms supporting industrial zone models engaged in industrial symbiosis and effective cost sharing of wastewater treatment systems need to emerge.

In the baseline, Myanmar is experiencing rapid economic expansion with largely unchecked expansion of production within existing industrial zones. Most company operations are GHG and resource intensive and environmentally unsound, especially in relation to wastewater effluent production and management. Output 1.1.2 will focus on trainings related to the transfer of environmentally sound technology and wastewater treatment. This output will build on national and international experiences to provide a capacity building program addressed toward public and private sectors, to strengthen national capacities for attending the urgent needs of resource efficiency and wastewater management. By tackling this subject under the TEST approach, the capacity building program will facilitate the adoption of a more sustained decision-making process to improve environmental performance in the long term.

As a result of the identified barriers in terms of lacking awareness of key stakeholder groups, the understanding of wastewater management needs to be increased in order to enable stakeholders to incorporate wastewater management into city planning and industrial processes. In order to increase knowledge on water pollution and resource efficiency, the project will cover the cost of organizing advocacy and awareness raising campaigns under Output 1.1.3.

Component 2:

Myanmar has very few examples of best practice wastewater treatment technology and resource and energy efficient industrial operations (with the exception of a handful of baseline projects in resource efficiency and cleaner production methods). Specifically focusing on the transfer of environmentally sound technology and wastewater treatment, Component 2 covers the incremental costs of demonstrating GHG emissions reduction achievable through the application of TEST and wastewater treatment technology. Targeted technical assistance and grant funding will be provided to partially cover the cost of procuring resource efficient WWTP and biogas equipment at pilot scale on (i) company level and (ii) industrial park level at selected sites located in Mandalay and Yangon. The technical and management improvements undertaken by these companies will then be used as examples during the dissemination campaign as part of the awareness raising activities outlined under Component 1. The GEF contribution will result in a UAC of 14.10 USD for direct GHG emissions avoided and UAC of under 3.52 USD for the combination of direct and indirect GHG emissions avoided, respectively.

Co-financing

During project formulation phase, commitments were received for grant and in-kind contributions from the key national stakeholders, international organizations and UNIDO. These co-financing letters are included in Annex O. All stakeholders have included sufficient co-finance to support the proposed activities in which they are involved. Table 5 below indicates the allocation of secured co-finance funding by output. In total Component 1 represents 11% of the total co-finance budget, Component 2 represents 79% and Component 3 and support to PMC represents 10% of the total co-finance budget.

Table 5: Co-finance Allocation per Project Outputs

Component 1 -Policy framework and national capacity for water quality and wastewater management improved	2,741,548
<i>Outcome 1.1: National capacity for promoting greenhouse gas emission reduction strengthened by an improved institutional and policy framework on water quality and wastewater management</i>	
Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and introduced, and institutional capacity on sound wastewater management strengthened	548,310
Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane harnessing technology strengthened by TEST capacity building program	1,782,006
Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented	411,232
Component 2 - Pilots at company and industrial park levels implemented applying UNIDO’s TEST integrated approach	19,645,709
<i>Outcome 2.1: Greenhouse gas emissions from industrial effluent discharges reduced through pilots at company and industrial park levels implementing TEST approach and procured WWTP and biogas technologies</i>	
Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions	5,899,198
Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants, including the delivery of procurement and monitoring support	13,746,511
Component 3: Monitoring and Evaluation	1,458,065
Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation	
Output 3.1.1: M&E mechanism developed and applied.	1,458,065
PMU	910,000
Total	24,755,322

5) Global environmental benefits (GEFTF), and adaptation benefits (LDCF/SCCF)

The project will deliver global environmental benefits by supporting Myanmar in the transition towards a sustainable and low-carbon development path. The project will contribute to reduce polluted discharges and GHG emissions from industries by facilitating the transfer of environmentally sound technologies. By increasing resource efficiency (raw material, energy and water), Myanmar industries will generate less waste and, as a direct consequence, fewer pollutants will be released into the atmosphere and discharged in sensitive environmental areas. Other indirect impacts can also be accounted for as a result of the TEST integrated approach, such as more sustainable use of scarce resources, reduced pollution to surface water bodies, as well as decreased releases of hazardous substances.

In addition to avoided GHG emissions through resource efficiency, the Project will capture methane from wastewater through biogas plants. The recovered methane will be used onsite within the Industrial zones for off-grid electricity and heat contributing to further GHG direct and indirect emissions reduction. The reduction is made by displacing traditionally used fossil fuels (grid electricity and diesel) and unsustainable wood material onsite, within the Industrial Zone, with

recovered methane, essentially providing an innovative, efficient and cleaner energy solution aligned with sustainable industrial development goals.

GHG emissions avoided: The project will have a dual contribution to CO₂ emission reduction estimated at 282,494 metric tons. Direct CO₂ reduction is achieved through wastewater treatment and production of electricity and heat from methane synthesized in WWTP appended digesters. From the total estimated emissions reduction of 282,494 tCO₂, technical assumptions suggest the methane harnessing technology component will contribute: 47,945 tCO₂ direct emissions reduction by energy production. This combined effect will in return reduce the overall consumption of fossil fuels and the unsustainable extraction of wood for the generation of energy. More specifically, the treatment plants in Yangon and Mandalay will be equipped with an installation of a gas-collecting system leading to emissions reduction as the gas can be utilized in a gas engine and the electricity can be supplied to the industrial zones to reduce energy consumption from the grid.

The cumulative direct GHG emission reduction from the Project is estimated to be 282,494 tons CO₂eq over the lifetime of investments triggered by the project (20 years). The GEF contribution for the Project for mitigation is USD \$ 3,984,351. This gives a direct CO₂ unit abatement cost (UAC) of USD 14.10 per ton of CO₂eq. The estimated bottom-up indirect emissions reductions are 847,481 tons CO₂eq – which would mean that a combination of direct and indirect emissions reductions would result in a UAC of under USD 3.52. Indirect emission reductions range from 847,481 tCO₂eq to 1,345,363 tCO₂eq. Therefore, only 10% of technical market potential will actually be achieved in the coming 10 years for top down. The wastewater treatment and methane conversion into energy provided the basis for calculating the global benefits in terms of avoided GHG emissions using the methodology described in the document “Manual for calculating GHG benefits of GEF Projects: Energy Efficiency and Renewable Energy Projects”. Furthermore, the applied methodology has included technical principles from the CDM methodology ACM0014 which draws on indicators from IPCC guidelines for national greenhouse gas inventories. The total reduction is estimated as follows:

- It is envisaged that project will result in 282,49 tons CO₂eq of direct GHG emissions over the lifetime of investments triggered by the project.
- Finally, it is expected that project result in 847,841 – 1,345,363 CO₂eq of indirect top-down GHG emissions using the GEF causality factor of 40%.

6) Innovativeness, sustainability and potential for scaling up.

This project is innovative as it applies a holistic approach when targeting effluents from industrial zones, which contribute to the common problem of GHG emissions release. At the city level, the proposed project represents the first large-scale approach to climate mitigation in Myanmar. As such the project will work with city authorities, the Ministry of Construction (MoC) and the Ministry of Natural Resources and Environmental Conservation (MoNREC) to tackle such issues through enhanced urban planning that incorporates improved wastewater treatment, technology transfer and private sector engagement. On a company and industrial zone level, the proposed project will apply UNIDO’s amended TEST approach that is adaptable for SMEs and the national context. Thus, the innovative adaptation of the TEST tools, which were initially designed for large and medium-sized companies, allows enough flexibility for effectively implementing cleaner production and low carbon growth principles among SMEs.

The continuous improvement approach to be initiated by the introduction of the TEST methodology will ensure the sustainability of the project beyond its completion with two underlying mechanisms applied. Firstly, the project will build national expertise and know-how on the application of the integrated TEST approach and more specifically on water pollution and wastewater treatment. In parallel, sustainability will be achieved by the strengthening of the regulatory framework, urban planning and enacted policies with regard to water resource and particularly wastewater treatment management as well as policies related to low carbon growth. Through the creation of institutional capacities and

leveraging private sector investments, efficient industrial development will be incentivized. Additionally, the project seeks to develop and strengthen interaction among government, city planning agencies, academia, and the private sector. It is important to facilitate partnerships that encourage investment and technology transfer and the diffusion of technical know-how and expertise to ensure replication. As such, capacity building and training is a core component in this project seeking to provide extensive technical assistance that is targeted at government and city officials as well as staff of participating companies and a pool of national experts trained on the TEST approach. In this regard, the lead government agencies will ensure sustainability through replication and scaling up beyond the end of the project. Secondly, at the business level the project seeks to develop the demand side by continuously engaging the private sector and communicating the successful results achieved by the pilot industrial sites and adoption of TEST tools in pilot companies.

There is substantial potential for scaling-up since Myanmar currently has 24 industrial zones with around 5,700 individual factories. In Yangon alone, 3,286³⁹ factories are not meeting YCDC mandated standards for wastewater treatment. According to Trading Economics global macro models and analysts expectations GDP Annual Growth Rate in Myanmar is expected to be 6% by the end of 2018. In the long-term, the Myanmar GDP Annual Growth Rate is projected to trend around 6.80% in 2020.⁴⁰ With industry powering this growth, it means that industrial areas, numbers of factories and wastewater generated will all continue to increase, creating ample opportunity for the scaling-up.

A.2. Child Project? If this is a child project under a program, describe how the components contribute to the overall program impact.

N/A

A.3. Stakeholders. Please provide the Stakeholder Engagement Plan or equivalent assessment. (Type response here; if available, upload document or provide link) In addition, provide a summary on how stakeholders will be consulted in project execution, the means and timing of engagement, how information will be disseminated, and an explanation of any resource requirements throughout the project/program cycle to ensure proper and meaningful stakeholder engagement.

Select what role civil society will play in the project:

- Consulted only;
- Member of Advisory Body; contractor;
- Co-financier;
- Member of project steering committee or equivalent decision-making body;
- Executor or co-executor;
- Other (Please explain)

Stakeholder Engagement Plan

A Stakeholder Engagement Plan has been developed for the Project and sits within the Environmental and Social Management Plan (EMSP) in Annex M. The Stakeholder Engagement Plan sets out the role and project interest for each

³⁹ Source: <https://www.mmtimes.com/news/yangon-factories-told-treat-water-or-else.html>

⁴⁰ Source: <https://tradingeconomics.com/myanmar/gdp-growth-annual/forecast>

key stakeholder as well as the engagement methods and timing. The Project is engaging with multiple sectors in parallel and recognizes the importance of inclusion and meaningful dialogue.

Stakeholder identification:

The project involves public and private stakeholders’ engagement to achieve the expected results. The following table shows the list of stakeholders identified as relevant and their role during the project implementation:

Table 6: Project Stakeholders

Stakeholder	Mandates/Role in the project
Main executing partners	
Department of Urban and Housing Development (DUHD) under the Ministry of Construction (MoC)	DUHD will act as the co-chair of the Project Steering Committee (PSC). DUHD develops and manages industrial zones around the country and develops industrial zones regulations including air and water pollution control, sanitation systems, solid waste disposal, and infrastructure. The DUHD will be the Project Executing Entity (PEE) for outputs 1.1.2, 2.1.1, 2.1.2 and 3.1.1 and as such act as the main partner for the project implementation. The DUHD will reach out to industries in the industrial zones and other stakeholders to engage them in the project.
Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation (MoNREC)	ECD will act as the co-chair in the PSC. ECD, within the Ministry of Natural Resources and Environmental Conservation, is the focal point of environmental conservation in Myanmar. ECD develops regulations related to wastewater discharges in industries, solid waste disposal and systematic waste disposal in industrial zones. One of its mandates is to raise awareness on hazards of industrial waste disposal in the industrial zones in Myanmar. The Director General of ECD is the GEF National Operational Focal Point in Myanmar. Specifically, ECD has a key role in output 1.1.1 since this institution has been working in the improvement of the regulatory framework of industrial wastewater and the national environmental management system. Thus, it will act as Project Executing Entity of outputs 1.1.1 and 1.1.3, and will support DUHD in the promotion activities to engage key stakeholders.
Directorate of Industrial Supervision and Inspection (DISI), Ministry of Planning, Finance and Industry (MoPFI)	DISI is tasked with inspecting production and process of industrial sectors in Myanmar whether environmental regulations are being met. DISI’s mandate is to handle industrial waste together with concerned government agencies and industries. As part of the Ministry of Planning, Finance and Industry, DISI also has a role of promotion, facilitating the transfer of good practices and technology in industry to increase productivity. Therefore, DISI is envisaged as a key stakeholder in capacity building and awareness raising activities related to private sector. DISI will facilitate the execution of those activities related to industry under outputs 1.1.2, 1.1.3 and 2.1.1 in close collaboration with private sector organizations such as MIA and national and international experts as execution partners.
Main counterparts	
Department of Research and Innovation (DRI) Ministry of Education (MoE)	As the government entity in charge of monitoring and controlling the quality of surface water bodies, the DRI will be the recipient center of knowledge related to wastewater technology. The DRI involvement in capacity building and awareness raising efforts under output 1.1.2 will ensure future replication and technology uptake in Myanmar after project completion. The DRI is a potential executing partner for water quality monitoring activities of output 2.1.2 upon availability of its technical facilities.

Yangon City Development Council (YCDC)	YCDC will be a member of the project steering committee and will connect the project with industries as well as respective communities and urban settlements located in Greater Yangon. YCDC will ensure that the project is in line with the Yangon city development plan. It will also have a relevant role in dissemination of information and promoting the outlined investment among industrial zones in Yangon.
Mandalay City Development Council (MCDC)	MCDC will be a member of the project steering committee and will connect the project in Mandalay industrial zones as well as respective communities and urban settlements located in the region of Mandalay. Furthermore, MCDC will ensure that the project complements the Mandalay City Development Plan. Furthermore, MCDC is a partner for investing in pilots projects in Mandalay's Industrial Zone, Pyi Gyi Tagon. Hence, it will be participating in agreements and procurement process to ensure the implementation of pilots in Mandalay.
Myanmar Industries Association (MIA)	<p>As the national reference organization for industry, MIA represents a key stakeholder to all projects related to enhance industrial development. Specifically, this project meets MIA's objective of improving productivity in private industries, enhancing industrial standards, and promote an effective exploitation of natural resources by acquiring appropriate modern technology and innovation. The project will provide the opportunity to increase MIA's capacities on collaboration with international cooperation projects addressed to industry, and a better positioning with industries by facilitating their access to training and technical assistance opportunities in relevant matters.</p> <p>MIA will participate in the project engaging industries and facilitating their enrolment in the project activities through dissemination of information to its members. Through its service centre, MIA is a potential executing partner for project's awareness raising activities, training and technical assistance to companies for TEST demonstration projects.</p>
Industrial Zone Management Committees (IZMC)	An Industrial Zone Management Committee has been established for each industrial zone. There are 29 industrial zone management committees in Yangon and one industrial zone management committee in Mandalay. The industrial zone management committee is responsible for infrastructure development and management of industries. Therefore, the IZMCs of industrial zones selected for the project implementation will be an important partner in approaching companies, and will participate in all activities related to strengthening wastewater management at industrial zone level.
Participating industries	<p>The private sector will largely be positioned to benefit from the project in terms of new and improved local knowledge and capacities in water treatment options and available technologies. Private sector is therefore positioned to use this advantage to invest in cleaner production models.</p> <p>Depending on their production processes as well as technical and financial feasibilities, participating industries will invest in resource efficiency measures and effective wastewater management.</p>

International cooperation and financial sector	
JICA	JICA is a Japanese Organization involved for a long time in Myanmar development. JICA supports the inclusive development of the country through 4 missions: i) addressing the global agenda; ii) reducing poverty through equitable growth; iii) improving governance; iv) achieving human security. Though active in many different fields, JICA has experience in the implementation and technical assistance for projects in the resources and disaster management, agricultural and rural development, natural environment conservation and food security. Through previous JICA activities in Myanmar, a baseline of pollution sources from industrial zones has been developed providing important information exchange for selection of prioritized industrial zones and potential industries for demonstration projects.
EU	The Tha Bar Wa Project is led by WWF in partnership with donor funds from the EU. It began implementation in 2018 with a focus on cleaner production for the SME F&B sector. WWF and the EU are supporting transition in four key areas: i) policy, ii) capacity and markets, iii) green finance, and iv) replication of project results. Sustainable energy use, adoption of green technologies and replication are strongly aligned with the UNIDO-GEF Myanmar Project. In implementing this 48-month project WWF and the EU have already established working relationships with key stakeholders in Myanmar such as government, private sector financial institutes, SMEs in Yangon and Mandalay and CSOs. In particular the Tha Bar Wa Project has been working closely to build capacity within the financial sector to enable access of green finance to companies. The project development team identified synergies during the Request for CEO Endorsement (RCE) design and formulation process and discussed collaboration with the Tha Bar Wa Project team. In order to ensure the two projects work synergistically towards common goals, collaboration mechanisms will be fostered between the two projects. The ability to scale and replicate aligned models that share common features will be actively pursued.
FMO	FMO - the Dutch Development Bank – is a financial institution with public-private ownership structure and international operation in of Africa, Asia, Latin America and The Caribbean, and Europe and Central Asia. The main sectors of business are Agribusiness, Food and Water; Energy; Financial Institutions; and Dutch Business. FMO’s mission is to invest in growth and frontier markets, supporting jobs and income generation, and improving people’s lives in those parts of the world where this makes the biggest difference. The bank is recognized for challenging business to meet high international standards regarding the welfare of people, corporate governance and the environment. In this regard, FMO has defined 3 SDG as main drivers: SDG 8 (decent work and economic growth), SDG 10 (reduced inequalities) and SDG 13 (climate action); the latest represented 36 % of the total investment portfolio as green investments in 2018. In Myanmar, FMO is promoting finance access for development through microfinancing mechanisms and other large-scale financial packages for telecom, infrastructure and agribusiness sectors. Through the partnership with WWF for <i>development of WWT projects in Irrawaddy basin</i> , FMO is expanding its potential to provide financial support in Myanmar. Through this initiative, bankable projects will be developed to improve water security, particularly through the adoption of green technology and WWT, promoting investment under public-private partnerships and participation of Dutch developers.

World Bank Office Myanmar	The World Bank is working with the government and other partners in support of reforms that will benefit Myanmar, and also support poor and vulnerable community members. The World Bank also supports SMEs and is positioned therefore to complement the work achieved by UNIDO.
Asia Development Bank Office Myanmar	ADB is helping to foster private sector development in Myanmar. It supported the government's formulation of a Private Sector Development Framework and Action Plan, which prioritizes strengthening legislation, access to finance, trade and investment, and human capital, as well as promoting public-private partnerships.
Small and Medium Enterprise Development Bank (SMEDB)	A public-sector bank which was previously under the MoI (now MoPFI). SMEDB offers a loan created to exclusively focus on SME lending for the manufacturing sector for collateralized loans of up to MMK 50 million (EUR 36,000) at 8.5% interest rates and three-year repayment periods.
Myanmar Economic Bank (MEB)	MEB, as a state-owned commercial bank, maintains the State Fund Account (SFA) system – and banking service for all the government agencies, included Ministries, Departments, State Economic Enterprises, etc. In order to promote SMEs in Myanmar, Myanmar Economic Bank is implementing the Two-step Loan Project as an Executing Agency with funds provided by JICA. MEB provides loans to participating financial institution (PFI) with a 4% interest rate and PFIs lend to SMEs with an 8.5% interest rate. MEB and the Treasury Department receive 3% and 1% commission respectively. <ul style="list-style-type: none"> • Amount of ODA Loan: 5033 million JPY • Interest (Annual): 0.01% • Grace Period: 10 years • Repayment Schedule: 30 years • Maturity: 40 years
Myanmar Foreign Trade Bank (MFTB)	Since MFTB is focusing on both the government and private sectors, its foreign exchange transactions of trade and non-trade volume are larger than others. MFTB is the one and only bank in Myanmar endeavoring to cooperate with other overseas financial institutions through Cooperation Agreements and Credit Line Agreements to support and develop various sectors. In collaboration with the Export Import Banks of neighbouring countries, Myanmar Foreign Trade Bank has been assisting financial facilities to implement important projects in the areas of infrastructure, agriculture, telecommunication and industry sectors e.g. Machinery Rehabilitation Project, Earth Moving Equipment Project of Ministry of Industry, Yangon Mandalay Trunk Line Railway Project of Ministry of Rail Transportation, Telecommunication projects of Ministry of Telecommunication, Hydropower projects of Ministry of Electric Power.
Myanmar Investment and Commercial Bank (MICB)	As one of the state-owned financial institutions, MICB is striving hard to mobilize funds in country by accepting deposits both in local currency (Kyat) and foreign currencies. MICB provides financing facilities to economic enterprises, which play an important role in the economic development of the country with aims to fulfil financial opportunities.
Kan Baw Za Bank (KBZ)	Kan Baw Za (KBZ) Bank is one of the private commercial banks in Myanmar which was founded on 1994. KBZ bank is supporting SMEs in Myanmar. It is optionalizing the activities and mechanisms to support green finance to SMEs in Myanmar such as providing loans to SMEs and initializing to set-up green financing components. The one stop SME banking center was opened on 2018 which offers a range of services to meet the needs of growing businesses, such as improving access to finance and financial literacy.

Other sectorial industry organizations	
Myanmar Food Processors & Exporters Association (MFPEA)	MFPEA was founded on 21 st August 2006 with the aim of supporting development and growth of the local food industry in Myanmar. MFPEA is supporting the export of local agri-based food processor. They are also seeking to bridge the gap between the private and public sectors and encouraging further collaboration on key food industries' issue such as producing safe high-quality food, accessing export markets and sourcing raw materials from countries outside Myanmar.
Mandalay Region Chamber of Commerce and Industry (MRCCI)	MRCCI was founded in 1991. There are 2016 members in total and 23 affiliates. MRCCI is helping members to meet counterparts in other countries and represent the wider business community. The vision is to promote trade through foreign contacts and cooperate with international organizations and businesses, and to conduct training.
Academia	
Department of Chemical Engineering, Yangon Technological University	<p>The department of chemical is considered a highly- prestigious engineering department both in teaching and research with a strong commitment to systematically educate and fortify chemical engineering graduates for professional practices and lifelong learning. The degrees offered are:</p> <ol style="list-style-type: none"> 1. Undergraduate chemical engineering 2. Master chemical engineering 3. PhD programme in chemical engineering 4. Post-graduate diploma in food technology 5. Master food technology <p>The project will involve the university in training activities and awareness raising activities. The project team will encourage participation of students and faculty members in practical and research experience opportunities under the project. The University is a potential executing partner for training activities, awareness raising and the application of TEST in industries.</p>
Department of Chemical Engineering, Mandalay Technological University	<p>The vision of Chemical Engineering Department is leadership in research and education that focuses on environmental quality improvements through the application of chemical engineering principles. The degree offered are</p> <ol style="list-style-type: none"> 1. Undergraduate chemical engineering 2. Master chemical engineering 3. PhD programme in chemical engineering <p>The project will involve the university in training activities and awareness raising activities. The project team will encourage participation of students and faculty members in practical and research experience opportunities under the project. The University is a potential executing partner for training activities, awareness raising and the application of TEST in industries.</p>
Myanmar Engineering Society, Mandalay	<p>(1) To enable engineers and architects to participate, using their expertise for the development of architecture and all-round development of other sectors of economy.</p> <p>(2) To enable engineers and architects all over the country to actively participate in the development and dissemination of engineering and architectural knowledge and in nation-building tasks.</p> <p>The Society also has a female Chapter of engineers that may be beneficial to engage with especially around the gender mainstreaming potential.</p> <p>The project will involve the engineering society in training activities and awareness raising activities. The project team will encourage participation of members in</p>

	opportunities under the project. The Engineering Society is a potential executing partner for training activities, awareness raising and the application of TEST in industries.
Federation of Myanmar Engineering Society, Yangon	<p>Fed. MES is the association of engineers which is established with the following objectives:</p> <p>1) To enable engineers and architects to participate, using their expertise for the development of architecture and all-round development of other sectors of economy.</p> <p>(2) To enable engineers and architects all over the country to actively participate in the development and dissemination of engineering and architectural knowledge and in nation-building tasks.</p> <p>The Society also has a female Chapter of engineers that may be beneficial to engage with especially around the gender mainstreaming potential.</p> <p>The project will involve the engineering society in training activities and awareness raising activities. The project team will encourage participation of members in opportunities under the project. The Engineering Society is a potential executing partner for training activities, awareness raising and the application of TEST in industries.</p>

A.4. Gender Equality and Women's Empowerment. Provide the gender analysis or equivalent socio-economic assessment. (Type response here; if available, upload document or provide link)

Does the project expect to include any gender-responsive measures to address gender gaps or promote gender equality and women's empowerment? (yes /no) If yes, please upload gender action plan or equivalent here.

If possible, indicate in which results area(s) the project is expected to contribute to gender equality:

- closing gender gaps in access to and control over natural resources;
- improving women's participation and decision making; and or
- generating socio-economic benefits or services for women.

Does the project's results framework or logical framework include gender-sensitive indicators? (yes /no)

UNIDO recognizes that gender equality and the empowerment of women have a significant positive impact on sustained economic growth and inclusive industrial development, key drivers of poverty alleviation and social progress. Gender mainstreaming will be based on GEF's Policy on Gender Mainstreaming and UNIDO's (i) Policy on Gender Equality and the Empowerment of Women (2009) as well as (ii) the Guide on Gender Mainstreaming Environmental Management Projects, an operational guide to support gender mainstreaming in environmental initiatives. A comprehensive gender analysis was undertaken to identify gender equality and female empowerment gaps and opportunities in Myanmar and in industrial zone settings. The gender analysis provided in Annex R identified gender roles, employment numbers, seniority and access to professional resources, as well as general barriers and opportunities in the workplace. The Project has mainstreamed gender across the activities seeking progressive participation targets for women in awareness and capacity building initiatives including from Civil Society. Gender sensitization training is also integrated to transition existing norms and attitudes, to a more gender equal setting.

Additionally, to meet UNIDO's guidelines on gender equality, local level decision making under this project will be aligned more in women's favour, for example, ensuring that any committees formed (either at community or government level) will target at least 30% representation from women, and that any consultation specifically involves women, enabling their voices to be heard. Additionally, female candidates will be encouraged to apply during recruitment process and given preference, when presenting professional qualifications similar to those of men. Throughout the project management and

execution, staff will also be trained and made aware of relevant gender sensitive issues. This addresses the tendency for technology transfer projects to be male-driven and more aligned with men’s needs.

The project’s capacity building and awareness raising activities will further strengthen and encourage female staff from local authorities (YCDC and MCDC), including engineers, planners and managers, envisioned to achieve 50% participation from the relevant departments. Targets in other Government sectors are on average 30% for women participation but vary based on findings encountered during the gender analysis. Special attention will be paid to gender equality when evaluating and inviting members to participate at the project steering committee or to attend trainings and awareness raising events. The time and location of these events will be adjusted according to the needs and cultural traditions of gender groups. The training materials will be adapted to the audience and gender sensitized, taking into account local specificities.

A.5 Risk. Elaborate on indicated risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, the proposed measures that address these risks at the time of project implementation (table format acceptable):

The table below outlines the indicated risks and the proposed mitigation measures that address these risks at the time of project implementation:

Table 7 Project risks and mitigation measures

Risk	Rating	Mitigation
Technical risk Lack of awareness about opportunities for adopting sound environmental technologies	Low-medium	The project will encourage a participatory approach and provide the adequate information and training on planning and implementation of sound environmental technologies and practices. International and local experts will work closely with the project management unit and relevant stakeholders. As the project will demonstrate new technologies to Myanmar, ‘buy-in’ from the private sector and public is very important to mitigate the risk of disinterest. Any such potential risk will be mitigated through targeted public awareness, engagement and outreach activities, dissemination of information and consultations, as well as capacity building, to be implemented under Outputs 1.1.2 and 1.1.3. In addition, the pilots to be undertaken under Output 2.1.2. will showcase the technology and different applications in a visible manner to present the opportunities and benefits of the proposed technologies.
Construction risk Negative construction, operation, and decommissioning phase impacts and technology failure	Low-medium	Effective due diligence and construction management will be carried out during the pre-construction and construction phases of the pilot projects to mitigate negative construction impacts. This will include an Environmental Impact Assessment as required by Myanmar law as well as public consultation and information disclosure. Appropriate precautions and safety measures will be taken to avoid related risks and hazardous situations, and to ensure a safe operation of the proposed biogas plants. Training of biogas plant construction and operating personnel will be

Risk	Rating	Mitigation
		aligned with the Government’s occupational health and safety regulations and international best practices in the biogas sector.
<p>Socio-economic risk Reluctance of industries to change towards climate resilient development, considering it as a burden instead of an opportunity. Besides cultural resistance, SMEs are often unable to undertake large investments, even though in the long run these generally pay off.</p>	Medium	<p>Through awareness raising and capacity building initiatives, the project will demonstrate the benefits of the application of sound environmental technologies.</p> <p>Examples of best practices and successful projects implemented by UNIDO will be presented to stakeholders based on results and indicators. Technical and financial feasibility studies will be offered by the project and investment plans developed for the companies. Awareness will be raised on financial schemes available in the country. Facilitating access to these schemes will also serve as an incentive for companies to participate in the project.</p>
<p>Climate change Risk/Infrastructure developed is vulnerable to climate change risks</p>	Low-medium	<p>Industries present in zones potentially exposed to flooding or natural hazards will not be selected for the technology pilot demonstration component. Sensitivity to climate risks will be taken into account when selecting the industrial zones where the project will have demonstrations. While the infrastructure to be developed under the proposed project could potentially be vulnerable to climactic disruptions (e.g. wastewater treatment systems feeding into open canals), sufficient due diligence will be undertaken prior to the procurement phase in a site through specific technical feasibility study in order to identify potential climate risks and where projects are seen as viable and risks identified, to develop a plan to mitigate this risk.</p>
<p>Institutional risk Lack of coordination between the key ministries, industries and other stakeholders. Limited experience of national institutions in executing similar projects. Slow response of some key actors may hinder the project implementation.</p>	Medium	<p>The Steering Committee will establish the institutional linkages among the stakeholders, and the Project Management Unit (PMU) will consult with executing partners, the Technical Advisory Group (TAG) and major stakeholders to ensure their involvement and ownership of the project. National or international entities will be selected through competitive tender processes.</p> <p>Meetings and workshops to strengthen the collaboration among main stakeholders will be organized on a regular basis to identify potential issues and develop adequate mitigation measures.</p> <p>All stakeholders are committed to and understand the project’s objective. The PSC will closely monitor project progress, and the TAG will provide valuable technical advice on the work plan. For the delivery of the different activities, the PEEs will procure services with experienced technical service providers and experts. The project design has also envisioned participation of international experts which aims to enhance the PEE’s capacity to undertake training and technical assistance processes and strengthen result delivery. Furthermore, the PMU will provide support to ensure effective execution, coordination, and regular, clear reporting. It is reinforced by 3</p>

Risk	Rating	Mitigation
		<p>professionals and will be based at the DUHD-Yangon office to ensure close collaboration with the PEE.</p> <p>The mid-term evaluation will also be an important instrument to ensure that the execution is progressing as planned and to make any necessary adjustments.</p> <p>UNIDO has broad experience in implementing similar projects, which may help to overcome possible problems with the project planning and implementation.</p>
<p>Regulatory risk The proposed regulatory framework is not adopted and enforced.</p>	Medium	<p>Decision makers will be engaged early on in the project preparation and implementation to ensure securing of a long-standing commitment.</p> <p>The key institutional stakeholders will be represented in the PSC to express their ideas and concerns with respect to roles and responsibilities of their own institution and to participate in the development process.</p> <p>Furthermore, the private sector's involvement in the development of the policies and strategies under Output 1.1.1 will help ensure that the policy framework and financial mechanisms are aligned with the needs of investors and manufacturers.</p>
<p>Gender risk Risk of resistance against, or lack of interest in, the project activities from stakeholders, especially with regard to the active promotion of gender equality.</p> <p>Low participation rates of suitable female candidates due to lack of interest, inadequate project activity or missing qualified female population within engineering sector.</p>	Low	<p>Myanmar, while having a number of significant gender issues, is a pro-gender equality society according to the National Strategic Plan for the Advancement of Women. This project will pursue thorough and gender responsive communication and ensure stakeholder involvement at all levels, with special regard to involving women and men, as well as civil society and non-governmental organizations promoting gender equality.</p> <p>This shall mitigate social and gender related risks, promote gender equality, create a culture of mutual acceptance, and maximize the potential contribution of the project to improving gender equality in industry and waste water management field. As gender has been clearly mainstreamed throughout the project design, this will help mitigate any potential risk.</p> <p>Subsequently, an autonomous Gender Management Plan will establish how, who, when, and where the measures will be managed including the cost of implementation.</p>
<p>Political risk Despite significant political progress, internal tensions remain.</p>	Medium – High	<p>The project will engage decision makers as well as civil society organizations early on during the project as well as involving them during project implementation.</p> <p>Members of the PSC and UNIDO Regional Office in Thailand will monitor the political situation. Potential changes or adaptation of project activities will be discussed and endorsed by the PSC.</p>

A.6. Institutional Arrangement and Coordination. Describe the institutional arrangement for project implementation. Elaborate on the planned coordination with other relevant GEF-financed projects and other initiatives.

Institutional Arrangements

As the GEF implementing agency, UNIDO will maintain overall oversight on the project implementation, manage the overall project budget and supervise the project execution. UNIDO will fulfil this responsibility by appointing a Project Manager and mobilizing services of its other technical, administrative and financial branches at UNIDO Headquarters, the UNIDO national office in Myanmar, and the UNIDO Regional office in Thailand.

UNIDO will be responsible for the following inputs:

- Overall project implementation, monitoring and reporting to GEF;
- Contracting the Project Execution Entities (PEE), allocating the corresponding resources of components and outputs to be executed by each PEE;
- Supervise the project execution through constant oversight of PEE execution services.
- Coordinate the MTR and TE of the project.

Full or partial title and ownership of equipment purchased under the project may be transferred to national counterparts and/or project beneficiaries during the project implementation as deemed appropriate by the UNIDO Project Manager in consultation with project stakeholders.

The Department of Urban Housing and Development (DUHD) of the Ministry of Construction is the project National counterpart and main partner. DUHD co-chairs the Project Steering Committee together with the Environment Conservation Department (ECD) of the Ministry of Natural Resources and Environmental Conservation (GEF Operational Focal Point), and as such has a coordinating role among the different Government institutions that have a direct involvement in the project. DUHD (Yangon office) will act as PEE for relevant part of the project outputs and will designate a Focal Point (FP) from their staff that will be the main communication and coordination counterpart from the Ministry. DUDH also will establish the Project Management Unit (PMU) of the project. In addition, the ECD will act as the second PEE covering part of the project's outputs. See supporting letters in Annex S.

Project Steering Committee (PSC)

The project Steering Committee is composed of high-level representatives from DUHD, ECD (GEF OFF), DISI, DRI, YCDC, MCDC, MIA, and UNIDO. The primary roles of the PSC are: (1) to provide overall guidance to the execution of the project; (2) to ensure good coordination among participating agencies and other organizations; and (3) to approve any substantial change or addition of new project outputs in response to the emerging issues. The PSC will meet on an annual basis to review and monitor the progress of the project implementation and to approve the work plan for subsequent years. Project amendments will be done in accordance with the GEF Council Document GEF/C.39/Inf.03. Under the PSC, one permanent technical representative each from DUHD, ECD, DISI, DRI, YCDC, MCDC, MIA, and UNIDO will form a **Technical Advisory Group** who will meet at a minimum quarterly, or when necessary, to ensure information is shared and coordination is achieved between PSC members.

Technical Advisory Group (TAG):

In order to ensure ongoing coordination across the project lifetime, the project will form a Technical Advisory Group to be formed of technical representatives from Departments of Ministries and other public sector representatives members of the PSC including the Department of Urban and Housing Development, Environmental Conservation Department, Department of Industrial Supervision and Inspection, Department of Research and Innovation, Yangon City Development Committee, Mandalay City Development Committee, Myanmar Industries Association. The TAG will meet on a quarterly

basis to advise on the work plan and coordinate synergies with other initiatives, and subsequently keep relevant Project Steering Committee members informed on a regular basis.

For more information, see Table 8 Executing Arrangements.

Execution Arrangement

Given the varied nature of the activities among outputs, the project will work with DUHD (Yangon office) and ECD as PEEs in charge of providing administrative and technical services, meeting the specialized needs of the project. PEEs will liaise with stakeholders defined in Table 6: Project Stakeholders.

As PEE, DUHD and ECD will administer the day-to-day activities of their corresponding project's outputs, managing the delivery of products and providing administrative and managerial services. Their execution role implies accountability for intended and appropriate use of funds, for procurement and contracting of goods and services, and for timely delivery of inputs and outputs.

The executing entities will keep close track of the execution of the activities under their responsibility, including progress against deliverables and project targets, and submit periodic reports to UNIDO as Implementing Agency.

To facilitate the service provision, PEEs will procure services with technical service providers that facilitate national and international specialists and expert teams to develop the project activities. The type of providers that could be involved in the execution of the project includes, but is not limited to: national institutions, business/professional associations (for example Myanmar Engineering Council, Federation of the Myanmar Engineering Society, Myanmar Industry Association, etc.), technical centers, universities, non-governmental organizations (NGOs) and consulting firms. They may be national, regional or locally based international entities with expertise in the respective topical areas such as policy review/reform, environmental services, training/capacity building, engineering, etc. The PMU will conduct a mapping of potential service providers during the inception phase and design the terms of reference based on the local conditions. If appropriate, PEEs may combine tasks from different outputs to be covered by one service provider in order to maximize resources and ensure cost effectiveness.

The committee established under Activity 2.1.2.3 will participate in the selection of the engineering firm responsible for the construction and commissioning of WWTP/biogas pilots.

DUHD (Yangon office) will recruit a Project Management Unit (PMU) with the main function to coordinate the work of the different executing partners, monitoring of overall progress, recruitment of consultants and project staff, and provide technical support as needed. The PMU staff will consist of a National Project Coordinator, a Technical Officer and an administrative assistant. It will be based in DUHD Yangon office. The PMU will prepare periodic progress reports (including work and budget plan) for submission to UNIDO and the GEF Operational Focal Point in MoNREC. The PMU will also produce annual progress reports, which must be submitted to the PSC members to be reviewed before the PSC meeting. At the end of the project, the PMU will produce the terminal report, which is to be submitted to the PSC.

The following table summarizes the PEEs and the assigned outputs, as well as the key stakeholders for each of them.

Table 8: Execution Arrangements

Component / Output	Project Executing Entity	Main Stakeholders
Component 1 – Policy framework and national capacity improved		
<p>Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened</p>	<p>Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation</p>	<ul style="list-style-type: none"> – Department of Urban and Housing Development – Yangon City Development Committee – Mandalay City Development Committee – Department of Research and Innovation, Ministry of Education – Department of Industrial Supervision and Inspection, Ministry of Planning, Finance and Industry
<p>Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane harnessing technology strengthened by TEST capacity building program.</p>	<p>Department of Urban and Housing Development (Yangon office), Ministry of Construction</p>	<ul style="list-style-type: none"> – Department of Industrial Supervision and Inspection, Ministry of Planning, Finance and Industry – Environmental Conservation Department – Myanmar Industries Association
<p>Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented</p>	<p>Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation</p>	<ul style="list-style-type: none"> – Department of Industrial Supervision and Inspection, Ministry of Planning, Finance and Industry – Environmental Conservation Department – Yangon City Development Committee – Mandalay City Development Committee
<p>Output 2.1.1: Industrial parks and companies with TEST integrated approach assessed to improve their environmental performance and reduce GHG emissions</p>	<p>Department of Urban and Housing Development (Yangon office), Ministry of Construction</p>	<ul style="list-style-type: none"> – Department of Industrial Supervision and Inspection, Ministry of Planning, Finance and Industry – Department of Research and Innovation, Ministry of Education – Environmental Conservation Department – Yangon City Development Committee – Mandalay City Development Committee – Myanmar Industries Association
<p>Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants</p>	<p>Department of Urban and Housing Development (Yangon office), Ministry of Construction</p>	<ul style="list-style-type: none"> – Environmental Conservation Department – Department of Industrial Supervision and Inspection, Ministry of Planning, Finance and Industry – Department of Research and Innovation, Ministry of Education – Yangon City Development Committee – Mandalay City Development Committee – Myanmar Industries Association

<p>Output 3.1.1:</p> <p>M&E mechanism developed and applied</p>	<p>Department of Urban and Housing Development (Yangon office), Ministry of Construction</p> <p>UNIDO (MTR, TE)</p>	<ul style="list-style-type: none"> - Department of Industrial Supervision and Inspection - Department of Urban and Housing Development - Environmental Conservation Department
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The Project management structure is presented in the figure below.

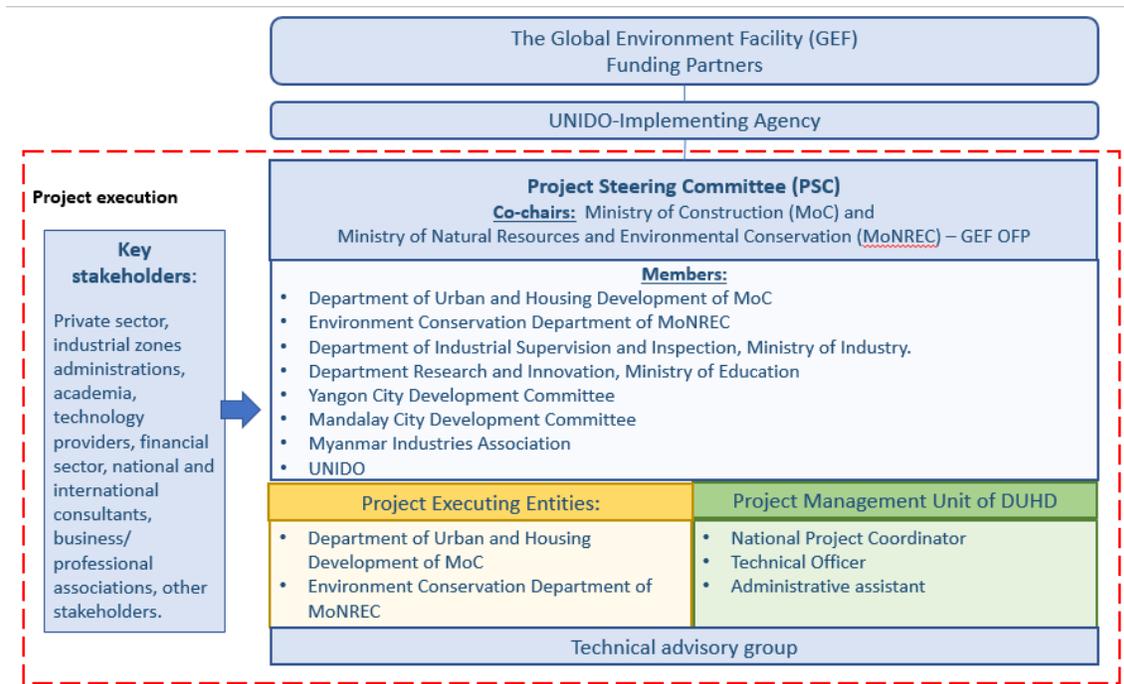


Figure 14: Project Management Structure

According to the above-mentioned executing arrangements, UNIDO will establish the following maximum budget allocation per PEEs, which is aligned with the project budget presented in Annex K. Contracts with PEEs will be issued according to annual work plans and based on performance progress.

Table 9: GEF-funded budget, with PEE breakdown

Project Execution Entity	Project's Output	GEF-funded budget (USD)
ECD	Output 1.1.1	180,000
	Output 1.1.3	200,000
	Sub-total	380,000
DUHD, Yangon office	Output 1.1.2	319,200
	Output 2.1.1	742,720
	Output 2.1.2	2,152,927
	Output 3.1.1 (activities 3.1.1 and 3.1.2)	110,000
	Project management cost	189,742
	Sub-total	3,514,589
	Total (both PEEs)	3,894,589
M&E, UNIDO	Activity 3.1.1.3 Mid-term review;	30,000
	Activity 3.1.1.4 Independent terminal evaluation;	60,000
	Sub-total	90,000
	Grand total	3,984,589

Planned coordination with other relevant GEF-financed and other initiatives

The proposed project will closely liaise with other GEF initiated projects under GEF-TF and other related initiatives through a coordination mechanism (regular set meetings, knowledge management and sharing lessons learned) by the PSC to ensure that there is no duplication and that all related projects can benefit from exchange of experience and best practices. Synergies and complementarities will be created with a range of other relevant GEF-financed projects and other initiatives in the country related to waste water treatment and biogas generation as outlined in the following table.

Table 10 Coordination with other GEF-financed projects and other initiatives

Projects implemented by UNIDO related to GHG emissions reductions in industry, resource efficiency, biogas and wastewater	
<p>UNIDO, “Green Industry for Low Carbon Growth in Cambodia, Lao People’s Democratic Republic and Myanmar”,</p> <p>UNIDO “Pilot National Resource Efficient and Cleaner Production (RECP) in Myanmar”</p> <p>and</p> <p>UNIDO, “Improvement of Industrial Energy Efficiency” in Myanmar (GEF ID 5321)</p>	<p>UNIDO implements a range of GEF and non-GEF financed projects in Myanmar. Three UNIDO projects in Myanmar have targeted GHG emissions reductions through improvements in industrial performance. Importantly, the GEF project has been designed taking into consideration important lessons learned from these initiatives. The Myanmar project will closely coordinate its activities, exchange information and lessons, and work toward a common objective with these three projects. The project “Improvement of Industrial Energy Efficiency” will be of particular relevance seeking to promote sustained GHG emissions reduction among Myanmar industry by: improving policy and regulatory frameworks; institutional capacity building for industrial energy efficiency (IEE); implementation of energy management system based on ISO 50001; and optimization of energy systems in industry. During implementation, the project will leverage existing partnerships and networks in order to enhance the project outputs. Furthermore, outputs of these existing projects will provide key inputs, for example from pilot</p>

	<p>projects and regulatory improvements to enhance adoption of low-carbon technology promoted by this GEF project.</p>
<p>UNIDO “Eco-industrial Park Initiative for Sustainable Industrial Zones in Vietnam” (GEF ID 4766)</p>	<p>The project looked at increased transfer, deployment and diffusion of clean and low carbon technologies and practices for the minimization of GHG emissions, POPs releases and water pollutants as well as improved water-efficiency and the sound management of chemicals in industrial zones. The Myanmar GEF project will build upon the valuable lessons learned, particularly measures to reduce GHG emissions as well as improved water efficiency and reduction of pollutants in industrial zones.</p>
<p>UNIDO “Mainstreaming Climate Change Adaptation through Water Resource Management in Leather Industrial Zone Development” Pakistan (GEF ID 5666)</p>	<p>The project mainstreaming climate change adaptation through water resource management in leather industrial zone development in Pakistan (GEF ID 5666) The project in Pakistan has similarities with that of the Myanmar industrial zones as it focused on a tannery in an industrial zone. The project will contribute with lessons learned and share resources where possible, especially those of project component 3. The component will look at ways to get a better understanding of appropriate effluent treatment technology and pollution reduction technologies.</p>
<p>UNIDO “Reduction of GHG Emission through Promotion of Commercial Biogas Plants” Cambodia (GEF ID 5421)</p> <p>UNIDO Biogas Applications for the Brazilian Agro-industry (GEF ID 9057)</p> <p>and</p> <p>UNIDO “Promoting the Development of Biogas Energy amongst Select Small- and Medium-Sized Agro-Industries” Chile (GEF ID 5335)</p> <p>and</p> <p>“Promoting Organic Waste-to-Energy and other Low-carbon Technologies in Small and Medium-scale Enterprises (SMMEs): Accelerating Biogas Market Development” South Africa (GEF ID 5704)</p>	<p>UNIDO has four existing biogas projects that will provide important lessons for the Myanmar biogas project. The Myanmar project design has taken into consideration important lessons learned during the implementation of UNIDO’s biogas projects particularly around policy reform (Component 1 in Cambodia, Chile, Brazil and South Africa), feasibility and engineering design studies (Component 3 of Cambodia, Chile, Brazil and South Africa), business models (Component 3 of Cambodia, Chile, Brazil and South Africa)</p> <p>The Myanmar project will closely coordinate its activities, exchange information and lessons, and work toward a common knowledge sharing with these projects. The UNIDO Myanmar project managers will rely on knowledge shared by the other UNIDO project managers in the three countries during project start up and implementation to integrate synergies and ensure knowledge products from these three projects are integrated and maintained. In particular, business models and knowledge related to technical aspects of biogas projects.</p>

Projects implemented by other entities/agencies related to biogas and waste water	
The EU and WWF Tha Bar Wa Project	<p>The Tha Bar Wa Project is led by WWF in partnership with donor funds from the EU. It began implementation in 2018 with a focus on cleaner production for the SME F&B sector. WWF and the EU are supporting transition in four key areas: i) policy, ii) capacity and markets, iii) green finance, and iv) replication of project results. Sustainable energy use, adoption of green technologies and replication are strongly aligned with the UNIDO-GEF Myanmar Project. In implementing this 48-month project WWF and the EU have already established working relationships with key stakeholders in Myanmar such as government, private sector financial institutes, SMEs in Yangon and Mandalay and CSOs. In particular the Tha Bar Wa Project has been working closely to build capacity within the financial sector to enable access of green finance to companies. The project development team identified synergies during the Request for CEO Endorsement (RCE) design and formulation process and discussed collaboration with the Tha Bar Wa Project team. In order to ensure the two projects work synergistically towards common goals, collaboration mechanisms will be fostered between the two projects. The ability to scale and replicate aligned models that share common features will be actively pursued. In particular around access to green finance targeted at resource efficiency and emissions reductions technologies investments for SMEs.</p>

<p>FMO – Development of WWT projects in Irrawaddy basin</p>	<p>As mentioned above, FMO will fund the development of potential wastewater treatment projects in alliance with WWF through the project “Development of WWT projects in Irrawaddy basin”. The initiative was signed on February 2019 between WWF Netherlands and FMO, and will be implemented through the WWF-Myanmar. Operational set-up is being established during 2019. FMO and UNIDO have identified high collaboration potential as this GEF project will facilitate the adoption of low carbon technology in industry and the implementation of pilot projects of WWT plants including methane recovery. This will contribute to raise awareness on the need of these investments and its feasibility, as well as promote the market of this technology. These goals contribute to FMO’s initiative and make possible joint efforts for investment promotion on pilot projects and business case development for WWT adoption in Myanmar. On the other hand, a green lines facility will be analysed by FMO, which can result in coordination efforts to facilitate finance access to companies implementing TEST demonstration projects.</p>
<p>UNDP Projects:</p> <p>1) “Reducing Pollution and Preserving Environmental Flows in the East Asian Seas through the Implementation of Integrated River Basin Management in ASEAN Countries (GEF ID 9654)”</p> <p>2) “NAMA on Integrated Waste Management and Biogas in Uganda” (GEF ID 9210)</p>	<p>The project implemented by UNDP, aims at delivering the integrated plans for the Tanintharyi River Basin and replication in the Lenya River Basin (both in South Myanmar). Important lessons will contribute to the water governance, decision-making processes and institutional arrangements and reduce pollution releases into freshwater and ultimately into the marine environment of the East Asian Seas.</p> <p>The NAMA on Integrated Waste Management and Biogas in Uganda project implemented by UNDP, aims at delivering GHG emissions reductions through utilisation of biogas from organic component of the municipal waste stream as well as combining municipal waste water. The Myanmar project team will coordinate with the Ugandan UNDP team to integrate lessons learned and share resources where possible regarding wastewater treatment and biogas production.</p>
<p>JICA projects:</p> <p>1) Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar – JICA</p> <p>2) “The Greater Yangon Water Supply Improvement Project (MY-P5)</p> <p>3) Japan Fund for Poverty Reduction (JFPR)</p>	<p>The potential pilot sites for this project have been identified based on the information gathered through the JICA project. The GEF project will continue to build upon the JICA projects data collection, results and local capacities developed during the last 3 years.</p> <p>The GEF project will also seek complementarities with two other JICA projects including 1) “The Greater Yangon Water Supply Improvement Project (MY-P5)” which provides loans to the Myanmar Government by expanding water treatment facilities and distribution network, and 2) The Japan Fund for Poverty Reduction (JFPR) which currently implementing a project in selected underserved areas of Yangon and Mandalay, which seeks to reduce environmental related diseases and provide access to basic services, such as water and sanitation facilities.</p>
<p>Asian Development Bank projects</p> <p>1) Safeguard support to Myanmar</p>	<p>ADB and other international partners have been supporting Myanmar to build an Environmental Impact Assessment (EIA) system to safeguard the country from the adverse environmental effects of economic development. Activities under Output 1.1.1 benefit and build upon the ADB capacity development around EIA. The UNIDO-GEF project will</p>

2) ADB led-Greater Mekong Sub region (GMS) Core Environment Program (CEP)	work with ADB to identify important lessons learned, particularly for water quality monitoring and management under Component 2. Furthermore, ADB is supporting Myanmar with loans for investment in municipal infrastructure, including residential wastewater infrastructure. The GEF project will seek complementarities with these activities where possible.
World Bank projects: 1) Ayeyarwady Integrated River Basin Management Project	The project focuses on a number of interrelated areas including: water resource management institutions, decision support systems and capacity building, hydro-meteorological observation and information systems modernization including institutional and regulatory strengthening, capacity building and implementation support, modernization of observation infrastructure, data management systems and forecasting, enhancement of Hydromet service delivery systems and water quality monitoring. The UNIDO-GEF project will seek collaboration with the World Bank to ensure synergies in institutional and regulatory strengthening and capacity building activities as well as exploring linkages for data sharing.

Additional Information not well elaborated at PIF Stage:

A.7 *Benefits*. Describe the socioeconomic benefits to be delivered by the project at the national and local levels. How do these benefits translate in supporting the achievement of global environment benefits (GEF Trust Fund) or adaptation benefits (LDCE/SCCF)?

The long-term socio-economic benefits to be delivered by the proposed project are associated with the training, and capacity development, awareness raising, widespread adoption of TEST methodologies and adoption of technology including wastewater treatment and biogas technology. In particular, the project will provide the following benefits:

- **Reduced greenhouse gas emissions:** Industrial parks in Myanmar typically comprise high polluting manufacturing sectors involving food and beverage, garment, consumer goods, chemical and toiletry factories. All industry sectors have an opportunity to greatly reduce their current and future carbon footprints allowing for compliance with national and international climate change policies and growth opportunities.
- **Pilots and scaled models for country-wide distribution:** First of their kind, TEST best practices proven in industrial park greenhouse gas mitigation with documented applied systems, processes and lessons learned for transferability to other sites able to leverage support towards inclusive sustainable industrial development in Myanmar.
- **More stable and efficient supply of electricity:** For those pilot projects that include biogas use for power generation, consumers will not be disrupted with electricity outages, in particular, production processes of industry will not be interrupted.
- **Energy savings for industry sector:** With adoption of sound wastewater treatment operations and methane recovery and renewable energy provision, along with energy efficient application in buildings, and industrial facilities, companies can save money on energy costs. At the management level, the project will foster a more in-depth knowledge of sustainable strategies and a strong commitment to using them for improving company and environmental performance. Benefits of the application of TEST result in economic benefits of cost savings and increased profitability from reduced raw inputs and resource efficiency. Through the recovery of economic value from the treated wastewater flows generating energy by way of heat or electricity, thereby avoiding GHG

emissions from fossil fuels. In addition, the project intends to demonstrate and scale up successful models for wastewater treatment so that it would be taken up by many other districts and municipalities in the country.

- **Reduced impact of energy price shocks to public and private sectors:** Deployment of renewable energy promoted by this project will reduce exposure to global energy price shocks and enable greater financial sustainability for local commerce.
- **Gender inclusion and cultural transition to equality:** Mainstreaming gender through all program activities will build awareness and capacities of industrial sites communities and neighbouring communities. The project will enable women in particular to participate in decisions that impact their lives, health and incomes potentially leading to a transition in the wider community towards greater gender equality.
- **Better access to green jobs:** The project will promote green industrial development which will lead to more green job opportunities through a new generation of vocationally trained experts in the context of wastewater related climate change expectations. Training will develop the capacity of a pool of professionals, company employees and government officials in resource and energy efficiency as well as other sound environmental management practices. As an outcome, training will: i) provide the technical background to motivate the adoption of these TEST methodologies and technology by industry; ii) create capacity at local level to disseminate the relevance and benefits of this approach; iii) promote collaborative efforts to find joint solutions to wastewater issues and other relevant environmental impacts from industry. Training will strengthen the capacity of national and local government to plan and manage wastewater much more effectively and by doing so deliver positive knock-on impacts to local economic prosperity, environmental wellbeing and improved river water quality, public health improvements as well as achieving GHG emissions reductions. Training of employees leads to benefits such as increased skillsets, employability and income earning potential.
- **Restored ecosystem services and improved human health:** Improved ecosystems health delivers clean and safe catchments to surrounding neighbourhoods with downstream river health improvement resulting in less human health issues such as asthma, emphysema, skin and eye problems as well as improved biodiversity linked to livelihood opportunities such as increased aquatic flora and fauna. This is significant for agricultural and fishery based-communities.

A.8 Knowledge Management. Elaborate on the knowledge management approach for the project, including, if any, plans for the project to learn from other relevant projects and initiatives (e.g. participate in trainings, conferences, stakeholder exchanges, virtual networks, project twinning) and plans for the project to assess and document in a user-friendly form (e.g. lessons learned briefs, engaging websites, guidebooks based on experience) and share these experiences and expertise (e.g. participate in community of practices, organize seminars, trainings and conferences) with relevant stakeholders.

Knowledge management is inherent to UNIDO's operating modality by sharing experiences across its interventions worldwide. This has been demonstrated through many publications, events, webinars, and more. Moreover, a dedicated Knowledge Management Plan will be designed during the inception phase and implemented under the proposed project, which will function as the basis for gathering and distributing all data, information and lessons learned. The plan will also include the development of a knowledge management system; the final format shall be decided taking into consideration the nature of the information gathered, but would include a website, as well as possibly social media and an associated platform with information accessible by the public as well as direct stakeholders. The webpage will be linked to the website of the executing agencies and project partners and updated with regular information on the project activities. There will be a strong emphasis on communication from project start to ensure involvement of all project stakeholders.

Additionally, the project will benefit from the experience and lessons learned from UNIDO's EU-funded SwitchMed programme, which implemented the TEST methodology in 8 countries of the southern Mediterranean region as part of the MED TEST II component⁴¹. This project will benefit from the revised TEST Guidelines and tools prepared under SwitchMed, and can learn from the market uptake and scale-up of TEST in the Mediterranean Region to help ensure replication and sustainability. A particular useful awareness-raising component was the development of communication

⁴¹ www.switchmed.eu/en/corners/service-providers/actions/MED_TEST_II_progress

material, such as 2-page factsheets presenting success stories of beneficiary companies in the targeted zones, which will be replicated in this project. The factsheets developed in SwitchMed can also serve as case studies to show companies the types of improvements and investments resulting from applying TEST. Additionally, a wider dissemination of the project's results to other non-beneficiary and companies is planned.

B. Description of the consistency of the project with:

B.1 Consistency with National Priorities. Describe the consistency of the project with national strategies and plans or reports and assessments under relevant conventions such as NAPAs, NAPs, ASGM NAPs, MIAs, NBSAPs, NCs, TNAs, NCSAs, NIPs, PRSPs, NPFE, BURs, etc.:

This project is highly consistent with the commitments of Myanmar as a non-Annex I member of the United Nations Framework Convention on Climate Change (UNFCCC) and it reflects national priorities that are expressed in Myanmar's policies and measures for industrial processes and environment to address climate change as stipulated in the INDC (2015) under section 2.1. and 2.2. The proposed project is synergetic and complementary to the activities undertaken by the country to implement the UNFCCC. As such, the projects provide capacity-building, technology development through active participation of the national private sector. As a result of the project activities, institutional capacity and knowledge will be strengthened to assist Myanmar in achieving climate resilient, low carbon and resource efficient industrial development. In this regard technical knowledge and good practice examples will be fostered and institutionalized in the area of sound wastewater treatment practices mitigating the emission of GHG, as well as generating access to renewable energy (i.e. biomass).

Additionally, as per Myanmar's Initial National Communication (INC) (2012), a large segment of the industrial community in Myanmar is not aware of industry related environmental problems and many factories are still using old machines and obsolete technologies. The INC also indicates that wastewater treatment and systematic waste disposal systems are lacking in most industrial zones. The publication gives recommendations that are in line with the project proposal as follows:

i) Toxic and hazardous wastewater from industries should be treated properly to avoid environmental pollution; ii) industrial zones should introduce GHG emission reduction measures, such as installation of individual or central wastewater treatment system; iii) industries should improve access to updated environmentally sound technologies information to help the industries identify the technologies most suited to them; iv) awareness raising campaigns on environmentally sound technologies should be increasingly conducted for industries in both public and private sectors; v) industries should set high environmental standards and energy efficiency; and vi) information on pollution concerns resulting from gaseous wastes, wastewater and solid wastes are to be made available through regular monitoring.

As part of the national strategy to mitigate climate change, the National Environment Policy of Myanmar was created in 1994 to establish sound environmental policies in the utilization of water, land, forests, minerals, marine resources and other natural resources for conserving the environment and preventing its degradation. According to the objectives of an environmentally sound management of toxic chemical and hazardous wastes expressed in the Myanmar Agenda 21, pollution control and cleaning rules have been drawn up by the Yangon City Development Committee for the enactment of a hazardous waste law. In these rules, 10 sections are pointed out in chapter 5 for environmental management and 15 sections are directed at prohibitions on improper disposal of waste and other manners which cause damages to public health and the environment.

The project has also been designed to align with the Myanmar National Climate Change Policy, Strategy and Action Plan. In particular, the project contributes directly to six key sectoral aims in the strategy to deliver inclusive climate resilient and low carbon development outcomes. The project contributes directly to sectoral expected results outlined below:

Sustainable Management of Natural Resources for Healthy Eco-System:

- a. Climate change dimensions are incorporated and enforced in environment and natural resources management policies, rules and regulations, including gender considerations;
- b. Environmentally sound technologies and good management practices are adopted to improve and maintain forest, water, land and coastal ecosystems, health and services;
- c. Framework for institutional coordination and multi-stakeholder engagement is established and supports access to finance and implementation of responses for health, environment and natural resources management.

Resilient and Low Carbon Energy, Transport and Industrial Systems for Sustainable Growth:

- Energy security for the country is based on generating a large share of its energy from renewable sources and high energy efficiency in domestic, industrial and other use;
- Transport systems are adapted to heightened risks of disasters from new climatic conditions, and sustainable to efficiency and low-carbon technologies;
- Industrial systems are highly productive and competitive due to their climate resilience, sustainable, low-carbon and green characteristics.

Education, Science and Technology for a Resilient Society:

- 1) The capacity of actors in the education sector is developed to integrate principles of sustainability, low-carbon development and resilience into the curricula at primary, secondary and tertiary levels;

C. DESCRIBE THE BUDGETED M &E PLAN:

Monitoring and Evaluation (M&E) of the project implementation is one of the key elements taken into account in the project design phase. Project M&E will be conducted in accordance with established UNIDO and GEF procedures. The M&E of the project's activity, output and outcome will be carried out to track the achievement of its targets and project performance including the underperformed activities. It will also act as the corrective measure to identify and correct any issues. The results of the regular M&E of the project will also be used to improve the project activity and to cope with any changes of the project's environment.

UNIDO as the Implementing Agency will involve the GEF Operational Focal Point and project stakeholders at all stages of the project monitoring and evaluation activities in order to ensure the use of the evaluation results for further planning and implementation. According to the Monitoring and Evaluation policy of the GEF and UNIDO, follow-up studies like Country portfolio evaluations and thematic evaluations can be initiated and conducted. All project partners and contractors are obliged to (i) make available studies, provide reports or other documentation related to the project and (ii) facilitate interviews with staff involved in the project activities.

The M&E outcome, output and activities are defined by project Component 3 as:

Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation

Output 3.1.1: M&E mechanism developed and applied

- Activity 3.1.1.1 Develop a monitoring system to track progress against indicators

- Activity 3.1.1.2 Annual implementation reports
- Activity 3.1.1.3 Mid-term review (MTR)
- Activity 3.1.1.4 Terminal evaluation.

These concrete activities are also specified and budgeted in the M&E plan. Monitoring will be based on indicators defined in the strategic results framework (which details the means of verification), and the annual work plans. M&E will make use of the GEF Tracking Tool, which will be submitted to the GEF Secretariat three times during the course of the project: at CEO Endorsement, at mid-term review, and at project closure. The M&E budget is presented in Table 9. The following M&E activities will be conducted:

Periodic monitoring and site visits

During the inception phase, the PMU in collaboration with project partners will develop a detailed monitoring plan, which will be updated at least annually. The monitoring system will at least include the tracking of progress, performance and accomplishments in relation to:

- Implementation of project activities;
- Effectiveness of awareness raising and capacity building program including their impacts and usefulness;
- Initiatives of project partners to support the project activities;
- CO₂ emission reduction due to the implementation of RECP and the wastewater treatment/biogas pilot plants;
- Performance of the pilot projects; and
- Potential replication of the pilot projects.

The PMU will conduct visits to the project sites based on the agreed schedule in the project's Inception Report/Annual Work Plans to assess first-hand project progress. Other members of the PSC may also join these visits. A back-to-office-mission report will be prepared and will be circulated no less than one month after the visit.

Annual reporting

The project status will be monitored each year through an Annual Monitoring Review (AMR) exercise covering the activities of the previous reporting period. The AMR activities to be carried out include, but are not limited to following:

- Review of the progress made towards project objective and project outcomes - each with indicators, baseline data and end-of- project targets (cumulative)
- Project outputs delivered per project outcome (annual).
- Expenditure reports
- Lesson learned/good practice
- Risk and adaptive management.

Based on this review, UNIDO, supported by the project PMU, will annually submit to the GEF secretary project implementation reports (PIR) after completed the first year of implementation. Also, it will provide valuable information to prepare GEF tracking tools 3 times during the implementation period of the project according to UNIDO and GEF regulations and policies.

Midterm review

The project will undergo a mid-term review at the mid-point of project implementation. The mid-term review will determine progress being made towards the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; it will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of

this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term.

The ToRs for the evaluation will be prepared by the UNIDO Project Manager, in cooperation with the UNIDO Evaluation office. The review will also include the GEF tracking tool update at midterm.

End of Project

An Independent Terminal Evaluation (ITE) will take place during the last quarter of the project implementation prior to the final PSC meeting and will be undertaken in accordance with UNIDO and GEF guidance. The independent terminal evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term review, if any such correction took place). The ITE will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental and adaptation benefits/goals. The tracking tool will also be completed during the terminal evaluation cycle. The ToRs for this evaluation will be prepared by the UNIDO Project Manager based on guidance from the UNIDO evaluation group to ensure an independent terminal evaluation is carried out as a stand-alone activity.

Learning and Knowledge Sharing

The project's interventions will result in a wealth of information and knowledge on approaches for effective wastewater treatment of mixed industrial zones in Myanmar. This value-add will be captured, documented and shared in agreement with project partners, through a variety of media such as reports, web links, videos, photos etc. This can include adopted processes, project rollout and time considerations, allocated budget and co-financing journey, technologies, stakeholder engagement, immediate results and expected benefits in the future and longer-term sustainability. Other beneficial lessons to be captured include: perceived and real barriers, applied course correction and project adaptation, surprises and governance.

The lessons learned and best practices will be disseminated widely within and beyond the project intervention zone (nationally, regionally and internationally) and through existing information sharing networks and forums.

Budgeting

The budget estimation of M&E activities is shown in the table below.

Table 9: Estimation of budget for M&E activities

Type of M&E activity	Engaged Parties	Total Budget (USD)	GEF Grant Budget (USD)	UNIDO Co-financing (USD)	Other Co-financing (USD)	Time Frame
Project inception workshop and report	PMU, UNIDO, DUHD	29,161	0	0	29,161	Within first three months after the 1 st PSC meeting
Monitoring and verification of project progress and performance	PMU, UNIDO, consultants	929,839	50,000	5,000	874,839	In line with the annual project monitoring, evaluation plan and tracking tool submission plan, which will be prepared by PMU in

						consultation with other project partners
Project reports	PMU, consultants, in consultation with other project partners	361,613	60,000	10,000	291,613	Annual report, PIR, and project terminal report
Midterm review	UNIDO, PSC, PMU, external evaluators	156,645	30,000	10,000	116,645	Midpoint of project implementation
Independent Terminal evaluation	UNIDO, PSC, PMU, independent external evaluators	220,806	60,000	15,000	145,806	Within 6 months after the project implementation completed and at least two months before the project termination
Total indicative cost		1,698,064	200,000	40,000	1,458,064	

Legal Context

It is expected that each set of activities to be implemented in the target countries will be governed by the provisions of the Standard Basic Cooperation Agreement concluded between the Government of the recipient country concerned and UNIDO, or – in the absence of such an agreement – by the following: (i) the Standard Basic Assistance Agreement concluded between the recipient country and UNDP; (ii) the Technical Assistance Agreement concluded between the recipient country and the United Nations specialized agencies, or (iii) the Basic Terms and Conditions Governing UNIDO Projects. Also included as a footnote 29 on p.51 of the Annex I (DoA).

PART III: CERTIFICATION BY GEF PARTNER AGENCY(IES)

A. GEF Agency(ies) certification

This request has been prepared in accordance with GEF policies⁴² and procedures and meets the GEF criteria for CEO endorsement under GEF-6.

Agency Coordinator, Agency Name	Signature	Date (MM/dd/yyyy)	Project Contact Person	Telephone	Email Address
Mr. Philippe Sholtés, Managing Director, Programme Development and Technical Cooperation - PTC, UNIDO GEF Focal Point			Ms. Carolina Gonzalez- Mueller, Project Manager	+43 1 26026 3814	c.gonzalez- mueller@unido.org

⁴² GEF policies encompass all managed trust funds, namely: GEFTF, LDCF, and SCCF
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ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

UNIDO/GEF Project: Climate change mitigation through methane recovery and reuse from industrial wastewater treatment
<p>Applicable GEF Strategic Objective and Program: CCM-1. “Promote Innovation, Technology Transfer, and Supportive Policies and Strategies:” Program 1: Promote the timely development, demonstration, and financing of low-carbon technologies and mitigation options CCM-2: “Demonstrate Systemic Impacts of Mitigation Options” Program 3: Promote integrated low-emission urban systems</p>
<p>Applicable GEF Outcomes and Indicators: Outcome A, Indicator 4: “Deployment of low GHG technologies and practices”. Outcome B, Indicator 5. “Degree of support for low GHG development in the policy, planning and regulatory framework”</p>

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
<p>Project Objective: Increasing Myanmar's efforts towards climate mitigation by minimizing GHG emissions through the application of integrated low-emission wastewater treatments and the Transfer of Environmentally Sound Technologies (TEST) methodology in private sector.</p>	<p>GHG emission reduction due to implementation of TEST and low carbon wastewater treatment technology.</p>	<p>Low or no wastewater treatment technology used in industrial zones leading to high intensity of GHG emissions from industrial wastewater.</p> <p>Limited technology development in SME and large companies reduces growth opportunities and increase negative environmental impact.</p> <p>Weak policy framework related to environmental regulations, industrial zone planning and incentives.</p>	<p>Direct GHG reduction: 343,825 metric tons of CO_{2eq} for 20-year projection.</p>	<p>Project’s annual reports Project’s final report Project midterm review and terminal evaluation reports</p>	<p><u>Assumptions:</u> Continuous international support. Continuous support from government bodies, national institutions, local authority and private sectors. Commitments of the private sector in ensuring the co-financing for 1) TEST/RECP, low carbon technology application, 2) low carbon wastewater treatment technology using biogas applications.</p> <p><u>Risks:</u></p>

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
					Change of international support to Myanmar Change of government policy and its priority of environmental issues caused by industrial development
Outcome 1.1 National capacity for promoting greenhouse gas emission reduction strengthened by an improved institutional and policy framework on water quality and wastewater management					
Component 1: Policy framework and national capacity for water quality and wastewater management improved.					
<i>Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened.</i>	Number of assessments of current industrial legal and regulatory measures, urban planning processes and policy frameworks on water quality and wastewater management.	Regulatory framework exists but there is weak enforcement, as well as weak incentives for compliance and overlapping jurisdictions	1 assessment report detailing gaps and improvement opportunities on regulatory and policy framework.	Assessment report submitted to ECD and DUHD	<u>Assumptions:</u> National authorities are willing to endorse, specific policy documents. Willingness of responsible agencies to implement the policy and regulatory improvements and tools proposed. Willingness of industry to participate and government to enforce polluter and user pays principals. Risks: Change of government policy and its priority of
	Number of proposals for strengthening regulations and policy tools on sound wastewater management.	Few policy tools exist for promotion of sound industrial wastewater treatment.	1 roadmap proposal for strengthening identified and prioritized regulations. 1 proposal of policy or regulation tool.	Roadmap proposal report and the proposal of policy or regulation tool submitted to ECD and DUHD	

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	Number of assessments on Public Private Partnership (PPP) models for wastewater treatment applying user-pay and polluter-pay principles.	Few examples of private sector engagement and participation in the construction and maintenance of wastewater infrastructure and user-pay and polluter-pay principals for wastewater treatment.	1 assessment report on PPP business models for development of wastewater infrastructure consulted with public and private stakeholders.	Assessment report submitted to ECD and DUHD	environmental issues caused by the industrial development.

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
<i>Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane harnessing technology strengthened by TEST capacity building program</i>	<p>Number of capacity building program material on the TEST and RECP methodologies developed.</p> <p>Number of national experts trained to perform as national consultants on RECP and TEST methodologies (disaggregated by gender)</p>	<p>Government sector stakeholders have limited understanding of methodologies such as RECP, TEST and low-carbon technologies and practices, to promote them in industrial sectors.</p> <p>National consultants have little knowledge of how to apply RECP and TEST in industries.</p> <p>Limited offer of technical assistance services related to TEST's tools.</p>	<p>1 capacity building program material on TEST.</p> <p>25 participants are trained through one Training of Trainers (ToT) course aimed at a national consultants and relevant government officials. 70 % men; 30 % women.</p>	<p>Set of training materials.</p> <p>Training report.</p> <p>Published material on the project website as an information-sharing tool.</p> <p>Attendance list of participants.</p>	<p>Assumptions:</p> <p>Willingness of key stakeholders, for example industry representatives, local experts, local authority's officials, etc., to attend training activities.</p> <p>Willingness of private sector to share information and participate in training programs.</p> <p>Accessibility of internet and digital technology supporting the access to online information-sharing tools.</p>

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	Number of participants (disaggregated by gender) from industry and key stakeholders attending training on introduction of the TEST integrated approach and RECP.	Companies have little understanding of the benefits of TEST and RECP application and its relationship with wastewater treatment and biogas technologies.	At least 100 participants from manufacturing sector, business associations, industrial zones management, city development committees and related professionals. 70 % men; 30% women.	Training report Attendance list of participants.	Risks: - Lack of availability or interest of government officials and representative from industrial sectors to attend the number of training days.
	Number of participants (disaggregated by gender) attending training on low-cost industry wastewater treatment, methane harnessing technology and wastewater management on industrial zones.	Limited expertise on low-carbon technology implementation for wastewater treatment in private sector. Need of strengthening local capacity to improve wastewater management and planning on spatial zoning to improve industrial zones performance.	50 participants from city development committees, industrial organizations, technical suppliers, industrial zone managers and companies from priority industrial zones. 80 % men; 20 % women	Training report Attendance list of participants.	
	Number of participants (disaggregated by gender) attending training on Environmental Management Accounting (EMA) and Environmental Management System (EMS).	High energy intensity coupled with firms' poor economic performance due to inefficient production practices and technology. Limited development on environmental management systems in industrial sectors to improve industry performance.	At least 120 participants from industrial sectors and relevant public offices. 80 % men, 20 % women	Training report Attendance list of participants.	
	Number of participants (disaggregated by gender) from YCDC	MCDC and YCDC have limited capacity for long term climate change planning.	At least 50 participants from YCDC and MCDC. 50 % men, 50 % women.	Training report	

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	and MCDC attending technical training on planning for climate change.			Attendance list of participants.	
	Number of participants of local governments (disaggregated by gender) attending technical training on issues connected with wastewater treatment, including water supply and sanitation.	Limited local government capacities to enforce regulation and promote incentives to improve wastewater management at local level.	At least 50 participants from local governments in the region of Yangon and Mandalay. 70 % men, 30 % women	Training report Attendance list of participants.	
<i>Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented.</i>	Number of events to disseminated lesson learned and best practices.	Low awareness of environmentally sound technologies and wastewater treatment technology.	At least 10 dissemination events developed. All events will promote at least 30% of women participation.	Reports of dissemination and awareness raising events Attendance list of participants.	Assumptions: Willingness of key stakeholders for example industry representatives, local experts, local authority's officers, and community representatives to attend awareness and training activities. Accessibility of internet and digital technology supporting the access to online information-sharing tools. Risk: Lack of willingness from industries to share information on the results of the TEST demonstration projects.
	Number of awareness raising materials, publications or outreach/educational materials on RECP, TEST or Low-carbon wastewater treatment technology	Limited availability of information sources on successful case studies and lesson learned regarding RECP measures and low-carbon wastewater treatment technology implementation.	At least 30 fact sheets of TEST demonstration projects in Industries. At least 10 publications and/or awareness raising, outreach/educational material.	Digital and printed publications and outreach materials. Published material on the project website as an information-sharing tool	
	Number of training material on the TEST approach and	Scarcity of knowledge and skills of local engineers and	1 training manual on TEST and sound wastewater management	Training manual elaborated.	

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	sound wastewater management to be used in universities and/or technical schools for vocational training.	companies to tackle the issue of wastewater treatment.	for use in relevant vocational training centres and institutes.		Weak engagement from key stakeholders in awareness raising activities.
Outcome 2.1: Pilots at company and industrial park levels implementing TEST approach and WWTP and biogas technologies					
Component 2: Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach					
<i>Output 2.1.1: Industrial parks and companies assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions</i>	Number of initial assessments to apply the TEST methodology to a target group of companies.	Limited awareness on the benefits and opportunities of applying environmentally sound technologies, energy savings potential and GHG emissions reduction opportunities in industry.	At least 50 companies with initial assessments developed.	Initial assessment reports.	<p>Assumptions:</p> <p>Positive economic growth in industrial sector motivates investment.</p> <p>Increasing of environmental enforcement engages industrial sector to improve environmental performance.</p> <p>Willingness of private sector to invest in recommended RECP measures.</p> <p>Environmentally sound technology is available for Myanmar industrial sector. Financial institutions have interest to finance environmentally sound technology.</p> <p>Risk:</p> <p>Lack of technical and economic resources in companies to carry out the demonstration projects.</p>
	Number of companies applying the TEST methodology as pilot projects adjusted to Myanmar industrial sector.	Limited knowledge on standardized procedures and methods to implement environmentally sound technologies, obtain energy savings potential and GHG emissions reduction in industry. Limited capacity to implement RECP/TEST and wastewater treatment technologies	50 companies develop pilot projects of the TEST methodology.	Participation agreements with companies. Technical assistance reports on the TEST methodology application in each company.	
	Number of companies with feasibility studies to request access to financial	Little investment opportunities on environmentally sound technologies identified,	At least 15 companies carry out feasibility studies and request finance	Feasibility study reports. Meeting minutes with financial institutions to	

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Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	mechanisms for RECP investments.	evaluated and demanded by the private sector. Limited access to financial mechanisms to develop investment projects on environmentally sound technologies	support for RECP investments.	promote RECP investments.	Companies do not fulfil with banking conditions to obtain credit.
<i>Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants</i>	Number of industrial zones with wastewater quality monitoring program conducted at selected sites.	Lack of information on the wastewater discharges and its chemical and physical characteristics to support decision-making processes at company and industrial zone level.	At least 2 industrial zones with improved wastewater quality monitoring program conducted at selected demonstration sites.	Monitoring program reports. Project implementation reports.	Assumptions: Industrial zones management and industries with relevant discharges into these zones have interest and readiness to implement a wastewater quality monitoring program. Risks: Infrastructure conditions restrict data collection in relevant monitoring site. Limited internal capacity on wastewater management at industrial zones hinder the continued application of the wastewater quality monitoring program.
	Number of technical and financial feasibility studies conducted to evaluate the implementation of pilot projects on wastewater treatment applying methane recovery	Limited technical assistance available to industries, industrial zones and authorities for implementing low-carbon wastewater treatment and methane recovery technologies.	At least 3 feasibility studies developed to evaluate the implementation of pilot projects.	Feasibility study reports	Assumptions: Willingness of key stakeholders to co-financing infrastructure to reduce the GHG emissions. Risk:

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	for energy generation (electricity or heating).				Lack of commitment from industrial zones to undertake wastewater treatment projects.
	Number of pilot projects on wastewater treatment applying methane harnessing for electricity or heating implemented.	Limited technical assistance services and financial mechanisms available to industries, industrial zones and government for implementing low-carbon wastewater treatment and biogas technologies. Low demand and inadequate supply chain of technology related to wastewater treatment and energy efficient technology.	At least 1 pilot project on wastewater treatment using methane harnessing for electricity or heating implemented.	Project implementation reports, including pictures and visits reports to the facilities.	Assumptions: Willingness of key stakeholders to co-financing infrastructure to reduce the GHG emissions Risks: Actions against the wastewater treatment facilities
	Number of sustainable management models for sound wastewater management including methane harnessing at industrial parks	Weak wastewater management strategies, policies and services at industrial park levels; limited capacity to improve services and provide sustainable options to reduce the environmental footprint of industrial zone facilities.	1 sustainable management model for sound wastewater management including methane harnessing at industrial parks.	Progress and final reports of the sustainable management model.	Assumptions: Involvement of relevant partners in development of sustainable management models. Risks: Lack of commitment to implement the management models.
Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation					
Component 3: Monitoring and Evaluation					
<i>Output 3.1.1: M&E mechanism developed and applied</i>	Monitoring and evaluation adequately conducted according	UNIDO and GEF monitoring and evaluation procedures are new for some of the project staffs and project partners.	PSC officially established and meet annually Training on monitoring procedures including gender and administrative	PSC establishment act Project inception workshop report	Assumptions: PSC set up in the timely manner Monitoring and evaluation, and project reporting mechanisms

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	<p>to UNIDO and GEF standard</p> <p>Timely availability of inception, annual and evaluation project reports</p> <p>Mid-term review conducted</p> <p>Independent, final evaluation conducted</p>	<p>The project result framework with outcome and output indicators and targets will be used to track the progress and achievement of the project.</p> <p>The detail annual work plan will be presented to PSC at the annual meeting.</p>	<p>processes held during inception period.</p> <p>Progress reports available annually</p> <p>Mid-term review delivered conducted</p> <p>Independent terminal evaluation report delivered within 3 months from project closure.</p>	<p>Annual Project Implementation Reports (PIRs)</p> <p>Mid-term review report</p> <p>Terminal evaluation report</p>	<p>agreed and adopted by all the relevant project partners</p> <p>Project stakeholders actively cooperating in all monitoring and evaluation activities</p> <p>All deliverables submitted in time</p> <p>Risks:</p> <p>Changes in government may delay the setup of PSC.</p>
	<p>Number of project progress reports presented to the Steering Committee for timely and adequately review.</p>		<p>1 annual report presented to the Steering Committee.</p>	<p>Project annual reports.</p> <p>Steering Committee meetings reports.</p>	

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

GEF Secretariat comments at PIF stage and response at PPG

Comments	UNIDO responses
Is the PIF being recommended for clearance and PPG (if additional amount beyond the norm) justified?	
<p>MO July 6, 2017 All comments cleared. Program manager recommends PIF clearance. Cost-efficiency is still low. Please improve during project preparation period.</p>	<p>During project preparation additional data was collected to estimate the cost of emissions reduction from a) electricity savings from the application of TEST methodology, b) avoidance of methane and nitrous oxide emissions, and c) energy produced from biogas. Subsequent to processing this data, the cost efficiency of the project has increased. a direct CO2 unit abatement cost (UAC) of USD 11.58 per tonne of CO2eq. This is a decrease of 42% from that estimated in the PIF.</p>

GEF STAP comments at PIF stage and response at PPG

Comments	UNIDO responses
<p>The actions planned in the project make logical sense, and the science related to the proposed treatment technologies and measuring their impacts on effluent discharges is well understood. It appears the technology to be used is still under consideration but "could" be a closed anaerobic digester system instead of open ponds. There are major cost and efficiency differences between the two.</p>	<p>As can be seen in Annex G, technical specifications are given for two potential closed anaerobic digesters, one in Yangon, one in Mandalay. In the case of Myanmar, conventional aerobic processes using carriers (MBBR – Moving Bed Biofilm Reactor) for wastewater treatment facilities are energy and materially intensive. MBBR reactor in combination with the anaerobic digester systems proposed are less energy intensive and more economic than aerobic treatment / aerobic septic system. The energy intensive aeration process required for the anaerobic digestion releases methane otherwise used as biogas for heat or electricity production in the proposed anaerobic system. Anaerobic digesters do not use chemicals to reduce BOD and there is less sludge production. The sludge will be stable and safe to use as a soil enhancer. There are also local environmental benefits of less odor and reduced localized environmental degradation from untreated sludge discharge.</p>
<p>Information provided in the project document indicates that the project will mainly focus on the mitigation of methane emissions. However, as rightly indicated in the</p>	<p>Nitrous oxide (N₂O) emissions from wastewater treatment plants vary substantially between plants, ranging from negligible to substantial (a few per cent of the total</p>

Comments	UNIDO responses
<p>second paragraph on page 4, wastewater is also an important source of nitrous oxide, the third most important GHG released to the atmosphere and the most significant ozone-depleting substance (ODS).</p> <p>Curbing nitrous oxide emissions related to ozone depletion was not considered in presenting the expected GEBs arising from this project.</p>	<p>nitrogen load), likely due to different designs and operational conditions. As evidence suggests, plants that achieve high levels of nitrogen removal emit less N₂O, indicating that no compromise is required between high water quality and lower N₂O emissions.⁴³ N₂O emissions primarily occur in aerated zones/compartments/periods owing to active stripping, and ammonia-oxidizing bacteria, rather than heterotrophic denitrifiers. Wastewater literature identifies various factors that induce N₂O emissions, however, a detailed understanding of the factors is currently missing. Studies show that a reduction of N₂O emissions from wastewater treatment systems through improved plant design and operation are possible. As described in activity 2.1.2.2. the project will ensure best practice (suited to national circumstances) is employed to reduce N₂O emissions from the pilot wastewater treatment plants and biogas facilities.</p>
<p>It is not clear what parameters will be employed when making the final selection of the most appropriate technology for the demonstrations, how much local manufacture may be involved, or who will make the final decision. The organic solids content of the effluents to be treated are not presented but are likely to be low. This should be taken into account when selecting the treatment system.</p> <p>Furthermore, studies have shown that poorly designed wastewater treatment could effectively lead to increased nitrous oxide emissions. Hence, it is important that the demonstration pilots are well designed and maintained.</p>	<p>Please refer to Annex G which provides details of the selection criteria for technology for the demonstrations. Under activity 2.1.2.1 monitoring of wastewater effluent at the factory and industrial zone level will provide the necessary organic solid content data to conduct technical feasibility studies under activity 2.1.2.2. The intention of these activities is to identify sites with sufficient organic and optimize the design and operating models of the biogas system in order to achieve optimal performance.</p> <p>Please refer to previous response for assurances the project and design of wastewater treatment plants will take all necessary measures to avoid N₂O emissions.</p>
<p>Local expertise will be utilized, and partner companies and industrial parks are being sought. It has been assumed there will be considerable interest in being involved, but this will partly depend on the investment and operating costs. Reducing freshwater demands on-site and recycling some of the treated water for irrigation will be co-benefits. However, there is a risk, not listed, that the USD15M equity assumed from the private sector for the project may not materialize.</p>	<p>During project preparation consultations identified 50 partner companies willing to participate in the implementation of TEST methodology and the wastewater treatment under project components 1 and 2. The implementation of the training and awareness raising under component 1 will drive the demand for participation in investment activities under component 2.</p> <p>During project preparation, particularly during stakeholder consultations, significant effort was expended</p>

⁴³ Law Y, Ye L, Pan Y, Yuan Z. Nitrous oxide emissions from wastewater treatment processes. *Philos Trans R Soc Lond B Biol Sci.* 2012;367(1593):1265-77.

Comments	UNIDO responses
	<p>to understand the private sector financial landscape, particularly the lending environment for SMEs (see Annex H). During consultations, industrial zones and factory owners expressed a desire to access affordable and attractive financing schemes provided by private sector financial institutions in order to comply with current and future wastewater discharge regulations. Private financial institutions have also expressed a desire to grow “green investment” lending portfolios and believe that risk-sharing mechanisms such as syndicated loans will provide appropriate risk sharing with attractive terms for such lending. The project takes a proactive approach to mitigate the risk posed by private equity will not materialize. For instance, the project will work alongside factory owners the Ministry of Finance, private and public financial institutions, WWF’s Tha Bar Wa project and GIZs Banking and Financial System Development project, to address the pertinent barriers to accessing finance for wastewater and biogas plants. Under activity 1.1.1.1. barriers and policy options will be explored. Policy recommendations, such as the user pays principal, will be made under activity 1.1.1.2.</p> <p>The project will seek to liaise efforts with financial institutions strengthened by Tha Bar Wa project in regard to green financing, as the primary (but not only) potential partners. Working in close coordination with partners under activity 2.1.2.2 the project will support pilot sites to identify and secure existing streams of finance and financial products such as grants and guarantees. This activity will take lessons learned from and be implemented in close coordination with similar activities being implemented by Tha Bar Wa project.</p> <p>As a result of the TEST application, a portfolio of investments in environmentally sound technologies will be identified in the targeted industries. Under activity 2.1.1.3, assistance will be provided to companies to access existing streams of finance for energy or raw input saving investments.</p>
<p>Reductions of 140 kt CO₂-eq are projected with a further 56 – 210 kt CO₂-eq avoided from indirect emissions (Table in Section F). However, Section 5 when quoting these same numbers only discusses CO₂ reductions from</p>	<p>At the PIF stage it was not possible to assess avoided methane and NO₂. During project preparation pre-feasibility has been undertaken avoided methane has been calculated using approved consolidated baseline and</p>

Comments	UNIDO responses
<p>the biogas displacing fossil fuels and reduced deforestation. Nitrous and methane emissions will also be reduced (as shown in the Table) but, it seems, are not included in the GEB calculation. The emission reduction potential should therefore be recalculated and presented in terms of tones CO₂-equivalent.</p>	<p>monitoring methodology ACM0014 “Avoided methane emissions from wastewater treatment”. Furthermore, it was not possible to assess the amount of nitrous compounds during the PPG stage. Therefore, it is expected that this will be possible during the project implementation period due to installation of monitoring systems.</p>

GEF Council comments at PIF stage and response at PPG

The following Table shows comments on the project received from Council members (Canada, France, Germany, Norway and USA) and responses.

Comments	UNIDO responses
<p>Canada:</p> <p>Canada supports the approval of the initiative for GEF funding.</p> <p>This project addresses an urgent need for appropriate wastewater management policy tools and integrated low-emission wastewater technology systems at company and industrial park levels. Current unsustainable industrial development and insufficient wastewater treatment result in high levels of GHG emissions that negatively impact climate change as well as the degradation of human health and the environment.</p> <p>Creating a linkage between the academic community and the private sector is a welcome approach.</p>	<p>During project preparation a number of academic institutions were consulted in the design of project activities and provided useful input. The type of entities that could be involved in the execution of the project includes universities with expertise in the respective topical areas.</p> <p>The project will also involve and partner with the Department of Chemical engineering, Yangon Technological University and the Department of Chemical Engineering, Mandalay Technological University in training and awareness raising activities under component 1. The project team will encourage participation of students and faculty members in practical and research experience opportunities under the project. Furthermore,</p> <p>Materials for dissemination will be targeted at relevant local, national and international events, industry networks, policy working groups and academic conferences. Outreach and educational opportunities may focus on cultural or community events, in addition to school climate and wastewater programs.</p> <p>Under Activity 1.1.3.3 the project will develop awareness raising material on the integrated TEST approach, and a training manual on sound wastewater management for use in relevant vocational training centers and institutes.</p>

Comments	UNIDO responses
<p>United States</p> <p>The concept of implementing wastewater treatment technologies through policy alignment and private sector involvement is obviously needed. However, the details of how this will be implemented are somewhat unclear. For example, it is not clear how this project would lead to more ‘sustainable land management’ for agriculture.</p> <p>The PIF does not explain what incentives will be in place to entice private industry to be involved and contribute financially to this project.</p> <p>There is a lack of focus on the long-term sustainability of this PIF. Reviewing existing policy mechanisms is a good start, but can be thwarted by lack of human capacity or resources in the government. We hope the project team will be able to mitigate or avoid such pitfalls.</p> <p>Because the ultimate goal of this project is waste reduction and technology implementation, it is not clear what the plans are for maintaining wastewater treatment technologies past the project time period.</p>	<p>Project preparation research and stakeholder consultation has allowed a greater understanding of the project baseline and thus informing project design and interventions. The RCE document details how through policy alignment and involving the private sector will lead to the desired results. Please also refer to the project theory of change in Annex L.</p> <p>As elaborated under activity 1.1.1.1 and 1.1.1.2 the project team will ensure there is sufficient capacity support provided to ECD and other ministries to carry out the intended review of policy mechanisms and subsequent recommendations for policy reform/strengthening to ensure long-term sustainability following project closure.</p> <p>The maintenance of wastewater treatment and biogas technologies after project closure will be the responsibility of the plant owners (Annex G provides further details of plant operation and Annex M details mitigation measures for plant retrofit and decommissioning). Training and system optimization during project implementation will ensure that sufficient capacity is developed to maintain plants beyond the lifetime of the project.</p>
<p>Norway</p> <p>There is no doubt that such a project is important and particularly useful in this area where appropriate wastewater treatment is often non-existent. There are certainly also co-benefits both for environment more generally and health.</p> <p>We cannot really assess how innovative this particular project is. In further project design and implementation of this and similar projects, one should also take into consideration lessons learnt from comparable projects in other countries including CDM projects.</p>	<p>The project aims to facilitate innovation and technology transfer, with supportive policies and strategies. The application of TEST is innovative as it applies a holistic systems approach when targeting effluents from industrial zones see the baseline section for the innovative applications of the TEST methodology. Furthermore, in Myanmar there are no programmes, policies or strategies that encourage the large-scale deployment of wastewater treatment plants combined with methane recovery systems. Wastewater treatment combined with biogas is nearly non-existent (with the exception of one distillery). The combination of training and capacity development, alongside the aim of driving demand for biogas plants throughout industrial wastewater treatment can be considered innovative in the Myanmar context. Innovative plant ownership and operational models will also be developed as an output of 2.1.2.2 and innovative financing mechanisms such as syndicated loans may be used under</p>

Comments	UNIDO responses
	component 2 for financing both TEST and wastewater treatment plants.
<p>Germany</p> <p>Germany requests for the following project that the Secretariat sends draft final project documents for Council review four weeks prior to CEO endorsement:</p> <p>Germany welcomes the ambitious proposal on a comprehensive approach for industrial waste wastewater treatment in Myanmar. Myanmar has already established a comprehensive legislative framework in particular under the Environmental Conservation Law but lacks particularly an adequate enforced monitoring system as well as regulatory framework. The project seeks to streamline and strengthen other existing policies. Germany would like to emphasize thereby to follow the user-pay and polluter-pay principles as well as to put waste minimization though the reduction, reuse and recycling of raw material, energy and water, in the focus of the project's capacity development and regulation activities.</p> <p>Germany appreciates the envisaged application of UNIDO's Transfer of Environmentally Sound Technologies (TEST) that has been proven in other projects. In this regards the project is innovative as it applies a holistic approach when targeting effluents from industrial zones. Germany sees a substantial potential for scaling-up, since Myanmar currently has 24 industrial zones with almost 3,500 individual factories, as mentioned in the PIF.</p> <p>Germany requests that the following points be taken into account during the drafting of the final project proposal:</p> <p>The log frame comprising the component, outcomes and outputs should be improved. In particular component 1 should be divided into three components, for example: 1) Enhancing wastewater regulatory framework; 2) Applying TEST integrated approach at industrial parks and companies; 3) Capacity development on industry wastewater treatment and methane recovery power generation technology. Output 1.1 should be more specified in relation to the specific output.</p>	<p>At the time of project implementation, and based on existing support from WWF and JICA, the regulatory enforcement framework for wastewater effluent discharge will be reviewed (further if necessary) under activity 1.1.1.1. Under activity 1.1.1.2 recommendations may be made on strengthening the enforcement framework (dependent on the progress attained by other support to ECD by JICA and WWF).</p> <p>The user-pay and polluter-pay principles will be explored under activity 1.1.1.1 with recommendations made or a policy tool developed (if selected by ECD) under activity 1.1.1.2. Waste minimization in line with the 3R principles (reduce, reuse and recycle) and Life Cycle Analysis (LCA) will form an integral component of the policy framework review and recommendations as well as the training activities conducted under activity 1.1.2.1.</p> <p>During project preparation the log frame was developed (see Annex A). Component one has been divided into two components, 1 focuses on the policy framework and national capacity for water quality and wastewater management improved with output 1.1 further elaborated since the PIF. Component 2 focuses on pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach.</p> <p>Please refer to Annex Optional Annex I: for detailed CO₂ emission calculations. In addition, the grid emission factor is now correct.</p> <p>A MoU with the World Bank was under discussion when the PIF was developed, however it has not materialized in the meantime and it does not look likely that one will be agreed in the near future.</p>

Comments	UNIDO responses
<p>The PIF states that the project will have both direct and indirect emission reductions of at 140,000 tons of CO₂: “Direct CO₂ reduction achieved through increased resource efficiency and wastewater treatment in industries”; and “indirect CO₂ reduction will be accomplished via the use of the organic matter captured by the wastewater treatment for the production of biogas”. Both activities, i.e. methane emission avoidance and methane capture and utilization are direct activities though. However, the replication factor of demonstration projects is estimated to 1.5 (indirect impact). The full proposal should more clearly present the expected direct emission reduction compared to indirect emission. In addition, the emission reduction calculation is not accurate, e.g. presenting wrong units for the grid emission factor.</p> <p>The PIF mentions a current Memorandum of Understanding (MoU) between UNIDO and the World Bank Group with regards to infrastructure investments in the targeted industrial zones in Myanmar. The final proposal should clarify what is covered by the MoU with regards to infrastructure investments in industrial zones and how this is related to the proposed project.</p>	

ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS ⁴⁴

A. Provide detailed funding amount of the PPG activities financing status in the table below:

PPG Grant Approved at PIF: 125,000			
<i>Project Preparation Activities Implemented</i>	<i>GEF/LDCF/SCCF Amount (\$)</i>		
	<i>Budgeted Amount</i>	<i>Amount Spent To date</i>	<i>Amount Committed</i>
Stakeholder consultations/discuss project implementation /execution modalities with relevant agencies /recruit national expert for drafting of final project documents.	21,000	25,000	
Collection of information and analysis of relevant baseline data on industrial sectors and ongoing initiatives for the calculation of GHG emission reduction potential. Selection of targeted industrial zones and industries.	20,000	28,535	
Preparation of a knowledge management plan.	5000	4,251	
Preparation of environmental and social management plan (ESMP).	23,000	8,000	
Preparation of a gender baseline analysis	18,000	9,800	
Stakeholder workshops to confirm co-financing amounts and collect letters.	18,000	11,820	3,000
Complete the drafting of project documents for CEO Endorsement.	20,000	28,752	5,842
Total	125,000	116,158	8,842

⁴⁴ If at CEO Endorsement, the PPG activities have not been completed and there is a balance of unspent fund, Agencies can continue to undertake the activities up to one year of project start. No later than one year from start of project implementation, Agencies should report this table to the GEF Secretariat on the completion of PPG activities and the amount spent for the activities. Agencies should also report closing of PPG to Trustee in its Quarterly Report.

ANNEX D: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used)

Provide a calendar of expected reflows to the GEF/LDCF/SCCF Trust Funds or to your Agency (and/or revolving fund that will be set up)

NA

ANNEX E: GEF 6 CORE INDICATOR WORKSHEET

Use this Worksheet to compute those indicator values as required in Part I, Table E to the extent applicable to your proposed project. Progress in programming against these targets for the program will be aggregated and reported at any time during the replenishment period. There is no need to complete this table for climate adaptation projects financed solely through LDCF and SCCF.

Core Indicator 1		Terrestrial protected areas created or under improved management for conservation and sustainable use				(Hectares)		
		Hectares (1.1+1.2)						
		Expected			Achieved			
		PIF stage	Endorsement	MTR	TE			
Indicator 1.1		Terrestrial protected areas newly created						
Name of Protected Area	WDPA ID	IUCN category	Hectares					
			Expected			Achieved		
			PIF stage	Endorsement	MTR	TE		
		(select)						
		(select)						
		Sum						
Indicator 1.2		Terrestrial protected areas under improved management effectiveness						
Name of Protected Area	WDPA ID	IUCN category	Hectares	METT Score				
				Baseline		Achieved		
					Endorsement	MTR	TE	
		(select)						
		(select)						
		Sum						
Core Indicator 2		Marine protected areas created or under improved management for conservation and sustainable use				(Hectares)		
		Hectares (2.1+2.2)						
		Expected			Achieved			
		PIF stage	Endorsement	MTR	TE			
Indicator 2.1		Marine protected areas newly created						

Name of Protected Area	WDPA ID	IUCN category	Hectares				
			Expected		Achieved		
			PIF stage	Endorsement	MTR	TE	
		(select)					
		(select)					
		Sum					
Indicator 2.2	Marine protected areas under improved management effectiveness						
Name of Protected Area	WDPA ID	IUCN category	Hectares	METT Score (Scale 1-3)			
				Baseline		Achieved	
				PIF stage	Endorsement	MTR	TE
		(select)					
		(select)					
		Sum					
Core Indicator 3	Area of land restored					(Hectares)	
				Hectares (3.1+3.2+3.3+3.4)			
				Expected		Achieved	
				PIF stage	Endorsement	MTR	TE
Indicator 3.1	Area of degraded agricultural land restored						
				Hectares			
				Expected		Achieved	
				PIF stage	Endorsement	MTR	TE
Indicator 3.2	Area of forest and forest land restored						
				Hectares			
				Expected		Achieved	
				PIF stage	Endorsement	MTR	TE

Indicator 3.3	Area of natural grass and shrublands restored					
			Hectares			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Indicator 3.4	Area of wetlands (including estuaries, mangroves) restored					
			Hectares			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Core Indicator 4	Area of landscapes under improved practices (hectares; excluding protected areas)					<i>(Hectares)</i>
			Hectares (4.1+4.2+4.3+4.4)			
			Expected		Expected	
			PIF stage	Endorsement	MTR	TE
Indicator 4.1	Area of landscapes under improved management to benefit biodiversity					
			Hectares			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Indicator 4.2	Area of landscapes that meet national or international third-party certification that incorporates biodiversity considerations					
Third party certification(s):			Hectares			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE

Indicator 4.3	Area of landscapes under sustainable land management in production systems					
			Hectares			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Indicator 4.4	Area of High Conservation Value Forest (HCVF) loss avoided					
			Hectares			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Core Indicator 5	Area of marine habitat under improved practices to benefit biodiversity					<i>(Hectares)</i>
Indicator 5.1	Number of fisheries that meet national or international third-party certification that incorporates biodiversity considerations					
Third party certification(s):			Number			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Indicator 5.2	Number of large marine ecosystems (LMEs) with reduced pollution and hypoxial					
			Number			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Core Indicator 6	Greenhouse gas emission mitigated					<i>(Tons)</i>
			Tons (6.1+6.2)			
			Entered		Entered	

		PIF stage	Endorsement	MTR	TE
	Expected CO2e (direct)	140,000	282,494		
	Expected CO2e (indirect)	210,000	847,481		
Indicator 6.1	Carbon sequestered or emissions avoided in the AFOLU sector				
			Tons		
			Entered		Entered
		PIF stage	Endorsement	MTR	TE
	Expected CO2e (direct)				
	Expected CO2e (indirect)				
	Anticipated Year				
Indicator 6.2	Emissions avoided				
			Hectares		
			Expected		Achieved
		PIF stage	Endorsement	MTR	TE
	Expected CO2e (direct)				
	Expected CO2e (indirect)				
	Anticipated Year				
Indicator 6.3	Energy saved				
			MJ		
			Expected		Achieved
		PIF stage	Endorsement	MTR	TE
Indicator 6.4	Increase in installed renewable energy capacity per technology				
			Capacity (MW)		
		Technology	Expected		Achieved
			PIF stage	Endorsement	MTR
		(select)			
		(select)			

Core Indicator 7	Number of shared water ecosystems (fresh or marine) under new or improved cooperative management				<i>(Number)</i>	
Indicator 7.1	Level of Transboundary Diagnostic Analysis and Strategic Action Program (TDA/SAP) formulation and implementation					
		Shared water ecosystem	Rating (scale 1-4)			
			PIF stage	Endorsement	MTR	TE
Indicator 7.2	Level of Regional Legal Agreements and Regional Management Institutions to support its implementation					
		Shared water ecosystem	Rating (scale 1-4)			
			PIF stage	Endorsement	MTR	TE
Indicator 7.3	Level of National/Local reforms and active participation of Inter-Ministerial Committees					
		Shared water ecosystem	Rating (scale 1-4)			
			PIF stage	Endorsement	MTR	TE
Indicator 7.4	Level of engagement in IWLEARN through participation and delivery of key products					
		Shared water ecosystem	Rating (scale 1-4)			
			Rating		Rating	
			PIF stage	Endorsement	MTR	TE
Core Indicator 8	Globally over-exploited fisheries Moved to more sustainable levels				<i>(Tons)</i>	
			Metric Tons			
			PIF stage	Endorsement	MTR	TE
Core Indicator 9	Reduction, disposal/destruction, phase out, elimination and avoidance of chemicals of global concern and their waste in the environment and in processes, materials and products				<i>(Tons)</i>	
			Metric Tons (9.1+9.2+9.3)			

			Expected		Achieved			
			PIF stage	PIF stage	MTR	TE		
Indicator 9.1	Solid and liquid Persistent Organic Pollutants (POPs) and POPs containing materials and products removed or disposed							
POPs type			Metric Tons					
			Expected		Achieved			
			PIF stage	Endorsement	MTR	TE		
(select)	(select)	(select)						
(select)	(select)	(select)						
(select)	(select)	(select)						
Indicator 9.2	Quantity of mercury reduced							
			Metric Tons					
			Expected		Achieved			
			PIF stage	Endorsement	MTR	TE		
Indicator 9.3	Number of countries with legislation and policy implemented to control chemicals and waste							
			Number of Countries					
			Expected		Achieved			
			PIF stage	Endorsement	MTR	TE		
Indicator 9.4	Number of low-chemical/non-chemical systems implemented particularly in food production, manufacturing and cities							
Technology			Number					
			Expected		Achieved			
			PIF stage	Endorsement	MTR	TE		
Core Indicator 10	Reduction, avoidance of emissions of POPs to air from point and non-point sources					(Grams)		
Indicator 10.1	Number of countries with legislation and policy implemented to control emissions of POPs to air							

			Number of Countries			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Indicator 10.2	Number of emission control technologies/practices implemented					
			Number			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Indicator 10.3	Number of countries with legislation and policy implemented to control chemicals and waste					
			Number of Countries			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Core Indicator 11	Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment					<i>5,885 (63% male; 37% female)</i>
					Number Achieved	
					MTR	TE
				Female		
				Male		
				Total		

ANNEX F: GEF PROJECT TAXONOMY WORKSHEET

Use this Worksheet to list down the taxonomic information required under Part I, item F by ticking the most relevant keywords/ topics/themes that best describe this project.

Level 1	Level 2	Level 3	Level 4
<input checked="" type="checkbox"/> Influencing models	<input checked="" type="checkbox"/> Transform policy and regulatory environments		
	<input checked="" type="checkbox"/> Strengthen institutional capacity and decision-making		
	<input type="checkbox"/> Convene multi-stakeholder alliances		
	<input type="checkbox"/> Demonstrate innovative approaches		
	<input type="checkbox"/> Deploy innovative financial instruments		
<input checked="" type="checkbox"/> Stakeholders	<input type="checkbox"/> Indigenous Peoples		
	<input checked="" type="checkbox"/> Private Sector		
		<input checked="" type="checkbox"/> Capital providers	
		<input type="checkbox"/> Financial intermediaries and market facilitators	
		<input checked="" type="checkbox"/> Large corporations	
		<input checked="" type="checkbox"/> SMEs	
		<input checked="" type="checkbox"/> Individuals/Entrepreneurs	
		<input type="checkbox"/> Non-Grant Pilot	
		<input type="checkbox"/> Project Reflow	
	<input checked="" type="checkbox"/> Beneficiaries		
	<input type="checkbox"/> Local Communities		
	<input checked="" type="checkbox"/> Civil Society		
		<input type="checkbox"/> Community Based Organization	
		<input type="checkbox"/> Non-Governmental Organization	
		<input checked="" type="checkbox"/> Academia	
		<input type="checkbox"/> Trade Unions and Workers Unions	
	<input checked="" type="checkbox"/> Type of Engagement		
		<input checked="" type="checkbox"/> Information Dissemination	
		<input checked="" type="checkbox"/> Partnership	
		<input checked="" type="checkbox"/> Consultation	
		<input checked="" type="checkbox"/> Participation	
	<input checked="" type="checkbox"/> Communications		
		<input checked="" type="checkbox"/> Awareness Raising	
		<input checked="" type="checkbox"/> Education	
		<input checked="" type="checkbox"/> Public Campaigns	
		<input type="checkbox"/> Behavior Change	
<input checked="" type="checkbox"/> Capacity, Knowledge and Research			
	<input type="checkbox"/> Enabling Activities		
	<input checked="" type="checkbox"/> Capacity Development		
	<input checked="" type="checkbox"/> Knowledge Generation and Exchange		
	<input type="checkbox"/> Targeted Research		
	<input type="checkbox"/> Learning		
		<input type="checkbox"/> Theory of Change	
		<input type="checkbox"/> Adaptive Management	
		<input type="checkbox"/> Indicators to Measure Change	
	<input checked="" type="checkbox"/> Innovation		
	<input checked="" type="checkbox"/> Knowledge and Learning		
		<input checked="" type="checkbox"/> Knowledge Management	
		<input checked="" type="checkbox"/> Innovation	
		<input checked="" type="checkbox"/> Capacity Development	
		<input checked="" type="checkbox"/> Learning	
	<input checked="" type="checkbox"/> Stakeholder Engagement Plan		
<input checked="" type="checkbox"/> Gender Equality			

	<input checked="" type="checkbox"/> Gender Mainstreaming		
		<input checked="" type="checkbox"/> Beneficiaries	
		<input type="checkbox"/> Women groups	
		<input checked="" type="checkbox"/> Sex-disaggregated indicators	
		<input type="checkbox"/> Gender-sensitive indicators	
	<input checked="" type="checkbox"/> Gender results areas		
		<input type="checkbox"/> Access and control over natural resources	
		<input checked="" type="checkbox"/> Participation and leadership	
		<input type="checkbox"/> Access to benefits and services	
		<input checked="" type="checkbox"/> Capacity development	
		<input checked="" type="checkbox"/> Awareness raising	
		<input checked="" type="checkbox"/> Knowledge generation	
<input checked="" type="checkbox"/> Focal Areas/Theme			
	<input type="checkbox"/> Integrated Programs		
		<input type="checkbox"/> Commodity Supply Chains (⁴⁵ Good Growth Partnership)	
			<input type="checkbox"/> Sustainable Commodities Production
			<input type="checkbox"/> Deforestation-free Sourcing
			<input type="checkbox"/> Financial Screening Tools
			<input type="checkbox"/> High Conservation Value Forests
			<input type="checkbox"/> High Carbon Stocks Forests
			<input type="checkbox"/> Soybean Supply Chain
			<input type="checkbox"/> Oil Palm Supply Chain
			<input type="checkbox"/> Beef Supply Chain
			<input type="checkbox"/> Smallholder Farmers
			<input type="checkbox"/> Adaptive Management
		<input type="checkbox"/> Food Security in Sub-Sahara Africa	
			<input type="checkbox"/> Resilience (climate and shocks)
			<input type="checkbox"/> Sustainable Production Systems
			<input type="checkbox"/> Agroecosystems
			<input type="checkbox"/> Land and Soil Health
			<input type="checkbox"/> Diversified Farming
			<input type="checkbox"/> Integrated Land and Water Management
			<input type="checkbox"/> Smallholder Farming
			<input type="checkbox"/> Small and Medium Enterprises
			<input type="checkbox"/> Crop Genetic Diversity
			<input type="checkbox"/> Food Value Chains
			<input type="checkbox"/> Gender Dimensions
			<input type="checkbox"/> Multi-stakeholder Platforms
		<input type="checkbox"/> Food Systems, Land Use and Restoration	
			<input type="checkbox"/> Sustainable Food Systems
			<input type="checkbox"/> Landscape Restoration
			<input type="checkbox"/> Sustainable Commodity Production
			<input type="checkbox"/> Comprehensive Land Use Planning
			<input type="checkbox"/> Integrated Landscapes
			<input type="checkbox"/> Food Value Chains
			<input type="checkbox"/> Deforestation-free Sourcing
			<input type="checkbox"/> Smallholder Farmers
		<input type="checkbox"/> Sustainable Cities	
			<input type="checkbox"/> Integrated urban planning
			<input type="checkbox"/> Urban sustainability framework
			<input type="checkbox"/> Transport and Mobility
			<input type="checkbox"/> Buildings
			<input type="checkbox"/> Municipal waste management
			<input type="checkbox"/> Green space
			<input type="checkbox"/> Urban Biodiversity
			<input type="checkbox"/> Urban Food Systems
			<input type="checkbox"/> Energy efficiency
			<input type="checkbox"/> Municipal Financing
			<input type="checkbox"/> Global Platform for Sustainable Cities
			<input type="checkbox"/> Urban Resilience

	<input type="checkbox"/> Biodiversity		
		<input type="checkbox"/> Protected Areas and Landscapes	
			<input type="checkbox"/> Terrestrial Protected Areas
			<input type="checkbox"/> Coastal and Marine Protected Areas
			<input type="checkbox"/> Productive Landscapes
			<input type="checkbox"/> Productive Seascapes
			<input type="checkbox"/> Community Based Natural Resource Management
		<input type="checkbox"/> Mainstreaming	
			<input type="checkbox"/> Extractive Industries (oil, gas, mining)
			<input type="checkbox"/> Forestry (Including HCVF and REDD+)
			<input type="checkbox"/> Tourism
			<input type="checkbox"/> Agriculture & agrobiodiversity
			<input type="checkbox"/> Fisheries
			<input type="checkbox"/> Infrastructure
			<input type="checkbox"/> Certification (National Standards)
			<input type="checkbox"/> Certification (International Standards)
		<input type="checkbox"/> Species	
			<input type="checkbox"/> Illegal Wildlife Trade
			<input type="checkbox"/> Threatened Species
			<input type="checkbox"/> Wildlife for Sustainable Development
			<input type="checkbox"/> Crop Wild Relatives
			<input type="checkbox"/> Plant Genetic Resources
			<input type="checkbox"/> Animal Genetic Resources
			<input type="checkbox"/> Livestock Wild Relatives
			<input type="checkbox"/> Invasive Alien Species (IAS)
		<input type="checkbox"/> Biomes	
			<input type="checkbox"/> Mangroves
			<input type="checkbox"/> Coral Reefs
			<input type="checkbox"/> Sea Grasses
			<input type="checkbox"/> Wetlands
			<input type="checkbox"/> Rivers
			<input type="checkbox"/> Lakes
			<input type="checkbox"/> Tropical Rain Forests
			<input type="checkbox"/> Tropical Dry Forests
			<input type="checkbox"/> Temperate Forests
			<input type="checkbox"/> Grasslands
			<input type="checkbox"/> Paramo
			<input type="checkbox"/> Desert
		<input type="checkbox"/> Financial and Accounting	
			<input type="checkbox"/> Payment for Ecosystem Services
			<input type="checkbox"/> Natural Capital Assessment and Accounting
			<input type="checkbox"/> Conservation Trust Funds
			<input type="checkbox"/> Conservation Finance
		<input type="checkbox"/> Supplementary Protocol to the CBD	
			<input type="checkbox"/> Biosafety
			<input type="checkbox"/> Access to Genetic Resources Benefit Sharing
	<input type="checkbox"/> Forests		
		<input type="checkbox"/> Forest and Landscape Restoration	
			<input type="checkbox"/> REDD/REDD+
		<input type="checkbox"/> Forest	
			<input type="checkbox"/> Amazon
			<input type="checkbox"/> Congo
			<input type="checkbox"/> Drylands
	<input type="checkbox"/> Land Degradation		
		<input type="checkbox"/> Sustainable Land Management	
			<input type="checkbox"/> Restoration and Rehabilitation of Degraded Lands
			<input type="checkbox"/> Ecosystem Approach
			<input type="checkbox"/> Integrated and Cross-sectoral approach
			<input type="checkbox"/> Community-Based NRM
			<input type="checkbox"/> Sustainable Livelihoods

			<input type="checkbox"/> Income Generating Activities
			<input type="checkbox"/> Sustainable Agriculture
			<input type="checkbox"/> Sustainable Pasture Management
			<input type="checkbox"/> Sustainable Forest/Woodland Management
			<input type="checkbox"/> Improved Soil and Water Management Techniques
			<input type="checkbox"/> Sustainable Fire Management
			<input type="checkbox"/> Drought Mitigation/Early Warning
		<input type="checkbox"/> Land Degradation Neutrality	
			<input type="checkbox"/> Land Productivity
			<input type="checkbox"/> Land Cover and Land cover change
			<input type="checkbox"/> Carbon stocks above or below ground
		<input type="checkbox"/> Food Security	
	<input type="checkbox"/> International Waters		
		<input type="checkbox"/> Ship	
		<input type="checkbox"/> Coastal	
		<input type="checkbox"/> Freshwater	
			<input type="checkbox"/> Aquifer
			<input type="checkbox"/> River Basin
			<input type="checkbox"/> Lake Basin
		<input type="checkbox"/> Learning	
		<input type="checkbox"/> Fisheries	
		<input type="checkbox"/> Persistent toxic substances	
		<input type="checkbox"/> SIDS : Small Island Dev States	
		<input type="checkbox"/> Targeted Research	
		<input type="checkbox"/> Pollution	
			<input type="checkbox"/> Persistent toxic substances
			<input type="checkbox"/> Plastics
			<input type="checkbox"/> Nutrient pollution from all sectors except wastewater
			<input type="checkbox"/> Nutrient pollution from Wastewater
		<input type="checkbox"/> Transboundary Diagnostic Analysis and Strategic Action Plan preparation	
		<input type="checkbox"/> Strategic Action Plan Implementation	
		<input type="checkbox"/> Areas Beyond National Jurisdiction	
		<input type="checkbox"/> Large Marine Ecosystems	
		<input type="checkbox"/> Private Sector	
		<input type="checkbox"/> Aquaculture	
		<input type="checkbox"/> Marine Protected Area	
		<input type="checkbox"/> Biomes	
			<input type="checkbox"/> Mangrove
			<input type="checkbox"/> Coral Reefs
			<input type="checkbox"/> Seagrasses
			<input type="checkbox"/> Polar Ecosystems
			<input type="checkbox"/> Constructed Wetlands
	<input type="checkbox"/> Chemicals and Waste		
		<input type="checkbox"/> Mercury	
		<input type="checkbox"/> Artisanal and Scale Gold Mining	
		<input type="checkbox"/> Coal Fired Power Plants	
		<input type="checkbox"/> Coal Fired Industrial Boilers	
		<input type="checkbox"/> Cement	
		<input type="checkbox"/> Non-Ferrous Metals Production	
		<input type="checkbox"/> Ozone	
		<input type="checkbox"/> Persistent Organic Pollutants	
		<input type="checkbox"/> Unintentional Persistent Organic Pollutants	
		<input type="checkbox"/> Sound Management of chemicals and Waste	
		<input type="checkbox"/> Waste Management	
			<input type="checkbox"/> Hazardous Waste Management
			<input type="checkbox"/> Industrial Waste
			<input type="checkbox"/> e-Waste
		<input type="checkbox"/> Emissions	
		<input type="checkbox"/> Disposal	

	<input type="checkbox"/> New Persistent Organic Pollutants	
	<input type="checkbox"/> Polychlorinated Biphenyls	
	<input type="checkbox"/> Plastics	
	<input type="checkbox"/> Eco-Efficiency	
	<input type="checkbox"/> Pesticides	
	<input type="checkbox"/> DDT - Vector Management	
	<input type="checkbox"/> DDT - Other	
	<input type="checkbox"/> Industrial Emissions	
	<input type="checkbox"/> Open Burning	
	<input type="checkbox"/> Best Available Technology / Best Environmental Practices	
	<input type="checkbox"/> Green Chemistry	
	<input checked="" type="checkbox"/> Climate Change	
	<input type="checkbox"/> Climate Change Adaptation	
		<input type="checkbox"/> Climate Finance
		<input type="checkbox"/> Least Developed Countries
		<input type="checkbox"/> Small Island Developing States
		<input type="checkbox"/> Disaster Risk Management
		<input type="checkbox"/> Sea-level rise
		<input type="checkbox"/> Climate Resilience
		<input type="checkbox"/> Climate information
		<input type="checkbox"/> Ecosystem-based Adaptation
		<input type="checkbox"/> Adaptation Tech Transfer
		<input type="checkbox"/> National Adaptation Programme of Action
		<input type="checkbox"/> National Adaptation Plan
		<input type="checkbox"/> Mainstreaming Adaptation
		<input type="checkbox"/> Private Sector
		<input type="checkbox"/> Innovation
		<input type="checkbox"/> Complementarity
		<input type="checkbox"/> Community-based Adaptation
		<input type="checkbox"/> Livelihoods
	<input checked="" type="checkbox"/> Climate Change Mitigation	
		<input type="checkbox"/> Agriculture, Forestry, and other Land Use
		<input checked="" type="checkbox"/> Energy Efficiency
		<input type="checkbox"/> Sustainable Urban Systems and Transport
		<input checked="" type="checkbox"/> Technology Transfer
		<input checked="" type="checkbox"/> Renewable Energy
		<input checked="" type="checkbox"/> Financing
		<input type="checkbox"/> Enabling Activities
	<input type="checkbox"/> Technology Transfer	
		<input type="checkbox"/> Poznan Strategic Programme on Technology Transfer
		<input type="checkbox"/> Climate Technology Centre & Network (CTCN)
		<input type="checkbox"/> Endogenous technology
		<input type="checkbox"/> Technology Needs Assessment
		<input type="checkbox"/> Adaptation Tech Transfer
	<input type="checkbox"/> United Nations Framework on Climate Change	
		<input type="checkbox"/> Nationally Determined Contribution
	<input type="checkbox"/> Climate Finance (Rio Markers)	<input checked="" type="checkbox"/> Paris Agreement
		<input type="checkbox"/> Sustainable Development Goals
		<input type="checkbox"/> Climate Change Mitigation 1
		<input type="checkbox"/> Climate Change Mitigation 2
		<input type="checkbox"/> Climate Change Adaptation 1
		<input type="checkbox"/> Climate Change Adaptation 2

ANNEX G: EXAMPLE TECHNICAL SPECIFICATIONS FOR WASTEWATER TREATMENT PLANTS WITH BIOGAS UNITS

Environmentally Sound Technologies for Wastewater Treatment – Design consideration

In following, the technical specifications are given for two potential wastewater treatment plants with combined closed anaerobic digesters, one in Yangon, one in Mandalay. The selection of the wastewater treatment stages is based on the state-of-the-art technologies and current praxis in Myanmar. In the case of Myanmar, conventional aerobic processes using carriers (MBBR – Moving Bed Biofilm Reactor) for wastewater treatment facilities are energy and materially intensive. MBBR reactor in combination with the anaerobic digester systems proposed are less energy intensive and more economic than aerobic treatment / aerobic septic system. The energy intensive aeration process required for the anaerobic digestion releases methane otherwise used as biogas for heat or electricity production in the proposed anaerobic system. Anaerobic digesters do not use chemicals to reduce BOD and there is less sludge production. The sludge will be stable and safe to use as a soil enhancer. There are also local environmental benefits of less odor and reduced localized environmental degradation from untreated sludge discharge.

1.1 Process Description

Treatment scheme based consists of the following steps:

- Collection Sump
- Coagulation/ Flocculation
- Primary Sedimentation
- Equalization
- Up flow Anaerobic Sludge Blanket (UASB)
- Aerobic Reactor (MBBR)
- Secondary Sedimentation
- Chlorination
- Sludge Dewatering System
- Gas Collection and Purification System

Pre-treatment:

Collection Sump

The raw effluent is passed through Collection Sump by gravity. The wastewater from 14 factories entering 10" inches pipeline entering from 3" pipe line of each factory.

Coagulation/Flocculation

The coagulation is the destabilization of colloids by addition of chemicals that neutralize the negative charges. The flocculation is the agglomeration of destabilized particles into large size particles known as flocs which can be effectively removed by sedimentation or flotation. Alum and polymer are used in the chemical dosing system for coagulation and flocculation to adjust the pH value and aid in the process of settling where inline static mixer accelerates slow mixing or reaction in the formation of coagulants.

Primary Sedimentation

Before entering Primary sedimentation, chemicals such as alum and polyacrylamide (PAM) are dosed inline at wastewater stream containing raw paper, vermicelli, rubber, Mir iced fish meat, surimi, seawater shrimp, frozen fish, potato chips, soft drink, sunflower seeds and sesame to adjust the pH value and aid in the process of settling where inline static mixer accelerates slow mixing or reaction in the formation of coagulants. Wastewater is settled down approximately for 30 minutes in each Primary Sedimentation.

Equalization

The excess flow from precipitation tanks is being equalized in the equalization tank. It is designed for a hydraulic retention time of around 8-10 hours and is provided with mechanical agitation using ejectors for mixing in the homogenization state.

Biological Treatment:

Upflow Anaerobic Sludge Blanket (UASB)

From equalization, the effluent will be taken into anaerobic digester tank. In the process, the first stage of the process allows the reduction of BOD and COD loadings approximately by 70 % of total and the later stage is followed by reducing approximately 90% of the rest BOD and COD loadings. Anaerobic treatment system, called UASB, is selected to transform organic matter in wastewater and converted into biogas. The more biogas is obtained, the more organic is removed. As UASB are closed-systems, the odor problem will be eliminated. The operating function of UASB system is designed in batch process in order to prevent the loss of bacterial population and increase the efficiency of reactor.

UASB can be used efficiently as biogas production reactor in full scale plant on molasses based ethanol distillery waste water. Moreover, it is developed to overcome the weakness of conventional systems, so called CSTR (Continuous Stirred-Tank Reactor). The advantage of the developed UASB system is described as the following;

- (1) The developed UASB system is the combination of UASB design concept and sedimentation tank in to one unit so the accumulation and control of bacterial sludge concentration can be easily made.
- (2) Anaerobic bacteria can settle easily and will be held in the system for a long period.

Aeration

The effluent water from the anaerobic digester flow into the aeration tank. In this stage, the process reduce the BOD loading.

MBBR System

Moving Bed Biofilm Reactor (MBBR) consists of the biofilm carriers which are kept in the reactor by an outlet sieve as shown in Figure 1. In MBBR, Pre-treated wastewater enters at the top of the tanks. Air is introduced at the bottom of the tanks through fine bubble diffusers. Carrier will be in suspension because of the turbulence created by the air and is used to provide a surface on which bacteria grows.

MBBR process is an attached growth biological wastewater treatment process, where the microorganisms that carry out the treatment are attached to a solid medium. MBBR combines the benefits of both activated sludge process and the fixed film process. A continuous flow process uses media/carriers to make available more surface area for the attachment of active bacteria in a suspended medium which has been used both for municipal wastewater and industrial wastewater. MBBR process can be used for organic matter BOD/COD removal, nitrogen and biological phosphorus removal.

MBBR system provides more treatment capacity within a given reactor volume, resulting in a smaller footprint compared to a conventional activated sludge process. Moreover, the required reactor size for a MBBR process is significantly smaller than that for an activated sludge process while treating the same wastewater flow, or that for other common attached growth processes such as trickling filter, rotating biological contactors (RBC), etc. The main advantage of using carriers is to retain active biomass within the bioreactor, thus eliminating the need to control mixed liquor suspended solids (MLSS) by recycling active sludge from secondary settlement tanks.

Secondary Sedimentation

The treated effluent from aeration tanks is settled down approximately for 3 hours in each Secondary Sedimentation. The excess sludge will be separated at the bottom and water will be overflowed from secondary sedimentation whereas calcium hypochlorite is injected inline before entering the Chlorination tank.

Chlorination

After chlorine injection, water is collected in the chlorination tank. And then, treated water from effluent tank will be discharged after monitoring at effluent wastewater monitoring station.

Sludge Digester and Sludge Transfer System

Excess sludge (excess microorganism) in aeration tank is transferred to sludge digester tanks by excess sludge pumps. In these tanks, microorganism were growth with oxygen from air diffuser and eaten each other during 72 hours. After 72 hours, heavy sludge are transferred into Sludge Holding Tank by Thicken Sludge Pumps.

Sludge Dewatering

Sludge is separated into sludge cake and liquid by using sludge drying bed. Filtrate water is stored in the filtrate sump and sludge cakes are dried on sludge drying bed. Filtrate water is recycled to the aeration tanks by filtrate pump.

Gas Collection and Purification System

Mixed gas including much of CH₄ is collected at the biogas holding tank, then passing through the scrubber where Methane is produced from the top of it. After purifying the methane gas, it is used to generate the electricity.

Electricity Production with Biogas Generator

The anaerobic digestion is a sustainable method to convert organic waste materials into renewable energy and recycled nutrients such as nitrogen and phosphorus. Anaerobic digestion occurs in the temperature range of 0°C to 65°C. The optimum temperature for methane production is 29°C to 35°C as in this range microbial activity takes place. In our wastewater treatment system, biogas is used as fuel for combustion engine, which convert it to mechanical energy, powering an electric generator to produce electricity. In principle, the chemical energy of the combustible gases is converted to mechanical energy in a controlled combustion system by a heat engine. This mechanical energy then activates a generator to produce electrical power.

Appropriate biogas quality: For use in gas or diesel engines, the gas must fulfil certain requirements:

- The methane content should be as high as possible as this is the main combustible part of the gas;
- The water vapour and CO₂ content should be as low as possible, mainly because they lead to a low calorific value of the gas;
- The sulphur content, mainly in form of H₂S, must be low, as it is converted to corrosion-causing acids by condensation and combustion.

Online Wastewater Monitoring System

Online wastewater monitoring system is installed at the influent of raw wastewater to the treatment plant and effluent from that of the plant. This system covers the measurement followed by the parameters such BOD, COD, TSS, pH, Turbidity. The individual quality of influent wastewater is measured manually for each factory weekly and the flow rate is measured by electromagnetic flow meter (EMF).

Environmentally Sound Technologies for Wastewater Treatment – Financial parts

In following, the cost breakdown structures for the two demonstration plants are presented. Infrastructural and equipment cost estimates are in part financed by the GEF with the expectation of leveraging a majority of funds through co-financing with public and private partners. Cost estimates are indicative and will be revisited during implementation phase. The cost calculations are done based of raw wastewater quality obtained from the site analyses. The consolidated tables of raw wastewater quality are presented in the Annex I where the calculations for the reductions in GHG emissions are presented.

Yangon demonstration wastewater treatment plant:

Project: Centralized Wastewater Treatment Plant (Shwe Pyi Thar)

Process: Anaerobic Digester (UASB) + Moving Bed Biofilm Reactor (MBBR)

Subject: Industrial Wastewater Treatment Plant

Table 10: Technical parameters - Yangon demonstration wastewater treatment plant:

No .	Item	Description	Q't y	Uni t	Unit Price (USD)	Amount (USD)
1	Industrial Waste Water Treatment Plant	Capacity: 1200 m ³ /day Flow rate: 50 m ³ /hr BOD: 6000 mg/L				
	COST STRUCTURE BREAKDOWN					
	(1) Waste Water Treatment Plant		1	set	713,600	713,600
	(2) Waste Water Treatment Plant Civil Cost		1	lot	1,767,300	1,767,300
	(3) Monitoring Station		1	lot	2 52,000	2 52,000
	(4) General Civil Work		1	lot	339,500	339,500
	(5) General Cost		1	lot	210,000	210,000
	(6) Waste Water Collection System		1	lot	366,500	366,500
	(7) Electricity Production with Biogas Generator		1	lot	173,000	173,000
	(8) Consultation, Installation, Supervision					
	(9) Transportation and Labors					
					Sub Total	3,821,900.0
					Commercial Tax (5%)	191,095.0
					Total USD	4,012,995.00

Mandalay demonstration wastewater treatment plant:

Project: Mandalay Centralized Wastewater Treatment Plan

Process: Anaerobic Digester + Moving Bed Biofilm Reactor

Subject: Industrial Waste Water Treatment Plant

Table 11: Technical parameters - Mandalay demonstration wastewater treatment plant

No .	Item	Description	Q't y	Uni t	Unit Price (USD)	Amount (USD)
1	Industrial Waste Water Treatment Plant	Capacity: 1000 m ³ /day Flow rate: 41.67 m ³ /hr BOD: 2000 mg/L				
	COST STRUCTURE BREAKDOWN					
	(1) Waste Water Treatment Plant		1	set	400,500	400,500
	(2) Waste Water Treatment Plant Civil Cost		1	lot	662,000	662,000
	(3) Monitoring Station		1	lot	126,000	126,000
	(4) General Civil Work		1	lot	339,500	339,500
	(5) General Cost		1	lot	210,000	210,000
	(6) Waste Water Collection System		1	lot	61,200	61,200
	(7) Electricity Production with Biogas Generator		1	lot	173,000	173,000
	(8) Consultation, Installation, Supervision					
	(9) Transportation and Labors					
					Sub Total	1,972,200
					Commercial Tax (5%)	98,610
					Total USD	2,070,810

ANNEX H: INDICATIVE TOR FOR A NATIONAL PROJECT COORDINATOR



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

INDICATIVE TERMS OF REFERENCE FOR PERSONNEL UNDER INDIVIDUAL SERVICE AGREEMENT (ISA)

Project “Climate change mitigation through methane recovery and reuse from industrial wastewater treatment in Myanmar”

Title:	National Project Coordinator
Duty Station	Yangon, Myanmar
Mission/s to:	Travel within Myanmar to be paid separately
Start of Contract (EOD):	tbc
End of Contract (COB):	tbc
Type of contract	Regular

ORGANIZATIONAL CONTEXT

The United Nations Industrial Development Organization (UNIDO) is the specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability through its mandate to promote and accelerate inclusive and sustainable industrial development.

The Department of Environment in UNIDO assists developing countries and countries with economies in transition with the transfer of best available environmentally sound technologies and environmental practices to improve resource productivity in industry and prevent emissions of contaminants into the environment thereby protecting resources for future generations.

This project is implemented by the Industrial Resource Efficiency Division, under the Department of Environment of UNIDO.

PROJECT CONTEXT

Main functions:

The National Project Coordinator will work in close cooperation with the project manager, as well as the executing agencies, being responsible for the following duties:

The objective of the project is to increase Myanmar's efforts towards climate change mitigation by minimizing GHG emissions through the introduction of integrated low-emission wastewater treatments and the application of Transfer of Environmentally Sound Technologies (TEST) in industries. UNIDO has developed and implemented TEST programs in several countries to address water pollution caused by productive activities. This integrated approach aims at initiating a cycle of continuous improvements in industries ensuring that the technology transfer is part of a company's strategy for increased resource efficiency, which consequently reduces GHG emissions.

The introduction of TEST combines (i) extensive capacity building and (ii) pilot demonstrations in industrial parks and companies. Air emission and effluents discharges will be monitored in the project in order to assess the contribution to climate change. To achieve the project objective in contributing to Myanmar's efforts in mitigating climate change, the project will build on UNIDO's previous capacity building activities in the country by introducing necessary policies, incentives and awareness raising initiatives to enable a self-sustaining environment encouraging low carbon industrial development centred in Yangon and Mandalay.

<u>Main Duties</u>	<u>Expected result(s)</u>	<u>Location</u>
<ol style="list-style-type: none"> 1. Oversee the day-to-day operations of the project in Myanmar and, coordinate with the executing partners to ensure adherence to the approved work plan. 2. Assure effective coordination between the PMU, national counterparts, lead Government Ministries, executing partners and local partners. 3. Facilitate and supervise the work of the executing partners and national experts to ensure the quality of their work and timely submission of deliverables; 4. Secure government and private sector commitment to the project, including the provision of co-financing in the form of in-kind and cash contributions; 5. Responsible for communication of the project scope, activities and upcoming plans with the National Counterpart, lead Government Ministries, and other national and/or local authorities as necessary. 6. Organize PSC meetings in coordination with the SC Chairs; provide a secretariat function and prepare reports of the meetings for distribution to all stakeholders; 7. Conduct site visits to selected participating industries and pilot projects to support in the supervision of activities and adherence to the work plan; 8. Coordinate and provide technical input in the preparation of promotional and informative material to present the project activities and results to key stakeholders. 9. Provide support to the mid-term review and terminal evaluation consultants, including provision of project information, documentation and support with local travel to meet with key stakeholders. 10. Prepare the progress and annual reports on the project. 	<ul style="list-style-type: none"> • Effective coordination of project activities • Ongoing communication with local partners • Minutes of PSC meetings. • Mission reports • Contributions to project promotional material. • Support to the evaluation consultants • Progress and annual reports drafted. 	<p>Yangon, Myanmar, with local, regional and international travel, as needed</p>

REQUIRED COMPETENCIES

Core values:

1. Integrity
2. Professionalism
3. Respect for diversity

Core competencies:

1. Results orientation and accountability
2. Planning and organizing
3. Communication and trust
4. Team orientation
5. Client orientation

MINIMUM ORGANIZATIONAL REQUIREMENTS:

Education: Advanced university degree in Engineering or other relevant discipline related to Environmental Management

Technical and Functional Experience:

A minimum of 3 years' practical experience in the field of environmental science preferably with a good understanding of the chemical and biological quality of wastewater, and/or resource efficiency in industry. Strong communication skills, and ability to liaise with various stakeholders, including government officials.

Languages: Written and spoken fluency in Myanmar language is required. Reading and writing skills in English is required

ANNEX I: DETAILED CO₂ EMISSION CALCULATIONS

The project intervention will lead to reduction in methane emissions since it envisages the implementation of the wastewater treatment technology. Furthermore, the project envisages to implement biogas digesters appending them to the WWTPs. These investments will be undertaken Component 2 of the project “**Climate change mitigation through methane recovery and reuse from industrial wastewater treatment in Myanmar**” under Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants.

The global benefits in terms of avoided GHG emissions were calculated for renewable energy using the methodology described in the document “Manual for calculating GHG benefits of GEF Projects: Energy Efficiency and Renewable Energy Projects” and using the CDM approved consolidated baseline and monitoring methodology ACM0014 “Avoided methane emissions from wastewater treatment”.

The main parameters used for calculation of GHG emission reductions were identified during the technical analysis developed during the PPG for Yangon and Mandalay areas. According to the screening of potential pilot sites, wastewater quality analysis were carried out for companies that can potentially contribute to wastewater discharges (see annex N). Taking into account these results, the technical team agreed on potential design values for the pilot wastewater treatment plants in terms of flow rates and organic loads, which provide the basis for the GHG emission calculations as is presented on the following tables:

Yangon input data

S/N	Factory Name	Wastewater Sampling	IZ	Product	Reliable Flow rate (m3/day)	BOD Conc. (mg/l)	COD Conc. (mg/l)	TSS (mg/l)	BOD Loading (kg/day)	COD Loading (kg/day)	Solid Loading (kg/day)
1	Pyi Lone Chan Tha	Yes	Zone (3)	Fish Meet, Surimi	110.5	4600.0	6500.0	770	508.3	718.3	85.085
2	High Win International	Yes	Zone (2)	Sea-water shrimp	96.9	110.0	80.0	50	10.7	7.8	4.845
3	Myanmar King Fish	Yes	Zone (3)	Sea-water shrimp	62.9	350.0	380.0	130	22.0	23.9	8.177
4	Shwe Kabar Maung Maung	No	Zone (4)	Frozen Fish	34	2000.0	3500.0	430	68.0	119.0	14.62
5	Daw Wai Wai	Yes	Zone (2)	Paper	93.5	1000.0	4600.0	3800	93.5	430.1	355.3
6	Duwun Vermicelli Factory	Yes	Zone (3)	Rice Vermicelli	59.5	270.0	320.0	79	16.1	19.0	4.7005
7	Win Win	Yes	Zone (2)	Vermicelli	48.45	1500.0	2400.0	2500	72.7	116.3	121.125
8	Aung Kyaw	No	Zone (4)	Vermicelli	35	1200.0	2100.0	600	42.0	73.5	21
9	Ka Thit Oo	No	Zone (3)	Potato chip	68	800.0	2400.0	3500	54.4	163.2	238
10	Sein Than Argo Industry Co., Ltd.	No	Zone (2)	Purified Sesame	39.1	1400.0	3700.0	1000	54.7	144.7	39.1
11	Mountain and Sea Co., Ltd.	Yes	Zone (4)	Sunflower Seeds	22.95	31000.0	44000.0	2800	711.5	1009.8	64.26
12	Khit Thit	Yes	Zone (4)	Vermicelli	30	540.0	580.0	430	16.2	17.4	12.9
13	High Win Family	No	Zone (2)	Rubber	382.5	13000.0	18000.0	3000	4972.5	6885.0	1147.5

GEF6 CEO Endorsement /Approval Template – August 29, 2018

14	SamPar Oo	No	Zone (1)	Soft Drink	84	17.5	10.0	2	1.5	0.8	0.168	
					Total	1,167				6644.0	9728.7	2116.8
							5691.75	8334.39	1813.4			
AGREED DESIGN VALUES					1200	6000.0	9000.0	2000				

Mandalay input data

S/N	Factory Name	Wastewater Sampling	IZ	Product	Reliable Flow rate (m3/day)	BOD Conc. (mg/l)	COD Conc. (mg/l)	TSS (mg/l)	BOD Loading (kg/day)	COD Loading (kg/day)	Solid Loading (kg/day)	
1	Aung Sein	No	Zone (1)	Textile	80	720.0	560.0	628	57.6)	50.24	
2	U Sai(Sesame)	Yes	Zone (1)	Sesame(white,brown,yellow)	327.3	1400.0	3700.0	1100	458.2	1211.0	360.03	
3	Lvbao (Whee Pout)	No	Zone (2)		159.5	1400.0	3700.0	1100	223.3	1211.0	175.45	
4	Kyat Sin Done Pyan	Yes	Zone (1)	Moakhinkhar(dry)	26	4500.0	6100.0	3300	117.0	158.6	85.8	
5	Moe Ma Kha	Yes	Zone (2)	Paper	8	800.0	1600.0	690	6.4	12.8	5.5	
6	Zabu Mate Swe(Paper)	No	Zone (2)	Paper	8	800.0	1600.0	690	6.4	12.8	5.5	
7	Paw Oo	No	Zone (2)	Paper	7	800.0	1600.0	690	5.6	11.2	4.8	
8	Shwe Win Win	No	Zone (2)	Paper	7	800.0	1600.0	690	5.6	11.2	4.8	
9	Shwe Khaung Laung	No	Zone (2)	Paper	9.3	800.0	1600.0	690	7.4	15.0	6.4	
10	Super	No	Zone (2)	Paper	7.7	800.0	1600.0	690	6.2	12.3	5.3	
11	Aung (Paper)	No	Zone (2)	Paper	19.3	800.0	1600.0	690	15.4	31.0	13.3	
12	ManMahar Myat	No	Zone (1)	Paper Carton box	23.2	800.0	1600.0	690	18.6	37.0	16	
13	Soe Moe Star	No	Zone (1)	Sole Leather	2	322.0	715.0	341	0.6	1.4	0.68	
14	Chan Seint Win(leather)	No	Zone (1)	Sole leather	17.3	2300.0	3500.0	990	39.8	60.6	17	
15	Aung (Leather)	Yes	Zone (2)	Leather	8.8	2300.0	3500.0	990	20.2	30.8	8.7	
16	Kyaw Zaw Thu (Leather)	No	Zone (2)	(Leather)	12	2300.0	3500.0	990	27.6	42.0	11.88	
17	Than Naing((Leather)	No	Zone (2)	(Leather)	9.6	2300.0	3500.0	990	22.0	33.6	9.5	
18	Taing Kyaw (Leather)	No	Zone (2)	(Leather)	12	2300.0	3500.0	990	27.6	42.0	11.88	
19	MK (Leather0	No	Zone (2)	(Leather)	12	2300.0	3500.0	990	27.6	42.0	11.88	
					Total	756				1093.1	2976.3	804.64
							1446.87	3939.523	1065.043			
AGREED DESIGN VALUES					1000	2000.0	4500.0	1200				

The following table presents the summary table for direct and indirect GHG emission reduction calculation.

Emission reductions summary

Name of the variable	Unit	Source of information	Value
Reduction from avoided methane through wastewater treatment			
Direct bottom-up GHG emissions reduction due to wastewater treatment	tCO ₂	GHG methane avoided	234,549
Indirect bottom-up GHG emissions reduction due to wastewater treatment	tCO ₂	Indirect bottom-up GHG	703,647
Top-down indirect GHG emissions reduction due to wastewater treatment	tCO ₂	Top-down GHG reduction	833,952
Reduction due to biogas production from treated wastewater (cogeneration)			
Direct bottom-up GHG emissions reduction from methane utilisation	tCO ₂	GHG biogas production	47,945
Indirect bottom-up GHG emissions reduction from methane utilisation	tCO ₂	Indirect bottom-up GHG	143,834
Top-down indirect GHG emissions reduction from methane utilisation	tCO ₂	Top-down GHG reduction	511,411
Total combined table			
Direct bottom-up GHG emissions reduction	tCO₂	Calculated	282,494
Indirect bottom-up GHG emissions reduction	tCO₂	Calculated	847,481
Top-down indirect GHG emissions reduction	tCO₂	Calculated	1,345,363

Direct GHG reductions

In total, the project is expected to result in a total of **282,494 tons CO₂ through period of 20 years**. The direct bottom-up emission calculations were broken down by its source. Firstly, direct bottom-up emission was calculated from the avoided methane emissions due to the installations of the two WWTP in Yangon and Mandalay, and secondly from the electricity and heat produced by utilizing methane synthesized in the above mentioned WWTPs. It is expected this energy will be used by the industrial zones/companies to reduce energy consumption from the grid and unsustainable sources of heating. The main results were as follows:

- More than 8 million m³ of methane avoided over the investment lifetime (20 years). Resulting in 234,549 tons CO₂eq emission reduction.
- 59 MWh of electricity and 62 MWh of thermal energy is expected to be produced over the investment lifetime for the case of Yangon potential pilot and 24 MWh of electricity and 29 MWh of thermal energy for the case of Mandalay potential pilot

The following table presents detailed calculations for direct emission reductions for Yangon and Mandalay region.

Direct-bottom up calculations for wastewater treatment plant in Yangon				
#	Name of the variable	Unit	Source of information	Value
A	Reliable flow rate	m ³ /day	Technical analysis	1,200
B	Number of WWTP operational days	days	Feasibility study	365
C=A*B	Total annual wastewater flow	M ³ /annually	Calculated	438,000
D	COD	mg/l	Feasibility study	9,000
E=D*0.001	COD	kg/m ³	Calculated	9.0
F=G*H	CH ₄ Emission factor for industrial wastewater	CH ₄ /kgm ³	Calculated	0.08
G	CH ₄ Emission factor for industrial wastewater - total potential	CH ₄ /kgm ³	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry	0.25
H	Methane correction factor	#	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry	0.30
I=C*E	Total organically degradable material in wastewater from industry	kgCOD/y	Calculated	3,942,000
J=I*F	Total CH ₄ emissions annually	kgCH ₄ /y	Calculated	295,650
K	Lifetime of the WWTP investment	Years	Feasibility study	20
L=J*K	Total lifetime CH ₄ emissions	kgCH ₄	Calculated	5,913,000
M	GWP Potential for methane	#	Fifth Assessment Report (AR5) - IPCC	28
N=(M*L)/1000	Total CO₂ direct emissions - Yangon methane avoided	tCO₂	Calculated	165,564

Direct-bottom up calculations for wastewater treatment plant in Mandalay				
#	Name of the variable	Unit	Source of information	Value
A	Reliable flow rate	m ³ /day	Feasibility study	1,000
B	Number of WWTP operational days	days	Feasibility study	365
C=A*B	Total annual wastewater flow	M ³ /annually	Calculated	365,000
D	COD	mg/l	Feasibility study	4,500
E=D*0.001	COD	kg/m ³	Calculated	4.5
F=G*H	CH4 Emission factor for industrial wastewater	CH ₄ /kgm ³	Calculated	0.08
G	CH4 Emission factor for industrial wastewater - total potential	CH ₄ /kgm ³	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry	0.25
H	Methane correction factor	#	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry - taken for rivers, lakes, and sea	0.30
I=C*E	Total organically degradable material in wastewater from industry	kgCOD/y	Calculated	1,642,500
J=I*F	Total CH4 emissions annually	kgCH ₄ /y	Calculated	123,188
K	Lifetime of the WWTP investment	Years	Feasibility study	20
L=J*K	Total lifetime CH4 emissions	kgCH ₄	Calculated	2,463,750
M	GWP Potential for methane	#	Fifth Report (AR5) - IPCC Assessment	28
N=(M*L)/1000	Total CO₂ direct emissions – Mandalay methane avoided	tCO₂	Calculated	68,985

Direct GHG emission reduction from biogas utilization for electricity and heat production - Yangon				
#	Name of the variable	Unit	Source of information	Value
A	Reliable flow rate	m ³ /day	Feasibility study	1,200
B	Number of WWTP operational days	days	Feasibility study	365
C=A*B	Total annual wastewater flow	M ³ /annually	Calculated	438,000
D	COD	mg/l	Feasibility study	9,000
E=D*0.001	COD	kg/m ³	Calculated	9.0
F=G*H	CH ₄ Emission factor for industrial wastewater	CH ₄ /kgm ³	Calculated	0.25
G	CH ₄ Emission factor for industrial wastewater - total potential	CH ₄ /kgm ³	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry	0.25
H	Methane correction factor	#	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry - Anaerobic digester	1.00
I=C*E	Total organically degradable material in wastewater from industry	kgCOD/y	Calculated	3,942,000
J=I*F	Total CH ₄ emissions annually	kgCH ₄ /y	Calculated	985,500
K	CH ₄ density	kg/m ³	http://wiki.gekgasifier.com/w/page/6123697/Densities%20of%20Com%20mon%20Gasses	0.67
L=I/K	Total volume of produced methane	m ³	Calculated	1,475,299
M	Electricity produced per 1m ³ of methane	kWh/m ³	https://www.aqper.com/en/how-much-energy-is-there-in-biogas	2
N=L*M	Total kWh of electricity from methane annually	kWh/y	Calculated	2,950,599
O	Annual electricity generation working hours	h	Assumption (Typical annual exploitation of biogas power generators)	8,000
P=N/O	Maximum needed power generation capacity	kW	Calculated	369
R	Lifetime of the WWTP investment	Years	Feasibility study	20

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S=N*R	Total lifetime electricity produced	kWh	Calculated	59,011,976
T	Myanmar grid emission factor	tCO ₂ /MWh	https://www.adb.org/sites/default/files/institutional-document/296466/guidelines-estimating-ghg.pdf	0.33
U=(S*T)/1000	Total lifetime CO₂ direct emission - electricity	tCO₂	Calculated	19,592
Additional reductions from heat production				
V	Heat produced from biogas plants which is utilised	%	Assumption	35%
W=(Y*L)*R	Energy in biogas	kWh	Calculated	177,035,928
Y	Energy in 1m ³ of methane	kWh/m ³	https://www.aqper.com/en/how-much-energy-is-there-in-biogas	6
Z=W*V	Heat utilised	kWh	Calculated	61,962,575
AA	CO ₂ eq of LPG gas burned	tonnes CO ₂ eq/MWh	IPCC (2006) Guidelines for National GHG Inventories	0.23
AB=(AA*Z)/1000	Total lifetime CO₂ direct emission - heat	tCO₂	Calculated	14,251
Total	Total Direct GHG emission reduction from biogas utilization for electricity and heat production - Yangon	tCO₂	Calculated	33,843

Direct GHG emission reduction from biogas utilisation for electricity and heat production - Mandalay				
#	Name of the variable	Unit	Source of information	Value
A	Reliable flow rate	m ³ /day	Feasibility study	1,000
B	Number of WWTP operational days	days	Feasibility study	365
C=A*B	Total annual wastewater flow	m ³ /annually	Calculated	365,000
D	COD	mg/l	Feasibility study	4,500
E=D*0.001	COD	kg/m ³	Calculated	4.5
F=G*H	CH ₄ Emission factor for industrial wastewater	CH ₄ /kgm ³	Calculated	0.25

G	CH4 Emission factor for industrial wastewater - total potential	CH ₄ /kgm ³	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry	0.25
H	Methane correction factor	#	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry - Anaerobic digester	1.00
I=C*E	Total organically degradable material in wastewater from industry	kgCOD/y	Calculated	1,642,500
J=I*F	Total CH4 emissions annually	kgCH ₄ /y	Calculated	410,625
K	CH4 density	kg/m ³	http://wiki.gekgasifier.com/w/page/6123697/Densities%20of%20Common%20Gasses	0.67
L=I/K	Total volume of produced methane	m ³	Calculated	614,708
M	Energy produced per 1m3 of methane	kWh/m ³	https://www.aqper.com/en/how-much-energy-is-there-in-biogas	2
N=L*M	Total kWh of electricity from methane annually	kWh/y	Calculated	1,229,416
O	Annual electricity generation working hours	h	Assumption (Typical annual exploitation of biogas power generators)	8,000
P=N/O	Maximum needed power generation capacity	kW	Calculated	154
R	Lifetime of the WWTP investment	Years	Feasibility study	20
S=N*R	Total lifetime electricity produced	kWh	Calculated	24,588,323
T	Myanmar grid emission factor	tCO ₂ /MWh	https://www.adb.org/sites/default/files/institutional-document/296466/guidelines-estimating-ghg.pdf	0.33
U=(S*T)/1000	Total lifetime CO2 direct emission - electricity	tCO₂	Calculated	8,163
Additional reductions from heat production				
V	Heat produced from biogas plants which is utilised	%	Assumption	35%
W=(Y*L)*R	Energy in biogas	kWh	Calculated	73,764,970

Y	Energy in 1m ³ of methane	kWh/m ³	https://www.aqper.com/en/how-much-energy-is-there-in-biogas	6
Z	Heat utilised	kWh	Calculated	25,817,740
AA	CO ₂ eq of LPG gas burned	tonnes CO ₂ eq/MWh	IPCC (2006) Guidelines for National GHG Inventories	0.23
AB=(AA*Z)/1000	Total lifetime CO₂ direct emission - heat	tCO₂	Calculated	5,938
Total	Total Direct GHG emission reduction from biogas utilization for electricity and heat production - Mandalay	tCO₂	Calculated	14,101

	Total Direct GHG emission reduction from biogas utilization for electricity and heat production - per year	tCO₂	Calculated	2,397
	Total Direct GHG emission reduction from biogas utilization for electricity and heat production	tCO₂	Calculated	47,945

Indirect GHG emissions reductions estimates

Indirect Bottom-up emissions reductions estimate

Bottom-up estimates of indirect emissions reductions were calculated using a conservative replication value of 3x the direct emissions reductions.

It is worth mentioning that the project is designed to ensure sustainability and replication of energy efficiency improvements beyond the project cycle through the application of the TEST methodology. However, quantitative data on GHG reductions were not estimated since there is no direct equipment investment envisaged within the project budget.

This project is designed to ensure sustainability and replication of sustainable energy, energy efficiency, and methane emission mitigation through following outputs:

- Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane recovery power generation technology strengthened by TEST capacity building program
- Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions
- Output 2.1.2: Demonstration and investment in integrated wastewater treatment and biogas plants, including the delivery of procurement and monitoring support.

The following table present indirect bottom-up emission reduction calculations:

Component	Year of indirect savings	Direct savings	Replication factor	Total	Unit
Variable	A	B	C	D = B x C	
INDIRECT SAVINGS BOTTOM-UP	2025-2034	282,494	3	847,481	tCO ₂

Indirect Top-down emissions reduction estimate from Renewable Energy

In order to calculate the Indirect-Top-down emissions reduction estimate, the 10-year market potential for GHG emissions reductions from avoided methane emission and corresponding energy production was evaluated based on market research carried out by consultants. The lifetime of investment was estimated to be 20 years. The realistic 10-year market potential is assumed that only 10% of technical market potential will actually be achieved in 10 years period for top down from 2025 to 2034. Therefore, it was estimated as follows: 7,446,000 kg of avoided methane (11,146,706.59 m³), 222,934 MWh of electricity, and 234,080 MWh of heat produced. The calculations were carried out on the country level including all, almost 6,800 factories located at Industrial Zones. The causality factor was estimated to be 40% since the project is not specifically focused only on methane emission mitigation.

Detailed top-down indirect emission reduction calculations are presented in the table below.

10 year market potential - Top-down indirect GHG emission reduction potential - avoided methane				
#	Name of the variable	Unit	Source of information	Value
A	Total numbers of factories that discharge and do not treat wastewater	#	https://www.google.com/url?q=http://www.industry.gov.mm/en/content/industrial-supervision-and-registration-sector&source=gmail&ust=1547540573405000&usg=AFQjCNEBw3HoavClnUUcSzi6Mjb1k3PvLw	6,800
B	Average daily flow rate per factory	m ³ /day	Assumption based on the project data for Mandalay and Yangon	12
C=A*B	Total wastewater flow for companies	m ³ /company	Calculated	81,600
D	Number of WWTP operational days	days	Feasibility study	365
E=C*D	Total annual wastewater flow	m ³ /y	Calculated	29,784,000
F	COD	kg/m ³	Assumption based on the project data for Mandalay and Yangon	5

G=H*I	CH4 Emission factor for industrial wastewater	CH ₄ /kgm ³	Calculated	0.03
H	CH4 Emission factor for industrial wastewater - total potential	CH ₄ /kgm ³	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry	0.25
I	Methane correction factor	#	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry	0.10
J=E*F	Total organically degradable material in wastewater from industry	kgCOD/y	Calculated	148,920,000
K=J*G	Total CH4 emissions annually	kgCH ₄ /y	Calculated	3,723,000
L	Lifetime of the WWTP investment	Years	Feasibility study	20
M=K*L	Total lifetime CH4 emissions	kgCH ₄	Calculated	74,460,000
N	GWP Potential for methane	#	Fifth Assessment Report (AR5) - IPCC	28
O	10-year market potential	# years	Estimation	10
P=(N*M)/1000	Top-down avoided GHG emission reduction potential at the country level	tCO ₂	Calculated	2,084,880
R	Likely implementation over 10 years	% of total technical potential	Assumption	10%
S=R*P*O	Top-down avoided GHG emission reduction potential at the country level - 10 year market potential	tCO ₂	Calculated	2,084,880
T	GEF Causality factor	%	Assumption	40%
U=T*S	Top-down avoided GHG emission reduction potential at the country level - 10 year market potential with GEF causality factor	tCO ₂	Calculated	833,952

Top-down indirect GHG emission reduction potential - electricity from methane				
#	Name of the variable	Unit	Source of information	Value
A	Total numbers of factories located at industrial zone in Myanmar	#	https://www.google.com/url?q=http://www.industry.gov.mm/en/content/industrial-supervision-and-registration-sector&source=gmail&ust=1547540573405000&usg=AFQjCNEBw3HovClnUUcSzi6Mjb1k3PvLw	6,800
B	Average daily flow rate per factory	m ³ /day	Assumption based on the project data for Mandalay and Yangon	12
C=A*B	Total wastewater flow per company	m ³ /company	Calculated	81,600
D	Number of WWTP operational days	days	Technical Analysis	365
E=C*D	Total annual wastewater flow	m ³ /y	Calculated	29,784,000
F	COD	kg/m ³	Assumption based on the project data for Mandalay and Yangon	5
G=H*I	CH ₄ Emission factor for industrial wastewater	CH ₄ /kgm ³	Calculated	0.25
H	CH ₄ Emission factor for industrial wastewater - total potential	CH ₄ /kgm ³	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry	0.25
I	Methane correction factor	#	2006 IPCC Guidelines for National Greenhouse Gas Inventories - Wastewater from industry - Anaerobic digester	1.00
J=E*F	Total organically degradable material in wastewater from industry	kgCOD/y	Calculated	148,920,000
K=G*J	Total CH ₄ emissions annually	kgCH ₄ /y	Calculated	37,230,000
L	CH ₄ density	kg/m ³	http://wiki.gekgasifier.com/w/page/6123697/Densities%20of%20Common%20Gasses	0.67
M=K/L	Total volume of produced methane	m ³	Calculated	55,733,533
N	Electricity produced per 1m ³ of methane	kWh/m ³	https://www.aqper.com/en/how-much-energy-is-there-in-biogas	2

O=M*N	Total kWh of electricity from methane annually	kWh/y	Calculated	111,467,066
P	Annual electricity generation working hours	h	Assumption (Typical annual exploitation of biogas power generators)	8,000
R=O/P	Maximum needed power generation capacity	kW	Calculated	13,933
S	Lifetime of the WWTP investment	Years	Technical Analysis	20
T=O*S	Total lifetime electricity produced	kWh	Calculated	2,229,341,317
U	Myanmar grid emission factor	tCO ₂ /MWh	https://www.adb.org/sites/default/files/institutional-document/296466/guidelines-estimating-ghg.pdf	0.33
V	Likely implementation over 10 years	% of total technical potential	Assumption	10%
W=(T*U*V)/1000	Total indirect top-down CO₂ direct emission - electricity	tCO₂	Calculated	74,014
Additional reductions from heat production				
W	Heat produced from biogas plants which is utilised	%	Assumption	35%
Y=(Z*M)*S	Energy in biogas	kWh	Calculated	6,688,023,952.10
Z	Energy in 1m ³ of methane	kWh/m ³	https://www.aqper.com/en/how-much-energy-is-there-in-biogas	6
AA=Y*W	Heat utilised	kWh	Calculated	2,340,808,383
AB	CO ₂ eq of LPG gas burned	tonnes CO ₂ eq/MWh	IPCC (2006) Guidelines for National GHG Inventories	0.23
AC=(AB*AA)/1000	Total lifetime CO ₂ direct emission - heat	tCO ₂	Calculated	538,386
AD	Likely implementation over 10 years	% of total technical potential	Assumption	10%
AE=AC*AD	Total indirect top-down CO₂ direct emission - heat	tCO₂	Calculated	53,838.59

AF=AE+W	Total Direct GHG emission reduction from biogas utilisation for electricity and heat production - 10 year potential	tCO ₂	Calculated	127,852.72
AG	Number of years of implementation	# years	Estimation	10
AH	GEF Causality factor	%	Assumption	40%
AI=	Top-down avoided GHG emission reduction potential at the country level - 10 year market potential with GEF causality factor	tCO ₂	Calculated	511,410.90
Total				
Total	Total indirect top-down GHG emission reduction 10 year potential	tCO ₂	Calculated	1,345,363

ANNEX J: STUDY ON EXISTING SUPPORT MECHANISMS AND BANKING CONDITIONS FOR PRIVATE SECTOR

Banking sector

The financial sector is still under-developed in Myanmar, consisting of about 2.5 banks per 100,000 people. In total there are 27 banks, of which 23 are private. The state-owned banks dominate the financial sector in terms of assets. The four state-owned banks MEB, MFTB, MADB and MICB account for over than 60% of the total banking assets. Besides the local banks, 43 foreign banks have established local offices in the country. The types of banks in Myanmar can be categorised according to their ownership (first layer) and, for the semi-governmental and private banks, their legal forms, i.e. private, public listed / not-listed, or international. The only financial product available to SMEs from banks is a fully collateralised (by land) loan with a maximum tenure of one year (which can be rolled over) and with interest rates of 13-14% per annum. The 200% coverage through land titles is a regulatory requirement imposed on banks, which most SMEs find impossible to fulfil.

An exception to these harsh conditions is a loan offered by the SMIDB (now its name is changed to SMEDB), a public-sector bank which is previously under the MoI (now MoPFI). This loan has been created to exclusively focus on SME lending for the manufacturing sector. SMIDB offers collateralised loans of up to MMK 50 million (EUR 36,000) at 8.5% interest rates and three-year repayment period. Yet, the application and approval procedures are cumbersome, which has resulted in a low number of loans dispersed to 300 SMEs from 2012 until May 2015 (Myanmar Business Today 2015). According to SMEs applying for the loans, preparing documents for the application is rather costly, consisting of up to 10% of the total loan amount.

In 2012, the Industrial Development Committee developed a strategy to facilitate SMEs in getting financial assistance by establishing the SMEs Development Bank and the implementation of a credit Guarantee Scheme offered through the Industrial Development Committee. The scheme assists SMEs to access financing from private banks and other financial institutions, encouraging the formation of Mutual Credit Guarantee Associations among SMEs and also established the Enterprise Innovation Fund and the Start-Up Fund.

To develop SMEs the Ministry of Industry collaborated with the SME Development Bank to provide the above-mentioned loans worth 5 billion kyat. Currently, only a handful of SMEs have received loans and the amount is not sufficient to meet the business requirement. SMEs are facing challenges in receiving loans from banks for many reasons, including not being able to provide collateral of enough value, inability to submit all documentation required and inability to handle the extra charges for loan processing by the banks. Initially, the loan application procedure was to go through the Myanmar Industries Association and the Industrial Development Committee to the SME Development Bank. Following this procedure, 137 proposals were submitted, but only 10 proposals were accepted with loan amounts covering from 10 million to 500 million kyat.

Since 2012, the procedure changed. Applications are submitted to the newly created SME centre in Yangon, where the applicants' credit history is checked. Later the application is forwarded to the SME Industrial Development Bank, who submits the application to the Industrial Development Committee where the Credit Guarantee Certificate is issued in return. Finally, the bank issues the loan directly to the borrower. After changing the process, only 3% of applications were successful. An application must contain 22 separate documents in order to go through the process, but not all of them are easily available to the public, such as the Credit Clearance Acknowledgment and Economic Assessment.

There is a need for regulations in the banking and financial sectors to be streamlined. Current financing schemes are not dependable in reality as interest rates are too high in comparison to other countries in the region. Business are struggling to cover the interest.

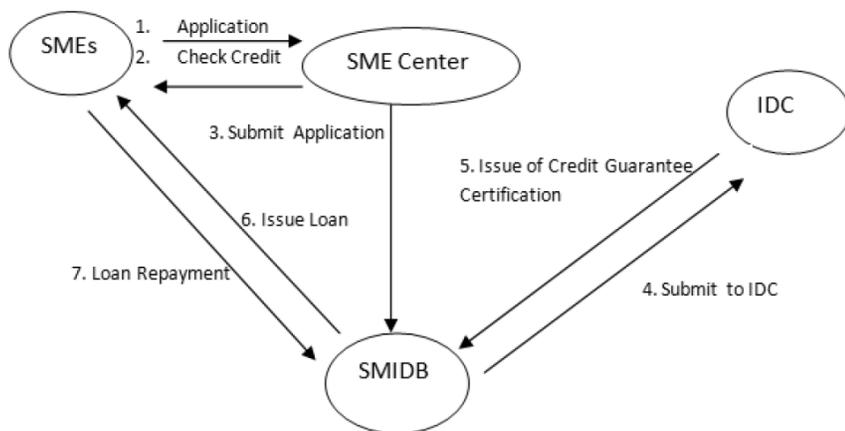


Figure 17: Procedure to access finance for SMEs after 2012

This shows that the penetration of the SME financial market through the banking sector in Myanmar is limited. An important reason resulting from this unfavourable situation is that the regulations regarding collateral requirement are very strict. SMEs with limited assets and financial history have therefore not been able to access financing from banks. With the creation of SMIDB, the first loan scheme dedicated to SMEs has been put in place. Whilst the need for collateral still remains, the interest rates of the scheme are lower than the commercial rates. Over the course of a few years SMIDB has collected valuable lessons that can be shared with other banks, where banks may together assess to what extent Sustainable Consumption and Production (SCP)/resource efficiency measures have been financed through the loan scheme. This in turn can make those banks consider the SCP aspects in their financing schemes.

International finance

International banks, donor organisation and their financial branches have recently started to look at the financial sector in Myanmar and develop programmes to support its advancement. Most of these initiatives are still in the planning stage and, in general, focus more on SME finance rather than dedicated green SME finance:

- The Central Bank of Myanmar (CBM) has given authorisation in May 2015 for SMIDB to avail of a EUR 18.8 million from Singapore banks (Myanmar Business Today 2015; The Irrawaddy 2014). Another authorisation to obtain financing from Vietnamese banks is still awaited. Together the funds will be disbursed under the aforementioned SMIDB financing scheme, with a potentially lower interest rate of 6%.
- In June 2015, JICA and Myanmar Government signed loan agreements which included the provision of JPY 5,033 million (EUR 38.7 million) for the development of financial products for SMEs. JICA will provide a medium-term financing to intermediary financial institutions through the Government of Myanmar.
- The European Investment Bank (EIB) plans to funnel EUR 30-100 million per year to support Myanmar SMEs through loans to local banks (Myanmar Times 2014). In 2015 EIB and the Government of Myanmar signed a Framework Agreement under which EIB will start financing capital investments in the country.
- In 2015 the International Finance Corporation (IFC) disbursed EUR 4.7 million to Yoma Bank for SME finance (The Irrawaddy 2014). This is expected to contribute to the 1,000 loans that Yoma Bank has planned to grant to SMEs by 2019, which will be worth EUR 348.5 million. IFC has also extended a loan to Myanmar Oriental Bank for facilitating international trade for local SMEs.
- The Trade Finance Programme (TFP) of the Asian Development Bank (ADB) and CB Bank signed an agreement on October 6, 2015. In this financing framework TFP will provide guarantees of up to EUR 11.3

million per annum to support trade finance operations of the CB Bank. As expected, this financing will further support the small and medium-sized Myanmar exporters and importers.

- In June 2015, the ADB declared that it would work with several commercial banks to raise the risk management capacity for lending to SMEs.
- In May 2015, the German Agency for International Cooperation (GIZ) offered financial support for SME development in the country through three local banks – SMIDB, Yoma Bank and Kanbawza Bank. In addition, GIZ will provide technical assistance to the banks to support them in developing financial products specifically designed for SMEs (DEALSTREETASIA 2015). The programme was planned to run until the end of 2016, when other banks are expected to be included to the programme.

Evidently, most of the initiatives have just started. International financial institutions therefore have an important role in inscribing the SCP concept from the very beginning in the product portfolio of Myanmar financial institutions. In turn, the take-up of SCP concepts by Myanmar's financial institutions will create a window of opportunity to communicate SCP with SMEs requiring (green) financing. Through support from international financial institutions, Myanmar's banks will be motivated to include SCP indicators in their credit ratings, establish a monitoring system and offer preferential conditions for SCP-related (green) loans. This early inclusion of SCP concepts in Myanmar financial sector will prevent problems that many of the neighbouring countries face, where the integration of green financing elements in the existing SME financing portfolio has been difficult. This also means that the provision of financing from international institutions needs to be accompanied with capacity building measures that will familiarise local financial institutions to the specifics of green SME finance.

Microfinance

Cooperatives have been playing an important role in microfinance in Myanmar for a long time. But it was only in 1997 that microfinance was introduced formally through the UNDP's Human Development Initiative. As of January 2013, multiple microfinance institutions (MFIs) reached 2.8 million micro clients with a total loan portfolio of EUR 266.6 million.

In 2011, a legal framework was established to regulate existing and new MFIs. To encourage new MFIs, the framework allowed the privately owned local and foreign MFIs to operate in Myanmar and legalised the already operating MFIs. The law capped the interest rate at 2.5% per month (declining) and the loan size at MMK 0.5 million (EUR 360). In 2014, the Microfinance Business Supervisory Committee introduced some changes in the existing law and the loan size was increased to MMK 5 million (EUR 3,600). As per the revision, local MFIs can take loans from the Myanmar Economic Bank (MEB) only – they are not allowed to borrow from international or private banks. Local MFIs can, however, receive equity funds from foreign as well as local institutions. Foreign MFIs, in turn, cannot borrow locally, but are allowed to take loans from foreign financial institutions given the CBM's approval (Myanmar Times 2015). They also have to maintain a debt to equity ratio of 5:1. MFIs are also allowed to enter the market using mobile payment systems with a limitation on the daily transaction volumes (GIZ 2015).

The new MFI law has attracted international players and encouraged local organisations to expand their operations. Examples of international players entering the financial market are the Cambodia-based microfinance institution ACLEDA MFI Myanmar Company Ltd that planned to loan out MMK 8 billion (EUR 5.7 million) to SMEs in 2013, and BRAC, a development organisation from Bangladesh that received a license to operate in the country in 2014 (Myanmar Times 2014). As of October 2014, there were 215 licensed MFIs in Myanmar. This included 95 local MFIs and 77 cooperatives (see Figure 2). Finally, there are 14 foreign companies and seven international NGOs giving out microloans (GIZ 2015).

Despite the fact that Myanmar's microfinance is an attractive market with a high number of MFIs being present, there is still a huge unmet demand. UNCDF estimates this demand to be EUR 942 million, with an existing MFI lending portfolio of EUR 111.2 million (GIZ 2015). The challenging conditions in the country have been a contributing factor in creating this gap, as a result the micro-finance sector has not expanded significantly.

The most important challenges facing MFIs are:

- Artificial caps on borrowing rates: Interest rates at which MFIs can borrow cannot be above 8% for US Dollar loans, and 10% for Myanmar Kyat loans. Although the government allows borrowing from international institutions, it is not possible to get funds from abroad at such low rates.
- Very thin spreads: Given the constraints on borrowing, MFIs depend on individual deposits which come at a minimum rate of 15%. The annual lending rates are capped at 30% for MFIs. Given that the local costs of operating and servicing the loans are high, the spread between actual costs of borrowing and lending is not economical. MFIs need to be supported to be able to attract lower cost funds and bring down costs of operations. This can be done with capacity development grants.
- Limited funding sources: Rules regarding the source of borrowing are restricting the growth of MFIs operating in the country. Local MFIs are restricted to borrow only from MEB, and foreign MFIs only from international sources.
- Unclear rules: The rules in regard to the requirements of solidarity group lending and reporting methodologies for MFIs remain unclear (Duflos et al. 2013).
- Weak financial system: The absence of a credit bureau and an underdeveloped payment system also negatively affects the growth of MFIs (Duflos et al. 2013).
- Fragmented supervision: Multiple organisations are involved in the supervision of MFIs: CBM controls the banks, the Ministry of Cooperatives controls the co-operatives, and the Financial Supervisory Department controls the MFIs. This leads to a confusion about responsibilities and hampers further development of the sector.
- Limited technical knowledge at MFI authority: There is a lack of technical knowledge on financial issues related to MFIs in the newly established Microfinance Supervisory Enterprise (MSE) which is the main organisation responsible for the daily supervision of MFIs. Clearly Myanmar's microfinance sector along with its regulatory framework is still in an early development phase, although microlending has existed in Myanmar for a long time. The law's revisions have helped in generating interest in this sector, but have not yet been able to achieve significant traction. Unclear rules and un-economical lending rates have made it difficult for MFIs to raise funds and increase the size of their loan portfolio. The ability of ACLEDA and BRAC to raise funds and expand will set precedence for MFIs planning to enter Myanmar. The performance of the 215 licensed MFIs in the wake of changing regulations will help in understanding how this sector will develop in the future.

Informal financial sector

The informal financial sector in Myanmar is large. Informal moneylenders are often unreliable and very expensive as they come with high interest rates. At the same time, requests for financing can be quickly processed, sometimes with only a phone call. The semi-formal financing sector includes pawnshops and community-based organisations. The informal sector also comprises a mercantile class that lends out to rural customers against providing collateral. The moneylenders often act as brokers between banks and less financially literate individuals. Interest rates vary between 3-8% per month and average repayment periods are 3-6 months.

Given the difficult access of SMEs to formal financing products, the informal financing sector has a prominent place in the financing landscape in Myanmar. The flexibility of these informal financing sources makes it especially attractive for

SMEs, in comparison to the formal financial sector. In a transition toward a formalised financial system in Myanmar with a better product portfolio for SMEs, the informal sector would need to be considered.

Challenges for SMEs' Access to Green Finance

There is a recognition that the future economic growth path of Myanmar strongly depends on SME development. However, SMEs have been and are still facing various challenges that are restricting the expansion of SME operations and the inclusion of SMEs in the formal sector – one of the most important is the limited access to finance (see Figure 3). A survey among 3,000 enterprises in Myanmar revealed that 91% of the business financing comes from personal savings, personal loans and retained earnings. Only 9% of business financing comes from bank loans or money lenders (GIZ 2015). This section describes the demand-side, supply-side and structural barriers to SME finance.

Demand-side barriers

1. SMEs lack in financial literacy. SMEs in need of external funding often lack the financial and bookkeeping knowledge required to prepare a complete loan application. Therefore, SMEs first need to understand what information is required for a loan application and have to be able to collect it. Yet, many SMEs do not have an appropriate accounting system in place that would allow an easy extraction of financial data. This leads to the situation in which SMEs cannot provide an accurate picture of their business situation, which again increases the reluctance of banks to lend money to SMEs at all. In addition, many SMEs lack in soft skills to present their business case to loan officers for obtaining financial support.
2. SMEs lack knowledge of financing options. As the financial sector is continuously growing in Myanmar, SMEs are often not up to date about the banking facilities that they can access. This makes the market entry for SME finance products rather difficult. New SME financing products, for which there is a demand, may not succeed, as the information does not reach the relevant target SMEs.
3. SMEs do not create demand for green financing products. The primary target of SMEs in the current economic situation is expansion, yet, very few SMEs consider SCP improvements or other green investments. There is a very limited knowledge among SMEs that SCP measures can increase their production efficiency and that green products can open up new markets. An underlying cause is that demand for such green products does not exist – green public and private procurement are not yet on the agenda in Myanmar.

Supply-side barriers

- Strict funding requirements constrain the access to SME finance. State-owned as well as private commercial banks have a limited funding capacity due to the strict collateral requirements. Banks are not allowed to extend loans without collateral which can take the form of land and buildings, gold and jewellery, as well as agricultural assets and deposits. Yet, even with collateral, banks can only lend up to 50-60% of the forced sale value of the collateral. Many SMEs cannot meet the collateral requirements and are therefore unable to access any formal financing.
- Time-consuming loan appraisal process and the cost of loan applications make external finance unattractive for SMEs. The preparation of loan applications including certifications and registration is costly. According to estimates of an SME representative, the application costs can amount to 10% of the loan. This is prohibitively high for many SMEs, and even if SMEs can manage to submit a loan application, the subsequent process of appraisal takes too much time. It is thus easier and faster for SMEs to approach informal money lenders. One reason for the long appraisal process is often the inexperience of loan officers in the local bank branches.
- Lack of credit assessment and risk management tools makes it difficult to assess SMEs' applications. The banking system in Myanmar is in need of credit assessment and risk management tools. Currently, banks do not have access to credit information of their customers which makes it difficult to lend out to SMEs for the first time. Thus, there is no way for banks to assess whether an SME is creditworthy and whether the investment is promising enough to guarantee a payback.

- Financial institutions do not perceive green finance as a business opportunity. The topic of green finance and SCP is still new to the majority of Myanmar’s financial institutions. Since SMEs are not yet aware of the green finance potentials, its demand is al-most non-existent where government does not see the need to produce supporting policies. Moreover, financial institutions have not yet realised that green finance portfolios can enhance their competitiveness.

Structural barriers

- An inadequate legal framework makes the development of financial products for SMEs difficult. The banking and financial sector faces challenges in developing products and releasing loans to SMEs due to inadequate legal and regulatory frameworks. The lending infrastructure including protection for creditors, enforcement of contract and collateral rights, rules dissolving commercial disputes and arbitration, and commercial laws are not yet well defined (IDE-JETRO 2008). In this context, the risks associated with lending to SMEs are perceived as too high by the financial institutions.

Apparently, the barriers identified have contributed largely to preventing more orchestrated collaboration between financial institutions and SMEs in the country. The opening of Myanmar’s economy and its expected economic effects provide a unique opportunity to design and create a system which supplies SMEs with the needed funding while offering banks the security required to continue their operations.

While addressing the overall problem of SME access to finance, it becomes increasingly important for the government and financial institutions to take green finance into consideration. A too narrow focus on the expansion of SME sectors without taking into account SCP practices will pose risks to Myanmar’s growing economy resulting in severe environmental pollution, resource depletion and locking the development of the country into a high emissions growth trajectory. Ensuring more sustainable growth would call for provisions favouring green finance in Myanmar’s financial system.

ANNEX K: BUDGET AND PROJECT IMPLEMENTATION TIMELINE

Table 12: General Budget per Output and Activity

Outcomes/ Outputs	Units	No. Units	Unit Cost (USD)	Total Cost (USD)	Associated indicator in the Log frame
Component 1 -Policy framework and national capacity for water quality and wastewater management improved					
Outcome 1.1: National capacity for promoting greenhouse gas emission reduction strengthened by an improved institutional and policy framework on water quality and wastewater management;					
Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened;					
Activity 1.1.1.1 Assessment of current industrial legal and regulatory measures, urban planning processes and policy frameworks on water quality and wastewater management;	Detailed assessment	1	50,000	50,000	1 assessment report detailing gaps and improvement opportunities on regulatory and policy framework.
Activity 1.1.1.2 Strengthen regulations on sound wastewater management and identify policy tools needed on a national and municipal level;	Number of draft regulations or policy tools developed	1	80,000	80,000	1 roadmap proposal for strengthening identified and prioritized regulations/1 proposal of policy or regulation tool.
Activity 1.1.1.3 Assessment on alternatives for public-private business models for construction and maintenance of wastewater infrastructure development;	Detailed assessment	1	50,000	50,000	1 assessment report on PPP business models for development of wastewater infrastructure consulted with public and private stakeholders.
Subtotal				180,000	
Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane harnessing technology strengthened by TEST capacity building program					
Activity 1.1.2.1 Prepare capacity building program material on TEST and train a pool of national consultants and Government officials;	Capacity building programme material developed and one TOT training workshop delivered	1	64,200	64,200	1 capacity building program material on TEST / 25 participants are trained through one Training of Trainers (ToT) course aimed at a national consultants and relevant government officials.
Activity 1.1.2.2 Deliver general training on introduction of the TEST integrated approach and RECP to industry and key stakeholders;	Number of trainings delivered	4	17,450	69,800	At least 100 participants from manufacturing sector, business associations, industrial zones

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					management, city development committees and related professionals.
Activity 1.1.2.3 Deliver a general training on low-cost industry wastewater treatment, methane recovery technology for energy generation and wastewater management on industrial zones;	Number of trainings delivered	1	35,800	35,800	50 participants from city development committees, industrial organizations, technical suppliers, industrial zone managers and companies from priority industrial zones.
Activity 1.1.2.4 Conduct trainings on Environmental Management Accounting (EMA) and Environmental Management System (EMS);	Number of trainings delivered	6	11,900	71,400	At least 120 participants from industrial sectors and relevant public offices.
Activity 1.1.2.5 Conduct training on planning for climate change for government officials from YCDC and MCDC;	Number of trainings delivered	2	25,000	50,000	At least 50 participants from YCDC and MCDC.
Activity 1.1.2.6 Carry out capacity building activities for local government to better tackle issues connected with wastewater treatment, including water supply and sanitation;	Number of trainings delivered	2	14,000	28,000	At least 50 participants from local governments in the region of Yangon and Mandalay.
Subtotal				319,200	
Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented					
Activity 1.1.3.1 Conduct awareness raising activities for industries, policy makers and civil society, to improve their understanding of wastewater management and the consequences of water pollution;	Awareness raising programme	10	8,000	80,000	At least 10 dissemination events developed
Activity 1.1.3.2 Lessons learned and best practices will be disseminated through events, publications and outreach/educational materials;	Number of publications and promotional materials developed and disseminated	30	3,000	90,000	At least 30 fact sheets of TEST demonstration projects in Industries. At least 10 publications and/or awareness raising, outreach/educational material.
Activity 1.1.3.3 Develop awareness raising material on the integrated TEST approach, and a training manual on sound wastewater management for use in relevant vocational training centres and institutes;	Training materials developed and disseminated	1	30,000	30,000	1 training manual on TEST and sound wastewater management for use in relevant vocational training centres and institutes.
Subtotal				200,000	
Total Component 1				699,200	

Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach					
Outcome 2.1: Greenhouse gas emissions from industrial effluent discharges reduced through demonstrated pilots at company and industrial park levels implementing TEST approach and procured WWTP and biogas technologies					
Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions					
Activity 2.1.1.1 Carry out an initial assessment phase to select a target group of 50 companies to be assessed on the TEST integrated approach as demonstration projects;	Assessment conducted and target group of 50 companies selected	50	1,534	76,720	At least 50 companies with initial assessments developed.
Activity 2.1.1.2 Provide technical assistance to implement TEST tools at 50 selected companies as demonstration projects, to improve their environmental performance and reduce GHG emissions.	Technical assistance provided to companies	50	11,400	570,000	50 companies develop demonstration projects of the TEST methodology
Activity 2.1.1.3 Assistance to companies to access finance for RECP investments	Technical assistance provided to companies	15	6,400	96,000	At least 15 companies carry out feasibility studies and request finance support for RECP investments.
Subtotal				742,720	
Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants					
Activity 2.1.2.1 Develop a wastewater quality monitoring system, including on-site measures;	# supported industrial zones	2	31,413	62,827	At least 2 industrial zones with improved wastewater quality monitoring program conducted at selected demonstration sites.
Activity 2.1.2.2 Develop technical and financial feasibility studies of the selected pilot projects for wastewater treatment applying biogas harnessing technology;	# of feasibility studies	4	63,750	255,000	At least 3 feasibility studies developed to evaluate the implementation of pilot projects.
Activity 2.1.2.3 Procurement and construction of the selected wastewater treatment and biogas pilot plants;	# of investments supported	2	877,500	1,755,000	At least 1 pilot project on wastewater treatment using methane harnessing for electricity or heating implemented.
Activity 2.1.2.4 Provide technical assistance to support the implementation of the selected wastewater treatment and biogas pilot plants;	# of investments supported	2	25,750	51,500	
Activity 2.1.2.5 Design a sustainable park management model for sound wastewater management and methane for energy use;	Study and report	1	28,600	28,600	1 sustainable management model for sound wastewater management

					including methane recovery at industrial parks.
Subtotal				2,152,927	
Total Component 2				2,895,647	
Component 3: Monitoring and Evaluation					
Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation					
Output 3.1.1: M&E mechanism developed and applied					
Activity 3.1.1.1 Develop a monitoring system to track progress against indicators;		1	50,000	50,000	
Activity 3.1.1.2 Annual implementation reports;		5	12,000	60,000	
Activity 3.1.1.3 Mid-term review;		1	30,000	30,000	
Activity 3.1.1.4 Independent terminal evaluation;		1	60,000	60,000	
Subtotal				200,000	
Total Component 3				200,000	
General subtotal				3,794,847	
Project Management Costs (5% of the subtotal)				189,742	
GRAND TOTAL				3,984,589	

Table 13: Annual Budget

Outcomes/ Outputs	Total Cost (USD)	USD year 1	USD Year 2	USD Year 3	USD Year 4	USD Year 5	Total (USD)
Component 1 -Policy framework and national capacity for water quality and wastewater management improved							
Outcome 1.1: National capacity for promoting greenhouse gas emission reduction strengthened by an improved institutional and policy framework on water quality and wastewater management;							
Output 1.1.1: Wastewater regulatory framework reviewed, policy tools identified and introduced, and institutional capacity on sound wastewater management strengthened;	180,000	37,500	77,500	65,000	-	-	180,000
Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane recovery power generation technology strengthened by TEST capacity building program	319,200	94,050	124,970	57,820	42,360	-	319,200
Output 1.1.3: Awareness programs on sound wastewater management developed and implemented	200,000	38,800	38,800	41,800	41,800	38,800	200,000
Total component 1	699,200	170,350	241,270	164,620	84,160	38,800	699,200
Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach							-
Outcome 2.1: Greenhouse gas emissions from industrial effluent discharges reduced through demonstrated pilots at company and industrial park levels implementing TEST approach and procured WWTP and biogas technologies							-
Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions	742,720	26,852	259,952	256,116	199,800	-	742,720
Output 2.1.2: Demonstration and investment in integrated wastewater treatment and biogas plants, including the delivery of procurement and monitoring support	2,152,927	56,914	341,065	1,159,524	576,544	18,880	2,152,927
Total Componente 2	2,895,647	83,766	601,017	1,415,640	776,344	18,880	2,895,647
Component 3: Monitoring and Evaluation							-

Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation							-
Output 3.1.1: M&E mechanism developed and applied.	200,000	22,000	22,000	52,000	22,000	82,000	200,000
Total Component 3	200,000	22,000	22,000	52,000	22,000	82,000	200,000
SUBTOTAL	3,794,847	276,116	864,287	1,632,260	882,504	139,680	3,794,847
Project Management Costs (5% of the subtotal)	189,742	37,948	37,948	37,948	37,948	37,948	189,742
GRAND TOTAL	3,984,589	314,064	902,236	1,670,209	920,453	177,628	3,984,589

Table 14 Project implementation timeline

Outcomes/ Outputs	Yr-1				Yr-2				Yr-3				Yr-4				Yr-5			
	Q1	Q2	Q3	Q4																
Component 1 -Policy framework and national capacity for water quality and wastewater management improved																				
Outcome 1.1: National capacity for promoting greenhouse gas emission reduction strengthened by an improved institutional and policy framework on water quality and wastewater management																				
Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened																				
Activity 1.1.1.1 Assessment on current industrial legal and regulatory measures, urban planning processes and policy frameworks on water quality and wastewater management;	■	■	■	■																
Activity 1.1.1.2 Strengthen regulations on sound wastewater management and identify policy tools needed on a national and municipal level					■	■	■	■	■	■	■	■								
Activity 1.1.1.3 Assessment on alternatives for public-private business models for construction and maintenance of wastewater infrastructure development					■	■	■	■	■	■	■	■								
Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane harnessing technology strengthened by TEST capacity building program																				
Activity 1.1.2.1 Prepare capacity building program material on TEST and train a pool of national consultants and Government officials		■	■	■																
Activity 1.1.2.2 Deliver general training on introduction of the TEST integrated approach and RECP to industry and key stakeholders					■	■	■	■	■	■	■	■	■	■	■	■	■			
Activity 1.1.2.3 Deliver a general training on low-cost industry wastewater treatment, methane harnessing technology for energy generation and wastewater management on industrial zones.			■	■	■	■	■	■												
Activity 1.1.2.4 Conduct trainings on Environmental Management Accounting (EMA) and Environmental Management System (EMS)					■	■	■	■	■	■	■	■	■	■	■	■	■			
Activity 1.1.2.5 Conduct training on planning for climate change for government officials from YCDC and MCDC		■	■	■	■	■	■	■												

Activity 1.1.2.6 Carry out capacity building activities for local government to better tackle issues connected with wastewater treatment, including water supply and sanitation																			
Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented																			
Activity 1.1.3.1 Conduct awareness raising activities for industries, policy makers and civil society, to improve their understanding of wastewater management and the consequences of water pollution																			
Activity 1.1.3.2 Lessons learned and best practices will be disseminated through events, publications and outreach/educational materials																			
Activity 1.1.3.3 Develop awareness raising material on the integrated TEST approach, and a training manual on sound wastewater management for use in relevant vocational training centres and institutes.																			
Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach																			
Outcome 2.1: Greenhouse gas emissions from industrial effluent discharges reduced through demonstrated pilots at company and industrial park levels implementing TEST approach and procured WWTP and biogas technologies																			
Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions																			
Activity 2.1.1.1 Carry out an initial assessment phase to select a target group of 50 companies to be assessed on the TEST integrated approach as pilot projects																			
Activity 2.1.1.2 Provide technical assistance to implement TEST tools at 50 selected companies as pilot projects, to improve their environmental performance and reduce GHG emissions.																			
Activity 2.1.1.3 Assistance to companies to access finance for RECP investments																			
Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants																			
Activity 2.1.2.1 Develop a wastewater quality monitoring system, including on-site measures																			
Activity 2.1.2.2 Develop technical and financial feasibility studies of the selected pilot projects for wastewater treatment applying biogas recovery technology																			

ANNEX L: PROJECT THEORY OF CHANGE

Baseline	Barriers	Inputs	Key Activities	Outputs	Outcomes	Impact Achieved
<p>Untreated wastewater released from industrial sector into the local environment is one of the most important water polluter contributing to climate change as well as on the degradation of human health. Untreated waste water represents three times the GHG emissions of conventional wastewater treatment.</p> <p>Pollution of downstream water resources.</p> <p>Depletion of oxygen levels in water bodies.</p>	<p>Policy: The existing legal framework provides unclear guidance and delineation of responsibilities in planning, regulating and managing industrial zone infrastructure.</p> <p>Monitoring: Weak government enforcement on industries to penalize illegal dumping and the mismanagement of industrial effluents.</p> <p>Economic: Poor incentives to implement environmental sound production strategies in industries and lack of pricing strategy to incentivize the private sector to construct industrial wastewater treatment.</p> <p>Capacity: Lack of technical and financial capacity of SME's to implement resource efficiency measures and wastewater treatment systems.</p>	<p>GOVERNMENT:</p> <ul style="list-style-type: none"> • Technical support and staff time. • Support for technical assistance programme to government institutions and private sector. • Interest to investment promotion. • Project management. <p>PRIVATE SECTOR:</p> <ul style="list-style-type: none"> • Factories with high improvement potential and growing market. • Industrial zones and factories with advance on construction and utilization of wastewater treatment facility. On going management and maintenance of wastewater system. • Provision of equipment and materials. <p>INTERNATIONAL AND NATIONAL TECHNICAL CAPACITIES</p> <ul style="list-style-type: none"> • Human and technical resources from previous experience. • Transfer of technical know-how on RECP and TEST . • Grants for technical assistance programme to government and Private sector. • Technical assistance /staff time. • Financial de-risking and investment finance. • Project management. 	<ul style="list-style-type: none"> • Policy and wastewater regulatory framework assessments. • Capacity building and awareness raising program. • Wastewater infrastructure development models. • Training programs on RECP and TEST to factories, industrial zones administrations and national experts. • TEST pilot projects in factories. • Support investment promotion mechanisms on RECP measures. • Grants and technical assistance to wastewater treatment plants and methane harnessing pilot projects. • Technical guidelines, success case studies and lesson learned systematized and promoted. • Awareness raising programs. 	<p>Strengthened policy framework and institutional capacity on sound wastewater management and RE generation.</p> <p>National capacity increased on RECP, low-cost industry wastewater treatment and methane harnessing technology.</p> <p>Companies and industries implement cleaner and more resource efficient measures energy.</p> <p>Industrial zones increase the use of wastewater treatment technologies and implement energy saving measures through methane capture waste to energy.</p> <p>Increased awareness on pollution prevention and its contribution to industrial sustainable development.</p>	<p>Increasing Myanmar's efforts towards climate mitigation by minimizing GHG emissions.</p> <p>Greenhouse gas emissions from industrial effluent discharges reduced through improved wastewater management and technologies, supported by and strengthened policy framework and increased capacity on TEST and RECP strategies and treatment technologies.</p> <p>Industry sector increase productivity, with cost recovery, reduced costs and better environmental performance.</p>	<p>Reduced GHG emission</p> <p>Towards carbon neutrality: Scale-up of wastewater treatment combined with energy-saving and renewable energy producing measures.</p> <p>Reduced environmental impact and increased competitiveness of industry</p> <p>Conservation of water</p>

Figure 18 Theory of Change

ANNEX M: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

An ESMP is compliant with a Category B rating from UNIDO's Environmental and Social Screening Process, which suggests that likely impacts will be few, site-specific, and few if any will be irreversible. This Category B project will impact the designated industrial park sites to include both:

- Physical interventions such as the demonstration of pilot projects in energy efficient and clean production technology for sound wastewater management and greenhouse gas reductions;
- Planning support, policy advice, and capacity building.

The purpose of the ESMP is to ensure that social and environmental impacts, risks and liabilities identified are effectively managed during the construction, operation and closure of the proposed project. The ESMP specifies the mitigation, adaptation, prevention and management measures to which the Proponent is committed and shows how the Project will mobilize organizational capacity and resources to account for the factors evaluated in order to implement the compiled measures. The ESMP also shows how mitigation and management measures will be scheduled.

The key objectives of the ESMP are:

- To outline mitigation measures against possible negative impacts;
- To enhance positive aspects brought by the project;
- To ensure that the programme will comply with relevant environmental legislation of Myanmar and other requirements throughout its pre-construction, construction, operation and decommissioning phases;
- To identify roles and responsibilities and the cost involved;
- To propose mechanisms for monitoring compliance;
- To provide adequate channels of input for the different stakeholders throughout the project activity; and
- To establish proven mechanisms to correct/adjust the findings resulting from the monitoring activity and to include the input received throughout the project activity.

The ESMP is a living document for project activities that will be updated as and when required. The ESMP acts as a quick guide for Contractors and project implementers to enhance positive impacts and eliminate or minimize the occurrence of negative impacts through proposed mitigations measures. The ESMP relies on the following key principles:

Compliance with local, national and international laws

The project will empower individuals and groups, particularly the most marginalized, to realize their rights and interests, and to ensure that they fully participate throughout the development and implementation of projects.

Transparency and inclusivity

The project development team will engage in meaningful and transparent consultation with affected communities particularly with vulnerable groups, to ensure that they can participate in a free, prior and informed manner in decisions about avoiding or managing environmental or social impacts. The project will also aim to achieve an average 30% female representation within capacity building and awareness raising activities.

Systematic assessment and tracking of environmental and social impacts and risks

The project will aim to provide clear and constructive responses to individual, group, and community grievances related to the social and environmental performance of the project. The project will also aim to correct non-compliance where it has occurred and share the results of its review of grievances and any actions taken. During project implementation, any changes likely to have negative social and environmental impacts must be communicated to UNIDO prior to implementation. The

key risks to be considered and tracked in a systematic way are described in Table 3 Environmental and Social Risks and Mitigating Measures, and further in Table 4 Environmental and Social Sustainability Monitoring, in this document.

Information will be collected on a real-time and quarterly basis by the Project team and will be treated as confidential within the project, to be kept in computerised form and backed-up by the central UNIDO office. It will be kept for a minimum of 10 years after project completion.

Harmonisation with other projects and programs

The project will aim at maximizing efficiency and minimizing costs in complying with environmental and social safeguards. The project development team will lead discussions at country level to decide on the use of the most appropriate environmental and social safeguards procedures.

Gender equality

The project will identify and integrate the different needs, constraints, contributions and priorities of women and men and where possible, it will aim at enhancing the positive gender impacts of projects by undertaking to develop mitigating measures to reduce any potential gender specific and disproportionate adverse gender impact.

This project aligns with the:

- GEF's Policy on Gender Mainstreaming which seeks gender equality mainstreamed through its operations;
- UNIDO Policy on Gender Equality and the Empowerment of Women 2009 and updated in 2015 to the United Nations System-Wide Action Plan on Gender Equality and the Empowerment of Women, which seeks to enhance the role of women in sustainable industrialization, and to engage all men and women equally;
- National Strategic Plan for the Advancement of Women 2013–2022, which seeks to ensure women's meaningful participation in the management and safeguarding of natural resources, the environment and in adapting to climate change; and
- Myanmar Climate Change Strategy and Action Plan (MCCSAP) 2016 – 2030, which seeks to build capacity building and guidance on mainstreaming gender into climate change actions, as well as ensure equal participation of men and women in interventions and improve the availability of gender-disaggregated data.

These policies outline the need for gender equality and inclusion and the positive results of multiplier effects such as driving poverty reduction, environmental safeguarding, local economic development and female business leadership growth, advancing women's human rights, and GEF project goal realisation.

The gender analysis undertaken in project development revealed gender gaps in terms of organisational and leadership, gender inclusion awareness, representation in decision-making, representation by sector numbers, wages gaps and significant gaps in representation in senior level roles in the manufacturing sectors in Yangon and Mandalay. The analysis further revealed that women working in the industrial sector have typically less education, are often low-income earners, have more children than educated counterparts, and are responsible for primary care giving to families in and outside of the home. Some families live above factories and are exposed to hazardous chemicals and air pollution, while women working in downstream agricultural livelihoods are likely exposed to health risks as well as loss of livelihood (yield loss and decreased selling price) as a result of industrial wastewater pollution. At local levels, gender equality is not considered in planning tools e.g. the Strategic Urban Development Plan of Greater Yangon fails to tackle gender inequality. While women can form a sector majority (e.g. garment industry) they remain employed at low levels without progressive work practices in place nor career progression opportunities. As a consequence, poverty and lack of employment opportunities are driving women and young girls to migrate to neighboring countries to find jobs and earn money.

This project brings forward an opportunity to invest in women and men through awareness raising, capacity building and project participation. Risks along with mitigative measures are outlined below in Section 3, based on contextual

understanding of the sites in Yangon and Mandalay. Possible measures can include: further identification of constraints for women's participation, positive discrimination (quotas) for including women on local climate change-related committees, women-only consultation meetings and supporting female engineers in project participation and career progression and including gender mainstreaming training in all activities.

Climate resilience

The project will ensure that supported activities enhance climate resiliency and avoid unwarranted increases in greenhouse gas emissions. The project seeks to both reduce current greenhouse gas emissions and avoid further generation of greenhouse gas emissions from the sites through securing energy efficiency gains, sound wastewater treatment options and use of renewable energy in the form of captured biogas.

The risks associated with untreated wastewater is the contribution of higher levels of nitrous oxides and methane emissions, which have much larger multiplier effects on global warming. Myanmar is exposed to extreme weather events based on geographic location and remains climate vulnerable going forward. Reductions in national greenhouse gas emissions generation are critical to mitigate against future extreme weather events, while securing livelihoods and sustainable development. In parallel, risk mitigation through climate resilience in the form of awareness raising, behavioural change, adoption of environmental management systems, installation of appropriate technology and transferring best practices to other industrial sites within Myanmar, will accelerate greenhouse gas emissions reduction and promote establishment of resilient practices by industry and the communities that live on or close to industrial sites. As such, the expansion of wastewater treatment combined with energy-saving and renewable energy producing measures, can lead towards utilities achieving carbon-neutrality and climate resilient futures.

Specific risks of extreme climate change impacts linked to the project include high-category cyclone related flooding. Historically the Mandalay Industrial Zone has never been impacted by flooding, while the Yangon Industrial Zone has only been flooded once following impacts from Cyclone Nargis in 2008. Abandonment of biogas digesters in a worst case scenario is also a risk following an extreme weather event resulting in flooding or inundation. These factors may impact infrastructure and interrupt operations and therefore emergency plans should be built into site operations for the Project in addition to mitigation options aligned with national policies supportive of risk management, such as the Myanmar Climate Change Strategy and Action Plan (MCCSAP) 2017-2030., if it occurs.

Project description

The project falls under Category B for UNIDO projects and is likely to have impacts that can be mitigated against, and which will be fewer in number (in comparison to a Category A project), site-specific, and less likely to be irreversible in nature. In most cases impacts can be readily minimized by applying appropriate management and mitigation measures or incorporating internationally recognized design criteria and standards. In addition, UNIDO will share similar project experience where relevant; in this case a project implemented in Thailand is likely to have beneficial information to share for the Myanmar experience.

The demonstration project will be conducted at least one industrial zone location in Myanmar. Environmental and social risks have been identified across the Project and mitigation will be applied at each project pilot site. In Yangon one of the following three sites will be selected: Shwe Lin Ban Industrial Zone, Shwe Pyi Thar Industrial Zone (2,3,4), or Hlaing Tharyar Industrial Zone (1, 2, 3, 4), see Figure 1. In Mandalay, Pyi Gye Tagon Industrial Zone is selected see Figure 2. These maps provide a sense of the location, site composition and size, adjacent land uses, proximity to natural assets such as rivers, ponds and lakes, and likelihood in regard to untreated industrial wastewater discharge. These actions are known to generate environmental impacts along with socio-economic impacts arising from water quality degradation both in the immediate area and downstream, leading to negative impacts on ecological and human health and livelihoods.

Industrial zones in Myanmar are an important strategy to promote industrial development with risks being identified and mitigated to enable sustainable industrial development. Each of the sites has been extensively detailed in the project proposal, however a brief description follows below to provide basic characteristics of the Industrial Zones considered for Project demonstration site selection.

Yangon – one of the following sites will be selected -

1. Shwe Lin Ban Industrial Zone: located at number 13 in Figure 1 and at 1,100 acres, is the fourth largest industrial zone in greater Yangon. It has been operating since 2002 and is currently hosting 237 factories of food and beverage, textile and household goods. Some factories treat wastewater basically, before discharge, however the majority release effluent without any treatment. All wastewater is left for natural treatment in one stabilized pond and subsequently discharged into the nearby Hlaing River.

2. Shwe Pyi Thar Industrial Zone (2,3,4): located at number 9 in Figure 1 and is comprised of Industrial Zone 2, 3 and 4. It has been operating since 1998 with a land area of 988 acres. 285 factories produce food and beverage, consumer goods, construction materials, garment and furniture and are bounded by a canal as well as the Hlaing River, both of which receive untreated wastewater discharges.

3. Hlaing Tharyar Industrial Zone (1, 2, 3, 4): located at number 12 in Figure 1, was established in 1995. This industrial zone is bounded by Hlaing River in the east, Shwe Than Lwin Industrial Zone in the west, Pan Hlaing River in the South, and Yangon Patheingyi Road in the north. The total land area is 1401.98 acres with factories occupying 1087.98 acres. There are 707 factories producing produce food and beverage, and garments. It is likely that both rivers receive untreated wastewater discharges.

Mandalay

1. Pyi Gyi Tagon Industrial Zone: located in red on the map in Figure 2, is comparable in size with industrial zones of Yangon. Its main producing industries are also food-processing companies. The current wastewater treatment facility consists of one stabilization pond with the majority of companies not yet connected to it. The Doke Hta Wady River 5 km away is the closest wastewater discharge point for the entire site. Also clear from the map is proximity to the urban area with likely mixed residential area. Community living on or adjacent to this Industrial Zone would be impacted by odour, air pollution and also significantly, access to poor water quality if using the rivers directly. It is assumed such mixed uses would also discharge untreated water directly to nearby rivers.

Industrial Zones in Yangon Region

1. Dagon Seikkan
2. East Dagon
3. North Dagon
4. South Dagon(1+2+3)
5. Shwe Paukkan
6. North Okkalapa
7. South Okkalapa
8. Thaketa
9. Shwe Pyithar(1+2+3+4)
10. Thadukan
11. Wartayar
12. Hlaing Thayar(1 to 7)
13. Shwe Linban
14. Thanlyin-Kyauktan
15. Thilawa
16. Myaungdakar
17. Mingalardon Industrial Park
18. Anawyahtar
19. Shwe Than Lwin
20. Pyinmabin
21. Yangon Industrial Zone
22. Ngwe Pin Lel
23. Mya Sein Yaung
24. December

YANGON INDUSTRIAL ZONE INDEX

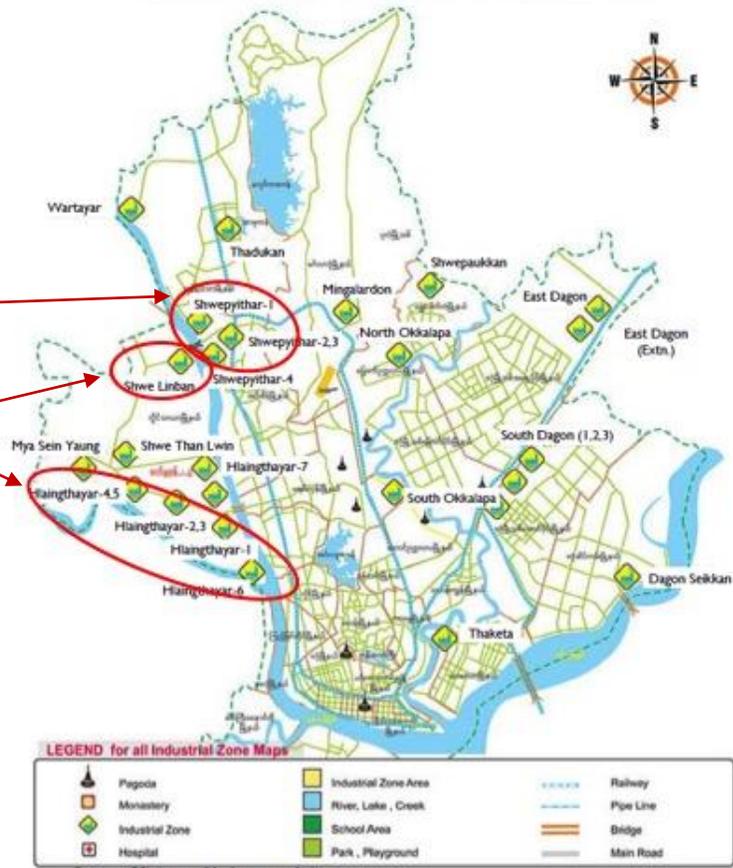


Figure 15: Map showing location of proposed Yangon industrial zones

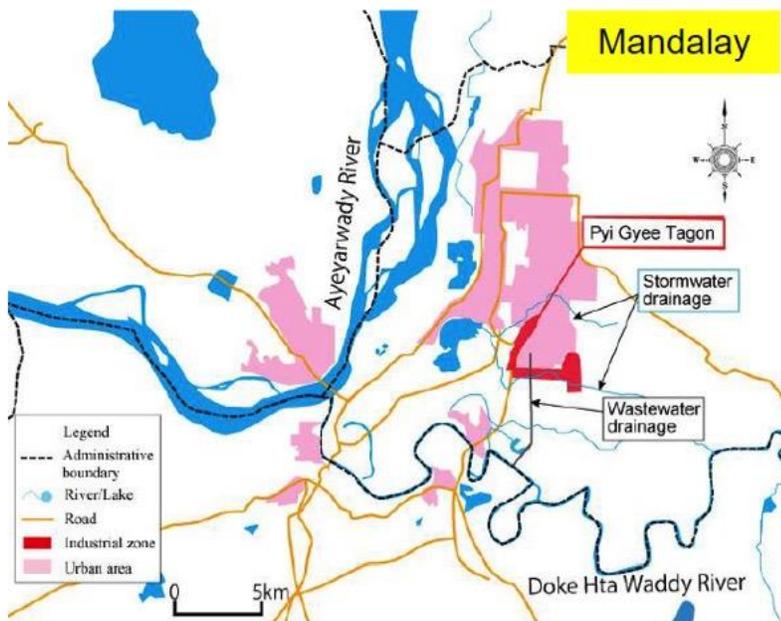


Figure 20: Map showing the location of Pyi Gyi Tagon industrial zone in Mandalay

The pilot project at both industrial sites will use a variety of applications in infrastructure, systems, governance, training and financial access. Some of these Project activities include: methane recovery from biogas for distributed energy generation, environmental management and accounting systems, TEST approach in companies; sound wastewater management policy strengthening at municipal and national levels, assistance with accessing finance for TEST development, provision of technical assistance including greenhouse gas emissions measurement, and TEST capacity building targeting government officials and service providers.

The long term socio-economic and environmental benefits of the proposed project are associated to widespread adoption of integrated approach to improve wastewater management from industry and industrial zones that will result in higher collaboration and liveability of the cities around the project sites, improving good quality of life and general wellbeing, healthy and viable communities, natural open spaces, reduced waste, increased equality, cleaner air and water quality, and increased biodiversity in rivers that will receive less polluted discharges. Particular environmental benefits associated with the project go beyond general terrestrial wellbeing, but also include river catchment improvements such as decreased siltation, chemical contamination, eutrophication, greenhouse gas emission and water clarity. Restoration of river and water body health as a result of industrial wastewater treatment has positive knock-on effects for biodiversity, possible clean ground water replenishment and general ecosystem services linked to human health and livelihood opportunity, such as fishing communities.

The opportunities of widespread uptake of the Myanmar industrial parks acting on climate change mitigation through industrial wastewater management and methane recovery will provide the following benefits:

- Reduced greenhouse gas emissions:** Industrial parks in Myanmar typically comprise high polluting manufacturing sectors involving food and beverage, garment, textile/dyeing, consumer goods, pulp & paper, leather/tanneries, and toiletry factories. All industry sectors have an opportunity to greatly reduce their current and future carbon footprints allowing for compliance with national and international climate change policies and growth opportunities.

- **Demonstration and scaled models for country-wide distribution:** First of their kind, best practices of industrial park greenhouse gas mitigation with documented applied systems, processes and lessons learned for transferability to other sites able to leverage support towards inclusive sustainable industrial development in Myanmar.
- **More stable and efficient supply of electricity:** Benefiting consumers will not be disrupted with electricity outages; in particular, production processes of industry will not be interrupted.
- **Energy savings for industry sector:** With the adoption of sound wastewater treatment operations and methane recovery with renewable energy provision, industry can save money on energy costs (speculatively 15% to 25% of energy costs can be saved from these interventions).
- **Reduced impact of energy price shocks to public and private sectors:** Deployment of renewable energy promoted by this project will reduce exposure to global energy price shocks and enable greater financial sustainability for local commerce.
- **Gender inclusion and cultural transition to equality:** Mainstreaming gender through all program activities will build awareness and capacities of industrial parks' communities. The project will enable women in particular to participate in decisions that impact their lives, health and incomes potentially leading to a transition in the wider community towards greater gender equality.
- **Better access to green jobs:** The project will promote green industrial development which will lead to more green job opportunities through a new generation of vocationally trained experts in the context of wastewater related climate change expectations.
- **Restored ecosystem services and improved human health:** Improved ecosystems health delivers clean and safe catchments to surrounding neighbourhoods with downstream river health improvement resulting in less human health issues such as asthma, emphysema, skin and eye problems as well as improved biodiversity linked to livelihood opportunities such as increased aquatic flora and fauna. This is significant for agricultural and fishery based-communities.

The possible adverse effects identified may include:

The potential negative environmental and social impacts identified in the ESMP (pilot plant pre-construction, construction, operation and decommissioning phases) are localized and temporary with the possibility of mitigation actions. The projected environmental and social risks for the various stages of the project are presented below.

Preconstruction Phase

No negative impacts are expected during the preconstruction phase. Preconstruction activities include the acquisition of land, required permits, definition of alignments, and layout of construction limits, location and establishment of equipment storage of staging areas. This phase should also include public consultation and communication with stakeholders and the general public on the scope, and possible impacts and proposed mitigation measures.

Land acquisition is not expected to have a negative impact. While the final site for the pilot projects will be confirmed during the project, the PPG was able to pre-identify two sites (as indicated in the co-financing letters provided by MCDC and Shwe Pyi Tha Industrial Zone) with high potential for locating the wastewater treatment plants and biogas digesters. Both of these sites are within the industrial zone and would not imply any resettlement of communities. If a different site (or sites) be identified during the project the Environmental Impact Assessment will take into account possible impacts resulting from the acquisition of the land for the pilots. Due attention will be paid to ensure there is no forced resettlements or other negative impacts on the local community.

Construction Phase

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The activities expected in this phase include construction of a wastewater treatment plant and a biogas digester in at least one pilot site at the industrial park level. These facilities include installation of the following typical components (adjustments to these components can be made during the final design phase and considering technical conditions in the final selected sites):

- Pre-treatment system:
- Collection sump
- Coagulation/flocculation tanks
- Equalization tank.
- Biological treatment system:
- Anaerobic digester
- Aeration tanks
- Sedimentation tank
- Final effluent discharging tank
- Effluent monitoring station
- Sludge treatment system:
- Sludge digester
- Filter press
- Filtrate sump
- Drying system (optional)
- Biogas collection and purification system
- Power generator and connections
- All auxiliary systems: power supply, pumps, dosing systems, air compressors, control systems, etc.
- smart metres to measure physical parameters (at the industrial park level);
- on-site automatic sampling devices to collect samples for chemical parameters (located at selected discharge points);
- 1 x office/server room per site.

The projected impacts and risks during this phase are expected to be limited in scope but may include:

- Disturbance to existing traffic: the proposed interventions may involve road cuttings, excavations of trenches, temporary road closures/lane closures, and vehicle and pedestrian traffic deviations. These could result in traffic congestion and perhaps risks of accidents.
- Increased traffic: delivery of infrastructure, technology, monitoring and sampling equipment and people responsible for onsite project management and service installation may lead to a temporary increase of traffic.
- Limited access to nearby buildings: during construction and installation of equipment, access may be limited to the adjacent buildings and some disturbance of the neighbouring residents and users. This is unlikely to be for an extended period.
- Air pollution: emissions from the use of machines and dust production while grading and excavating could result in a decrease in air quality impacting nearby residents, pedestrians and/or nearby activities.
- Noise pollution: the generation of noise through the use of excavation machines, construction equipment and traffic could potentially impact on workers and neighbourhood residents.
- Water resource demand: A significant amount of water may be needed to fill the digester for technical hydraulic tests before operating the plant as a temporary impact.
- Construction Safety: Excavations, technology installations and testing, and other construction site activities, must be effectively managed to prevent injury to workers and disruption of the project.

Operations Phase

There are no projected major negative environmental impacts during the operation phase. The project is instead geared towards reducing negative impacts of current industrial greenhouse gas emissions from untreated wastewater discharge and poor energy efficiency practices. The project seeks to deliver beneficial results across social, environmental and economic aspects through cleaner production and energy efficiency gains.

The potential negative impacts are projected to be minor, most of which can be readily mitigated. Any negative impacts would be related to inappropriate maintenance of established equipment/ facilities and the operation of the centralized and decentralized industrial wastewater technology and biogas digesters themselves.

The biogas technology at the scale considered is first of its kind in the project region. The projected impacts and risks during this phase are expected to be limited in scope but may include:

- Occupational health and safety:
- due to increased traffic flow and related traffic accidents;
- due to the materials transported, stored, and used for routine and non-routine activities and potential of biological and chemical hazard exposure related to contamination with pathogens, particularly if sewage/contaminated wastewater is involved and long exposure to leaking gas occurs;
- Increased traffic flow: related to delivery and removal of digestate exposes workers, residents and nearby communities to traffic accidents, noise and air pollution. This is expected to be limited with advanced timing and risk mitigated where possible;
- Accidental gas and liquid leakage: failure of structural elements of the wastewater technologies and biogas digester may lead to release of sludge, release of pathogens and methane emissions impacting operations, greenhouse gas emissions and human and environmental health;
- Odour emissions: gaseous products from biochemical process during anaerobic decomposition of organic compounds arise, which produce biogas's scent. This is derived from hydrogen sulphide, ammonia, and other gases with negative odour effects. Biogas facilities with no odour management affect immediate surroundings with odour emissions of different intensity. Avoidance of odour emissions during operations must be considered at the design and construction phase and can include the type of construction materials selected and adding equipment to reduce odours.
- Worker's rights compromised: The technical capacity for implementation of project activities is low and it is assumed that local security personnel will be locally employed. This may pose a challenge to ensure that security and duty-bearer obligations are met without compromising worker's rights;
- Waste generation: "new" waste in the form of: excess wet sludge (potentially to be used as fertiliser) and dry sludge (potentially to be used as compost soil), discharged water (potentially to be used for fertigation) not finding a place in the market, excess of electricity that cannot be fed into the grid, and excess of heat that cannot be utilised.

An Environmental Impact Assessment will be conducted for each specific implementation site. Environmental measures and safeguards will be required for each site in the project. These measures will address specific operational risk, compliance with national laws, environmental management systems, and Emergency Plan, rapid responses, sensitizing approaches and exercising of due diligence.

Decommissioning Phase

It is assumed the project will operate optimally for a lifetime of 20 years. WWTP and power generation facilities will likely continue operation as long as industrial zones keep growing. Maintenance and upgrading may therefore be necessary in order to keep optimal functionality. After the lifespan is finished and/or no more upgrades are feasible, a decommissioning period will commence. The environmental and social impacts of decommissioning would reflect its operational history, the projected use of the site and the social and environmental conditions within the program area. Inappropriate disposal of wastewater technology and biodigester equipment and infrastructure, may involve environmental harm. Recycling and disposal of waste will be done by a company with a license and experience in this type of decommissioning projects.

The projected impacts and risks during this phase are expected to be limited in scope but may include:

- Disturbance to traffic: the proposed interventions may involve road cuttings, excavations of trenches, temporary road closures/lane closures, heavy vehicle movement from trucks loaded with demolition material, and vehicle and pedestrian traffic deviations. These could result in traffic congestion and perhaps risks of accidents;
- Air pollution: emissions from the use of machines and dust production from infrastructure and equipment dismantling may result in a decrease in air quality impacting nearby residents, pedestrians and/or nearby activities;
- Noise pollution: noise generated through dismantling infrastructure and equipment could potentially impact on workers and neighbourhood residents;
- Occupational health and safety: possibility of injury to workers from onsite accidents;
- Accidental gas and liquid leakage: failure of structural elements of the waste water technologies and biogas digester may lead to release of sludge, release of pathogens and methane emissions impacting operations, greenhouse gas emissions and human and environmental health;
- Waste generation: decommissioning of infrastructure and equipment may cause excess material generation. Equipment such as generator, gas conditioning systems, piping, valving, pumps, instrumentation and control equipment, can have residual values and can be sold or relocated off-site for reuse. Where recycling options are possible these will be implemented prior to the last option of landfilling. Other waste such as lubricants, oils and greases must be treated as hazardous waste and disposed accordingly.
- Emergencies for residual biogas, liquids and digester materials management: pipes or tanks need to be vented to avoid sealing in contained biogas. These pipes or tanks could be at very high pressure and/or contain hazardous/explosive gases. Risks occur when cutting pipes and opening valves. On the other hand, agitating digester liquids to pump them out could result in the release of hazardous gases such as hydrogen sulphide and create conditions that are dangerous to human health. Pumping out the digester contents can introduce air into the gas storage space, resulting in an oxygen/methane blend that is explosive if exposed to an ignition source. A proper use of safe procedures around potential ignition sources such as gases storage and distribution systems, electric motors and pumps are critically needed, ensuring that all workers are aware of the precautions required for hazardous gases when working around digester vessels.

Policy, legal, and administrative framework

The key national policies relevant for implementation of ESMP are listed in related policies within the text of the Request for CEO Endorsement under Baseline: Regulatory Environment. Most critical include:

- Environmental Conservation Law 2012 and the Environmental Impact Assessment procedure
- National Water Policy 2015;
- Myanmar Climate Change Strategy and Action Plan (MCCSAP) 2017-2030.

In addition to policies at the national level, there are a number of local urban planning policies:

Mandalay City Development Committee (MCDC):

- MCDC Law 2015 (Jan 12);
- MCDC Environmental Conservation and Cleansing bylaws 2015;
- The City of Mandalay Development Law 2002

Yangon City Development Committee (YCDC):

- The Yangon Water work Act 1885;
- The City of Yangon Municipal Act 1922;
- The Water Power Act 1927;
- The Underground Water Act 1930;
- The City of Yangon Development Law 1990;
- The Yangon Civil Development Law 2013.

Environmental and social risks and mitigation measures

This section describes relevant environmental and social risks identified during the project preparation period (PPG). Please see detailed risks outlined above, under the headings of: construction, operations and decommissioning. Since ESMP should serve as an active tool, additional risks that are identified during the project implementation will be included in the table below. Environmental and social measures and safeguards will be required for each site in the Project.

Table 15: Environment and social risks and mitigation measures

E&S risks	Mitigating Measure	Technical details of the mitigation technology, process, equipment, design and operating procedures	Location	Timeline, including frequency, start and end date	Responsibility	Cost of Mitigation (USD)	Source of funding
Risks identified during the PIF preparation and verified during the project preparation (PPG)							
Poor engagement due to lack of awareness and technological capacity in sound wastewater management and energy efficiency	Comprehensive engagement, education and training activities targeting the Industrial Park communities, civil society, government, private sector, financial institutes, industry associations and technicians.	<p>The TEST integrated approach is the first of its kind in the Project region. Both general awareness and technical capacity for implementation of Project activities is low. Project engagement, education and training are the central themes of Outputs 1.1.2 and 1.1.3 of Component 1.</p> <p>All activities within these Outputs seek to mitigate the risk of ‘no to low’ knowledge and/or capacity. General and specific trainings through presentations, materials, campaigns and tools are offered for cross-sectorial and single sector audiences to build capacity in: existing regulation, climate change and low carbon transition, preventative strategies, river and public health, TEST integrated approach, RECP, national and local policies and incentives, spatial planning.</p>	Yangon Mandalay	<p>Y1Q1 - Y5Q4</p> <p>Whole Project life (Activities: 1.1.2.1, 1.1.2.2, 1.1.2.3, 1.1.2.4, 1.1.2.5, 1.1.2.6, 1.1.3.1, 1.1.3.2, 1.1.3.3, 2.1.1.1, 2.1.1.2, 2.1.1.3, 2.1.2.2 and 2.1.2.3.)</p>	Project team, Environmental, Social and Gender Consultant	100,000	GEF grant allocated to existing capacity building and training activities from – Outputs 1.1.2, 1.1.3, 2.1.1 and 2.1.2

		In addition, demonstrations undertaken under Outputs 2.1.1 and 2.1.2. of Component 2 will showcase the technologies and products at company and industrial parks levels in a visible manner to present the opportunities and benefits of the proposed technologies.					
<p>Negative construction, operation, and decommissioning phase impacts and technology failure. Includes risks of:</p> <p>a) occupational accidents</p> <p>b) accidental release of toxic/pathogenic solid, sludge, liquid or gaseous waste/emissions</p> <p>c) increased traffic</p>	<p>A range of combined mitigation measures address this broad risk.</p> <p>Compliance with national and local laws at all phases. Development of the Environmental Impact Assessment and implementation of the environmental management plan (EMP) approved by environmental authorities.</p> <p>Due diligence exercised at all phases.</p>	<p>Pre-construction and construction phase: Compliance with laws, robust due diligence and construction management will be carried out during the pre-construction and construction phases of the Project to mitigate negative construction impacts. This will include industrial site and neighbouring site consultation, information disclosure, training of personnel on occupational health, safety, environment and operations, ensuring technical assessments have been carried out, and factory managers and technicians employed have the correct skills and training to also apply the mitigation hierarchy (avoid, reduce, restore), emergency planning and sensitizing approaches (training security, managers and staff on human rights, gender inclusion and safeguarding the local community). Traffic, air and noise pollution increases kept to a minimum</p>	<p>Yangon</p> <p>Mandalay</p>	<p>Y1Q1 – Y5Q4</p> <p>Whole Project life</p> <p>This will take place at the beginning with a minimum of monthly reviews through the period.</p> <p>The TAG will meet on a quarterly basis.</p> <p>(Relevant Activities: 1.1.2.3, 1.1.2.4, 1.1.3.1, 2.1.2.1, 2.1.2.2, 2.1.2.3, and 2.1.2.4)</p>	<p>Technical Advisory Group, National Project Coordinator, Project Team, Site Manager, Contractor, in cooperation with Environmental, Social and Gender Consultant</p>	<p>300,000</p>	<p>GEF grant allocated to existing capacity building, training, feasibility studies and technical assistance activities from – Outputs 1.1.2, 1.1.3, and 2.1.2</p>

d) decreased air quality	Technical Advisory Group (TAG) oversight at all phases.	<p>through load covers (excavated material in trucks), on-site wet suppression (for active vehicles and roads), vehicle and route planning, and daytime work schedules. Water demand required during construction will be monitored and kept to a minimum for equipment testing needs.</p> <p>Operational phase: Compliance with laws, robust due diligence and management will be carried out during the operational phase of the Project to mitigate negative impacts. Use of proven technologies and methods applied with monitoring for a new local context. This will include industrial site information disclosure, continued application of onsite occupational health, safety, environmental and operations policies and procedures – especially related to environment, ensuring factory managers and technicians apply the correct skills regarding environmentally sound technology and management for a safe operation of WWTP and biogas recovery systems, , emergency planning, evacuation planning (in case of toxic solid, liquid or gas leaks) and sensitizing approaches (security, managers and staff awareness and demonstration of human rights, gender inclusion</p>					
e) increased noise	Construction management implemented at all phases.						
f) water demand increases	Training, implementation and compliance with:						
g) non-hazardous and hazardous waste materials.	environmental management systems, environmental accounting systems, emergency plans, rapid response plans and sensitizing approaches at all phases.						
h) workers' rights compromised	Utilisation of existing/ proven technologies and methods.						
i) land acquisition	Waste management at operational and decommissioning phases.						
	Traffic management at all phases.						

	<p>Noise management at construction and decommissioning phases.</p> <p>Air quality management at construction and decommissioning phases.</p> <p>Land acquisition is done in line with local regulations and does not imply forced resettlements.</p>	<p>and safeguarding of the local community). Traffic, air and noise pollution increases kept to a minimum through load covers, on-site wet suppression (for active vehicles and roads), vehicle and route planning, and daytime work schedules and establishing buffers where possible.</p> <p>Contingency plans in place and ready to be activated.</p> <p>Decommissioning phase:</p> <p>Compliance with laws, robust due diligence and management will be carried out during the decommissioning phase of the Project to mitigate negative impacts. This will include industrial site and neighbouring site consultation, information disclosure, personnel applying correct occupational health and safety and environment procedures, ensuring technical assessments have been carried out and applied, emergency planning (in case of toxic solid, liquid or gas leaks) and sensitizing approaches (security, managers and staff awareness and demonstration of human rights, gender inclusion and safeguarding of the local community). Traffic, air and noise pollution increases</p>				
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		<p>kept to a minimum through load covers (excavated material in trucks), on-site wet suppression (for active vehicles and roads), vehicle and route planning, and daytime work schedules.</p> <p>To address risks of inappropriate disposal of equipment/material during the decommissioning phase, there will be the provision of training on hazardous materials as well as adoption of official policies for dealing with disposal of materials. Additionally, an assessment will be undertaken regarding the need for landscaping and rehabilitation. Contingency plans in place and ready to be activated.</p>					
<p>Infrastructure developed is vulnerable to climate change risks</p>	<p>Sufficient due diligence to be undertaken including infrastructure material selection process aligned with weatherisation,</p> <p>Technical assessments, feasibility and integration of resilience and future proofing of infrastructure.</p>	<p>Comprehensive project scope and design for the demonstration project(s) taking into account: technical feasibility results including historical event records and site hydrology and geography, integration of national legislation such as <i>Myanmar Climate Change Strategy and Action Plan (MCCSAP) 2016 – 2030</i>, integration of global indices such as <i>Global Climate Risk Index 2018</i>, identification of potential climate risks such as heat or extreme weather with particular focus on cyclone related flooding/inundation</p>	<p>Yangon</p> <p>Mandalay</p>	<p>Y2Q1-Y4Q4</p> <p>Bi-Annually</p> <p>(Relevant Activities: 2.1.1.1, 2.1.1.2, 2.1.1.3 and 2.1.2.2)</p> <p>The TAG will meet on a quarterly basis.</p>	<p>Project team – with consultants engaged for feasibility studies/ technical plans, Technical Advisory Group input</p>	<p>50,000</p>	<p>GEF grant – Output 2.1.1 and 2.1.2</p>

		<p>and inclusion of future proofed tested infrastructure during pilots (pre and post-monsoon) with demonstrated results.</p> <p>Contingency plans in place and ready to be activated.</p>					
<p>Low participation rates of females in project implementation and females not empowered</p>	<p>Gender is mainstreamed throughout the project design. Revision of adopted annual work plans and implementation strategies to ensure the expected results of gender mainstreaming.</p>	<p>This project is supported by a robust gender responsive action plan based on a detailed and context specific gender analysis. The Action Plan ensures that stakeholders engaged in the Project at all levels, will improve awareness and understanding of gender equality. Components 1 and 2 include training on gender roles, impacts and equality, gender representation, gender promotion (e.g. improved livelihoods, working conditions and career opportunities for females) and prescription for a percentage of female participation in activities (% determined by sector/sub-sector).</p> <p>The Technical Advisory Group should also comprise female representatives where possible.</p> <p>Also integrated is the <i>National Strategic Plan for the Advancement of Women 2013–2022</i>, in addition to the GEF and UNIDO positions and policies on gender empowerment.</p>	<p>Yangon</p> <p>Mandalay</p>	<p>Y1Q2-Y5Q1</p> <p>Quarterly</p> <p>(All Activities relevant under Components 1 and 2)</p> <p>The TAG will meet on a quarterly basis.</p>	<p>Project team,</p> <p>Environmental, Social and Gender Consultant</p>	<p>20,000</p>	<p>GEF grant – Output 1.1.1, 1.1.2, 1.1.3, 2.1.1, and 2.1.2</p>

		This shall mitigate social and gender related risks, promote gender equality, create a culture of mutual acceptance, and maximize the potential contribution of the project to improving gender equality in the industrial field.					
Additional risks identified during the project implementation							

Table 16: Environment and social sustainability monitoring

E&S risks	Parameters to be measured	Monitoring methods and procedures used	Timing/Frequency of measurement	Detection limit	Definition thresholds of	Sampling/ monitoring location	Responsibility
Risks identified during the PIF preparation and verified during the project preparation (PPG)							
Poor engagement due to lack of awareness and technological capacity in sound wastewater management and energy efficiency	- Stakeholder opinions and acceptance	Survey, Impact Assessment Opinions gathered through the stakeholder consultations, having channels of input open through the internet, log book onsite in industrial park	Y1Q1-Y4Q3 Annually	>20%	Percentage of population opposing interventions	Industrial park communities, Local Government, and City Development Committees	Environmental, Social and Gender Consultant
Negative construction, operation, and decommissioning phase impacts and technology failure. Includes risks of:	Compliance with national and local laws	EIA and EMP approval, Survey, interviews, inspection	Y1Q1 – Y5Q4 Continuous	0	Number of national and local laws not complied with (it is expected all national and local laws are complied with in full)	Industrial Park demonstration sites	Site Manager and Environmental, Social and Gender Consultant

E&S risks	Parameters to be measured	Monitoring methods and procedures used	Timing/Frequency of measurement	Detection limit	Definition of thresholds	Sampling/monitoring location	Responsibility
a) occupational accidents	Due diligence exercised	Due diligence, site incident reports, audits, staff interviews (e.g. observations and smell of gas/sludge leaks)	Y1Q1 – Y5Q4 Continuous	0	Number of accidental fatalities resulting from lack of procedural due diligence onsite (it is expected that no directly related fatalities will occur)	Industrial Park demonstration sites	Site Manager and Environmental, Social and Gender Consultant
b) accidental release of toxic/pathogenic solid, sludge, liquid or gaseous waste/emissions	Technical Advisory Group (TAG) oversight	Meeting, agendas, minutes and absenteeism log	Y1Q3 – Y5Q4 Continuous	2	Number of meetings cancelled consecutively	Offices TBD	National Project Coordinator
c) increased traffic	Utilisation of existing/ proven technologies	Logs of technology failures, interventions, and time before repair	Y1Q3 – Y5Q4 Continuous	3	Number of sustained energy outages per quarter	Industrial Park demonstration sites	Project team
d) decreased air quality	Training of personnel in construction management, for safety and operations in compliance with: environmental management systems, environmental accounting systems, emergency plans, rapid response plans and sensitizing approaches	Logs of trainings of personnel on safety and operations, human rights and gender inclusion and environmental systems and plans, interviews (peer accounts), audits, feedback mechanism	Y1Q1 – Y5Q1 Continuous	90% of personnel	Percentage of personnel undergoing training on safety and operations able to apply trainings adequately (adequately means meeting basic requirements and excludes major incidences such as fatalities or project compromise for which there is zero tolerance)	Industrial Park demonstration sites	Site Manager and Environmental, Social and Gender Consultant
e) increased noise pollution							
f) water demand increases							
g) workers' rights compromised	Waste Management	All potentially problematic waste will be tracked and disposed of legally.	Y1Q1 – Y5Q4 Continuous	0%	Percentage of potentially problematic waste which is not	Industrial Park demonstration sites	Site Manager and Environmental, Social and

E&S risks	Parameters to be measured	Monitoring methods and procedures used	Timing/Frequency of measurement	Detection limit	Definition of thresholds	Sampling/monitoring location	Responsibility
					accounted for in reporting (it is expected that all potential problematic waste is documented transparently and accurately, and disposed of in accordance with the law)		Gender Consultant
	Fugitive methane emissions	Routine inspection and maintenance of valves, pipe connections, mechanical seals and storage tank. Methane gas detector. Methane inventory updated. Feedback mechanism.	Y1Q1 – Y5Q4 Continuous	<10%	Percentage of gas detected as leakage from estimated monthly inventory	Industrial Park demonstration sites	Site Manager and Environmental, Social and Gender Consultant
	Traffic management	Vehicle logs (drivers, mileage, departure/arrival times), incident logs, interviews (drivers, industrial park community), feedback mechanism	Y1Q1 – Y5Q4 Monthly	>10	Official complaints per month from personnel, industrial park community and neighbouring community	Industrial Park demonstration sites	Site Manager and Environmental, Social and Gender Consultant
	Noise management	Noise monitors to establish onsite decibel (dB) baseline	Y2Q1-Y5Q4 Continuous	>10%	Increase from baseline (white noise dB)	Industrial Park demonstration sites	Site Manager and Environmental, Social and Gender Consultant
	Air quality management	Air monitors to establish onsite baseline: sulfur oxides (SOx), nitrogen oxides (NOx), volatile	Continuous	>10	Increase from baseline	Industrial Park demonstration sites	Site Manager and Environmental, Social and

E&S risks	Parameters to be measured	Monitoring methods and procedures used	Timing/Frequency of measurement	Detection limit	Definition of thresholds	Sampling/ monitoring location	Responsibility
		organic compounds (VOC), particulate matter (PM). Observational logs and photos for odours and visual pollution (e.g. smog/dust/haze)					Gender Consultant
	Water demand increases	Water monitoring of supply to establish onsite demand change, metres, logs/documentation, interviews of technicians, surveys, photos, observational, feedback mechanism	Y2Q1-Y5Q4 Continuous	>15%	Increase from baseline	Industrial Park demonstration sites	Site Manager and Environmental, Social and Gender Consultant
	Workers' rights compromised	Logs of trainings of personnel on human rights, interviews (peer accounts), audits, feedback mechanism	Quarterly	≤1	Number of workers reported to have had their rights compromised	Industrial Park demonstration sites	Site Manager and Environmental, Social and Gender Consultant
	Land acquisition	Number of people living on land identified for the construction of the pilot projects	Y1Q3-Y5Q4 Continuous	≤1	Number of inhabitants reported to reside in proposed site for pilots	Industrial Park demonstration sites	Site Manager and Environmental, Social and Gender Consultant
Infrastructure developed is vulnerable to climate change risks	Infrastructure performance	Technical assessment of infrastructure, surveys/ interviews of Technicians, photo/video evidence	Y2Q1-Y5Q4 Bi-Annually measurement: pre-monsoon (April-May) and post-monsoon (October-November)	<5%	Reduction of system optimisation/ capacity, due to climate hazard impacting infrastructure and system performance	Industrial Park demonstration sites	Environmental, Social and Gender Consultant

E&S risks	Parameters to be measured	Monitoring methods and procedures used	Timing/Frequency of measurement	Detection limit	Definition of thresholds	Sampling/monitoring location	Responsibility
Low participation rates of suitable females in project implementation, and females not empowered	Output 1.1.2 Number of national experts trained to perform as national consultants on RECP and TEST methodologies	Surveys, interviews of females and males regarding female presence and gender awareness, Project observation, training registrations/attendee lists, photos, feedback mechanism	Y1Q1-Y3Q4 Quarterly	32%	Percentage of female participants active in capacity building events	Workshop Trainings, Vocational Centres,	Environmental, Social and Gender Consultant
	Output 1.1.2 Number of participants from industry and key stakeholders attending training on introduction of the TEST integrated approach and RECP	Surveys, interviews of females and males regarding female presence and gender awareness, Project observation, training registrations/attendee lists, photos, feedback mechanism	Y1Q1-Y3Q4 Quarterly	30%	Percentage of female participants active in capacity building events	Workshop Trainings, Industrial Park Trainings, Vocational Centres	Environmental, Social and Gender Consultant
	Number of participants attending training on low-cost industry wastewater treatment, methane harnessing technology and wastewater management on industrial zones.	Surveys, interviews of females and males regarding female presence and gender awareness, Project observation, training registrations/attendee lists, photos, feedback mechanism	Y1Q1-Y3Q4 Quarterly	20%	Percentage of female participants active in capacity building events	Workshop Trainings, Vocational Centres, Industrial Park Trainings	Environmental, Social and Gender Consultant
	Number of participants attending training on Environmental	Surveys, interviews of females and males regarding female presence and gender awareness,	Y1Q1-Y3Q4 Quarterly	29%	Percentage of female participants active in	Workshop Trainings, Vocational Centres,	Environmental, Social and

E&S risks	Parameters to be measured	Monitoring methods and procedures used	Timing/Frequency of measurement	Detection limit	Definition of thresholds	Sampling/monitoring location	Responsibility
	Management Accounting (EMA) and Environmental Management System (EMS).	Project observation, training registrations/attendee lists, photos, feedback mechanism			capacity building events	Industrial Park Trainings,	Gender Consultant
	Number of participants from YCDC and MCDC attending technical training on planning for climate change.	Surveys, interviews of females and males regarding female presence and gender awareness, Project observation, training registrations/attendee lists, photos, feedback mechanism, relevant government meeting minutes	Y1Q1-Y3Q4 Quarterly	50%	Percentage of female participants active in capacity building events	Workshop Trainings, Vocational Centres, Government meetings	Environmental, Social and Gender Consultant
	Number of participants of local governments attending technical training on issues connected with wastewater treatment, including water supply and sanitation.	Surveys, interviews of females and males regarding female presence and gender awareness, Project observation, training registrations/attendee lists, photos, feedback mechanism, relevant government meeting minutes	Y1Q1-Y3Q4 Quarterly	30%	Percentage of female participants active in capacity building events	Workshop Trainings, Vocational Centres, Government meetings	Environmental, Social and Gender Consultant
Additional risks identified during the project implementation							

Capacity development

1. The Management structure of the ESMP is represented below:

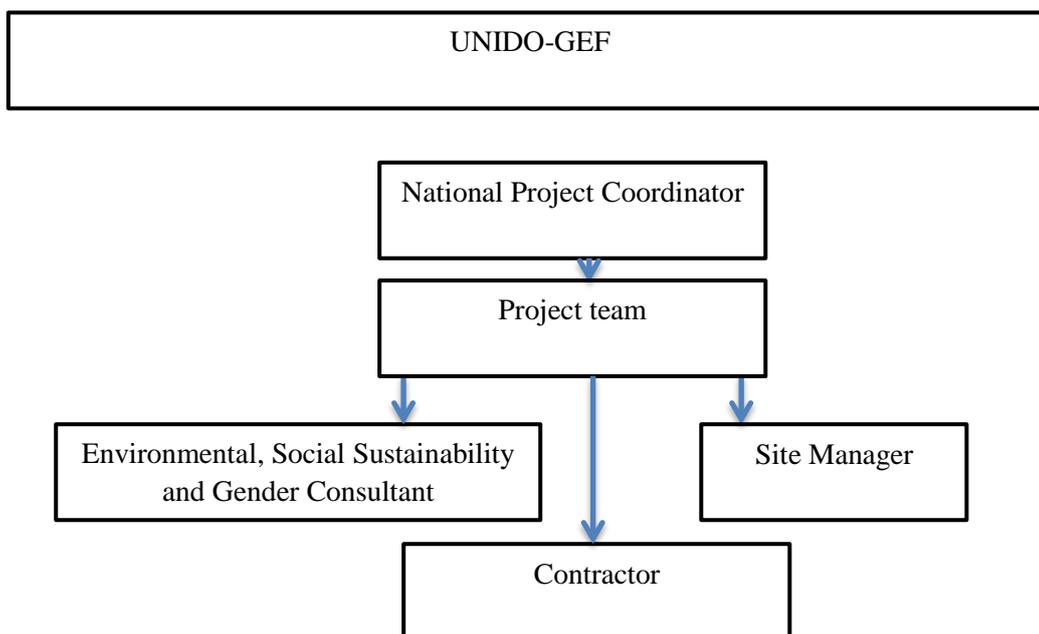


Figure 16: ESMP Management Structure Adopted

2. EMSP Roles

UNIDO/GEF

UNIDO-GEF provides the broader context of which the management structure below is embedded.

National Project Coordinator

The National Project Coordinator (NPC) hired by DUHD as part of the PMU. The NPC has overall responsibility for coordination of project partners in the execution of the project and compliance with the ESMP. The National Project Coordinator is supported by an administrative assistant and technical advisors.

Project Team

The project development team is responsible for

1. Conducting and providing evidence of meaningful consultation (i.e., consultation that is free, prior and informed) with communities likely to be affected by environmental and social impacts, and with stakeholders, and also for ensuring broad community support.
2. Overseeing environmental and social assessment studies that need to be undertaken prior to project appraisal. These studies will identify and assesses the potential opportunities for, risks to, and impacts on biological diversity and ecosystem services, including direct, indirect, cumulative and pre-mitigation impacts.
3. Applying the mitigation hierarchy: to avoid potentially adverse impacts; if avoidance is not possible, to reduce and minimize potential adverse impacts; if reduction or minimization is not enough, to mitigate and/or restore; and as a last resort to compensate for and offset.

Site Manager

The Site Manager is responsible for team direction and ensuring that project is implemented according to all the design requirements and technical specifications. The Site Manager reports to National Project Coordinator.

His/her duties include:

- Review and approval of construction plan
- Approval of monitoring and audit schedules
- Update and maintenance of the project ESMP
- Verifying contractor environmental performance and compliance with the project goals
- Monitor construction activities to ensure that control measures are effective and ensure compliance with the ESMP
- Monitor activities to ensure risks are monitored and effectively addressed.
- Prepare monthly and other status reports on environmental monitoring, activities, compliance, etc.
- Coordinate with construction teams to ensure that environmental risks are identified and appropriate controls are developed
- Coordinate environmental training for site personnel and subcontractors.

Environmental, Social and Gender Consultant

The Environmental, Social and Gender Consultant's duties are:

- Undertake Environmental and Social screening
- Review and approve environmental procedures prepared by the contractor and identify any areas for improvement
- Evaluation of the environmental competence of all contractors (and sub-contractors) working on the project
- Conduct scheduled audits of contractors' activities with the support of the Supervision Site Manager.
- Management of the environmental monitoring program, including noise, vibration and dust and review of the routine reports
- Management and monitoring of implementation of the project social standards in line with UNIDO/GEF guidelines
- Environmental audit of subcontractors
- Undertake regular site inspections, initiate actions, complete a bi-weekly environmental inspection report
- Ensure correct procedures are followed in the event of an environmental incident
- Assist with integrating gender and other results frameworks, indicators and related monitoring and results tracking systems
- Develop guidelines for mainstreaming gender issues into strategy development to enable planning and policy formulation
- Facilitate the involvement of women in project activities
- Prepare surveys and reports addressing gender issues within the project
- Design and implement gender responsive communication for project implementation
- Contribute to creation of awareness raising materials that reflect gender issues.

Contractor

Contractor will be required to:

- Subscribe to the Goals and Objectives of ESMP
- Comply with all the negotiated Project requirements, policies, procedures and systems
- Work under guidance from the Site Manager.
- Report to the National Project Coordinator and Environmental, Social and Gender Consultant any Incident/accident and the corrective action undertaken.
- Participate in training, induction programs and review programs as required
- Attend performance meetings as directed by the Project Team

4. Monitoring plan

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable response to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the ESMP.

Environmental monitoring will be carried out to ensure that all project activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. Monitored data will be made publicly accessible through full disclosure and transparency arrangements to be developed during project execution stage.

Monitoring should be undertaken at a number of levels as indicated in role descriptions provided, on the Project Team, Site Manager, Environmental, Social and Gender Consultant and the Contractor.

- **Internal Monitoring:** It is the responsibility of the Project Team along with the Environmental, Social and Gender Consultant, to conduct regular internal monitoring of the project to audit direct implementation of environmental and social mitigation measures contained in the ESMP.

An EIA will be carried out as part of a separate sub-contract arrangement with the company designing and building the wastewater treatment plant and methane recovery installation.

The responsibility for mitigation monitoring during the operation phase will be responsibility of the Environmental, Social and Gender Consultant hired by the Project Team. Environmental monitoring of the following parameters is recommended for the Project: Gas/liquid/sludge/solid leak Monitoring, Noise Levels Monitoring, Air Quality Protection, Monitoring of Vegetation Clearing, Monitoring Rehabilitation of Work Sites, Monitoring of Accidents/Health.

The Contractor's environmental inspectors must make sure that appropriate signs are posted at appropriate locations/positions to minimise/eliminate risk of safety hazards (e.g. electrocutions). The following parameters could be used as indicators: Presence of posted visible signs; Level of awareness of communities; and Accident reports.

- **External Monitoring and Evaluation:** A consultant may be hired to carry out a mid-term review and an Independent consultant will be hired to carry out the final evaluation of the project – including its compliance with the ESMP. Further elaboration on the need for, and number of consultants hired to assist in the evaluations will be made during project execution. The Project Team will provide UNIDO with reports on the EMSP implementation as part of their annual progress reports.

The project affected persons should be represented through public participation forums to be held during the project.

5. Institutional Strengthening

Implementation of, and adherence to ESMP, is the responsibility of every member of the project team. All project personnel will be provided the requisite training and orientation/induction to enable their active and informed participation in the ESMP. Capacity building measures will be required to ensure that stakeholders involved in developing and implementing the various ESMP components have the technical, management and other skills to fulfil their roles. The key focus areas for capacity building will be:

- An intensive one-day training/orientation for Project Team on ESMP Process, Communication and Consultation, compliance with relevant policies and guidelines.
- The Site manager shall ensure that all workers have been made aware of the ESMP. The Site Manager shall regularly monitor that occupational health and safety requirements are implemented.
- The Environmental, Social and Gender Consultant shall audit that all requirements are met. Where occupational health and safety requirements are not being implemented relevant workers shall immediately be trained and instructed to implement these requirements.

Communication

The ESMP also focuses on communications with project stakeholders as this relates to risks and impacts. Given Project implementation is based at existing Industrial Zones, risks and impacts are generally limited to the demonstration sites, the factories, employee/contractors and small residential populations onsite. Table 4 shares the on-going monitoring of risks which include poor stakeholder engagement. Options to communicate and mitigate risks include: opinion gathering through stakeholder consultation, undertaking stakeholder surveys to collect feedback on identified risks and stakeholder impacts, establishing a log for anonymous grievances/complaints/concerns onsite.

Communications will be established for implementation progress on issues that involve ongoing risk to or impacts on the project stakeholders, and on issues that the consultation process or grievance mechanism has identified as of concern to those stakeholders and use of other channels such as internet. For example, grievance claims and anonymous reporting can be implemented by a simple feedback mechanism in the form of a public log in the Project areas, available to local communities and individuals to gather and resolve their concerns. In addition, these communications will be backed up by operational and environmental management and procedures such as worker safety trainings, audits on adherence to due diligence and in-confidence interviews which can be undertaken to ensure social risk mitigation representation and voices are heard. Resources are also available to engage directly onsite with stakeholders including the Site Manager and the Environmental, Social and Gender Consultant. When a review and evaluation of the ESMP is undertaken, and findings see the need for material changes in, or additions to, the mitigation, monitoring or capacity development measures or actions on issues of concern to the stakeholders, the updated measures or actions will also be developed in close consultation with stakeholders and disclosed. These reports will be in a format accessible to the stakeholders. The frequency of these reports will be proportional to the concerns of the stakeholders but not less than annually.

As part of the GEF Annual Monitoring Report (AMR), UNIDO will annually communicate implementation progress on issues that involve ongoing risk to or impacts on the project stakeholders, and on issues that the consultation process or grievance mechanism has identified as of concern to those stakeholders. Furthermore, reporting on the compliance with the ESMP will be made during the project steering committee meetings.

Stakeholder Engagement Plan

In alignment with the GEF Public Involvement Policy and the GEF Guidelines for the Implementation of the Policy on Stakeholder Engagement, the Stakeholder Engagement Plan seeks to ensure the Project:

- Effectively involves public to enhance the social, environmental, and financial sustainability of projects.
- Takes responsibility for assuring public involvement rests within the country, normally with the government, project executing agency or agencies, with the support of GEF Partner Agencies.
- Designs and implements public involvement activities in a flexible manner, adapting and responding to recipient countries' national and local conditions and to project requirements.
- Delivers effective, public involvement activities that are broad-based and sustainable.
- Includes the appropriate allocation of resources, throughout the identification, design, implementation, monitoring and evaluation of GEF-Financed Activities, to ensure sustained commitments and actions related to public involvement activities.
- Carries out public involvement activities in a transparent and open manner.
- Has full monitoring and documentation of public involvement.

Stakeholder Engagement Approach

1. **Formalised Communications Plan** - A Communications Plan will be prepared and implemented in the first year of project implementation and updated when necessary throughout the Project to clearly disseminate timely and relevant information and to gather feedback regarding the needs and priorities of all stakeholders. Communications are based on engaging a wide-range of stakeholders based in UNIDO's stakeholder engagement classification system (see below). In addition, key stakeholders to be consulted with include members of the industrial and residential communities onsite of the selected Industrial Zones for demonstration, as well as adjacent communities which may be impacted.
2. **Social Inclusion** - Consultation sessions will include outreach tailored to the need of all groups from the national to the local levels. A socially inclusive process will be adopted where a range of stakeholders, including those identified as vulnerable, are effectively engaged to share their perspectives and are adequately represented. Consultation methods will vary according to audience and levels of education. These will include awareness raising campaigns, posters and general information sessions as well as theoretical and applied technical trainings. All sessions and communication modes will be offered in Burmese and follow the customs and norms of local communities in Yangon and Mandalay at each of the industrial zones.
3. **Transparency and Reporting** - Consultation sessions will be well-documented, identifying attendees (men/women), topics discussed, feedback and issues raised by stakeholder groups, and outcomes or actions resulting from the consultation. Management measures must be completed, disclosed, and discussed with stakeholders prior to implementation of any activities that may cause adverse social and environmental impacts.
4. **Stakeholder Risks** - Specific stakeholder risks and mitigations have been outlined in the Environment and Social Management Plan (ESMP). For example, grievance claims and anonymous reporting can be implemented by a simple feedback mechanism in the form of a public log in the Project areas, available to local communities and individuals to gather and resolve their concerns. In addition, worker safety trainings, audits on adherence to due diligence and in-confidence interviews can be undertaken to ensure social risk mitigation representation and voices are heard.
5. **National Level Engagement** - the project management team will build on the stakeholder consultation process that included the inception workshop, validation workshop and other bi-lateral meetings. A Project kick-off meeting with key stakeholders will take place led by Chairs of the Project Steering Committee, the Department of Urban Housing and Development (DUHD) under the Ministry of Construction, and the Environmental Conservation Department (ECD) under the Ministry of Natural Resources and Environmental Conservation. The Project kick-off meeting would include the participation of relevant Ministries, Industry Associations, Co-Financiers and City Development Committees of Yangon and Mandalay. Outcomes will include the establishment of a Technical Advisory Group (TAG), awareness raised on the Project and the establishment of communication and networking approaches to

be used throughout the Project duration. In particular, the TAG will be a mechanism to keep a constant communication and empowerment of main stakeholders through the participation of technical representatives to provide feedback on ongoing activities during the Project implementation.

6. **Local Site Level Engagement** - the project steering committee will work closely with key project stakeholders such as the Yangon City Development Committee and the Mandalay City Development Committee, technical/ operational trainers on sound wastewater and biogas technologies, industrial site pilot companies and management teams, wider industrial site community members (factory workers and their families, neighbouring communities), female chapters of the Myanmar Engineering Society, vocational centres, along with project sponsors and co-financing institutions. The Project will work closely with relevant local authorities and civil society organisations to identify ways of raising general awareness on the benefits of renewable energy and cleaner production through sound wastewater treatment in the industrial zones. A general improvement in community knowledge may assist further collaborations and buy-in for demonstrations to be scaled beyond the selected industrial zones sites.
7. **Gender Equality and Female Empowerment** – will be supported through engaging women directly in the Project as active participants through capacity building session on climate change and water pollution impacts on health and environment, as well as sound wastewater treatment and energy efficiency benefits to the community’s social, environmental and economic prosperity. Female Project involvement will be secured by setting specific participation targets related to gender equality aligned with the Project’s Gender Analysis Report and the ESMP. The aim will be to improve the participation of women in renewable energy and cleaner production programs. This supports project optimisation by representing wider stakeholder views, ensuring women’s human rights are progressed, and supports women’s empowerment through career development opportunities.

Stakeholder Identification and Inclusion

The GEF Guidelines require stakeholder identification as the first step in developing a stakeholder engagement plan. Stakeholders have been identified for the Project based on their mandates and relevant interests, as well as an understanding of who would impact or influence the Project, or conversely who the Project might impact. In identifying relevant stakeholders, research and existing professional networks were used in Myanmar to develop a tabulated list shown below. Desktop analysis, key contact conversations and snowballing (where contacts share their contacts or suggest a relevant stakeholder) were the research techniques applied to develop the list.

Many of the key stakeholders listed below have been approached and shown interest in being included as Project stakeholders. This list is by no means exhaustive and will likely be updated upon Project implementation when there is a possibility that more stakeholders may show interest in the Project. Part of the Project Communications Plan will also include promoting stakeholder consultation sessions and this is likely to bridge any gaps made in stakeholder identification.

The Stakeholder List adopts five cluster categories applied under UNIDO’s stakeholder classification system, these include:

1. Operational focal point
2. Line Ministries and their departments / institutes
3. Private Sector (Individual and groups of enterprises)
4. Local banks and financial institutions
5. Civil Society Organizations (CSOs) and NGOs.

Stakeholder Identification List

Stakeholder	Mandates/Role in the project	Relevant interests/Why they are included in the Project	Main Project Outputs
Operational Focal Point			
<p>Department of Urban and Housing Development (DUHD), Ministry of Construction (MoC)</p>	<p>DUHD will act as the co-chair of the Project Steering Committee (PSC). DUHD develops and manages industrial zones around the country and develops industrial zones regulations including air and water pollution control, sanitation systems, solid waste disposal, and infrastructure. The DUHD will lead activities related to wastewater technology demonstration for industrial zones. The DUHD will reach out to industries in the industrial zones to engage them in the project.</p>	<p>Main executing partner. DUHD will act as the co-chair of the Project Steering Committee (PSC). DUHD develops and manages industrial zones around the country and develops industrial zones regulations. They will lead activities related to wastewater technology demonstration for industrial zones.</p>	<p>Collaboration with output 1.1.1 - capacity building in wastewater regulation and strengthening of water quality and management policies and frameworks Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery. Also includes: Train the Trainer theory on TEST methodology, and local climate change implications, local plans and mitigation measures. Gender promotion and recruitment in national pools of experts. Output 2.1.2 –Identification of pilot companies for implementation of TEST Output 2.1.2 Pilot projects on WWTP/biogas recovery</p>
Line Ministries and their departments / institutes			
<p>Environmental Conservation Department (ECD), Ministry of Natural Resources and Environment Conservation (MoNREC)</p>	<p>ECD will act as the co-chair in PSC. ECD within Ministry of Natural Resources and Environmental conservation is a focal point of environmental conservation in Myanmar. ECD develops regulations related to wastewater discharges in industries, solid waste disposal and systematic waste disposal in industrial zones. One of its mandates is to raise awareness on hazards of industrial waste disposal in the industrial zones in Myanmar. The director general of</p>	<p>Executing partner. MONREC plays a critical coordination role regarding GEF matters at the country level as well as serving as the liaison with the GEF Secretariat and Implementing Agencies while representing their constituencies on the GEF Council.</p>	<p>Output 1.1.1 - capacity building in wastewater regulation and strengthening of water quality and management policies and frameworks. In line with Myanmar National Climate Change Policy, Strategy & Action Plan (NCCP and MCCSAP 2017-2030) activities, the MoNREC has to produce policies and strategies with a gender perspective. Output 1.1.3 - capacity building on how to engage in community outreach as a select ‘champion’.</p>

	<p>ECD is the GEF National Operational Focal Point in Myanmar.</p>	<p>They are therefore engaged across the Project and specifically in the outputs listed. Supports the DUHD across the project so that relevant Ministries are engaged at specific times, individually or collectively depending on the activity. Responsible under the MCCSAP to develop mass communication and dissemination strategy for communicating climate change to local communities with a gender-sensitive communications approach.</p>	
<p>Directorate of Industrial Supervision and Inspection (DISI), Ministry of Planning, Finance and Industry</p>	<p>DISI is tasked with inspecting production and process of industrial sectors in Myanmar to determine whether environmental regulations are being met. DISI is mandated in handling industrial waste together with concerned government agencies and industries.</p>	<p>Government agent responsible for handling industrial waste and legal compliance. Working closely with MIA.</p>	<p>Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery. Also includes: Train the Trainer theory on TEST methodology and local climate change implications, local plans and mitigation measures. Output 1.1.3 - Dissemination of awareness on wastewater treatment, climate change and its different impacts by gender and vulnerable people, e.g. children of the live-in workers. Outputs 2.1.1- Industrial Park sites, pilot companies and national consultants engaged throughout component 2 on technical assessing,</p>

			selecting and demonstrating pilot TEST and RECP methods.
Department of Research and Innovation-DRI, Ministry of Education	As the government entity in charge of monitoring and controlling the quality of surface water bodies, the DRI will be the recipient center of knowledge related to wastewater technology. The DRI involvement in capacity building and awareness raising efforts will ensure future replication and technology uptake in Myanmar after project completion.	Government agent responsible for surface water quality. Interest in wastewater technology knowledge hub and capacity building. Operates national laboratories that will support in water quality monitoring activities and analyses.	Output 1.1.1 - capacity building in wastewater regulation and strengthening of water quality and management policies and frameworks. Gender mainstreaming through gender sensitivity training, equality promotion and female education and recruitment for training. Output 2.1.2 – Support in identification of pilot companies for implementation of TEST. The wastewater quality monitoring will also take into consideration the location and level of risk exposure to different gender and different groups of people.
Ministry of Planning and Finance and Industry	Responsible for financial governance and market regulations.	Policy and market reform to improve access to loans and financing of wastewater technology and RECP improvements in partnership with existing mechanisms and potential initiatives.	Output 1.1.1 - capacity building in wastewater regulation and strengthening of water quality and management policies and frameworks. Working with WWF's Tha Bar Wa project and GIZs Banking and Financial System Development project, to explore pertinent barriers to accessing finance for RECP investments as well as wastewater and biogas plants, and provide recommendations for financial sector reform. The recommendations may also include possible financial incentives for technology transfer such as tax incentives and financial support for biogas operations.
Local Government Agencies			

Yangon City Development Council (YCDC)	YCDC will be a member of the project steering committee and will connect the project with industries as well as respective communities and urban settlements located in Greater Yangon. YCDC will ensure that the project is in line with the Yangon city development plan.	Project Steering Committee member Oversees urban development within Yangon region.	Output 1.1.1 - capacity building in wastewater regulation and strengthening of water quality and management policies and frameworks Output 1.1.2 – capacity building in local climate change implications, climate resilient urban development, decarbonisation of industrial zones, and vulnerability and risk aspects including gender mainstreaming. Also includes water supply, wastewater and sanitation trainings. Output 1.1.3 - capacity building on how to engage in community outreach as a select ‘champion’. Also includes capturing lessons learned. Output 2.1.1 – Support in identification of pilot companies for implementation of TEST.
Mandalay City Development Council (MCDC)	MCDC will be a member of the project steering committee and will connect the project in Mandalay with industrial zones as well as respective communities and urban settlements located in the region of Mandalay. Furthermore, MCDC will ensure that the project complements the Mandalay City Development Plan.	Project Steering Committee member. Oversees urban development within Mandalay region.	Output 1.1.1 - capacity building in wastewater regulation and strengthening of water quality and management policies and frameworks Output 1.1.2 – capacity building in local climate change implications, climate resilient urban development, decarbonisation of industrial zones, and vulnerability and risk aspects including gender mainstreaming. Also includes water supply, wastewater and sanitation training. Output 1.1.3 - capacity building on how to engage in community outreach as a select ‘champion’. Also includes capturing lessons learned. Output 2.1.1 – Support in identification of pilot companies for implementation of TEST.
Private Sector (Individual and groups of enterprises)			

<p>Myanmar Industries Association (MIA)</p>	<p>As the national reference organization for industry, MIA represents a key stakeholder to all projects related to enhance industrial development. Specifically, this project meets MIA’s objective of improving productivity in private industries, enhancing industrial standards, and promoting an effective exploitation of natural resources by acquiring appropriate modern technology and innovation. The project will provide the opportunity to increase MIA’s capacities on collaboration with international cooperation projects addressed to industry, and a better positioning with industries by facilitating their access to training and technical assistance opportunities in relevant matters.</p> <p>MIA will participate in the project's outreach activities to engage other industries and can provide support for initial assessments to select companies for TEST demonstration projects. This will be particularly important for capacity building and awareness raising outputs and the dissemination of information to other members.</p>	<p>The cluster group of Energy and Environmental Group (EEnG) within MIA will work closely with the Project.</p> <p>Engagement with industries, full engagement with pilot companies, the manufacturing sector and national expert consultants.</p> <p>Represents the interests, challenges and opportunities of its industrial sector membership.</p> <p>Promote gender mainstreaming for females in SME businesses.</p>	<p>Output 1.1.1 - capacity building in wastewater regulation and strengthening of water quality and management policies and frameworks.</p> <p>Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery; local climate change implications, local plans and mitigation measures; and introduction to TEST integrated approach and RECP.</p> <p>Output 1.1.3 - capacity building on how to engage in community outreach as a select ‘champion’. Also includes: capturing lessons learned and formal vocational training through institutional centres.</p> <p>Component 2 (Outputs 2.1.1 and 2.1.2) Industrial Park sites, pilot companies and national expert consultants engaged throughout component 2 on technical assessing, selecting, and demonstrating pilot TEST and RECP methods. Companies will be encouraged to develop a plan to promote gender equality, as well as improving livelihood of their workers and families.</p>
<p>Industrial Zone Management Committees (IZMC)</p>	<p>An Industrial Zone Management Committee has been established for each industrial zone. There are 29 industrial zone management committees in Yangon and one industrial zone management committee in Mandalay. The industrial zone management committee is responsible for</p>	<p>Engagement with Industrial site companies within the Industrial Zones selected as demonstration sites.</p>	<p>Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery. Also includes: Train the Trainer theory and practice on TEST methodology; local climate change implications, local plans and mitigation measures; introduction to TEST integrated</p>

	<p>infrastructure development and management of industries. Therefore, the IZMCs of industrial zones selected for the project implementation will be an important partner in approaching companies and will participate in all activities related to strengthen wastewater management at industrial zone level.</p>	<p>Interested in supporting pilot companies and cluster potential. Interested in developing training linkages with vocational training centres or institutes.</p>	<p>approach, including RECP and training on EMS and EMA. Output 1.1.3 - capacity building on how to engage in community outreach as a select ‘champion’. Also includes: capturing lessons learned and formal vocational training through institutional centres. Dissemination of awareness on wastewater treatment, climate change and its different impacts by gender and vulnerable people Component 2 (Outputs 2.1.1 and 2.1.2) Industrial Park sites, pilot companies and national expert consultants engaged throughout component 2 on technical assessment, selecting and demonstrating pilot TEST and RECP methods..</p>
Participating industries	<p>The private sector will largely be positioned to benefit from the project in terms of new and improved local knowledge and capacities in applying TEST/RECP, as well as water treatment options and available technologies.</p> <p>Depending on their production processes as well as technical and financial feasibilities, participating industries will invest in RECP measures, effective water management and wastewater treatment technologies.</p>	<p>Engagement with the manufacturing sector and technology transitions for effective wastewater management and cleaner production.</p>	<p>Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery. Also includes: Train the Trainer theory and practice on TEST methodology and local climate change implications, local plans and mitigation measures; introduction to TEST integrated approach and RECP; and training on EMS and EMA. Output 1.1.3 – benefit from awareness raising activities and providing case studies to disseminate best practices to other companies, sectors and regions. Component 2 (Outputs 2.1.1 and 2.1.2) Industrial Park sites, pilot companies and national expert consultants engaged throughout component 2 on technical assessment and demonstrating pilot TEST and RECP methods. Companies will be encouraged to develop a plan to promote gender equality, as well as</p>

			improving livelihood of their workers and families.
Local banks, financial institutions and bilateral donors			
Small and Medium Enterprise Development Bank (SMEDB)	SMEDB (formerly SMIDB) public-sector bank which was previously under the MoPFI (formerly MoI). SMEDB offers a loan created to exclusively focus on SME lending for the manufacturing sector for collateralized loans of up to MMK 50 million (EUR 36,000) at 8.5% interest rates and three-year repayment periods.	Engagement with financial lending/co-finance institutions	Output 2.1.1 – engaged to leverage SME market penetration, dialogue on options to finance companies in industrial zones using cost recovery, tariffs or other financial mechanisms such as cost-sharing. Also, collaborations sought for existing streams of financing for RECP. Output 2.1.2 – engagement to mobilise investment post financial feasibility of the TEST pilots.
KBZ Bank	Kanbawza Bank is a private commercial bank in Myanmar. The bank was established on 1 July 1994. KBZ Bank is in the process of operationalizing several activities and mechanisms to support green finance in Myanmar including - Providing loans to SMEs under the category of SME banking with the loan size of 10 million to 1000 million MMK - Initializing to set up green financing components.	Engagement with financial lending/co-finance institutions	Output 2.1.1 – engaged to leverage SME market penetration, dialogue on options to finance companies in industrial zones using cost recovery, tariffs or other financial mechanisms such as cost-sharing. Also, collaborations sought for existing streams of financing for RECP. Output 2.1.2 – engagement to mobilise investment post financial feasibility of the TEST pilots.
FMO	Dutch development bank. International finance institution with business operations in Asia, among others regions. The bank is in the process of deploying a project to develop bankable projects to promote green technologies for industrial wastewater treatment.	Interest on development of WWT business cases for investment promotion. Engagement with financial lending for investing in WWT pilot projects	Output 2.1.2 – engagement to mobilise investment in pre financial and financial phase of WWT pilot projects

JICA	JICA is a Japanese Development Organization involved for a long time in Myanmar. JICA supports the inclusive development of the country through 4 missions: i) addressing the global agenda; ii) reducing poverty through equitable growth; iii) improving governance; iv) achieving human security. Though active in many different fields, JICA has experience in the implementation and technical assistance for projects in resources and disaster management, agricultural and rural development, natural environment conservation and food security.	Through JICA previous activities in Myanmar, a baseline of pollution sources from industrial zones has been developed providing important information for selection of prioritized industrial zones and potential industries for demonstration projects. Supports ECD through existing program work.	Output 1.1.1 – dialogue with industry associations on public private models for construction and maintenance of wastewater infrastructure development. Support ECD with the review of the regulatory enforcement framework for wastewater effluent discharge.
Civil Society Organizations (CSOs) and NGOs			
Myanmar Climate Change Alliance (MCCA)	MCCA was launched in 2013 supported by the Global Climate Change Alliance (GCCA) and implemented by UN-Habitat and UNEP. MCCA is a platform to mainstream climate change into Myanmar policy development and supports climate change actions from the National Government, Local Authorities, NGOs, Development partners, Civil Society and Private Sector. The MCCA has a core technical unit based within the Ministry of Natural Resources and Environmental Conservation and works with a Technical Working Group composed of almost all line Ministries, the three main cities, Academia, Civil Society, NGOs and technical development partners – working with environmental specialists, climate change policy experts, urban & regional planners,	Engaged with Ministries, Industry Associations, Academia and CSOs/NGOs on climate change action and technical capacity building. Liaises directly with MoNREC for implementing the MCCSAP 2017 – 2030. MCCA delivers existing work through mobilizing national and international experts and may be positioned to leverage this for the Project’s technical and vocational capacity building requirements.	Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery. Output 1.1.3 - capacity building on how to engage in community outreach as a select ‘champion’. Also includes: capturing lessons learned and formal vocational training through institutional centres.

	socioeconomic specialists. It cooperates with WWF, CCSR Columbia University, RIMES, IHS, IRRI.	Gender mainstreaming and promotion of needs of impacted vulnerable groups.	
WWF	The EU and WWF began implementation of Tha Bar Wa Project in 2018 (with a 48-month implementation period). The project will provide training to 200 SMEs in the F&B processing industries in Yangon and Mandalay region to implement sustainable energy and water management practices through supporting policies and business structures, capacity and markets, green finance, and replication of project results.	The project development team identified synergies during the Request for CEO Endorsement (RCE) design and formulation process, between the UNIDO-GEF and Tha Bar Wa projects in order to maximize both projects resource use in common areas of interests. Green finance and training mechanisms will be fostered between the two projects. Supports ECD and MoF through existing program work. Working in partnership with local financial institutions (FIs) or IFIs.	Output 1.1.1 – Supports ECD with the review of the regulatory enforcement framework for wastewater effluent discharge. Collaboration in policy assessment and dialogue activities. Output 1.1.2 – Collaboration in capacity building activities related to sustainable water and energy management practices. Output 2.1.1. – Collaboration in trainings and technical assistance to companies on waste water treatment and energy efficiency; as well as capacity building to pool of local experts.
Selected Yangon demonstration site: 1. Shwe Lin Ban Industrial Zone OR, 2. Shwe Pyi Thar Industrial Zone (2,3,4) OR, 3. Hlaing Tharyar Industrial Zone (1,2,3,4)	Selected for the demonstration component of the project engaging directly with the Industrial Zone companies and working very closely with selected pilot companies. 1. Shwe Lin Ban Industrial Zone: at 1,100 acres, is the fourth largest industrial zone in greater Yangon. It has	Industrial Zone interest is to take up TEST methodology and apply wastewater management technologies, as well as provide future Industrial Zone knowledge transfer in reducing industrial wastewater discharge,	Output 1.1.1 – dialogue with industry associations on public private models for construction and maintenance of wastewater infrastructure development Output 1.1.2 - capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery

	<p>been operating since 2002 and is currently hosting 237 factories of food and beverage, textile and household goods. Some factories treat wastewater basically, before discharge, however the majority release effluent without any treatment. All wastewater is left for natural treatment in one stabilized pond and subsequently discharged into the nearby Hlaing River.</p> <p>2. Shwe Pyi Thar Industrial Zone: is comprised of Industrial Zone 2, 3 and 4. It has been operating since 1998 with a land area of 988 acres. 285 factories produce food and beverage, consumer goods, construction materials, garment and furniture and are bounded by a canal as well as the Hlaing River, both of which likely receive untreated wastewater discharges.</p> <p>3. Hlaing Tharyar Industrial Zone (1, 2, 3, 4) was established in 1995. The industrial zone is bound by Hlaing River in the east, Shwe Than Lwin Industrial Zone in the west, Pan Hlaing River in the South, and Yangon Pathein Road in the north. The total land area is 1401.98 acres with factories occupying 1087.98 acres. There are 707 factories producing produce food and beverage, and garments. It is likely that both rivers receive untreated wastewater discharges.</p>	<p>improving water quality and energy performance onsite.</p> <p>Consultation with potential demonstration companies, engagement with pilot companies, awareness raising and capacity building.</p> <p>Consultation to develop cluster and single model methane extraction for renewable energy.</p> <p>Consultation with adjacent/neighbouring communities during project implementation.</p>	<p>Output 1.1.3 - capacity building on how to engage in community outreach as a select 'champion'. Also includes: capturing lessons learned and formal vocational training through institutional centres.</p> <p>Output 2.1.1 – Support in identification of pilot companies for implementation of TEST.</p> <p>Output 2.1.2 – Contribution to assessments, prefeasibility studies and selection of activities (sites, actors, PPP partners, etc.).</p>
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<p>Pyi Gyi Tagon Industrial Zone, Mandalay</p>	<p>Selected for the demonstration component of the project engaging directly with the Industrial Zone companies and working very closely with selected pilot companies. Its main producing industries are also food-processing companies. The current wastewater treatment facility consists of one stabilization pond with the majority of companies not yet connected to it. The Doke Hta Wady River at 5 km away is the closest wastewater discharge point for the entire site. It is in close proximity to an urban area with likely mixed residential living. Community living on or adjacent to this Industrial Zone would be impacted by odour, air pollution and poor water quality if using the rivers directly. It is assumed such mixed uses (urban, residential) would also discharge untreated water directly to nearby rivers.</p>	<p>Industrial Zone interest is to take up TEST methodology and wastewater management technologies, as well as provide possible future Industrial Zone knowledge transfer in reducing industrial wastewater discharge, improving water quality and energy performance onsite.</p> <p>Consultation with potential demonstration companies, engagement with pilot companies, awareness raising and capacity building.</p> <p>Consultation to develop cluster and single model methane extraction for renewable energy.</p> <p>Consultation with adjacent/neighbouring communities during project implementation.</p>	<p>Output 1.1.1 – dialogue with industry associations on public private models for construction and maintenance of wastewater infrastructure development</p> <p>Output 1.1.2 - Output 1.1.2 - capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery.</p> <p>Output 1.1.3 - capacity building on how to engage in community outreach as a select ‘champion’. Also includes: capturing lessons learned and formal vocational training through institutional centres</p> <p>Output 2.1.1 – Support in identification of pilot companies for implementation of TEST.</p> <p>Output 2.1.2 – Contribution to assessments, prefeasibility studies and selection of activities (sites, actors, PPP partners, etc.).</p>
<p>Myanmar Engineering Society, Mandalay</p>	<p>To enable engineers and architects to participate, using their expertise for the development of architecture and all-round development of other sectors of economy.</p> <p>Also, to enable engineers and architects all over the country to actively participate in the development and dissemination of</p>	<p>The Society has a female Chapter of engineers that will be beneficial to engage with on gender mainstreaming potential. The project will involve the engineering society in training activities and</p>	<p>Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery. Also includes: Train the Trainer theory and practice on TEST methodology; local climate change implications, local plans and mitigation measures; introduction to TEST integrated approach, including RECP and training on EMS and EMA.</p>

	engineering and architectural knowledge and in nation-building tasks.	awareness raising activities. The project will encourage participation of members.	Output 1.1.3 - capacity building on how to engage in community outreach as a select 'champion'. Also includes: capturing lessons learned and formal vocational training through institutional centres.
Federation of the Myanmar Engineering Society (Fed. MES), Yangon	To enable engineers and architects to participate, using their expertise for the development of architecture and all-round development of other sectors of economy. Also, to enable engineers and architects all over the country to actively participate in the development and dissemination of engineering and architectural knowledge and in nation-building tasks.	The Society has a female Chapter of engineers that will be beneficial to engage with on gender mainstreaming potential. The project will involve the engineering society in training activities and awareness raising activities. The project team will encourage participation of members.	Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery. Also includes: Train the Trainer theory and practice on TEST methodology; local climate change implications, local plans and mitigation measures; introduction to TEST integrated approach including RECP and training on EMS and EMA. Output 1.1.3 - capacity building on how to engage in community outreach as a select 'champion'. Also includes: capturing lessons learned and formal vocational training through institutional centres.
Department of Chemical Engineering, Yangon Technological University	The Department of Chemical Engineering is considered a highly- prestigious engineering department both in teaching and research with a strong commitment to systematically educate and fortify chemical engineering graduates for professional practices and lifelong learning. The degrees offered are: <ol style="list-style-type: none"> 1. Undergraduate chemical engineering 2. Master chemical engineering 3. PhD programme in chemical engineering 4. Post-graduate diploma in food technology 5. Master food technology. 	The project will involve the university in training activities and awareness raising activities. The project team will encourage participation of students and faculty members in practical and research experience opportunities under the project.	Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery. Also includes: Train the Trainer theory and practice on TEST methodology; local climate change implications, local plans and mitigation measures; introduction to TEST integrated approach including RECP and training on EMS and EMA. Output 1.1.3 - capacity building on how to engage in community outreach as a select 'champion'. Also includes: capturing lessons learned and formal vocational training through institutional centres.

<p>Department of Chemical Engineering, Mandalay Technological University</p>	<p>The vision of Chemical Engineering Department is leadership in research and education that focuses on environmental quality improvements through the application of chemical engineering principles. The degrees offered are:</p> <ol style="list-style-type: none"> 6. Undergraduate chemical engineering 7. Master chemical engineering 8. PhD programme in chemical engineering. 	<p>The project will involve the university in training activities and awareness raising activities. The project team will encourage participation of students and faculty members in practical and research experience opportunities under the project.</p>	<p>Output 1.1.2 – capacity building in industrial sustainable development including low cost wastewater treatment and methane recovery. Also includes: Train the Trainer theory and practice on TEST methodology; local climate change implications, local plans and mitigation measures; introduction to TEST integrated approach including RECP and training on EMS and EMA.</p> <p>Output 1.1.3 - capacity building on how to engage in community outreach as a select ‘champion’. Also includes: capturing lessons learned and formal vocational training through institutional centres. Outreach posters will address different short-term and long-term impacts by gender and by vulnerable group.</p>
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Civil society will be actively ‘consulted’⁴⁶ as part of the Project. Beyond consultation it is possible under Output 1.1.3 that civil society ‘champions’ are asked to step forward and participate at a more proactive level in the Project. The role of ‘champion’ is based on a select small group of industries, policy makers and civil society to facilitate discussion and opportunities to collaborate on improving industrial resource efficiency, wastewater treatment and reducing negative impacts on river health through behavioural change.

Stakeholder Engagement Activities

Consultation	Purpose	Participants	Lead/Chair	Reporting	Schedule
Initial	<ul style="list-style-type: none"> • Project Start up: • Project Overview • Project Organization • Project Schedule • Social and Env Impacts • ESMP 	<p>UNIDO Executing Partners (DUHD, ECD) Project Steering Committee (PSC) and other relevant government agencies Technical Advisory Group (TAG)</p>	<p>Executing Partner Chairs (DUHD and ECD) PSC UNIDO National Project Coordinator</p>	<p>In-person presentations, meetings agendas News and reports, proceedings of the event</p>	<p>Within 6 months after the project start date</p>

⁴⁶ GEF requests definition of the role that Civil Society will play in Projects. This Project will see Civil Society play the role of being consulted.

		<p>Regional government partners (MCDC and YCDC)</p> <p>National Project Coordinator</p> <p>Industry representatives and partners (MIA, IZMC – Shwe Pyi Thar and Pyi Gyi among others, Pylonechantha Trading Co. Ltd.)</p> <p>Selected industrial demonstration sites and factories</p> <p>Financial institutes and partners (SMIDB, KBZ, FMO/WWF)</p> <p>Development Organizations</p> <p>CSOs and NGOs (MCCA, WWF Tha Bar Project, Engineering Societies in Mandalay and Yangon, Academic community)</p>		<p>Project Steering Committee Meetings and Quarterly Technical Advisory Group (TAG) minutes</p>	
<p>Public consultation & site visit</p>	<ul style="list-style-type: none"> • Adjusting of mitigation measures, if necessary; • Impact of replacing and updating activities; • Comments and suggestions 	<p>PSC</p> <p>National Project Coordinator</p> <p>TAG</p> <p>Project Team</p> <p>Site Manager</p> <p>Environmental, Social Sustainability and Gender Consultant</p> <p>Contractor</p> <p>MCDC, YCDC</p> <p>National Experts</p> <p>Demonstration site factories</p> <p>Demonstration site residents and neighboring communities</p>	<p>PSC</p> <p>National Project Coordinator</p>	<p>In-person presentations, meetings agendas</p> <p>News and reports, proceedings of the event</p> <p>Site visit report</p> <p>Materials/information packs, checklists and tools – hardcopies, PowerPoint slides,</p>	<p>At least once a year</p>

				<p>USB sticks where appropriate</p> <p>Posters for 'Champion' outreach</p> <p>Delivery of case studies/best practices</p>	
Public consultation & site visit	<ul style="list-style-type: none"> Effectiveness of mitigation measures; Impacts of project implementation; Comments and suggestions. 	<p>Executing partners</p> <p>National Project Coordinator</p> <p>TAG</p> <p>Project Team</p> <p>Site Manager</p> <p>Environmental, Social Sustainability and Gender Consultant</p> <p>Contractor</p> <p>MIA</p> <p>MCDC, YCDC</p> <p>National Experts and WWTP and methane recovery technicians</p> <p>Demonstration site factories</p> <p>Demonstration site residents and neighboring communities</p>	<p>PSC</p> <p>National Project Coordinator</p>	<p>In-person presentations, meetings agendas</p> <p>News and reports, proceedings of the event</p> <p>Site visit report</p> <p>Materials/information packs, checklists and tools – hardcopies, PowerPoint slides, USB sticks where appropriate</p> <p>Technical manual used in vocational training centres</p> <p>Focus groups/interviews on lessons learned</p>	<p>At least once a year from Year 2.</p>
Expert workshop or press	<ul style="list-style-type: none"> Comments and suggestions on impacts; 	<p>Executing partners</p> <p>PSC</p> <p>TAG</p>	<p>PSC</p>	<p>In-person presentations, meetings agendas</p>	<p>At least once a year from year 2</p>

conference	<ul style="list-style-type: none"> public opinions 	<p>National Project Coordinator Environmental, Social Sustainability and Gender Consultant Strategic partners</p>	National Project Coordinator	<p>News and reports, proceedings of the event</p> <p>Site visit report</p> <p>Materials/information packs, checklists and tools – hardcopies, PowerPoint slides, USB sticks</p> <p>Technical manual used in vocational training centres</p> <p>Posters for ‘Champion’ outreach</p> <p>Delivery of case studies/best practices</p>	
Addressing Community Concerns	<ul style="list-style-type: none"> Consultation on Grievance Procedure 	<p>PSC National Project Coordinator Environmental, Social Sustainability and Gender Consultant Site Manager Strategic partners (e.g. CSO representatives)</p>	PSC National Project Coordinator	<p>News and reports, proceedings of the events, PSC and TAG Meetings Minutes</p> <p>Due Diligence Reports</p> <p>Feedback mechanism and public onsite log report handling</p>	At least at Project beginning and whenever the Procedure is applied

				disclosed (anonymity complied with) Project Communications Plan	
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ANNEX N: ANALYSIS FOR SELECTION OF POTENTIAL PILOT SITES AND COMPANIES

Section I – Analysis for Selection of Potential Pilot Sites at Industrial Zones.

1.1 Background

Myanmar's recent capacity development on the national environmental management system provided the basis for the project design. After the relatively recent approval of the Environmental Conservation Law (ECL, 2012), Myanmar's government has been committed to strengthening capacities to better respond to current environmental challenges. National and international cooperation has been mobilized to support the Environmental Conservation Department (ECD) of the Ministry of Natural Resources and Environmental Conservation (MONREC) — the government agency responsible for developing and implementing Myanmar's Environmental Impact Assessment (EIA) system. The following are the main initiatives developed by ECD together with other governmental agencies that provided the technical background and led the selection process of the intervention areas of this project:

- *Asian Development Bank's safeguard support to Myanmar*: Through this initiative, ECD has received technical assistance to put in place the regulatory architecture for a national environmental impact assessment (EIA) system since 2012. Among the policy and regulatory tools elaborated are the Environmental Conservation Rules, Environmental Impact Assessment (EIA) procedure, sector-specific EIA technical guidelines, and national environmental quality emission guidelines. Although the impressive progress of the regulatory framework, it breeds the need for increasing the institutional and technical capacity to apply safeguard requirements as well as the participation of the private sector⁴⁷. As a country with high water resource availability, concerns on water pollution are reflected in the developed tools and is currently one of the major challenges of the regulatory framework implementation.
- *Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar – JICA*⁴⁸: The ECD implemented this initiative together with MCDC, YCDC, and the JICA expert team, as a coordinated effort with the process for strengthening of the regulatory framework. It aimed at enhancing the capacities of environmental authorities in Myanmar for water environmental management and Environmental Impact Assessment (EIA) review work. Hence, the project included a solid water-management component whereby a water quality survey was implemented. The survey's objective was to understand the current condition of water environment, especially the impact of industrial wastewater in Myanmar as one of the sources of water pollution and also one of the challenging areas to enforce pollution control strategies. The pilot study areas were **Hlaing River basin in Yangon and Doke Hta Waddy River basin in Mandalay**, selected by ECD, MCDC, and YCDC. The selection considered the large concentration of industrial zones around the main channel of the rivers. Both rivers also represent important sources of economic development in their regions.

Final recommendations from JICA's studies include: construction of centralized waste water treatment plant (WWTP) in industrial zones, increasing the number of primary treatment (and secondary where apply) in factories, and establishment of realistic PPP schemes to promote private sector participation in wastewater treatment². In this context, UNIDO initiative was identified by local stakeholders as an opportunity to continue with the governmental strategy of strengthening environmental management capacities, particularly with regard to private sector participation⁴⁹. UNIDO's project represents an opportunity to support a technology transfer process by means of pilot projects and enhancement of technical capacity in government and industrial sector. Therefore, the potential pilot sites for this project have been identified based on the information gathered through the JICA project in order to build upon its data collection, results and local capacities developed during the last 3 years.

⁴⁷ Source: Publication "Safeguarding Myanmar's Environment", ADB, February 2018. <https://www.adb.org/publications/safeguarding-myanmar-environment>

⁴⁸ Source: Final Report of Water Environment Management Component. Volume No.1, Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar. JICA, June 2018.

⁴⁹ Source: Final Seminar "Water quality status and case studies for water environment management in Myanmar". JICA, May 17th, 2018. https://www.jica.go.jp/myanmar/english/office/topics/c8h0vm0000d1y53i-att/press180509_npt_03.pdf

1.2 Selection of priority industrial zones

Yangon and Mandalay were defined as national economic growth centers in the Industrial Development Plan of Myanmar⁴. Therefore both regions are selected as intervention regions of this project.

There are 24 industrial zones (IZs) in Yangon, located around the basin of the **Hlaing River** and its tributaries⁵⁰. Figure 1 shows the area of major concentration of industrial zones around the main channel of Hlaing River and one of the most important tributary, the Pan Hlaing River. The pollution survey conducted by JICA selected 6 IZs in the Hlaing River basin: Hlaing Thar Yar, Shwe Lin Ban, Shwe Pyi Thar, Wataya, Shwe Than Lwin and Ngwe Pinlal. The studies also mention future plans of water use from the river for urban development, identifying important planned sites within a radius of potential influence from the environmental performance of the IZs: Shwe Lin Ban, Hlaing Thar Yar, Shwe Than Lwin, War Ta Yar, Shwe Pyi Thar and Hmawbi, as shown in figure 2.

YANGON INDUSTRIAL ZONE INDEX



Figure 1.

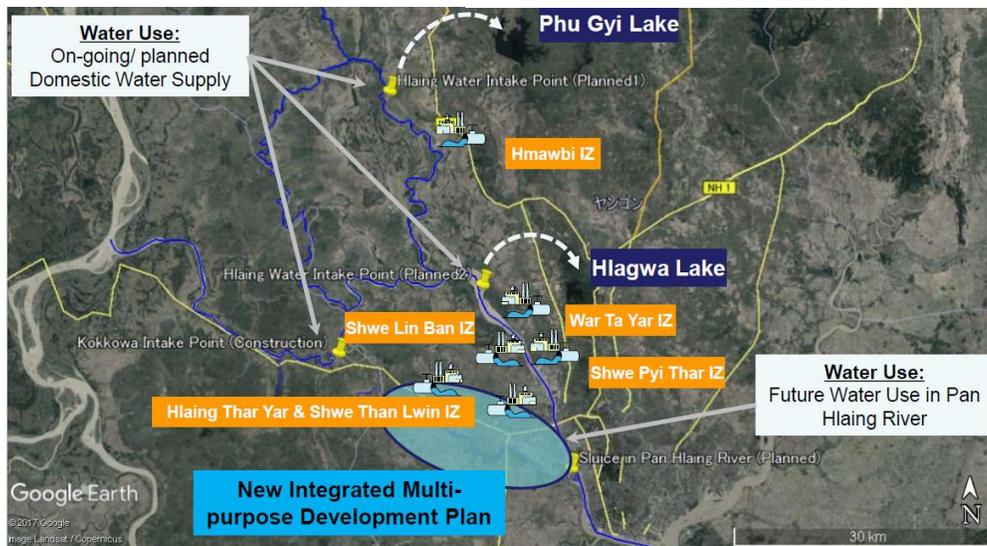


Figure 2. Water Use and Industrial Zones in the downstream of Hlaing River Basin⁵¹

Considering 1) the close location to relevant points of water usage plans and to the main channels of rivers, and 2) the concentration of relevant industrial sectors, UNIDO's project will concentrate efforts on 3 industrial zones in Yangon: **Hlaing Thar Yar, Shwe Pyi Thar and Shwe Lin Ban.**

⁵⁰ Source: Presentation "Myanmar Major Industrial Zones and Development Plan". Moe Moe Hlaing Myint, Deputy Director, Urban and Regional Development Division, DUHD, MOC. Korean Investment Seminar, 24th May, 2016

⁵¹ Source: Source: Final Seminar "Water quality status and case studies for water environment management in Myanmar". JICA, May 15th, 2018

In the case of Mandalay, Pyi Gyi Tagon industrial zone was selected as the most important zone in the region to concentrate efforts from the national stakeholders during JICA’s project. More than one thousand factories are located in this IZ which includes an important representation of relevant industrial sectors. MCDC and the industrial zone administrative committee have advanced in establishing infrastructure for the collection of wastewater from part of the factories and in the pre-investment phase of a WWTP. Wastewater collection is carried out through a 10-inch pipeline which is currently discharging into the Doke Hta Waddy River; it is expected that this pipeline will connect to the future WWTP. Taking into account this context, UNIDO’s project will work in **Pyi Gyi Tagon** in Mandalay to support the process started by the national stakeholders.

The following figures⁵² show the course of wastewater discharging from the selected industrial zones. Figure 4 shows that in Mandalay, the Thuang Tha Man Lake, which is a source of fishing, tourism and recreation, is also receiving wastewater mainly without treatment from Pyi Gyi Tagon zone, which increases concern on industry environmental performance.

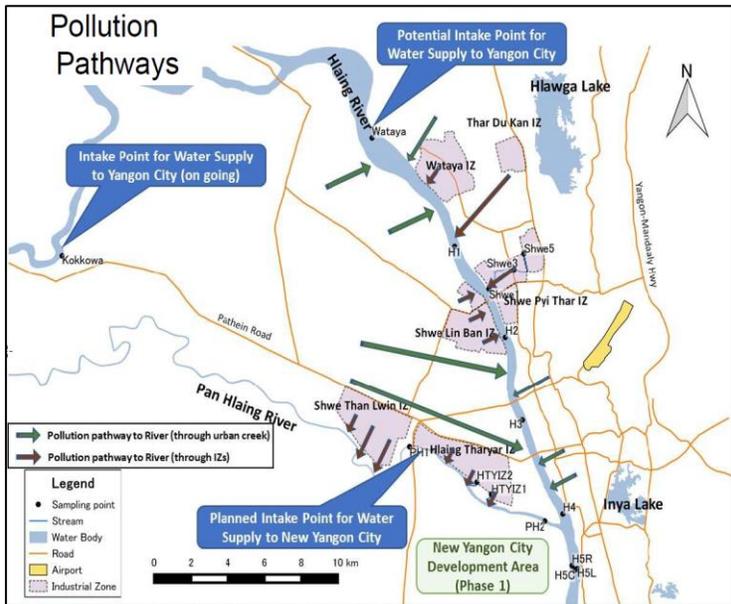


Figure 3. Yangon - Pollution Pathways in the Hlaing River Basin

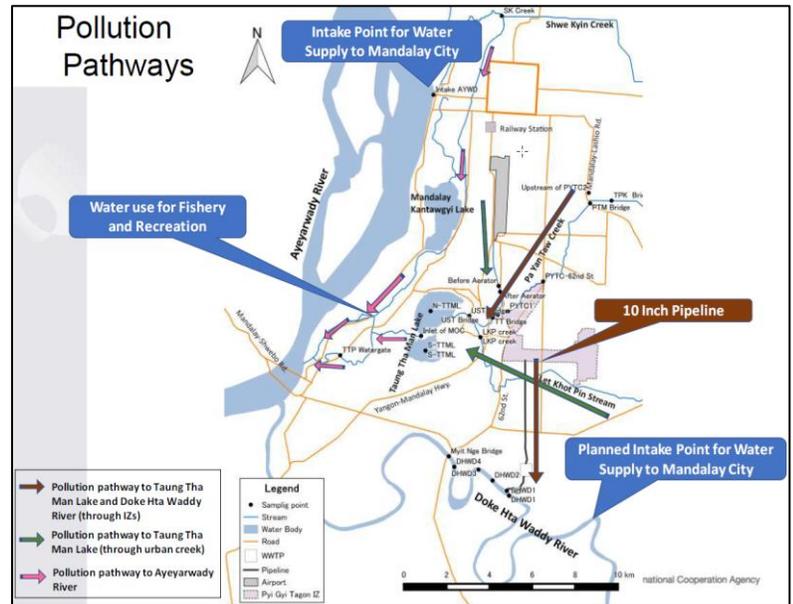


Figure 4. Mandalay - Pollution Pathways in the Doke Hta Waddy River Basin

1.3 Screening of selected industrial zones to select the potential pilot sites.

A local company with strong and relevant technical capability - ‘**Myanmar Water Engineering and Products Co.,Ltd**’ - was hired to develop a technical analysis for selecting potential pilot sites in target industrial zones. It proved beneficial to hire a local engineering company to contribute to the design based on their technical insights and contextual understanding of the location. The local company’s team visited industrial zone administrative committees to collect information on defined areas, short-term and medium-term plans for the construction of WWTPs. The team also identified industries with potential of wastewater collection for a centralized WWTP, either for a site previously identified by the industrial zone (central WWTP project) or sites for potential clusters of companies whose locations do not make it feasible to connect to a defined central treatment site. During this process, a survey was carried out to collect more information about the wastewater discharges and facilities in companies that can contribute with organic loads in the wastewater streams. Some companies were selected for a more detailed analysis through wastewater quality sampling and analysis.

Mandalay

⁵² Source: Final Report of Water Environment Management Component. Volume No.1, Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar. JICA, June 2018

The number of industries in operation by sector varies due to seasonal production, market fluctuations, energy availability, and lack of environmental compliance. According to the Pollution Source Survey Report of JICA (PSSR), sector distribution in Pyi Gyi Tagon was as it is shown in figure 5 when the study was carried out (2016-2017). Figure 6 shows an updated distribution based on interviews with the MCDC and the Industrial Zone administrative committee carried out by the local team during the preparation of this project by the end of year 2018.

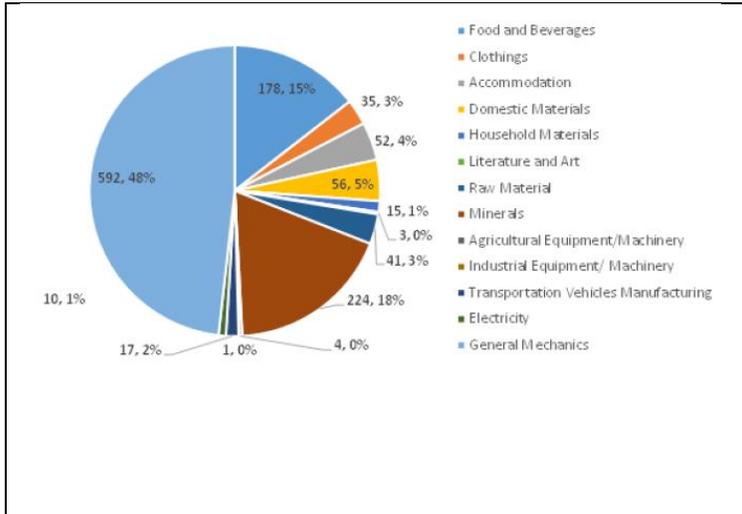


Figure 5. Factories per sectors in Pyi Gye Tagong IZ in Mandalay according to Pollution Source Survey Report.

Highlights:

1. Total of companies: 1,276
2. Main food sub-sectors: Bean, sesame, oil, sugar mills, snack, and wheat.
3. Beverage sector with small representation of 10 % in F&B category.
4. Distilleries: 5 units reported.

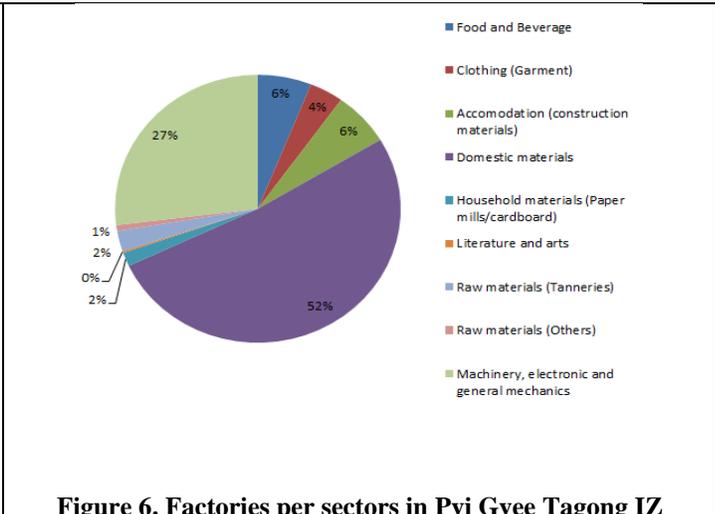


Figure 6. Factories per sectors in Pyi Gye Tagong IZ according to interviews with MCDC and IZ committee.

Highlights:

1. Total of companies: 1,384
2. Main food sub-sectors: Bean, sesame, oil, snack, and wheat.
3. Reduced participation of beverage sectors.
4. Industry classification in Myanmar groups some sectors in bigger categories such as Tanneries on raw materials production and Paper mills in household materials production.
5. Distilleries: 2 units reported.

The PSSR identified that beverage companies, sugar mills and distilleries increased the average of discharged wastewater flow and organic loads. However, the updating process found the following issues; some of them have influence in the change of industry distribution and the selection of pilot sites:

- There are three discharging points from the Pyi Gyi Tagon IZ: 1) industries connected to a 10-inch pipeline constructed by MCDC, which discharges to the Doke Hta Waddy river; 2) Industries discharging to Pa Yan Taw Creek; and (3) Industries discharging to No. 6 Extra Dam. See map in figure 7.
- 90 % of the sugar mills were closed down and the rest work irregularly due to lack of environmental compliance and other issues. A similar case was found for the distilleries; by the time of the UNIDO’s survey, most had been shut down.
- Paper and pulp companies are mainly concentrated in IZ-2. Their close locations make a cluster with potential of sharing wastewater treatment facilities.
- Tanneries already connect their wastewater discharges to a common tank which in turn sends the wastewater stream to the 10-inch pipeline. Water monitoring is possible to be done at this point and it also represents a potential cluster for sharing a potential wastewater treatment facilities.

- Most of large companies are connected to the 10-inch pipeline. The PSSR identified that approximately 1,150 m³/day of wastewater flow was being discharged through this pipeline. Currently, with many F&B companies out of operation, it is expected to have a lower water flow with high variation along the operational day and seasons.
- MCDC has initiated the process to design a centralized wastewater treatment plant connected to the 10-inch pipeline discharging point and plan its construction. However, some legal issues have delayed the design completion by the contractor.
- Companies such as distilleries or sugar mills will need a permit to discharge wastewater in the common point (10-inch pipeline). These companies shall treat their effluent in their own facilities before discharging.

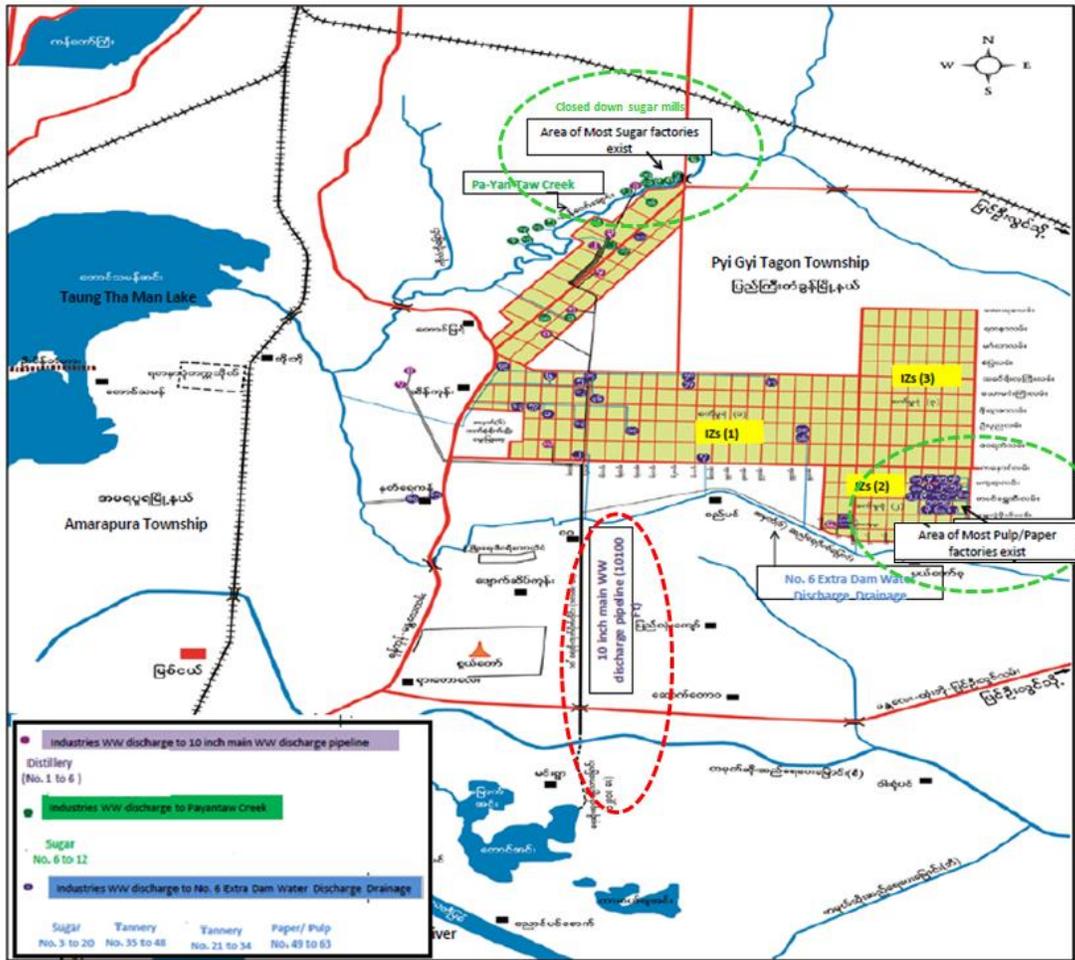


Figure 7. Map showing the pollution pathways with the locations of Mandalay Industrial Zones in Pyi Gyi Tagon (reference from ECD).

Taking into account this context, the potential sites for the WWTP pilot projects in Pyi Gyi Tagon are described below. To make the final site selection a comprehensive monitoring exercise will be needed during the project implementation to determinate the water quality conditions and actual contributions of the food and beverage sectors to the different wastewater streams.

1. **First option:** Join efforts with MCDC and the IZ administrative committee to invest in a centralized WWTP, integrating the biogas use and energy generation for self-consumption (biogas recovery was not included in the first proposed design). The pilot site corresponds to the planned area for connecting with the 10-inch pipeline which collects most of the relevant wastewater discharges in the IZ. See figure 7.

2. **Second option:** On-site treatment plant for cluster of industries closely located (such as tanneries which already share treatment facilities or papers companies located at IZ-2).
3. **Third option:** On-site treatment plant for large companies with significant discharges and specific needs of treatment (i.e. select a distillery or sugar mill with operating permit to improve its environmental performance as a successful case study to avoid closure of companies).

Based on the preliminary location analysis, the local team circulated the questionnaire in 19 companies at Pyi Gyi Tagon from the sectors of **Food, Textile/Dyeing, Paper/Pulp and Tanneries**. Estimates of wastewater quality were made for the 19 companies based on selected sampling and water quality analysis collected in the field⁵³ and information obtained from JICA's water quality monitoring. All these companies are connected to the 10-inch pipeline, figure 8 shows their location. Wastewater quality estimates are as shown in table 1:

Table 1: Wastewater flow rates and organic load estimates - Mandalay

S/N	Jica No.	Factory Name	IZ	Product	Reliable Flow rate (m ³ /day)	BOD Conc. (mg/l)	COD Conc. (mg/l)	TSS (mg/l)	BOD Loading (kg/day)	COD Loading (kg/day)	Solid Loading (kg/day)
1	M1-11	Aung Sein	Zone (1)	Textile	80	720.0	560.0	628	57.6)	50.24
2	M1-3	U Sai(Sesame)	Zone (1)	Sesame (white, brown, yellow)	327.3	1400.0	3700.0	1100	458.2	1211.0	360.03
3	M1-6	Lvbao (Whee Pout)	Zone (2)		159.5	1400.0	3700.0	1100	223.3	1211.0	175.45
4	M1-9	Kyat Sin Done Pyan	Zone (1)	Moakhinkhar(d ry)	26	4500.0	6100.0	3300	117.0	158.6	85.8
5		Moe Ma Kha	Zone (2)	Paper*	8	800.0	1600.0	690	6.4	12.8	5.5
6	M1-19	Zabu Mate Swe(Paper)	Zone (2)	Paper*	8	800.0	1600.0	690	6.4	12.8	5.5
7	M1-20	Paw Oo	Zone (2)	Paper*	7	800.0	1600.0	690	5.6	11.2	4.8
8	M1-50	Shwe Win Win	Zone (2)	Paper*	7	800.0	1600.0	690	5.6	11.2	4.8
9	M1-49	Shwe Khaung Laung	Zone (2)	Paper*	9.3	800.0	1600.0	690	7.4	15.0	6.4
10		Super	Zone (2)	Paper*	7.7	800.0	1600.0	690	6.2	12.3	5.3
11	M1-21	Aung (Paper)	Zone (2)	Paper*	19.3	800.0	1600.0	690	15.4	31.0	13.3
12	M1-22	ManMahar Myat	Zone (1)	Paper Carton box	23.2	800.0	1600.0	690	18.6	37.0	16
13	M1-83	Soe Moe Star	Zone (1)	Sole Leather	2	322.0	715.0	341	0.6	1.4	0.68
14	M1-12	Chan Seint Win(leather)	Zone (1)	Sole leather	17.3	2300.0	3500.0	990	39.8	60.6	17
15		Aung (Leather)	Zone (2)	Leather**	8.8	2300.0	3500.0	990	20.2	30.8	8.7
16	M1-13	Kyaw Zaw Thu (Leather)	Zone (2)	(Leather)**	12	2300.0	3500.0	990	27.6	42.0	11.88
17	M1-63	Than Naing(Leather)	Zone (2)	(Leather)**	9.6	2300.0	3500.0	990	22.0	33.6	9.5
18	M1-56	Taing Kyaw (Leather)	Zone (2)	(Leather)**	12	2300.0	3500.0	990	27.6	42.0	11.88
19	M1-60	MK (Leather0	Zone (2)	(Leather)**	12	2300.0	3500.0	990	27.6	42.0	11.88

* Average values estimated for paper companies (small).
** Average value estimated for Tanneries (small)

⁵³ Water analysis was made in three companies of this sample.

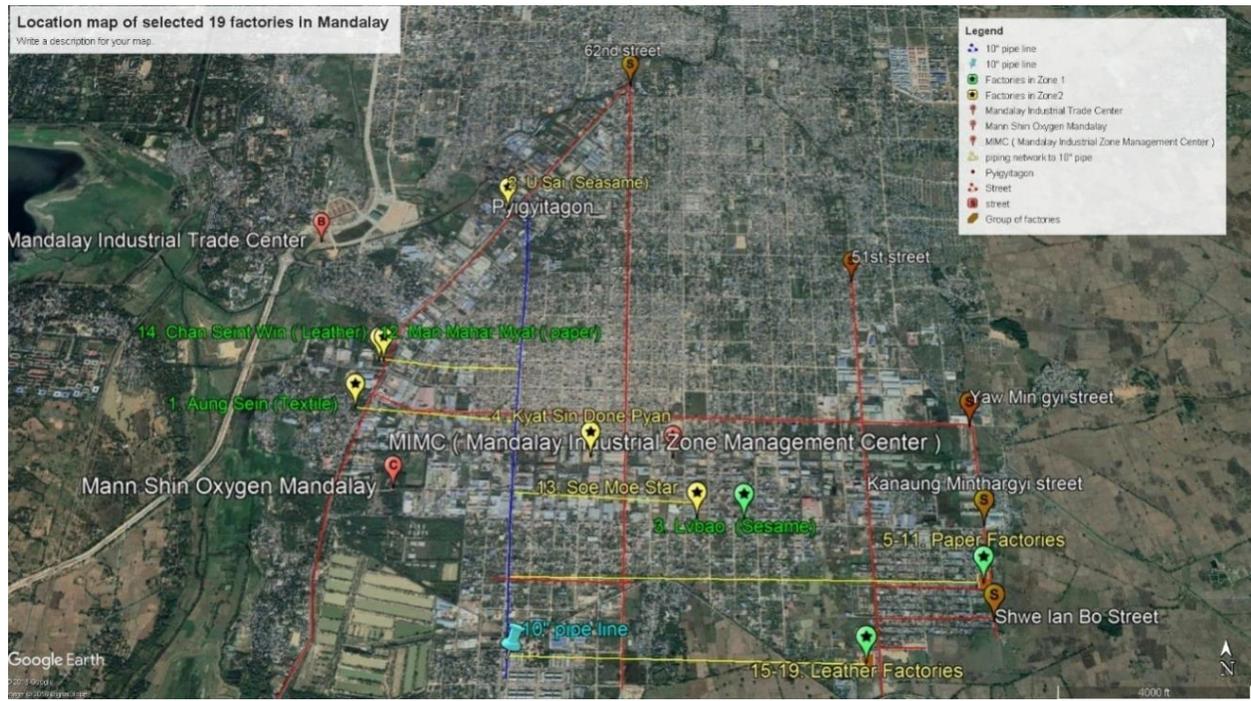


Figure 8 - Location of industries contacted during screening process in Pyi Gyi Tagon, Mandalay

Considering the obtained information, the technical team estimated an average flow rate and organic load taking into account the current number of companies connected to the 10-inch pipeline and data bases available⁵⁴. The following values are selected as the technical basis for estimates of methane production by adding the UASB technology to yield biogas at this potential pilot site.

Flow rate (m3/day)	BOD Conc. (mg/l)	COD Conc. (mg/l)	TSS (mg/l)
1,000	2,000	4,500	1,200

⁵⁴ Other data were analyzed from a data base of 53 companies in Pyi Gyi Tagon provided by JICA.

Yangon

The following table summarizes the conditions found during the IZs screening in Yangon.

Industrial zone: Shwe Lin Ban

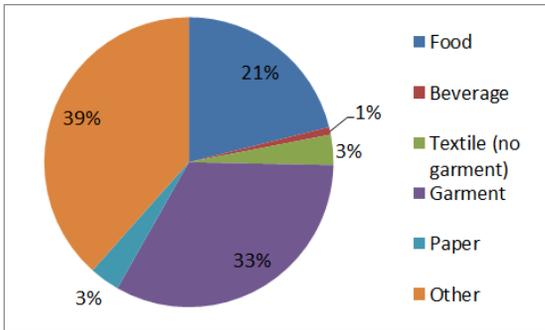


Figure 9. Distribution of companies by sectors Shwe Lin Ban

- Number of companies: 297
- Operation from: 2002
- Main potential sector with wastewater discharges: Food, dying-textile, paper.
- Relevant food sub-sectors: fishery, sesame/bean/rice production, snack, and bakery.
- Lack of measurement of water consumption in companies. No use of flow meters for ground water consumption.
- Almost all industries discharge wastewater to open channels, which end up as direct discharge into the river. No data regarding the wastewater quantity could be obtained. There are 4 discharge channels to the river.
- There is one stabilized pond that collects part of wastewater and also discharges into the river.
- The IZ faces issues with unofficial/illegal dwellings/household highly present around the available land.

Industrial zone: Shwe Pyi Thar

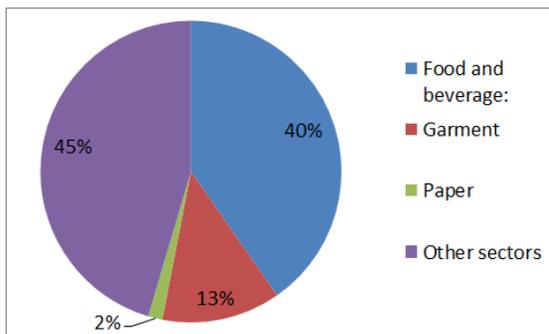


Figure 10. Distribution of companies by sectors, Shwe Pyi Thar.

- Number of companies: 196
- Operation from: 1998 – 2000
- Main potential sector with wastewater discharges: Food and beverage, paper.
- Main potential food sub-sectors: fishery, snack, noodles/vermicelli, soft drinks.
- Capacity to host among 300 producers (70% of capacity is used).
- Lack of measurement of water consumption in companies. No use of flow meters for ground water consumption.
- Most of the companies have low wastewater flows. However, a few companies with large discharges are identified.
- Difficulties to collect wastewater due to scattered location of companies.
- The wastewater is discharged via open channels directly to the river. The pollution in the wastewater stream is obvious due to the strong scent and significant colour.
- An area of 30 hectares is reserved for a future WWTP. Piping system for wastewater collection is also needed.

Industrial zone: Hlaing Thar

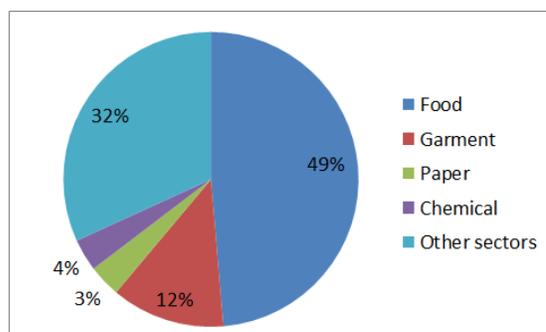


Figure 11. Distribution of companies by sectors, Hlaing Thar

- Number of companies: 707 in operation
- Operation from: 1995
- Hlaing Thar Yar Industrial City is one of the largest industrial zones in Yangon with a land area of about 567 hectares, divided in 4 zones.
- Main potential sector with wastewater discharges: Food.
- Main potential food sub-sectors: fishery, sesame/bean/rice production.
- Most of the companies have low wastewater flows. However, a few companies with large discharges are well-known.
- In collaboration with JICA, conceptual WWTP designs have been developed for: 1) Centralized WWTP for zone 1 with a capacity of 6500 m³/day, and 2) centralized WWTP for zones 2, 3 and 4 with a capacity of 43,300 m³/day⁵⁵.
- Due to the size of the IZ and difficulties to collect the water, there is a better possibility of several decentralized WWTPs grouping industries with relevant wastewater discharges.

Although the Food & Beverage sector represents more than 60 % of the industries in Myanmar, industries located at industrial zones have a diverse representation of other manufacturing processes that have been grouped in the category Other Sectors. This category includes the production of electronic devices, furniture, construction material, metal and mechanics manufacturing, among others sectors whose production processes are characterized by low wastewater discharges. Even though the three pre-selected IZs are priority to participate in the project's activities, Shwe Pyi Thar and Hlaing Thar have a bigger concentration of food industries. As the food sector provides higher potential of wastewater and organic load generation, and considering the availability of land, the selection of pilot sites in Yangon at this stage has been recommended in either Shwe Pyi Thar or Hlaing Thar.

The project will develop at least 1 pilot site in place and operating during the project execution time (ideally, 1 in Yangon and 1 in Mandalay). For Yangon, two options can be considered for conducting a detailed monitoring plan for the ultimate selection of the WWTP facility:

1. **Hlaing Thar:** potential pilot site located at industrial zone 1 taking into account recommendations of JICA's studies. Strategy of clustered WWTP is also relevant to consider due the big size and scattered location of industries with relevant wastewater discharges (see figure 12).
2. **Shwe Pyi Thar:** Assessment of the identified area for a centralized WWTP and potential on-site treatment plants for cluster of industries closely located.



Figure 12. Hlaing Thar Industrial zone

For the preliminary selection of one pilot site in Yangon at this stage, the technical team carefully assessed the case of Pyi Gyi Thar, as its size allows the possibility of a more suitable investment level for the project. In an interview with the administrative committee, a list of 14 companies with relevant wastewater discharges were identified and included for the survey collection by the local team. Sampling and

⁵⁵ Source: Presentation "Current Status and Implementation Approach for Industrial Zones Wastewater Management In Yangon Region". INCHEM, Tokio, 2017. Dr. Than Than Twe, Director. Ministry of Construction.

water quality analysis were carried out in 8 out of 14 companies. The following table shows results of the water quality analysis, which includes estimates for the rest of companies; figure 13 shows their location.

Table 2. Wastewater flow rates and organic load estimates - Yangon

S/N	Factory Name	Wastewater Sampling	IZ	Product	Reliable Flow rate (m ³ /day)	BOD Conc. (mg/l)	COD Conc. (mg/l)	TSS (mg/l)	BOD Loading (kg/day)	COD Loading (kg/day)	Solid Loading (kg/day)
1	Pyi Lone Chan Tha	Yes	Zone (3)	Fish Meet, Surimi	110.5	4600.0	6500.0	770	508.3	718.3	85.085
2	High Win International	Yes	Zone (2)	Sea-water shrimp	96.9	110.0	80.0	50	10.7	7.8	4.845
3	Myanmar King Fish	Yes	Zone (3)	Sea-water shrimp	62.9	350.0	380.0	130	22.0	23.9	8.177
4	Shwe Kabar Maung Maung	No	Zone (4)	Freezed Fish	34	2000.0	3500.0	430	68.0	119.0	14.62
5	Daw Wai Wai	Yes	Zone (2)	Paper	93.5	1000.0	4600.0	3800	93.5	430.1	355.3
6	Duwun Vermicelli Factory	Yes	Zone (3)	Rice Vermicelli	59.5	270.0	320.0	79	16.1	19.0	4.7005
7	Win Win	Yes	Zone (2)	Vermicelli	48.45	1500.0	2400.0	2500	72.7	116.3	121.125
8	Aung Kyaw	No	Zone (4)	Vermicelli	35	1200.0	2100.0	600	42.0	73.5	21
9	Ka Thit Oo	No	Zone (3)	Potato chip	68	800.0	2400.0	3500	54.4	163.2	238
10	Sein Than Argo Industry Co., Ltd.	No	Zone (2)	Purified Sesame	39.1	1400.0	3700.0	1000	54.7	144.7	39.1
11	Mountain and Sea Co., Ltd.	Yes	Zone (4)	Sunflower Seeds	22.95	31000.0	44000.0	2800	711.5	1009.8	64.26
12	Khit Thit	Yes	Zone (4)	Vermicelli	30	540.0	580.0	430	16.2	17.4	12.9
13	High Win Family	No	Zone (2)	Rubber	382.5	13000.0	18000.0	3000	4972.5	6885.0	1147.5
14	SamPar Oo	No	Zone (1)	Soft Drink	84	17.5	10.0	2	1.5	0.8	0.168
Total					1,167				6644.0	9728.7	2116.8

As in the case of Mandalay, the technical team estimated an average flow rate and organic load for a centralized WWTP, taking into account the current number of companies identified by the industrial committee as relevant wastewater dischargers. The following values are selected as the technical basis for estimates methane production by adding the UASB technology to yield biogas at this potential pilot site.

Flow rate (m ³ /day)	BOD Conc. (mg/l)	COD Conc. (mg/l)	TSS (mg/l)
1,200	6,000	9,000	2000

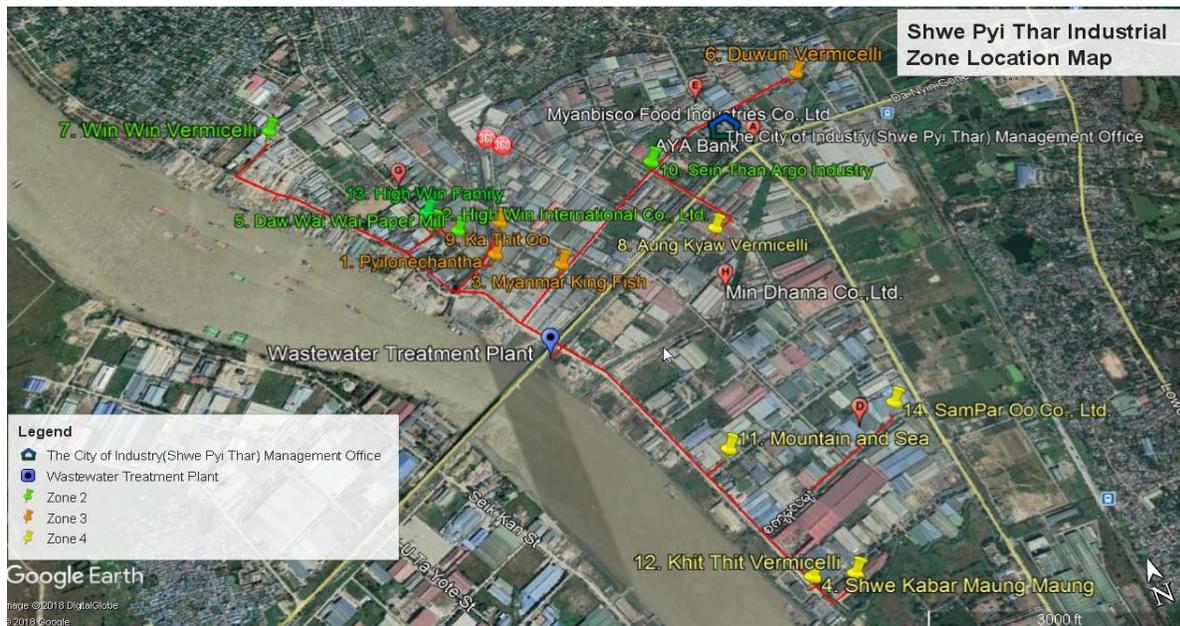


Figure13. Location of industries contacted during screening process in Shwe Pyi Thar.

Conclusion

The potential site selection in Yangon and in Mandalay has similar challenges in both regions. The final selection will be made during the project implementation based on a detailed and updated water quality monitoring exercise taking into consideration the organic loads and potential for biogas generation. Nevertheless, Pyi Gyi Tagon already now is considered to have favorable conditions given the existing infrastructure for collection of the wastewater discharges from the main industries in the IZ. Overall the preliminary estimates of organic loads give a good indication of potential for biogas generation for centralized systems. However, challenges regarding locations and wastewater collection system can delay the endeavors for a centralized WWTP and make the project give priority to smaller investment for on-sites pilot projects to demonstrate the economic and technical feasibility of the selected technology and meet the GHG emission reduction targets.

Section II – Sectors and companies for Demonstration Projects in the TEST Methodology

Application of the TEST methodology in 50 companies contributes to an integrated improvement of environmental performance of industrial sectors. Considering that the project will promote WWTP technology (end-of-pipe technology - last step of the prevention hierarchy), the integration of the TEST methodology will allow strengthening industrial capacities for the long term using resource efficiency strategies. Therefore, the selection of 50 companies will be targeted toward companies participating in WWTP pilot projects to facilitate a comprehensive improvement process and generate successful case studies. As the companies' participation is voluntary, the project will open a broad call to companies giving priority to those sectors with main wastewater discharges. On the other hand, the TEST approach enhances energy management practices that contribute to reduce energy demand in production facilities. In consequence, the defined implementation strategy will sum added-value through the potential of GHG emission reduction by resource efficiency measures in companies, as an extra contribution for GHG emission accountability during implementation phase.

The methodological approach for identification of the potential 50 companies for TEST and determine its potential benefits is described below.

- **Geographic scope definition:** Potential companies for TEST demonstration projects will be located at the same selected industrial zones for the WWTP/biogas pilot projects (Shwe Lin Ban, Shwe Pyi Thar, Hlaing Tharyar, Pyi Gyi Tagon).

- Definitions of Industrial Sectors: A screening on the existing sectors and companies in the 4 IZs was developed through secondary sources and interviews with the industrial zone committees’ representatives to determine the main sectors with high potential of being connected to a WWTP in the selected IZs.
- Survey: Data collection of production values, market, employees, energy and water consumptions, wastewater treatment facilities, among other information was carried out by the local team. A total of **40 companies** located at the selected IZs were surveyed for the TEST component, which also include those companies selected for the screening process for the WWTP pilot projects. The questionnaire included relevant information for several analyses (gender, water quality, energy consumption, etc), to enrich many aspects of the project design.
- Estimate of potential energy consumption baseline: From the survey and interviews, it was possible to obtain information about the most likely sector composition for TEST target group in Yangon and Mandalay. Also, averages of energy consumptions related to company size were collected. An energy consumption baseline for companies per sector of interest and regions (Yangon and Mandalay) was estimated.
- Estimate of energy saving potential: Considering the relevance for the project, potential energy saving indicators per energy system (e.g. compressed air, refrigeration, lighting, boilers, motors/pumping) and per tentative energy measures were collected taking into account: a) energy systems used in the main sectors (as it was reported in the survey), b) UNIDO experiences applying resource efficiency measures and TEST demonstration projects in a sample of 15 companies with 80 energy efficiency evaluated measures. This information provides a basis of the potential benefits to be obtained by the TEST component in terms of energy savings. However, it does not account GHG emission reduction at this stage since investments in energy efficiency are not included directly in the project grant.

The following sections show the results of the analysis based on the methodology described above:

Definition of industrial sectors for TEST component

Table 3. Companies in operation per IZ⁵⁶

Distribution by main sectors	YANGON					MANDALAY	
	Hlaing Tharyar	Shwe Pyi Thar	Shwe Lin Ban	Total	%	Pyi Gyi Tagon	%
Industrial zone							
Sectors							
<i>Food (excepting fishery and Sesame/Bean processing/Rice)</i>	81	72	33	186	38.5%	82	60%
<i>Fishery</i>	21	7	6	34	7.0%	0	0%
<i>Sesame/Bean processing/Rice</i>	242	0	11	253	52.4%	0	0%
<i>Soft drinks</i>	0	0	0	0	0.0%	0	0%
<i>Distillery</i>	0	0	2	2	0.4%	2	1%

⁵⁶ Sources: Interviews with Industrial Zone Committees.

<i>Textile (dying, not garment)</i>	0	0	5	5	1.0%	0	0%
<i>Pulp, Paper and paperboard production</i>	0	0	3	3	0.6%	18	13%
<i>Leather</i>	0	0	0	0	0.0%	34	25%
TOTAL	344	79	60	483	100%	136	100%
	78%					22%	
Other sectors (no high water use and/or biochemical loads)							
<i>Chemical</i>	25	0	0	25	5.2%	0	0%
<i>Garment</i>	88	25	78	191	39.5%	53	39%
<i>Others</i>	250	92	99	441		1195	
TOTAL	707	196	237	1140		1384	

Table 3 shows 483 companies in Yangon’s industrial zones and 136 in Mandalay’s industrial zone from sectors that contribute with wastewater discharges. Therefore, 619 companies represent the pool of potential companies for the TEST component.

Table 4. Other sub-sectors of interest identified by the “Pollution Sources Survey Report”⁵⁷

At Yangon	At Mandalay
Fishery	Pulp, Paper and paperboard production
Sesame/ Bean processing/Rice	Leather (Tanneries)
Food (excepting fishery and Sesame/Bean processing/Rice)	Food (excepting fishery and Sesame/Bean processing/Rice)
Dyeing	
<i>Important subsectors under Food category to be considered</i>	
Oil production	Bean/sesame/oil
Dairy	Diary (ice cream)
Meat	Sugar Mill
Noodles/rice/vermicelli	
<i>Others</i>	
Distillery	Distillery
Paper	

Considering the number of companies reported by the industrial committees per IZ and the findings in the Pollution Sources Survey Report of JICA, the following final list of potential sectors was selected to target 50 TEST demonstration projects. It is of note that **distilleries** and **sugar mills** were not included in this list. Various sources informed that companies of these sectors recently closed operations due to non-compliance in terms of environmental regulations. This

⁵⁷ “Pollution Sources Survey Report”. Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar. JICA 2018.

situation will be confirmed during project implementation in case they are reopened, as they would be an important case study to demonstrate the potential of an improved environmental management.

Table 5. List of prioritized sectors

No	Sectors	Mandalay	Yangon
1	<i>Food and Beverage</i>		
1.1	Sesame/Bean processing	x	x
1.2	Snack		x
1.3	Rice/noodle/vermicelli		x
1.4	Dairy	x	x
1.5	Meat		x
1.6	Fish		x
1.7	Oil production		x
3	<i>Textile (Dyeing)</i>	x	
4	<i>Leather</i>	x	
5	<i>Paper/Cardboard</i>	x	x

Survey main results regarding the energy consumption

Table 6. Survey results related to energy consumption (electricity)

Sector	Size	No. of surveyed companies			Total Energy consumption	Energy consumption indicators			
		Yangon	Mandalay	Total	KWh/year	Average (kWh/unit-year)	Average MWh/ton	Min (MWh/ton)	Max (MWh/ton)
Fishery	Large	7	0	7	10,163,539	1,451,934	1.01	0.07	2.42
Sesame/bean	Small	0	1	1	1,600,000	1,600,000	1.33	n/a	n/a
Sesame/bean	Medium-Large	1	1	2	1,866,667	933,334	1.28	0.22	2.34
Leather	Small	0	6	6	102,500	17,083	0.37	0.07	0.89
Textile (dyeing)	Large	0	2	2	8,800,000	4,400,000	3.48	2.85	4.10
Pulp and paper	Small		6	6	522,000	87,000	0.17	0.04	0.28
Pulp and paper	Medium-Large	2	2	4	7,520,000	1,880,000	0.88	0.03	0.80
<i>Food</i>				0					
Noodles/rice/vermicelli	Medium-Large	5	1	6	2,748,000.00	458,000	0.40	0.03	0.82
Snack	Medium-Large	2	0	2	770,000	385,000	11.17	7.00	8.33

Consumption of fossil fuel oil in Mandalay companies was reported as non-existent. All companies in the survey pointed out the use of biomass (such as sawdust, grain shell, charcoal) as the energy source for steam generation and heating processes. However, power outages happen frequently in these IZs so that industries use emergency plants of diesel to offset electricity needs during energy blackouts. Since fossil fuel oil is commonly not used in the normal operation, no GHG emissions reduction can be expected from this source.

Estimate of likely distribution of companies by region and potential energy consumption baseline

The project will target 30-35 companies in Yangon and 15-20 companies in Mandalay. This considers the general concentration of existing companies from the sectors of interest (table 3). The energy consumption baseline will be determined by the companies ultimately participating in the TEST demonstration projects.

The following tables show the likely distribution of companies per industrial sector in each region. It considers the industrial sectors concentration at the selected industrial zones and the estimate of energy consumption based on the average obtained from the survey.

Table 7. Estimate of energy consumption baseline for potential companies in Yangon (electricity)

Region	Yangon
Number of companies	30
Distribution criteria (assumptions)	1-Sectors with less than 10 % of the total number of companies (table 1): Capture of 30 % (fishery, pulp and dyeing) 2- Food sector with more than 30 % of the total number of companies: 50 % of the rest. 3- Most of the companies at IZ at Yangon under the selected sectors are medium or large

Sector	No. of companies	Energy consumption averages		Total energy consumption (estimate)	% companies	% energy contribution
	Medium-Large	Average (kWh/unit-year)	Average MWh/ton	KWh/year		
Fishery	10	1,451,934	1.0	14,809,728.26	34%	42%
Sesame/ Bean processing/Rice	9	933,334	1.28	8,120,001.45	29%	23%
Food (excepting fishery and Sesame/Bean processing/Rice)	9	421,500	5.78	3,667,050.00	29%	11%
Dyeing	2	4,400,000	3.48	6,600,000.00	5%	19%
Paper	1	1,880,000	0.88	1,692,000.00	3%	5%
Total	30			34,888,779.71	100%	100%
Total (MWh/year)				34,888.78		

Table 8. Estimate of energy consumption baseline for potential companies in Mandalay (electricity)

Region	Mandalay
Number of companies	20
Distribution criteria	<p>1- Food sector represents 60 % of the total number of companies, so this % is applied to the sample (sesame production is included under Food sector, as this subsector is included in this category for Mandalay data)</p> <p>2- Leather and paper sectors are accounting the rest of companies in the same proportion. Leather companies are mainly small. Paper companies are represented by a mix of small and medium-large companies.</p>

Sector	No. of companies	Energy consumption averages		Total energy consumption (estimate)	% companies	% energy contribution
		Average (kWh/unit-year)	Average MWh/ton	KWh/year		
Leather	4	17,083	0.2	68,333.33	20%	0.5%
Food (all companies including sesame)	12	844,083	3.54	10,129,000.50	60%	71.7%
Paper (small)	2	87,000	0.17	174,000.00	10%	1.2%
paper (medium-large)	2	1,880,000	0.88	3,760,000.00	10%	26.6%
Total	20			14,131,333.83	100%	100%
Total (MWh/year)				14,131.33		

Final result of this calculation is a potential total energy consumption baseline of 49,020.11 MWh/year (electricity) for 50 companies in the selected IZs in Mandalay and Yangon.

Estimate of energy saving potential

Energy saving average indicators from UNIDO experiences (SwitchMed-MED TESTII project) applying resource efficiency measures (sample of 15 companies with 80 energy efficiency measures).

Table 9. Average of electricity saving per type of measure (related to kWh/year)

Electricity	Average of electricity reduction (%)
Energy efficiency measure in electricity	
Compressed air	22%
Equipment replacement/incorporation	25%
Good practices	27%
Operational controls	7%
Energy Management	10%
Energy management	10%
Lighting	54%
Equipment replacement/incorporation	54%
Motors/pumps	13%

Equipment replacement/incorporation	13%
Refrigeration	16%
Equipment replacement/incorporation	20%
Good practices	12%
Operational controls	12%
Renewable energy incorporation as energy supply	15%
Biogas plant for self-consumption	8%
Solar energy for self-consumption	17%

Table 10. Average of energy saving (related to kWh/year)

Sectors	Energy saving average (electricity)	Energy saving average (thermal)
Dairy	23%	35%
Leather	35%	12%
Paper and cardboard	13%	2%
Processing and preserving of Fish	23%	20%
Textile - Dyeing	36%	20%
Meat	21%	2%
Grand Total	26%	19%

Taking into account the estimates on energy consumption baseline and the overall indicator of 26 %, the potential energy saving in 50 companies is 12,745 MWh/year which equivalents to 3,343 CO₂eq-ton/year⁵⁸.

Conclusion

The data collected and assessed during the PPG phase made it possible to identify the priority industrial sectors to be targeted. Priority will be given to companies that present significant improvement in terms of environmental impact, such as those with a high wastewater emissions and strong potential for energy savings. The project will also make efforts to have a representative distribution per region and among sectors in order to demonstrate the applicability of TEST to a variety of industries.

The information collected during the preparatory phase was informative to understand the distribution and composition of industries in the target industrial zones. However, it will be important to reconfirm this information during the project inception phase, supported by further monitoring and water quality analysis, in order to make the final selection.

⁵⁸ Using a emission factor of 0.2623 ton/MWh of electricity for Myanmar.

ANNEX O: CO-FINANCING LETTERS

Below are all the Project Co-finance letters, received to date, in order from first received to most recent.

1. Pylonechantha Trading Co., Ltd. (Individual Industry)



ပြည်လုံးချမ်းသာရောင်းဝယ်ရေးကုမ္ပဏီလီမိတက်
PYLONECHANTHA TRADING CO., LTD.

Office / Factory: No. 160, Twin Thin Tike Won U Tun Nyo Street, Industrial Zone (3), Insein Township, Yangon, Myanmar.
Tel : 95-1-618163 , 618611 , Fax : 95-1-618766 , E - mail : pylonechantha@mptmail.net.mm.

Date: 30 October 2018

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: *Co-financing commitment for the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment"*

Dear Mr. Scholtes,

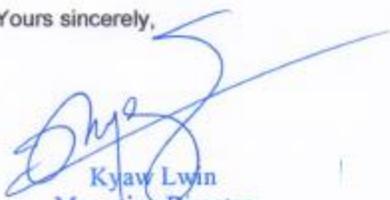
I am pleased to confirm that the Pylonechantha Trading Co., Ltd is fully committed to the success of the project "*Climate change mitigation through methane recovery and reuse from industrial wastewater treatment*" in Myanmar. This project forms an important part of Pylonechantha Trading Co., Ltd efforts in the implementation of activities in this area.

Our company is currently implementing 5 S (Kaizen) in our daily practices to prevent the pollution to the environment. We are fully understood that we must ensure pollution levels are not damaging to the health of the people or ecosystems. Moreover, it is our responsibility to plan and implement at all levels to promote the sustainable production, consumption and effective use of our natural resources. I am sure that this understanding will also trigger others participation in the project implementation.

Therefore, Pylonechantha Trading Co., Ltd confirms that co-financing in the amount of USD 300,000 (in the form of investment in GHG mitigation technology under Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach) has been made available for this UNIDO-GEF project in Myanmar.

On behalf of Pylonechantha Trading Co., Ltd, I hereby confirm the co-financing commitment to this project.

Yours sincerely,



Kyaw Lwin
Managing Director
Pylonechantha Trading Co., Ltd.

2. Department of Research and Innovation (DRI), Ministry of Education



THE GOVERNMENT OF THE REPUBLIC OF UNION OF MYANMAR
MINISTRY OF EDUCATION
DEPARTMENT OF RESEARCH AND INNOVATION
No.(6) KABA AYE PAGODA ROAD, YANGON

Director General : +95-1- 664930
Deputy Director General: +95-1- 663024
Director(Admin): +95-1- 663310
FAX: +95-1- 668033

Date: 9 November 2018

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: Letter of resource commitment (co-financing) for the implementation of "Climate change mitigation through methane recovery and industrial waste water treatment" in Myanmar

Dear Mr. Scholtes,

It is my pleasure to note that UNIDO and Department of Urban Housing and Development, Ministry of Construction has been completed the preparatory activities of the project "Climate change mitigation through methane recovery and industrial waste water treatment" with the funding support from Global Environment Facility (GEF).

We are currently operating National Analytical Laboratory with the objective to ensure and support the high-quality standard of manufacturing, economic and social sector by carrying out laboratory activities that are required. We are hoping that this National Analytical Laboratory would be great asset in project implementation. In addition, we have established Renewable Energy Training Center (RTC) to contribute knowledge, special skill and to come out technicians in renewable energy fields. It is also aimed to support the government policy to provide electricity and to eliminate poverty in rural areas. Moreover, we are also providing short term course on renewable energy such as solar, wind, micro-hydropower and biomass. Among them training course on "Technology and application of biomass energy" will be collaborated in the project activities. Thus, we are willing to support the activities under component 2: Pilot projects at company and industrial park level implemented applying UNIDO's Test integrated approach and output 1.1.2 National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane recovery power generation technology strengthened by TEST capacity building program.

On behalf of Department of Research and Innovation, I am pleased to commit our collaboration with GEF/UNIDO project in its implementation with the support of staff times, training activities and laboratory facilities which typically amounts to USD 1,500,000.

Yours sincerely,

U Win Khaing Moe
Director General
Department of Research and Innovation
Ministry of Education

3. Directorate of Industrial Supervision and Inspection (DISI), Ministry of Industry



Ministry of Industry
Directorate of Industrial Supervision and Inspection

Co-financier Letterhead

Date: 14th November 2018

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: *Letter of resource commitment (co-financing) for the implementation of "Climate change mitigation through methane recovery and industrial waste water treatment" in Myanmar*

Dear Mr. Scholtes,

Department of Industrial Supervision and Inspection (DISI), Ministry of Industry, is glad to note that UNIDO and Department of Urban Housing and Development, Ministry of Construction has been completed the preparatory activities of the project "Climate change mitigation through methane recovery and industrial waste water treatment" with the funding support from the Global Environment Facility (GEF).

DISI is leading in inspecting the industries for sustainable industrial development in preventing pollutions caused by industries to the environment. The government officials from the DISI are also delivering awareness raising workshops and trainings to the industries of industrial zones. Thus, we would like to confirm to participate in the project implementation as the project's objectives are complementary to the DISI's mandate and priorities. DISI will lead in the project implementation under the output 1.1.2, National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane recovery power generation technology strengthened by TEST capacity building program. In addition, DISI will support implementing project activities under output 2.1.1, Demonstration and investment in integrated wastewater treatment and biogas plants. DISI will also collaborate in organizing the trainings, calling the companies for the participation in the project. DISI has already allocated project office for the above-mentioned project.

In this regard, I hereby confirm DISI's co-financing contribution to the project as 1,620,322 USD in-kind.

Sincerely,

Daw Aye Aye Win
Director General
Directorate of Industrial Supervision and Inspection
Ministry of Industry

4. Myanmar Industries Association (MIA)



မြန်မာနိုင်ငံစက်မှုကုန်ထုတ်လုပ်သူများအသင်း
စွမ်းအင်နှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးအဖွဲ့
Cluster Group of Myanmar Industries Association (MIA)
Energy & Environmental Group (EEnG)
MIA Office, No.29 Min Ye Kyaw Swa Street, 5th Floor, UMFCCL Building, Yangon

Date: 03 December 2018

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: Letter of resource commitment (co-financing) for the implementation of "Climate change mitigation through methane recovery and industrial waste water treatment" in Myanmar

Dear Mr. Scholtes,

I am pleased to confirm that the Myanmar Industries Association (MIA) fully committed to the success of the project entitled "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment" in Myanmar. This project forms an important part of Myanmar Industrial Association (MIA) since MIA recognize the importance of sustainable industrialization in Myanmar and to prevent pollution caused by the industries to the ecosystem.

The Energy and Environmental Group which is one of the cluster group at MIA will be taking responsibility for cooperation with UNIDO.

Therefore, on behalf of EEnG (Energy & Environmental Group) at MIA, I confirm our full support and commitment in this project. We will ensure participation of the industries in the project implementation. In addition, we will support the project in selecting companies to be assessed on the TEST integrated approach under output 1 and by participating in the activities in pilot demonstration site. These activities in-kind are estimated to be equivalent to 1,000,000 USD.

Yours sincerely,

Htun Naing Aung
Chairman (Energy & Environmental Cluster Group)
Myanmar Industries Association

Copy to (1) Chairman, Myanmar Industries Association
(2) Office Receipt

5. Mandalay City Development Committee



The Government of Mandalay Region
Mandalay City Development Committee
Mandalay

No: 1001 / 1 / NKY(2971)

Date: December 7, 2018

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: Co-financing commitment for the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment"

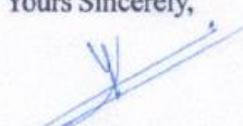
Dear Mr. Scholtes,

I am pleased to confirm that Mandalay City Development Committee (MCDC) is fully committed to the success of the project "*Climate change mitigation through methane recovery and reuse from industrial wastewater treatment*" in Myanmar.

This project is inline with MCDC mandate and priorities in controlling and preventing pollution caused by industrialization in the industrial zones of Mandalay City. Our focus is to upgrade Mandalay city to the smart city in Myanmar. Thus, we believe that UNIDO's aforementioned project activities would be of great assistance to our objective. We will work in collaboration with this project especially in capacity building and in the demonstration project sites. We have already allocated the area for the project site in Mandalay industrial zone. MCDC will also assign the necessary officials to work in project implementation. These contributions are estimated to be equivalent to 5,500,000 USD.

On behalf of Mandalay City Development Committee, I hereby confirm our full support and commitment to the success of aforementioned project and co-financing in the amount of 5,500,000 USD. Of the total amount, 4,000,000 USD is in the form of land upon which a waste water treatment facility can be constructed.

Yours Sincerely,


Dr. Ye Lwin

Mayor of Mandalay City

Mandalay City Development Committee

6. Department of Urban and Housing Development, Ministry of Construction



The Republic of the Government of the Union of Myanmar
MINISTRY OF CONSTRUCTION
Department of Urban and Housing Development

Office No.40, Nay Pyi Taw

Letter No: Admin/PRS/UNIDO/2019(0030)

Date : 15th January, 2019

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: Co-financing commitment for the project “Climate change mitigation through methane recovery and reuse from industrial wastewater treatment”

Dear Mr. Scholtes,

I am pleased to confirm that the Department of Urban Housing and Development (DUHD), Ministry of Construction is fully committed to the success of the project entitled “*Climate change mitigation through methane recovery and reuse from industrial wastewater treatment*” in Myanmar. This project forms an important part of DUHD’s efforts in upgrading existing industrial zone in Yangon. We have been actively involved in the project development and it is inline with the department’s mandate and priorities.

As the UNIDO-GEF project’s main government counterpart, DHUD confirms a contribution of co-financing to the amount of USD 2,000,000 in the form of 1) office space for the project management team 2) venues for hosting meetings and events 3) DUHD staff salaries/wages and time dedicated to the project.

On behalf of DUHD, I hereby confirm the co-financing commitment to this project as 2,000,000 USD (in-kind).

For and on behalf of Director General)
Dr. Than Than Thwe
Director
Department of Urban Housing and Development
Ministry of Construction

7. Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation

Government of the Republic of the Union of Myanmar
Ministry of Natural Resources and Environmental Conservation
Environmental Conservation Department

No. Pollution/Industry-4/General (69 /2019)

Date: ၁၇ February 2019

To:

Mr. Philippe Scholtes
Officer-in-Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF- Focal Point

Subject: **Letter of resource commitment (co-financing) for the implementation of “Climate change mitigation through methane recovery and industrial waste water treatment” in Myanmar**

Dear Mr. Scholtes,

It is my pleasure to note that UNIDO and Department of Urban Housing and Development, Ministry of Construction, has completed the preparatory activities of the project “Climate change mitigation through methane recovery and industrial waste water treatment” with the funding support from Global Environment Facility (GEF).

Environmental Conservation Department (ECD) has participated in the project development by providing endorsement letter since the project was in line with the department’s mandate and priorities.

On behalf of ECD, I am pleased to commit our collaboration with GEF/UNIDO project in its implementation with the support of human resource in terms of staff and their project-related tasks including their salaries, training activities and participation in providing technical assistance under output 1.1.1; wastewater regulatory framework reviewed, policy tools identified and introduced, and institutional capacity on sound wastewater management strengthened. Moreover, we will support the project activities under output 2.1.2 of demonstration and investment in the integrated wastewater treatment and biogas plants.

Letter from Environmental Conservation Department (ECD) continued.

2

Therefore, ECD confirms that co-financing with the amount of 1,000,000 USD in-kind has been made available for this UNIDO project in Myanmar.

On behalf of Environmental Conservation Department, I hereby confirm the co-financing commitment.

Sincerely yours,

Handwritten signature in Burmese script, slanted upwards to the right.

Hla Maung Thein (Mr.)
Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation

Tel (off): 95-67-431343

Fax: 95-67-431322

E-mail: dg.ecd@moecaf.gov.mm
hlamaungthein.env@gmail.com
www.ecd.gov.mm

8. Shwe Pyi Thar Industrial Zone Management Committee



ရွှေပြည်သာစက်မှုမြို့. ၊ စက်မှုမြို့.စီမံခန့်ခွဲရေးကော်မတီ

**အဖွဲ့ဝင်(၂+၃+၄)၊ ရွှေပြည်သာတံတားလမ်းနှင့် ဆူရင့်နောင်လမ်းထောင့်
ဇုန်-မြေခရေဂု၊ မြေခရေဂု၊ဇက်စ်-မြေခရေဂု**

Date: 24 January 2019

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: Letter of resource commitment (co-financing) for the implementation of "Climate change mitigation through methane recovery and industrial waste water treatment" in Myanmar

Dear Mr. Scholtes,

Shwe Pyi Thar Industrial Zone (2,3,4) management committee recognizing the importance of the accelerated development of industries in Myanmar, endeavors to prevent pollution caused by industries through collaboration between the government and the private industries. We are eager to implement waste and wastewater treatment activities in Shwe Pyi Thar Industrial zone (2,3,4) to promote the sustainable production practices and effective use of our natural resources. As the industrial zone is planning to upgrade the standardized industrial zone of Yangon City, we believe that this project will be assisting to fulfill our mandate.

On behalf of Shwe Pyi Thar Industrial Zone (2,3,4) Management Committee, I am pleased to confirm our full support and commitment to the success of the project entitled "Climate change mitigation through methane recovery and industrial wastewater treatment" in Myanmar. We will ensure participation of the industries in the project implementation. In addition, we will support the project by organizing and participating in the trainings, hosting the meetings and in selecting companies to carry out TEST integrated approach.

Of the total amount, 4,000,000 USD is provided in equity in the form of land upon which a waste water treatment facility can be constructed. This land will remain the property of Shwe Pyi Thar Industrial Zone. 1,000,000 USD will be in kind resources in the form of Shwe Pyi Thar Industrial Zone Management Committee's participation in other project activities.

Yours sincerely,

U Aye Ko
Chairman
Shwe Pyi Thar Industrial Zone (2,3,4)
Management Committee

9. High Win International Company Limited



HIGH WIN INTERNATIONAL COMPANY LIMITED

မြင့်မြတ်သောအောင်မြင်မှု အပြည်ပြည်ဆိုင်ရာကုမ္ပဏီလီမိတက်

NO 107-110, BAMAW AHTWINWUN ROAD, INDUSTRIAL ZONE (2), (39),
SETHMU QUARTER, SHWEPYITHA, YANGON, MYANMAR.

TEL : 09-799801660, FAX / TEL : 95-1-618058, E-mail : highwin.international@gmail.com

Date: 24 January 2019

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: Co-financing commitment for the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment"

Dear Mr. Scholtes,

I am pleased to confirm that the *High Win International Co.Ltd.* is fully committed to the success of the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment" in Myanmar. This project forms an important part of our efforts in the implementation of activities in this area.

We are fully understood that we must ensure pollution levels are not damaging to the health of the people or ecosystems. Moreover, it is our responsibility to plan and implement at all levels to promote the sustainable production, consumption and effective use of our natural resources. I am sure that this understanding will also trigger others participation in the project implementation.

Therefore, we confirms that co-financing in the amount of USD 30,000 (in the form of investment in GHG mitigation technology under Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach) has been made available for this UNIDO-GEF project in Myanmar.

I hereby confirm the co-financing commitment to this project.

Yours sincerely,

Than Than Htay
Manager
High Win International Co., Ltd.

ဒေါ်ဝေဝေကျွန်း (New Paper Mill)
အမှတ်(၁၀၉/၁၂၂) သံချက်ဝန်ဦးညွန့်လမ်းနှင့် ဝန်းမော်အတွင်းဝန်လမ်းထောင့်
စက်မှုဇုန်(၂)၊ ရွှေပြည်သာမြို့နယ်။

Date: 24 January 2019

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: *Co-financing commitment for the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment"*

Dear Mr. Scholtes,

I am pleased to confirm that the Daw Wai Wai Paper Mill is fully committed to the success of the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment" in Myanmar. This project forms an important part of our efforts in the implementation of activities in this area.

We are fully understood that we must ensure pollution levels are not damaging to the health of the people or ecosystems. Moreover, it is our responsibility to plan and implement at all levels to promote the sustainable production, consumption and effective use of our natural resources. I am sure that this understanding will also trigger others participation in the project implementation.

Therefore, we confirms that co-financing in the amount of USD 30,000 (in the form of investment in GHG mitigation technology under Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach) has been made available for this UNIDO-GEF project in Myanmar.

I hereby confirm the co-financing commitment to this project.

Yours sincerely,



Than Soe
Director
Daw Wai Wai Paper Mill

11. Sein Than Agro Industry Co. Ltd (STAI)



SEIN THAN AGRO INDUSTRY CO., LTD

No.17/18, 4th Floor, Room No(4), Bohosi Housing, (10) Ward,
Lanmadaw Township, Yangon, Myanmar.

Tel: 951225072, Fax: 951226654,

Email: atzseinthan@gmail.com, yanglanchaun@gmail.com

No.75/76, U PHO HLAING ROAD,

SHWE PYI THAR INDUSTRY ZONE (2), YANGON

Date: 24 January 2019

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: *Co-financing commitment for the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment"*

Dear Mr. Scholtes,

I am pleased to confirm that the *Sein Than Agro Industry Co., Ltd* is fully committed to the success of the project "*Climate change mitigation through methane recovery and reuse from industrial wastewater treatment*" in Myanmar. This project forms an important part of our efforts in the implementation of activities in this area.

We are fully understood that we must ensure pollution levels are not damaging to the health of the people or ecosystems. Moreover, it is our responsibility to plan and implement at all levels to promote the sustainable production, consumption and effective use of our natural resources. I am sure that this understanding will also trigger others participation in the project implementation.

Therefore, we confirms that co-financing in the amount of USD 30,000 (in the form of investment in GHG mitigation technology under Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach) has been made available for this UNIDO-GEF project in Myanmar.

I hereby confirm the co-financing commitment to this project.

Yours sincerely,

Manager.

S.T.A.I.

Approved by

12. Yangon City Development Committee

၈

Date: 12 March 2019

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject : Co-financing commitment for the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment"

Dear Mr. Scholtes,

I am pleased to confirm that Yangon City Development Committee (YCDC) is fully committed to the success of the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment" in Myanmar.

This project forms an important part of Yangon City Development Committee's mandate and priorities in controlling and preventing pollution caused by industrialization in the industrial zones of Yangon City. We are also expecting to strengthen the wastewater regulatory framework of Myanmar and we hope that the capacity of staffs in tackling issues connected with wastewater treatment will be improved. Moreover, YCDC could collaborate in conducting awareness raising activities for industries to improve their understanding of wastewater management and the consequences of water pollution.

On behalf of Yangon City Development Committee, I hereby confirm our full support and commitment to the success of UNIDO/GEF project. YCDC confirms its in-kind contribution to this project as 895,000 USD.

Sincerely,



U Cho Tun Aung
Head of Department
Pollution Control and Cleansing Department
Yangon City Development Committee



13. KBZ Bank



No.615/1, PYAY ROAD, KAMAYUT TOWNSHIP, YANGON, MYANMAR. Ph: 538 075-76, 538 078-80 Fax: 538 069-71 www.kbzbank.com

Date 4 Dec 2018

Mr. Philippe Scholtes
Officer in Charge
Programme Development and Technical
Cooperation Division (PTC)
UNIDO GEF Focal Point

Subject: Co-financing commitment for the project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment" in Myanmar

Dear Mr. Scholtes,

I am pleased to inform that KBZ Bank is in the process of operationalizing a number of activities and mechanisms to support green finance in Myanmar, including:

1. Providing loans to the SMEs under the category of SME Banking with the loan size of 10 million to 1,000 million MMK
2. Initializing to set-up green financing components

These mechanisms are available for applicable and qualifying demonstration projects under the UNIDO-GEF "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment" in Myanmar. KBZ Bank could contribute to the success of the project by providing loans to the companies under the definition of SME that are collaborating with aforementioned project.

On behalf of KBZ Bank, I hereby confirm the co-financing commitment to this project which complies with KBZ Bank's credit policy, procedures and practices.

Yours sincerely,

U Zaw Lin Aung
Managing Director
SME Banking Department
KBZ Bank

**To: Mr. Philippe Scholtes
Officer in Charge
Programme and Technical Development
Cooperation Division (PTC)
UNIDO GEF Focal Point**

Direct +31 (0)70 314 93 42
t.koper@fmo.nl

Anna van Saksenlaan 71
2593 HW The Hague - NL

P.O. Box 93060
2509 AB The Hague - NL

Commercial Register
The Hague 270 78 545

Date	Page
22 nd of July 2019	1/2

Subject: Expression of Interest for exploring possibilities to finance projects related to the UNIDO program of "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment" in Myanmar

Dear Mr. Scholtes,

We thank you for approaching us to assist you in the development of a financing structure for projects related to the UNIDO program of "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment" in Myanmar (the "Program").

FMO is the Dutch development bank. As a leading impact investor, FMO supports sustainable growth in developing countries and emerging markets by investing in ambitious projects and entrepreneurs. FMO believes that a strong private sector leads to economic and social development, and has a more than 45-year proven track-record of empowering people to employ their skills and improve their quality of life. FMO focuses on sectors that have high development impact. In addition, its NL business department specifically supports projects with a Dutch interest. With a committed portfolio of EUR 9.8 billion spanning over 92 countries, FMO is one of the larger bilateral private sector development banks globally. FMO was founded in 1970 and is a public-private partnership, with 51% of the shares held by the Dutch State and 49% held by commercial banks and other members of the private sector. FMO has an AAA rating from Fitch and Standard & Poor's.

Since 2011, FMO has been active in Myanmar, serving over 10+ private clients and currently engaging with the federal government in a loan for a drinking water supply project.

FMO, via the Project and Partnership Development team (PPD) within the NL Business (NLB) department, makes funds available for early stage project development in certain sectors aimed at contributing to the UN Sustainable Development Goals (SDGs). Funds are used to make projects bankable and bring them to financial close. FMO, has made available early development capital to World Wildlife Fund for Nature Netherlands (WWF-NL) in partnership with WWF-Myanmar to promote green technologies for industrial wastewater treatment and identify innovative investment options including private sector investment. The aim is to improve the treatment of industrial wastewater and reduce the discharge of pollutants in the Ayeyarawady river basin.

Page

2/2

Subject:

Expression of Interest for exploring possibilities to finance projects related to the UNIDO program of "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment" in Myanmar

The partnership with WWF-NL in this project is to create a pipeline of projects in Myanmar for potential Dutch industrial wastewater treatment exporters. This project could also result in to setting up the Greenlines facility (SME financing for green technology) of the FI department of FMO with local commercial banks in Myanmar.

FMO NL Business is willing to further look into the structuring of finance packages for projects in relation to the Program. FMO's interest is subject to a suitable credit risk structure and the availability of appropriate risk mitigants. FMO would be able to lend in euros, dollars or local currency and in general FMO NL Business focus is to provide facilities in the range of EUR 5 – 25 million (or the equivalent in USD or Myanmar Kyats). In addition, we can advise on possible ECA (Export Credit Agency) support by the Dutch ECA Atradius Dutch State Business in the form of credit insurance, which might help improve the structure and reduce financing cost. The interest of our NL Business department is subject to a Dutch contractor or supplier being involved in the implementation phase of the project

Indication of the cost of advising and structuring of any loan facility will be dependent on the project structure and has to be analysed at a later stage during project development, once the credit risk base is clearer.

Please note that this letter does not constitute, nor shall it be construed as a binding commitment from FMO. Any final commitment to provide financing for the Project is subject to i.a. satisfactory due diligence, client acceptance procedures, internal approvals and satisfactory documentation. This letter should therefore be treated as a basis for further discussions only and be treated with confidence.

We remain at your disposal for any further information. If further clarification and/or discussion is required, please do not hesitate to contact Tom Koper (t.koper@fmo.nl) or Pritha Hariram (p.hariram@fmo.nl).

We highly appreciate the opportunity of cooperating with UNIDO and look forward to discussing the financing of the Project in further detail.

Yours sincerely,

NEDERLANDSE FINANCIERINGS-MAATSCHAPPIJ
VOOR ONTWIKKELINGSLANDEN N.V.



Tom Koper
Associate
NL Business



Erwin Boon
Manager
NL Business

15. UNIDO co-financing letter



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

VIENNA INTERNATIONAL CENTRE

P.O. BOX 300, A-1400 VIENNA, AUSTRIA

TELEPHONE: (+43 1) 260 26 3690 FAX: (+43 1) 263 6849 www.unido.org unido@unido.org

13 March 2019

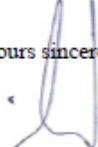
Dear Ms. Ishii,

Please refer to our submission to the GEF Secretariat for final review and approval of the CEO Endorsement Request for the GEF-6 project "Climate change mitigation through methane recovery and reuse from industrial wastewater treatment in Myanmar."

The project is closely aligned to the GEF focal area strategy under Climate Change Mitigation and supports CCM-1 to promote innovation, technology transfer, support policies and strategies and CCM-3 to demonstrate systemic impacts of mitigation options.

I am writing to confirm UNIDO's contribution in the amount of US\$ 40,000 in cash and US\$ 10,000 in-kind as co-financing this project.

Yours sincerely,



Philippe R. Scholtès
Managing Director
Programme Development and
Technical Cooperation

Ms. Naoko Ishii
Chief Executive Officer and Chairperson
Global Environment Facility
Washington, D.C. 20433
United States of America

ANNEX P – UNIDO TEST METHODOLOGY

The TEST (Transfer of Environmentally Sound Technology) methodology was developed by UNIDO in 2000 and first piloted through the GEF-funded project in the industrial hot spots of the Danube River Basin. Since then, TEST has been applied in several regions worldwide in industrial hot spots. The core of the TEST approach is that it allows the companies which apply it to identify and implement the full potential of resource efficiency in their operations, exploiting the full financial and environmental benefits arising from improvements. The potential to enjoy financial benefits is the key for convincing companies to pursue sustainable production beyond the life of a project. Convincing them of this can be achieved by:

- Revealing the actual costs of resource use inefficiencies in their production processes along with the associated pollution, by quantifying the costs of all materials that have not left the manufacturing site as a product, but have become so-called non product outputs (NPOs). The purchase costs of all NPOs are typically at least one order of magnitude higher than the average expenses for waste disposal and emissions treatment. However, the latter costs are more visible in a company's accounting system, while material losses are often not recorded in its information systems. The concept and the methodology to calculate NPO costs builds on the ISO standard 14051 on Material Flow Cost Accounting (MFCA);
- Setting priorities by linking company goals in area of productivity and environmental management with the use of raw materials, water, energy and the generation of major losses (waste and emissions) - and benchmarking a company's performance with international best practices for the industry sector (when available, benchmarks can often provide a preliminary indication of achievable improvements);
- Identifying and investigating in detail the leverage points (sources and causes of major losses and pollution) to gain an in-depth understanding of the factors influencing key resource/energy consumers within a process, thus focusing on the core problems;
- Using preventive techniques by challenging assumptions about the core process input needs when generating options for resource productivity and energy efficiency. This approach leads to the identification of an optimal set of measures with the least effort and highest benefits (see example in figure 1). The feasibility analysis of identified resource efficiency measures will incorporate economic savings associated with reducing the non-product output costs;
- Improving the information system on material and energy flows step-by-step, to allow regular monitoring of a company's performance through a set of indicators for important material and energy flows and productivity bottlenecks, enabling continuous generation of new resource efficiency opportunities.

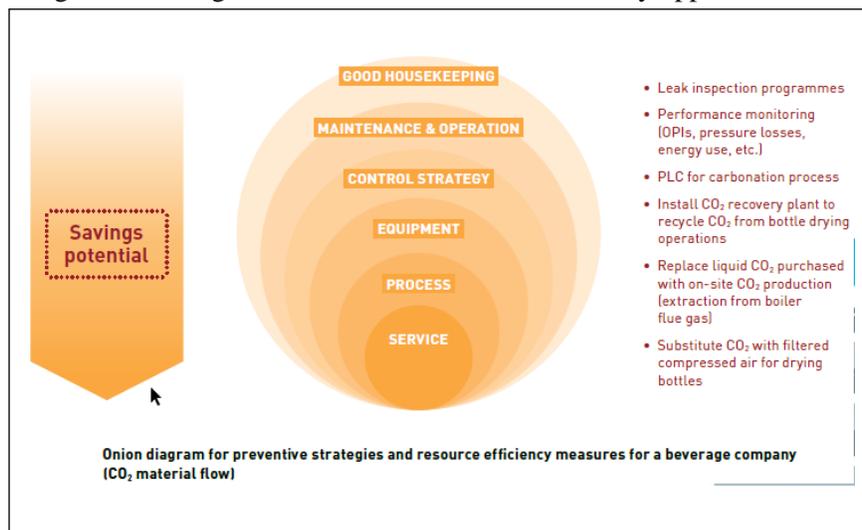


Figure 17: Preventative Strategies and Resource Efficiency Measures for a Beverage Company

The adoption of sustainable production strategies by companies needs the commitment and engagement of the different people who influence resource efficiency, not only inside an enterprise but also outside it (customers, suppliers, production managers, workers, etc.). Acknowledging this, the implementation of TEST has been structured into the four phases aligned to the learning cycle, also known as Deming cycle, used in the ISO standards. A company going through all the phases of the TEST cycle can initiate the required changes at each level of the management pyramid (fig. 2) to drive the process of continuous improvement of resource productivity patterns.

- **PLANNING** –Pushed forward by management leadership, enterprise values, policies and strategies are used to establish smart objectives, planning, and step-by-step assessment;
- **SUPPORT and OPERATION** - the necessary resources are provided and the actions are implemented;
- **PERFORMANCE EVALUATION** - the results of implementation are monitored and evaluated against smart objectives and indicators while performance is reviewed by the top management;
- **IMPROVEMENT** - Reflection on the experience gained at management level is used to update policies, strategies, or even business values - providing the basis for new planning and continuous improvement.

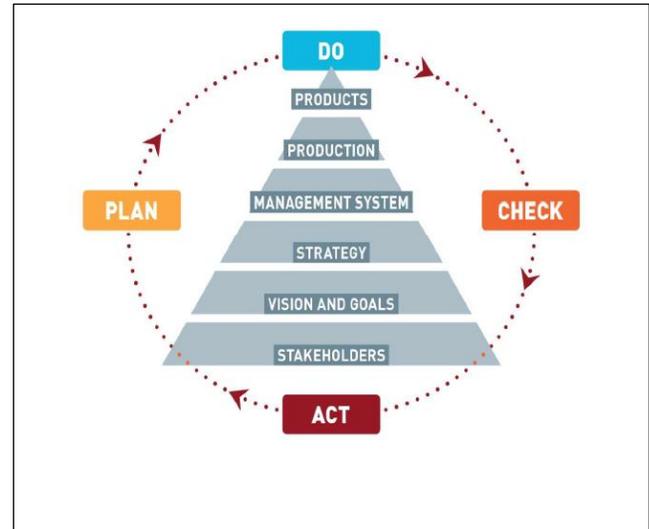


Figure 18: Plan-Do-Check-Act

TEST combines the essential elements of a set of tools for sustainable production, namely Resource Efficient and Cleaner Production Assessment (RECPA), Environmental Management Accounting (EMA)/Material Flow Cost Accounting (MFCA) and environmental and energy management systems (EMS/EnMS) within the framework of the learning cycle (Plan, Do, Check, Act). As a result of the customized integration and implementation of these tools and their elements, best practices, new skills and a new management culture are adopted, enabling the company to move forward toward more sustainable production business models.

At the centre of the TEST approach is the **Resource Efficient and Cleaner Production Assessment (RECPA)** tool, a step-by-step assessment of financially feasible options for improving the resource efficiency and environmental performance improvements of production systems. The core output of this tool is a portfolio of financially feasible solutions, including good housekeeping, operational control improvement, process and product modifications, eco-innovative technologies.

Elements of **Material Flow Cost Accounting (MFCA – ISO 14051 standard)** are built into steps of RECPA to strengthen priority-setting based on non-product output costs and to put in place ad hoc information and monitoring systems for the important material and energy flows as well as for key areas/processes where major losses and consumption are occurring. An MFCA-based information system is necessary for monitoring the performance of implemented measures and programs to demonstrate their real impact on medium to long-term decisions. It also enables accountability of enterprise staff, as well as monitoring and reporting actual company performance against baselines and targets set up within smart objectives and key indicators. An effective information system enables control of resource efficiency by linking consumption of priority flows (recorded within MFCA) to specific driving factors (for example volume of production which must be monitored separately). One of the best practices in this area is Monitoring and Targeting (M&T).

Core elements of **Environmental Management System (EMS)** and **Energy Management System (EnMS)** are used in TEST to integrate resource efficiency into the company's overall management systems, providing operating criteria and internal resources for ensuring that the outputs of improvement programs are implemented, sustained and further developed. EMS and EnMS which are designed in synergy with the implementation of CPA and MFCA tools have a solid foundation for leading companies toward continuous improvements in their production patterns.

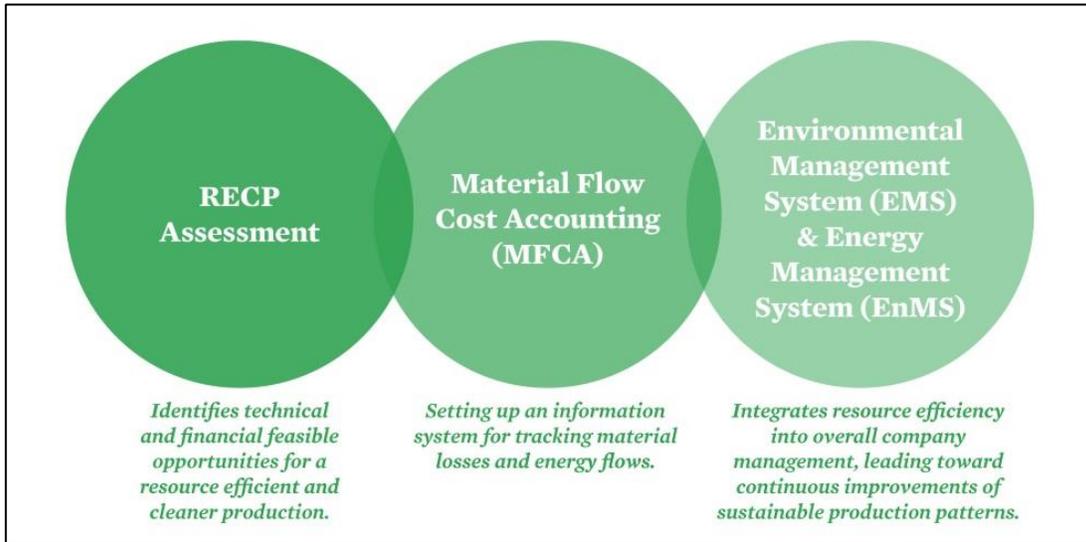


Figure 19: TEST Approach and Adoption of Environmental Processes

ANNEX S – DEPARTMENT OF URBAN AND HOUSING DEVELOPMENT AND– ENVIRONMENTAL
CONSERVATION DEPARTMENT (GEF OFP) LETTERS ON EXECUTING ARRANGEMENTS



The Republic of the Government of the Union of Myanmar
MINISTRY OF CONSTRUCTION
Department of Urban and Housing Development

Office No.40, Nay Pyi Taw

Letter No: Admin/PRS/UNIDO/2020 (039 A)

Date : 28th February, 2020

Mr. Phillippe Scholtes
UNIDO GEF-Focal Point
Officer-in-Charge
Programme Development and Technical Cooperation Division
United Nations Industrial Development Organization

Dear Mr. Scholtes,

The Ministry of Construction – Department of Urban Housing and Development (DUHD) and the United Nations Industrial Development Organizations have jointly developed the project “Climate change mitigation through methane recovery and reuse form industrial wastewater treatment in Myanmar” for submission to the Global Environmental Facility (GEF). The development of this project has been a collaborative effort which included extensive consultation with national stakeholders and potential execution partners, thus ensuring the strong commitment of the local stakeholders and the private sector to the objective of the project.

DUHD (Yangon region) expresses its commitment to take the role of Project Execution Entity and provide our technical and administrative capacities to augment the effective delivery of the project, specifically for the following outputs:

- Output 1.1.2: National capacity on industrial sustainable development, low-cost industry wastewater treatment and methane recovery power generation technology strengthened by TEST capacity building program
- Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions
- Output 2.1.2: Demonstration and investment in integrated wastewater treatment and biogas plants, including the delivery of procurement and monitoring support.
- Output 3.1.1: M&E mechanism developed and applied.
- Establishment of the Project Management Unit.

As the organization in charge of the execution of the Project Management Cost (PMC), DUHD will keep close communication with other execution entities involved in the project for efficient monitoring and reporting.

We look forward to hearing about the early approval of the project and continuing work closely with UNIDO. Thank you for your collaboration and support.

For and on behalf of Director General)
Dr. Than Than Thwe
Director
Department of Urban and Housing Development
Ministry of Construction



Government of the Republic of the Union of Myanmar
Ministry of Natural Resources and Environmental Conservation
Environmental Conservation Department

No. PCD – 4/ General (၂၀၂၀ /2020)

Date. ၂၀ April 2020

To

Mr. Phillippe Scholtes
UNIDO GEF Focal Point
Officer in Charge
Programme Development and Technical Cooperation Division
United Nations Industrial Development Organization

Subject: **Interest Letter for the Implementation of “Climate Change Mitigation Through Methane Recovery and Reuse from Industrial Wastewater Treatment in Myanmar” Project**

Dear Mr. Scholtes,

The Environmental Conservation Department (ECD) has participated in consultation efforts that the UNIDO and the Department of Urban Housing and Development (DUHD) of the Ministry of Construction, have jointly developed for the project “Climate Change Mitigation Through Methane Recovery and Reuse from Industrial Wastewater Treatment in Myanmar” Project, to be submitted to the Global Environmental Facility (GEF).

ECD expresses its commitment to take the role of Project Execution Entity and provide our technical and administrative capacities to augment the effective delivery of the project, specifically for the following outputs:

Output 1.1.1:Wastewater regulatory framework reviewed, policy tools identified and introduced, and institutional capacity on sound wastewater management strengthened and

Output 1.1.3:Awareness programs on sound wastewater management developed and implemented.

In accordance with our Government procedure, the Memorandum of Understanding (MoU) (or) Project Cooperation Agreement (PCA) either between ECD and UNIDO (or) triparties ECD, DUHD and UNIDO will be needed to sign for this cooperation. ECD will collaborate closely with the DUHD in the annual reporting of the project activities.

We look forward to hearing about the early approval of the project and continuing work closely with UNIDO.

Yours Sincerely,



(Hla Maung Thein)

Director General

Environmental Conservation Department

Ministry of Natural Resources and Environmental Conservation