



Climate Change Mitigation through Methane Recovery and Reuse from Industrial Wastewater Treatment

Part I: Project Information

GEF ID

9830

Project Type

FSP

Type of Trust Fund

GET

Project Title

Climate Change Mitigation through Methane Recovery and Reuse from Industrial Wastewater Treatment

Countries

Myanmar

Agency(ies)

UNIDO

Other Executing Partner(s):

Main Executing Partner: - Department of Urban Housing and Development Department (DUHD), Ministry of Construction, - Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation. Supporting Executing Partners: -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)

Executing Partner Type

Government

GEF Focal Area

Climate Change

Taxonomy

Climate Change, Focal Areas, Climate Change Mitigation, Energy Efficiency, Financing, Technology Transfer, Renewable Energy, Paris Agreement, United Nations Framework Convention on Climate Change, Influencing models, Transform policy and regulatory environments, Strengthen institutional capacity and decision-making, Stakeholders, Communications, Awareness Raising, Public Campaigns, Education, Civil Society, Academia, Beneficiaries, Private Sector, SMEs, Large corporations, Capital providers, Individuals/Entrepreneurs, Type of Engagement, Partnership, Consultation, Information Dissemination, Participation, Gender Equality, Gender Mainstreaming, Sex-disaggregated indicators, Gender results areas, Capacity Development, Participation and leadership, Knowledge Generation and Exchange, Capacity, Knowledge and Research, Innovation, Learning, Knowledge Generation, Training, Workshop, Seminar, Knowledge Exchange, Conference, Field Visit

Rio Markers

Climate Change Mitigation

Climate Change Mitigation 2

Climate Change Adaptation

Climate Change Adaptation 0

Duration

60In Months

Agency Fee(\$)

378,536

A. Focal Area Strategy Framework and Program

Objectives/Programs	Focal Area Outcomes	Trust Fund	GEF Amount(\$)	Co-Fin Amount(\$)
CCM-1_P1	Outcome A	GET	1,793,065	14,099,686
CCM-2_P3	Outcome B	GET	2,191,524	10,655,636
			Total Project Cost(\$)	3,984,589
				24,755,322

B. Project description summary

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 Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing(\$)	Confirmed Co-Financing(\$)
Component 1 - Policy framework and national capacity for water quality and wastewater management improved	Technical Assistance	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; 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; Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented;	GET	699,200	2,741,548

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing(\$)	Confirmed Co-Financing(\$)
Component 2 - Pilots at company and industrial park levels implemented applying UNIDO's TEST integrated approach	Technical Assistance	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; Output 2.1.2: Pilots and investment in integrated wastewater treatment and biogas plants	GET	2,895,647	19,645,709
Component 3: Monitoring and Evaluation	Technical Assistance	Outcome 3.1: Project achieves objective on time through effective monitoring and evaluation	Output 3.1.1: M&E mechanism developed and applied.	GET	200,000	1,458,065
Sub Total (\$)					3,794,847	23,845,322
Project Management Cost (PMC)						
				GET	189,742	910,000
Sub Total(\$)					189,742	910,000

Project Management Cost (PMC)

Total Project Cost(\$)	3,984,589	24,755,322
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C. Sources of Co-financing for the Project by name and by type

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Amount(\$)
Government	DUHD	In-kind	2,000,000
Government	ECD	In-kind	1,000,000
Government	DRI	In-kind	1,500,000
Government	DISI	In-kind	1,820,322
Government	MCDC	In-kind	1,500,000
Government	MCDC	Equity	4,000,000
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	Pyilonechantha 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	Grant	40,000
GEF Agency	UNIDO	In-kind	10,000

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Amount(\$)
Government	YCDC	In-kind	895,000
Donor Agency	FMO	Loans	5,600,000
Total Co-Financing(\$)			24,755,322

Agency	Trust Fund	Country	Focal Area	Programming of Funds	NGI	Amount(\$)	Fee(\$)
UNIDO	GET	Myanmar	Climate Change		No	3,984,589	378,536
Total Grant Resources(\$)						3,984,589	378,536

E. Non Grant Instrument

NON-GRANT INSTRUMENT at CEO Endorsement

Includes Non grant instruments? **No**

Includes reflow to GEF? **No**

PPG Required

PPG Amount (\$)

PPG Agency Fee (\$)

Agency	Trust Fund	Country	Focal Area	Programming of Funds	NGI	Amount(\$)	Fee(\$)
UNIDO	GET	Myanmar	Climate Change		No	125,000	11,875
Total Project Costs(\$)						125,000	11,875

Core Indicators

Indicator 6 Greenhouse Gas Emissions Mitigated

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO ₂ e (direct)	0	282494	0	0
Expected metric tons of CO ₂ e (indirect)	0	847481	0	0

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

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO ₂ e (direct)				
Expected metric tons of CO ₂ e (indirect)				
Anticipated start year of accounting				
Duration of accounting				

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

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO ₂ e (direct)		282494		
Expected metric tons of CO ₂ e (indirect)		847481		
Anticipated start year of accounting		2025		
Duration of accounting		20		

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

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

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

Technology	Capacity (MW) (Expected at PIF)	Capacity (MW) (Expected at CEO Endorsement)	Capacity (MW) (Achieved at MTR)	Capacity (MW) (Achieved at TE)
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Indicator 11 Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment

	Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)
Female		2,163		
Male		3,722		
Total	0	5885	0	0

PART II: Project JUSTIFICATION

1. Project Description

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 CO2e)	PIF Stage	CEO Endorsement Stage	Comments / Rational for changes
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Direct	140,000 (14,000 ton/year)	282,494 (14,124 ton/year)	<p>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[1]¹.</p> <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.

	<p>Output 1.1.1: Wastewater regulatory framework reviewed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened.</p>		<p>Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened;</p>	<p>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 at component 2, as one of the crucial initial steps to develop pilot projects and generate 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 with a strong lead of governmental agencies.</p>
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	<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 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</p>
	<p>Output 1.1.3.: National capacity increased on low-cost industry wastewater treatment and methane harnessing technology through TEST training delivery.</p>		<p>Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented</p>	<p>Output 1.1.3 of the CEO endorsement document keeps goals and activities of output 1.1.4 as outlined in the PIF.</p>

	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 Evaluation	Outcome 2.1: Project objective achieved on time through effective monitoring and evaluation		Output 2.1.1: Companies located within industrial zones assessed with the TEST integrated approach to improve their environmental performance and reduce GHG emissions	This new output takes the original target of 50 companies in the original PIF for implementing 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.	

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

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 area[1] 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;

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 waterways[1]. 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 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 Mandalay^[2].
- **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 2014^[3]. 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 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.

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

[2] 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.

[3] Source: <https://tradingeconomics.com/myanmar/gdp-growth-annual>

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 vehicles[1].

Based on 2016 estimates, industry accounts for 27.5% of Myanmar's GDP[2]. Economic growth is expected to be rapid, GDP growth is expected to average 7.2% a year in 2018-22[3]. According to the Economist Intelligence Unit, Industry is expected to contribute 9.1 % GDP growth in 2018 and 8.6% in 2019[4]⁴.

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)[5]⁵.

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.

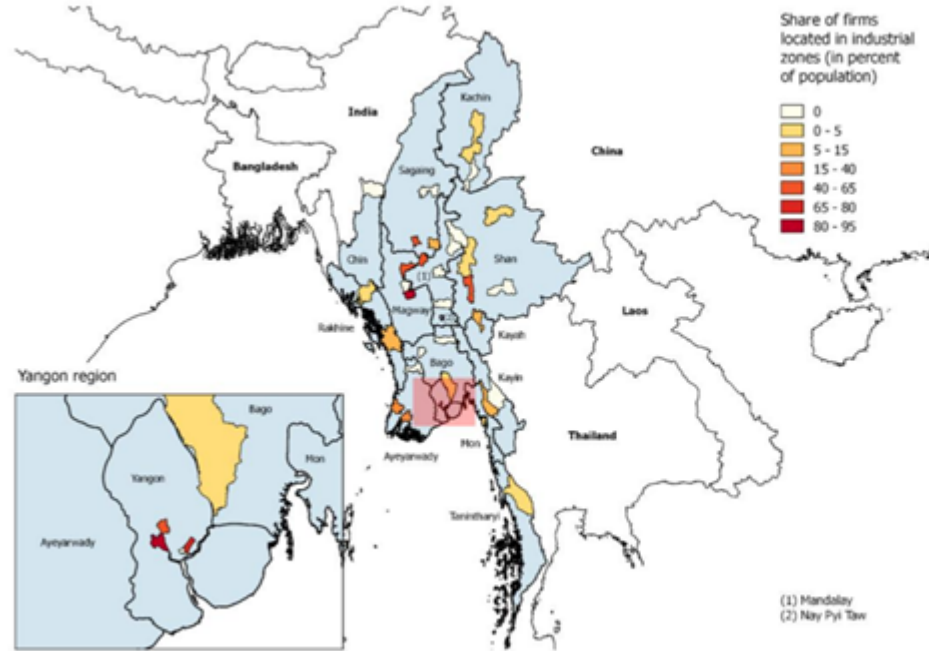
[1] See: <http://www.nationsencyclopedia.com/Asia-and-Oceania/Myanmar-INDUSTRY.html>

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

[3] See: <http://country.eiu.com/Myanmar>

[4] See: <http://country.eiu.com/Myanmar>

[5] 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 factories[1] 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.[2] 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 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 Myanmar[3]. The survey area includes 6 Industrial Zones in Yangon (Hlaing Tharyar, Shwe Linban, Shwe Pyi Thar, Wataya, Shwe Than Lwin and Ngwe Pinlal) 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 health[4]. 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)[5] in Yangon and Mandalay.
- 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)[6]⁶ and Chemical Oxygen Demand (COD)[7]⁷.
- 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:
 - o High cost of technology and wastewater treatment facilities.
 - o 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).
 - o Lack of technical and financial expertise (in-house and external) to put in place the best suitable technology.
 - o Unrealistic regulation: many factories may not be able to satisfy the NEQEG (2015) requirements.

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.

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

[2] Source: Ministry of Industry (1), Directorate of Industrial Supervision and Inspection.

[3] 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”

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

[5] 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.

[6] 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.

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

- 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).

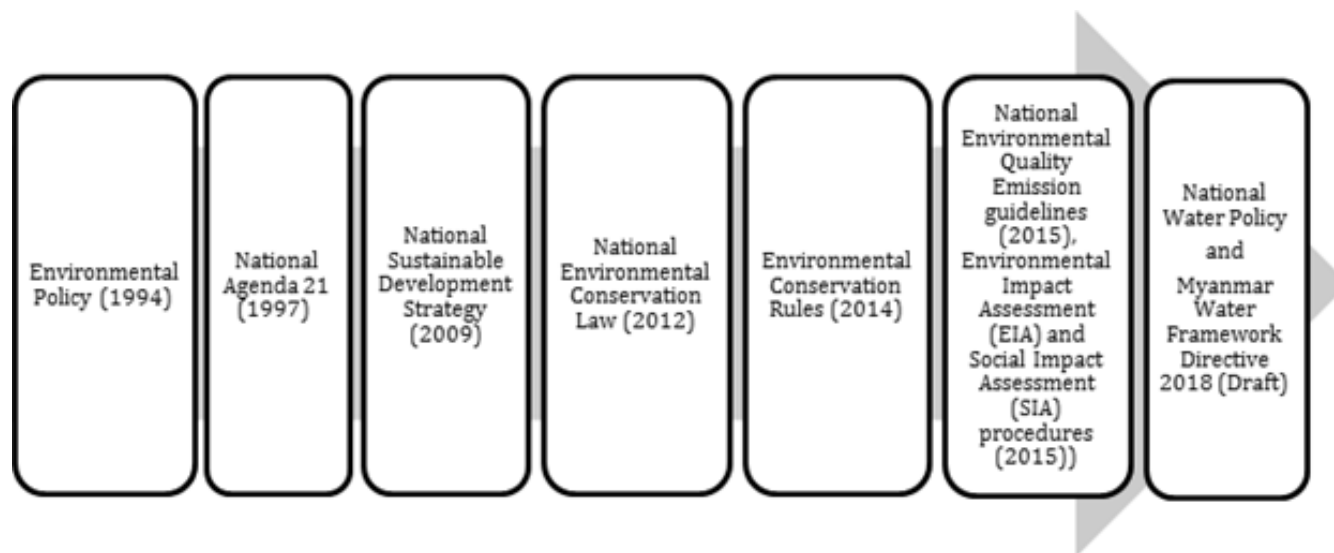


Figure 2: National Environmental Policies and Laws

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 MOECAP, 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)
§ MCDC Law 2015 (Jan 12) § MCDC Environmental Conservation and Cleansing bylaws 2015 § The City of Mandalay Development Law 2002	§ 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	§ NDC Pollution Control and Cleansing Department bylaws § NDC Water and Sanitation Department bylaws § The Nay Pyi Taw Development Law 2009

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%^[18] 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)^[19]. 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.^[20]¹⁰

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)[1]” 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/MAP[2]-SCP/RAC[3] and UNEP-DTIE[4] 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 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.[\[5\]](#)

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, 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.[\[6\]](#)

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.[7]

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.

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.

[1] UNEP/MAP initiative <http://www.medpartnership.org/>

[2]Mediterranean Action Plan for the Barcelona Convention

[3] Regional Activity Centre for sustainable consumption and production – linked to UNEP/MAP

[4] Division of technology, industry and economics, now Economy Division

[5]Source: <http://myanmar-waterenvironment.com/index.php/en/project/>

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

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

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:

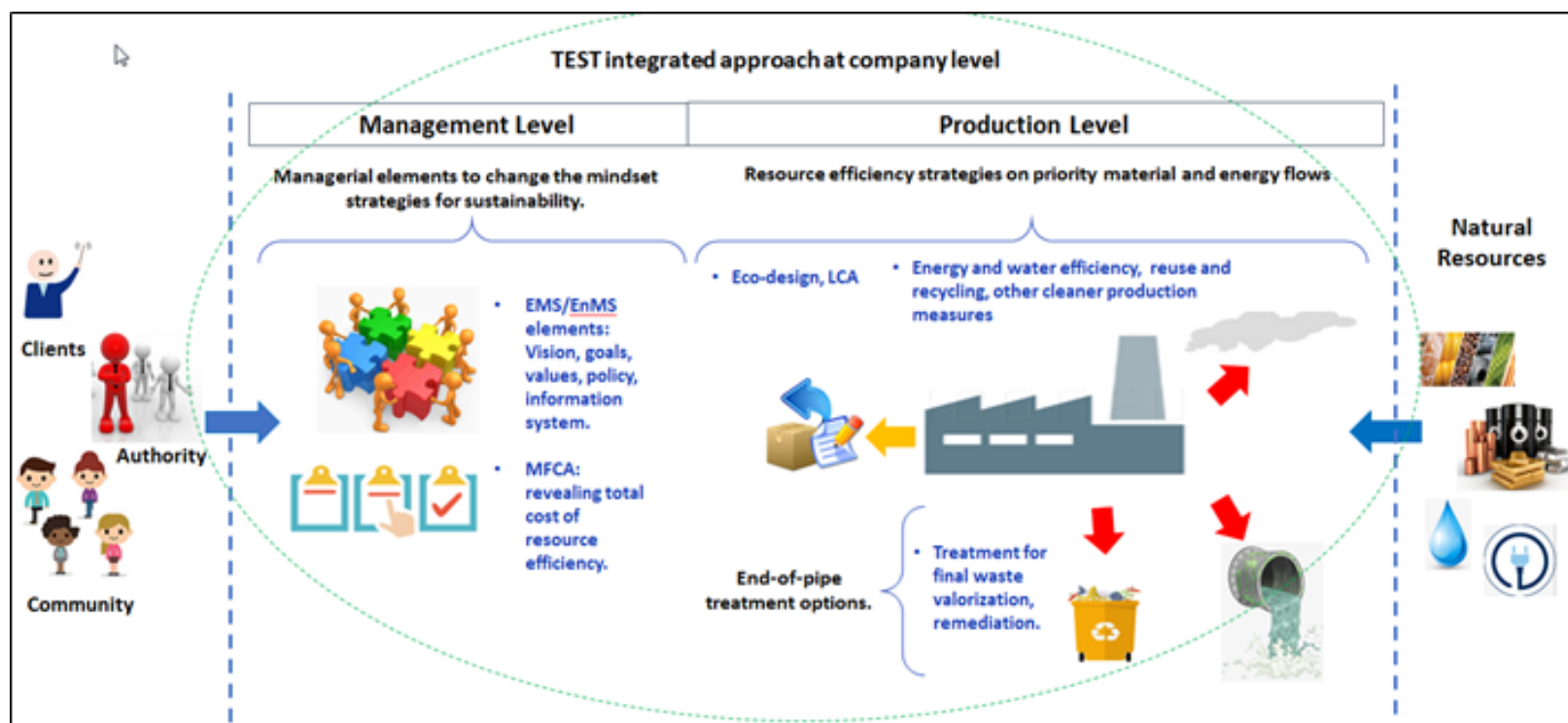


Figure 3: TEST Integrated Approach at Company Level

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.

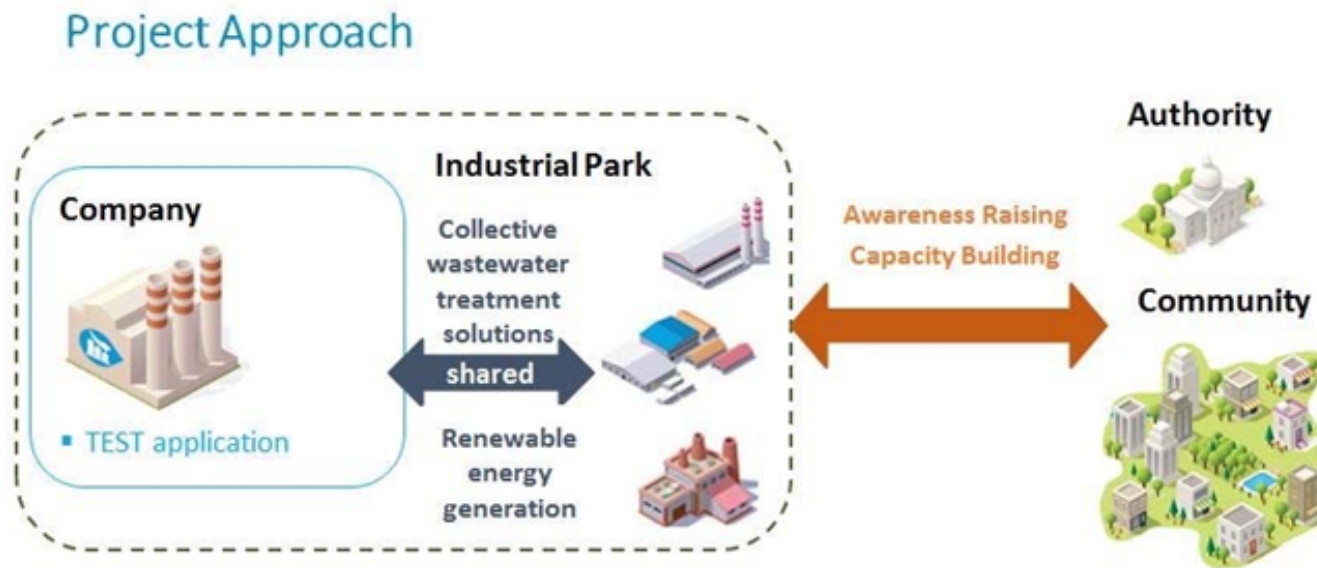


Figure 4: Project Approach

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 environment[1]. However, industrial zones development is still a core strategy for industrialization in Myanmar with a threefold objective[2]: 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 2015[3] by subsector and size

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%	
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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 ECD[4], 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.
 - o Total of industries (for 3 IZs): 1,140
- Mandalay region:
 - o 1) Pyi Gyi Tagon
 - o 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-dying, 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.

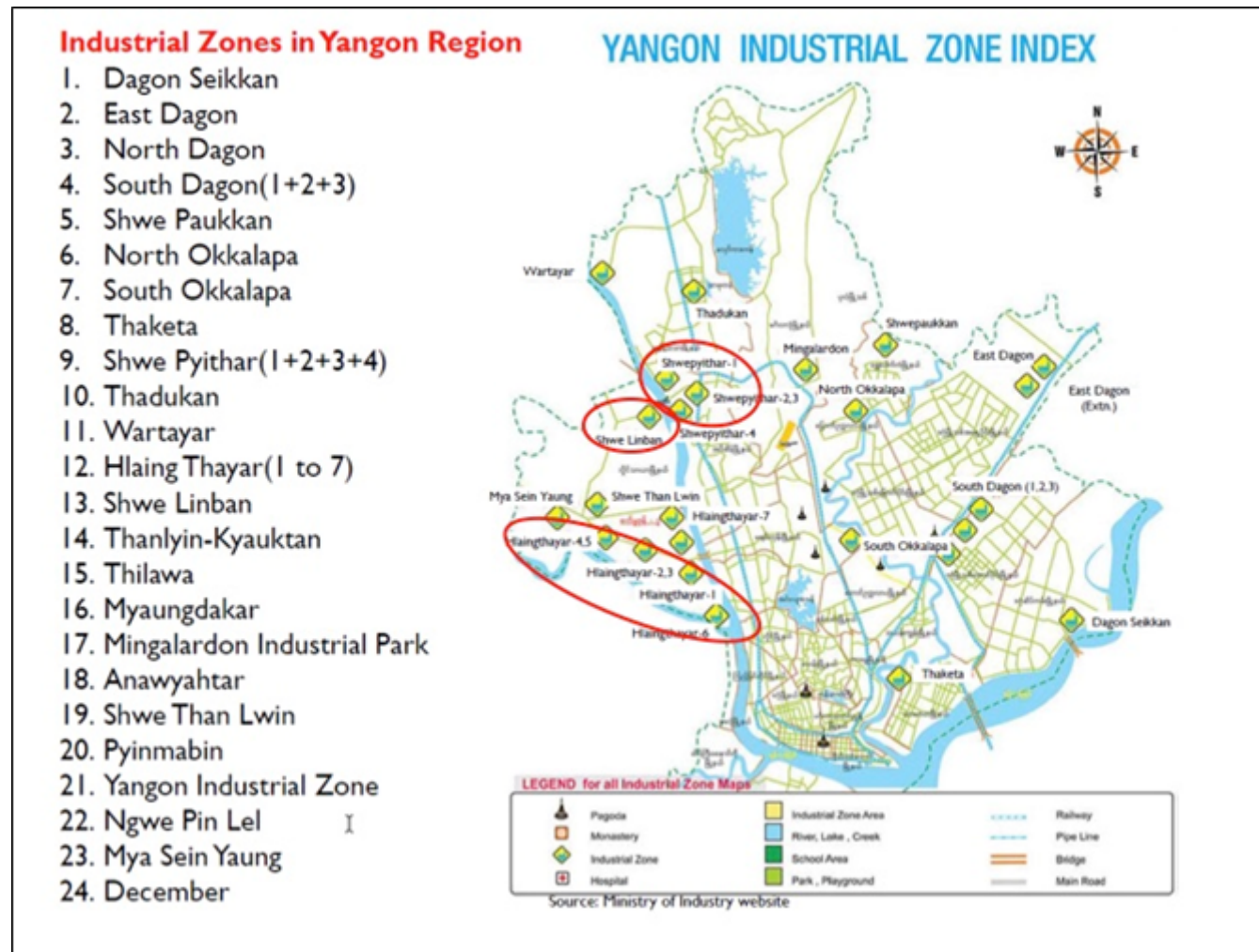


Figure 5: Map showing location of proposed Yangon industrial zones

Ø 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 6: Map of Shwe Lin Ban Industrial Zone

Ø Shwe Pyi Thar Industrial Zone

The Shwe Pyi Thar industrial zone is comprised of three industrial areas which are Shwe Pyi Thar industrial zone 2, 3 and 4. The zone has been in operation since 1998. The land area is 988 acres in which 196 factories are operating. The factories mainly produce food and beverage, consumer goods, construction materials, garment and furniture. The sector of industry in Shwe Pyi Thar industrial zone is shown in the graph below.

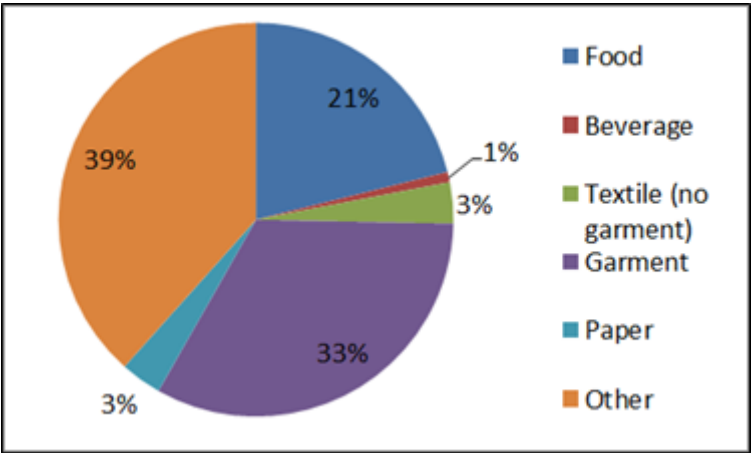


Figure 7. Distribution of companies by sectors Shwe Lin Ban



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

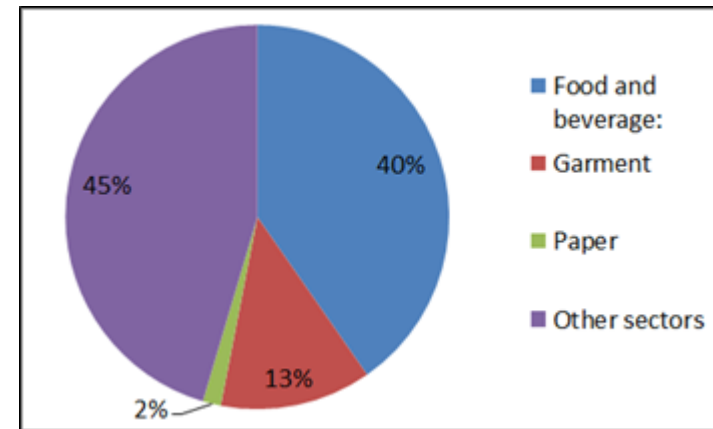


Figure 7b: Industry Sector and number of companies in Shwe Pyi Thar Industrial Zone

Ø 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)

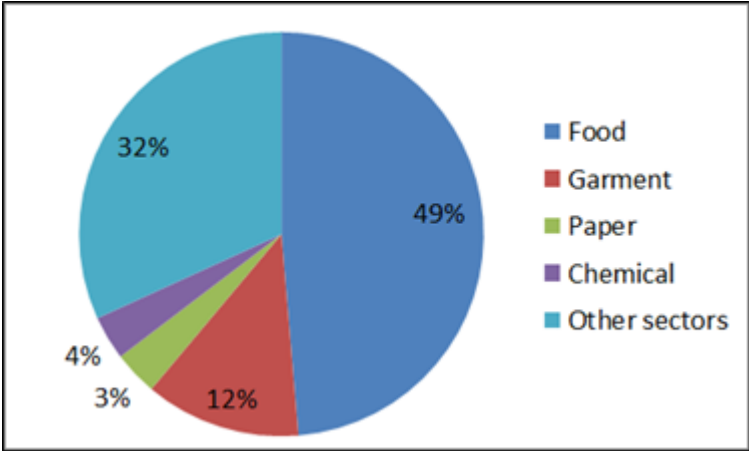


Figure 9: Industry Sector and number of companies in Hlaing Tharyar Industrial Zone (1,2,3,4)

Selected industrial zones in Mandalay

Ø 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.

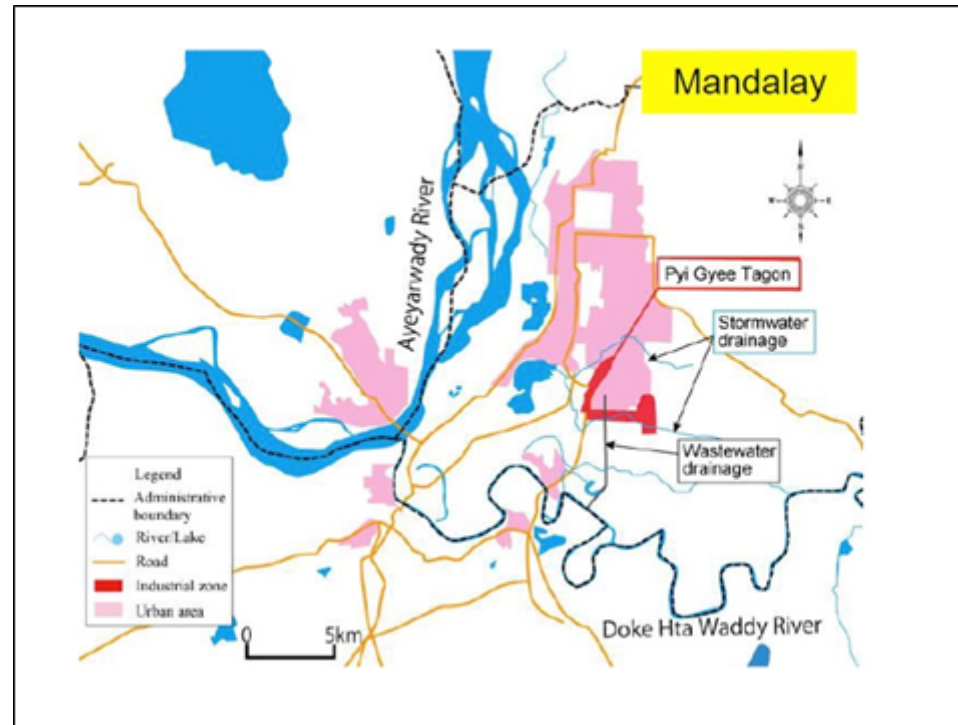


Figure 10: Map showing the location of Pyi Gyi Tagon industrial zone in Mandalay

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

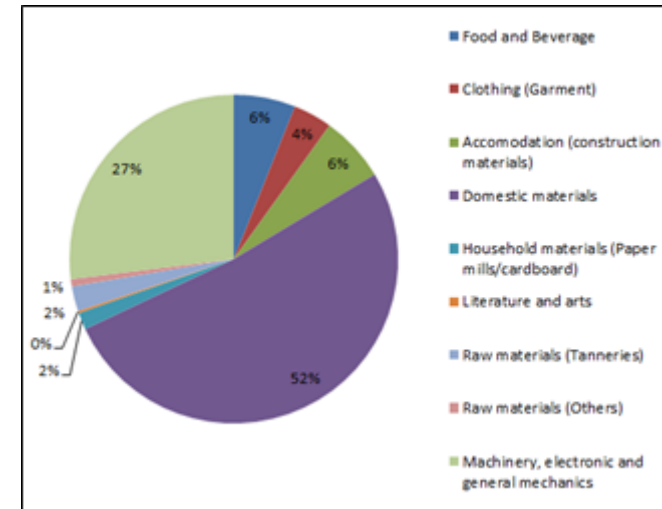


Figure 12: Industry sector and number of companies in Pyi Gyi Tagon industrial zone

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

[2] Source: Private Industrial Enterprise Law of 1990. Myanmar.

[3] Source: Ministry of Industry (2015)

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

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 14: Project Components

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

[2] Source: Private Industrial Enterprise Law of 1990. Myanmar.

[3] Source: Ministry of Industry (2015)

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

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 administration[1].

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 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.

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

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 zones[1]. 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 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 MCDC[2], 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.
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.

[1] See more details in annex N, section 2.

[2] 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).

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 biodigester 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 Environment 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 adaption 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, 3,286[4] 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.[5] 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.

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

[2] See more details in annex N, section 2.

[3] 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).

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

[5] Source: <https://tradingeconomics.com/myanmar/gdp-growth-annual/forecast>

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.

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 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.

Documents

Title	Submitted
ANNEX M - Enviromental and Social Management Plan (updated)	
ANNEX M - Environmental and Social Management Plan	

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.

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	<p>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.</p>
EU	<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.</p>

FMO	<p>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.</p>
World Bank Office Myanmar	<p>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.</p>
Asia Development Bank Office Myanmar	<p>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.</p>
Small and Medium Enterprise Development Bank (SMEDB)	<p>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.</p>

Myanmar Economic Bank (MEB)	<p>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.</p> <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)	<p>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.</p>
Myanmar Investment and Commercial Bank (MICB)	<p>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.</p>
Kan Baw Za Bank (KBZ)	<p>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.</p>
Other sectorial industry organizations	
Myanmar Food Processors & Exporters Association (MFPEA)	<p>MFPEA was founded on 21st 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.</p>

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 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>
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>

Select what role civil society will play in the project:

Consulted only;

Member of Advisory Body; Contractor; Yes

Co-financier; Yes

Member of project steering committee or equivalent decision-making body;

Executor or co-executor; Yes

Other (Please explain)

A.4. Gender Equality and Women's Empowerment

Please briefly include below any gender dimensions relevant to the project, and any plans to address gender in project design (e.g. gender analysis).

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 favor, 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 training 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 specific cities.

Documents

Title

Submitted

Title

Submitted

ANNEX R - Gender Analysis Report_Myanmar

Does the project expect to include any gender-responsive measures to address gender gaps or promote gender equality and women empowerment?

Yes

If yes, please upload document or equivalent here

Please refer to Annex R

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 Yes

Generating socio-economic benefits or services or women Yes

Will the project's results framework or logical framework include gender-sensitive indicators?

Yes

Please refer to Annex A.

A.5. Risks

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.

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
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Risk	Rating	Mitigation
Technical risk Lack of awareness about opportunities for adopting sound environmental technologies	Low-medium	<p>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.</p> <p>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.</p>
Construction risk Negative construction, operation, and decommissioning phase impacts and technology failure	Low-medium	<p>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 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.	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.</p> <p>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>
Climate change Risk/Infrastructure developed is vulnerable to climate change risks	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.</p> <p>While the infrastructure to be developed under the proposed project could potentially be vulnerable to climatic 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>

Risk	Rating	Mitigation
<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.</p> <p>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 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. 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. 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. 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. DUHD 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 OFP), 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		
Output 1.1.1: Wastewater regulatory framework assessed, policy tools identified and drafted, and institutional capacity on sound wastewater management strengthened	Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation	<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
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.	Department of Urban and Housing Development (Yangon office), Ministry of Construction	<ul style="list-style-type: none"> - Department of Industrial Supervision and Inspection, Ministry of Planning, Finance and Industry - Environmental Conservation Department - Myanmar Industries Association
Output 1.1.3: Awareness raising programs on sound wastewater management developed and implemented	Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation	<ul style="list-style-type: none"> - Department of Industrial Supervision and Inspection, Ministry of Planning, Finance and Industry - Department of Urban and Housing Development - Yangon City Development Committee - Mandalay City Development Committee

<p>Output 2.1.1:</p> <p>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:</p> <p>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 - Environmental Conservation Department

The Project management structure is presented in the figure below.

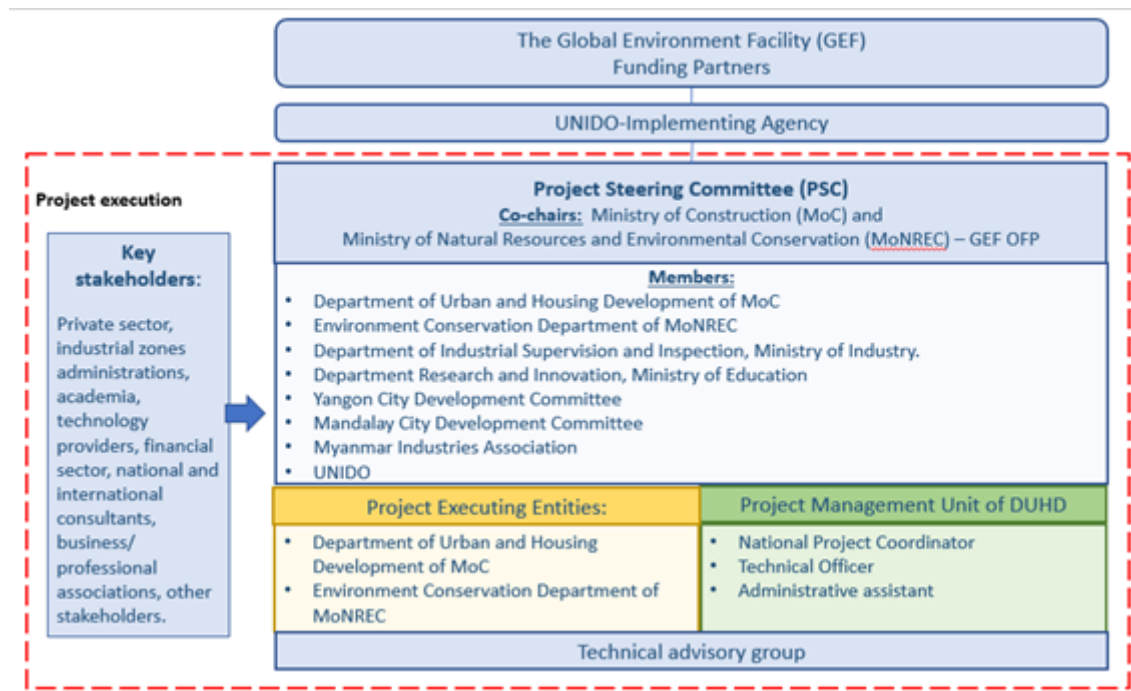


Figure 14: Project Management Structure

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
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<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 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>
<p>Projects implemented by other entities/agencies related to biogas and waste water</p>	

<p>The EU and WWF</p> <p>Tha Bar Wa Project</p>	<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>2) ADB led-Greater Mekong Sub region (GMS) Core Environment Program (CEP)</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 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.</p>

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.
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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 adaptaion benefits (LDCF/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 component^[1]. 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 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.

^[1] www.switchmed.eu/en/corners/service-providers/actions/MED_TEST_II_progress

B. Description of the consistency of the project with:

B.1. Consistency with National Priorities

Describe the consistency of the project with nation 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, INDCs, 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 10. 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 11: 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

GEF Agency Coordinator	Date	Project Contact Person	Telephone	Email
Mr. Philppe Sholtés, Managing Director, Programme Development and Technical Cooperation - PTC, UNIDO GEF Focal Point		Ms. Carolina Gonzalez Mueller, Project Manager		c.gonzalez- mueller@unido.org

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					
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					
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”					
Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
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.	GHG emission reduction due to implementation of TEST and low carbon wastewater treatment technology.	Low or no wastewater treatment technology used in industrial zones leading to high intensity of GHG emissions from industrial wastewater. Limited technology development in SME and large companies reduces growth opportunities and increase negative environmental impact. Weak policy framework related to environmental regulations, industrial zone planning and incentives.	Direct GHG reduction: 343,825 metric tons of CO _{2eq} for 20-year projection.	Project's annual reports Project's final report Project midterm review and terminal evaluation reports	<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. <u>Risks:</u> - 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.					

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
<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> <ul style="list-style-type: none"> - 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 <u>Risks:</u> <ul style="list-style-type: none"> - Change of government policy and its priority of environmental issues caused by the industrial development.
	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	
	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	

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
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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> <ul style="list-style-type: none"> - Willingness of key stakeholders, for example industry representatives, local experts, local authority's officials, etc., to attend training activities. - Willingness of private sector to share information and participate in training programs. - Accessibility of internet and digital technology supporting the access to online information-sharing tools. <p>Risks:</p> <ul style="list-style-type: none"> - Lack of availability or interest of government officials and representative from industrial sectors to attend the number of training days.
	<p>Number of participants (disaggregated by gender) from industry and key stakeholders attending training on introduction of the TEST integrated approach and RECP.</p>	<p>Companies have little understanding of the benefits of TEST and RECP application and its relationship with wastewater treatment and biogas technologies.</p>	<p>At least 100 participants from manufacturing sector, business associations, industrial zones management, city development committees and related professionals. 70 % men; 30% women.</p>	<p>Training report</p> <p>Attendance list of participants.</p>	

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	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 and MCDC attending technical training on planning for climate change.	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 Attendance list of participants.	

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	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
	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	

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	Number of training material on the TEST approach and sound wastewater management to be used in universities and/or technical schools for vocational training.	Scarcity of knowledge and skills of local engineers and companies to tackle the issue of wastewater treatment.	1 training manual on TEST and sound wastewater management for use in relevant vocational training centres and institutes.	Training manual elaborated.	the results of the TEST demonstration projects. - 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.	Assumptions: - Positive economic growth in industrial sector motivates investment. - Increasing of environmental enforcement engages industrial sector to improve environmental performance. - Willingness of private sector to invest in recommended RECP measures. - Environmentally sound technology is available for Myanmar industrial sector. - Financial institutions have interest to finance environmentally sound technology. Risk:
	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	Little investment opportunities	At least 15 companies carry	Feasibility study reports.	

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	with feasibility studies to request access to financial mechanisms for RECP investments.	on environmentally sound technologies identified, evaluated and demanded by the private sector. Limited access to financial mechanisms to develop investment projects on environmentally sound technologies	out feasibility studies and request finance support for RECP investments.	Meeting minutes with financial institutions to promote RECP investments.	<ul style="list-style-type: none"> - Lack of technical and economic resources in companies to carry out the demonstration projects. - 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.	<p>Assumptions:</p> <p>Industrial zones management and industries with relevant discharges into these zones have interest and readiness to implement a wastewater quality monitoring program.</p> <p>Risks:</p> <p>Infrastructure conditions restrict data collection in relevant monitoring site.</p> <p>Limited internal capacity on wastewater management at industrial zones hinder the continued application of the wastewater quality monitoring program.</p>

Project Narrative	Indicator	Baseline	Target	Source of Verification	Assumptions/Risks
	Number of technical and financial feasibility studies conducted to evaluate the implementation of pilot projects on wastewater treatment applying methane recovery for energy generation (electricity or heating).	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: 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.

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

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
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Comments	UNIDO responses
Is the PIF being recommended for clearance and PPG (if additional amount beyond the norm) justified?	
MO July 6, 2017 All comments cleared. Program manager recommends PIF clearance. Cost-efficiency is still low. Please improve during project preparation period.	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.

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GEF STAP comments at PIF stage and response at PPG

Comments	UNIDO responses
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.	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.

Comments	UNIDO responses
<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 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>Nitrous oxide (N₂O) emissions from wastewater treatment plants vary substantially between plants, ranging from negligible to substantial (a few per cent of the total 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.^[1] 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>

Comments	UNIDO responses
<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 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>

Comments	UNIDO responses
Reductions of 140 kt CO ₂ -eq are projected with a further 56 – 210 kt CO ₂ -eq avoided from indirect emissions (Table in Section F). However, Section 5 when quoting these same numbers only discusses CO ₂ reductions from 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 CO ₂ -equivalent.	At the PIF stage it was not possible to assess avoided methane and NO ₂ . During project preparation pre-feasibility has been undertaken avoided methane has been calculated using approved consolidated baseline and 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.

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 component 2 for financing both TEST and wastewater treatment plants.</p>

Comments	UNIDO responses
<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>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>	<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> <p>-</p>

[1] 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.

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

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

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

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

N/A

ANNEX E: GEF 7 Core Indicator Worksheet

Use this Worksheet to compute those indicator values as required in Part I, Table G 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	
		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
		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
		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
		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)					(Hectares)
		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				(Hectares)
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					(Tons)
		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					
		Technology	Capacity (MW)			
			Expected		Achieved	
			PIF stage	Endorsement	MTR	TE
Core Indicator 7	Number of shared water ecosystems (fresh or marine) under new or improved cooperative management					(Number)
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					(Tons)
			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					(Tons)
		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	
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		
				<i>Total</i>		

ANNEX: Project Taxonomy Worksheet

Use this Worksheet to list down the taxonomic information required under Part1 by ticking the most relevant keywords/topics//themes that best describes the project

Please refer to Annex F. Attached document



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