Independent mid-term review

KINGDOM OF CAMBODIA

Climate change related technology transfer for Cambodia: Using agricultural residue biomass for sustainable energy solutions

UNIDO project No.: GF/CMB/12/002
UNIDO SAP ID: 100223
GEF project ID: 4042

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This report has been prepared for UNIDO for the independent mid-term review of UNIDO GEF project Climate change related technology transfer for Cambodia: Using agricultural residue biomass for sustainable energy solutions (UNIDO project No. GF/CMB/12/002 - SAP 100223; GEF ID 4042) in the Kingdom of Cambodia

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ABBREVIATIONS

ASEAN	Association of South East Asian Nations
AWP	Annual work plan
CCD	Climate Change Department (under MoE)
CDM	Clean development mechanism
COMFAR	UNIDO's Computer Model for Feasibility Analysis and Reporting
CTA	Chief technical advisor
DO	Diesel oil
EDC	Electricite du Cambodia
EED	Energy Efficiency Department (under MoME)
EMS	Environmental management system
EOP	End of project
ESCO	Energy service company
FiT	Feed in tariff
FSP	Full Scale Proposal
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas
GJ	Gigajoules
HQ	Headquarters
HUO	Head of UNIDO operations in Cambodia
IBR	International Boiler Regulation
IEE	Industrial energy efficiency
IFC	International Finance Corporation
IP	Intellectual property
ISO	International Standard Organization
ITC	Institute of Technology of Cambodia
LDC	Least developed country
LEAP	Long-range energy alternative planning system
M&E	Monitoring and evaluation
MAFF	Ministry of Agriculture, Fisheries and Forests
MIME	The former Ministry of Industry, Mines and Energy
MoE	Ministry of Environment
MoIH	Ministry of Industry and Handicrafts
MoME	Ministry of Mines and Energy
MTE	Mid-term evaluation
MW	Megawatt
NCPO	National Cleaner Production Office of Cambodia
PAC	Project Advisory Committee (renamed as Project Steering Committee)
PC	Project Coordinator
PDR	People's Democratic Republic
PIF	Project identification form

PIR	Project Implementation Report
PMU	Project management unit
PPA	Power purchase agreement
PPG	Project preparation Grant
PSC	Project Steering Committee
RE	renewable energy
RGoC	Royal Government of Cambodia
RUPP	Royal University of Phnom Penh
SEC	Specific energy consumption
SMART	Specific, measurable, achievable, relevant and time-bound
SME	Small to medium enterprises
SNC	Second National Communication
TT	Technology transfer
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework on Climate Change Convention
UNIDO	United Nations Industrial Development Organization
VAT	Value added tax
WAB2E	Waste Agricultural Biomass Project (under UNEP)
WB	World Bank
USD	United States dollar

GLOSSARY OF EVALUATION-RELATED TERMS

Term	Definition
Baseline	The situation, prior to an intervention, against which progress can be assessed.
Effect	Intended or unintended change due directly or indirectly to an intervention.
Effectiveness	The extent to which the development objectives of an intervention were or are expected to be achieved.
Efficiency	A measure of how economically inputs (through activities) are converted into outputs.
Impact	Positive and negative, intended and non-intended, directly and indirectly, long term effects produced by a development intervention.
Indicator	Quantitative or qualitative factors that provide a means to measure the changes caused by an intervention.
Intervention	An external action to assist a national effort to achieve specific development goals.
Lessons learned	Generalizations based on evaluation experiences that abstract from specific to broader circumstances.
Logframe (logical framework approach)	Management tool used to guide the planning, implementation and evaluation of an intervention. System based on MBO (management by objectives) also called RBM (results based management) principles.
Outcomes	The achieved or likely effects of an intervention's outputs.
Outputs	The products in terms of physical and human capacities that result from an intervention.
Relevance	The extent to which the objectives of an intervention are consistent with the requirements of the end-users, government and donor's policies.
Risks	Factors, normally outside the scope of an intervention, which may affect the achievement of an intervention's objectives.
Sustainability	The continuation of benefits from an intervention, after the development assistance has been completed.
Target groups	The specific individuals or organizations for whose benefit an intervention is undertaken.

REQUIRED PROJECT IDENTIFICATION AND FINANCIAL DATA

Project title	**Climate Change Related Technology Transfer for Cambodia: Using Agricultural Residue Biomass for Sustainable Energy Solutions**
GEF ID	**4042**
UNIDO project No. (SAP ID)	**100223**
Region	**Asia and the Pacific**
Country(ies)	**Cambodia**
GEF Focal area(s) and operational programme	**Climate Change, CC-4**
GEF Agencies (implementing agency)	**UNIDO**
Co-implementing agency(ies)	**None**
Project executing partners	**National Cleaner Production Centre of Cambodia (hosted by MoME)**
Project size (FSP, MSP, EA)	**FSP**
Project CEO endorsement/Approval date	**25 May 2012**
Project implementation start date (PAD issuance date)	**01 August 2012**
Original expected implementation end date (indicated in CEO endorsement document)	**25 May 2016**
Revised expected implementation end date (if any)	**25 May 2016 (based on 4 years from date of CEO endorsement)**
Project duration (months)	**48**
GEF Grant (USD)	**1,690,000**
GEF PPG (USD) (if any)	**80,000**
UNIDO inputs (USD)	**100,000 (in-kind); 200,000 (grant)**
Co-financing (USD) at CEO Endorsement	**4,565,000 (cash + in-kind)**
Total project cost (USD) (GEF Grant + Co-financing at CEO Endorsement)	**6,335,000**
Mid-term review date	**June 2015**
Planned terminal evaluation date	**March 2016**
Agency fee (USD)	

Milestone	Expected date	Actual date
Project CEO endorsement/ approval date	October 2011	25 May 2012
Project implementation start date (PAD issuance date)	November 2011	1 August 2012
Original expected implementation end date (indicated in CEO endorsement/approval document)	November 2015	25 May 2016
Revised expected implementation end date (if any)	February 2016	25 May 2016

Project Framework - Financing

Project component	Activity type	GEF financing (in USD)		Co-financing (in USD)	
		Approved	Actual	Promised	Actual
1. Technology transfer and implementation of 3 pilot plants	Technical assistance Investment	200,000 850,000	179,619 96,089	150,000 3,600,000	50,000 0
2. Capacity building and development of tools for technology adaptation and transfer	Technical assistance	200,000	91,621	100,000	50,000
3. Strengthening of institutional framework for technology transfer	Technical assistance	150,000	46,270	85,000	25,000
4. Upscaling of biomass fuelled technologies in Cambodia	Technical assistance	140,000	44,249	80,000	0
5. Policies, regulations and mechanism to promote sustainable renewable energy generation	Technical assistance	50,000	4,993	50,000	0
6. Project management	Technical assistance	100,000	43,954	100,000	25,000
Total		**1,690,000**	**506,795**[1]	**4,565,000**[2]	**140,000**

[1] Expenditure up to September 30, 2015.

[2] USD 400,000 has not been allocated to any of the Project components or Project management.

Project Co-financing

Source of co-financing	Type	Project preparation		Project implementation		Total	
		Expected	Actual	Expected	Actual	Expected	Actual
Host gov't contribution	In-kind			150,000	50,000	150,000	50,000
GEF Agency(-ies)	Cash			200,000	20,000	200,000	20,000
	In-kind			100,000	50,000	100,000	50,000
Bilateral aid agency(ies)							
Multilateral agency(ies)							
Private sector	Cash			3,600,000	0	3,600,000	0
	In-kind			400,000	0	400,000	0
NGO							
Other	In-kind			115,000	20,000[3]	115,000	20,000
Total co-financing		**80,000**[4]	**80,000**	**4,565,000**	**140,000**	**4,645,000**	**140,000**

[3] From NCPO-C
[4] Sources for co-financing for the Project preparation were not identified.

EXECUTIVE SUMMARY

An independent mid-term review (MTR) was conducted for the UNIDO-GEF project entitled Climate change related technology transfer for Cambodia: Using agricultural residue biomass for sustainable energy solutions (UNIDO project No. GF/CMB/12/002 – SAP 100223; GEF ID 4042) (herein referred to as the "TT Project" or the "Project") during the May to August 2015 period by Mr. Roland Wong and Mr. Kamal Uy. The MTE field mission to Phnom Penh was carried out from June 9-24, 2015.

The TT Project was approved by GEF on May 25, 2012 but commenced operations on August 1, 2012, and has a set terminal date of 31 May 2016 (4 years after GEF approval). The MTE time frame for this report is August 2012 to May 2015.

The purpose of the MTE for this Project was to evaluate the progress towards attainment of global environmental objectives, Project objectives and outcomes, capturing lessons learned and suggesting recommendations on major improvements. The MTE serves as an agent of change and plays a critical role in supporting accountability.

This MTE was conducted using a participatory approach through interviewing selected key stakeholders of the Project, and keeping them informed and regularly consulted throughout the evaluation period. In addition, the evaluation team has analysed all available evidence from desk studies, literature reviews, direct observations and interviews with key stakeholders. This has enabled the evaluation to assess causality and provide reasons for the actual outcomes. This is in accordance with UNIDO Evaluation Policy and the Terms of Reference (ToRs) as included in Appendix 1.

Project background

Cambodia continues to use imported heavy fuel oil and diesel oil to satisfy energy demands of the industrial sector. The need for imported fossil fuels can be attributed to the lack of reliable electricity supplies throughout most of Cambodia. Although the capital city of Phnom Penh has only recently been supplied with reliable electricity, transmission and distribution systems throughout other areas of Cambodia have not been well developed, and will likely not be developed for the foreseeable future. As such, most industrial enterprises meet their energy demands through fossil fuel based captive power generation. This exposes their businesses to uncertain production costs exacerbated by fluctuating global fossil fuel prices. The alternative being proposed by the TT Project is generation of power from agricultural residues such as rice husk.

The objective of the TT Project is sustained transfer of cost effective, efficient and biomass energy technology systems derived from agricultural waste (to replace fossil fuels for powered generators and boilers) for power generation and thermal energy applications. To achieve this objective, the TT Project was designed to achieve 5 outcomes as follows:

1. Transfer of clean and energy efficient low carbon technologies;
2. Supply of national service providers in technology evaluation and technology transfer;
3. Stronger institutional framework in place to ensure long-term support for renewable energy biomass promotion;
4. Increased adoption of energy generation technologies by Cambodian businesses and private investors, creating a market for biomass technologies;
5. Establishment of policy, legal and regulatory frameworks that sustainably promote and support renewable energy generation.

Project Strengths and Weaknesses

The TT Project suffered a setback in mid-2014 when three co-financing enterprises withdrew their commitments to invest in pilot biomass energy systems. These systems to be used as a technology transfer vehicle to demonstrate the benefits of renewable energy generation to the industrial sector. As of August 1, 2015, the TT Project had only 10 months remaining until its terminal date of May 25, 2016. Any achievements or successes on the TT Project will, to a large extent, be determined on the success of finding an investor for a techno-economically feasible pilot biomass energy cogeneration project. The conditions for a techno-economically feasible pilot project, however, consist of a plant that has a 24-hour energy demand for thermal and electrical energy. Such a pilot project would be able to successfully demonstrate lower production costs for industrial enterprises.

Project personnel, however, are experiencing a number of obstacles in achieving this outcome:

- TT Project plans have been shared with the Project Steering Committee (PSC). However, there has not been full dissemination of this information within the relevant institutions due to a need for more effective communication between TT Project personnel and certain government departments (such as the Department of New and Renewable Energy under MoME). This scenario limits opportunities to network and increase the number of potential pilot projects in biomass energy. The evaluators have not seen any documentation of current biomass energy investment opportunities. The CTA, however, has detailed knowledge of these opportunities involving industrial enterprises that includes the use of biomass energy for:
  - Cogeneration for industrial facilities requiring electricity and thermal energy on a 24-hour basis;
  - Drying ovens located in cassava and rubber plantations; and
  - Absorption chiller units that would replace the use of diesel oil for cooling units.

There is an urgent need to strengthen the efforts of the CTA in preparing and promoting biomass energy system opportunities to a wider selection of industrial enterprises in Cambodia. This should include the addition of a senior national energy expert to the PMU to improve the effectiveness of these efforts. The evaluators understand that the Project has been pursuing such a person for the past 18 month but without much success to date;

- There are a small number of foreign equipment suppliers making regular business visits to Cambodia to finalize strategic partnerships that may result in:
  - Cambodian equipment vendors increasing their sales of imported quality equipment such as boilers and gasifiers;
  - a long term possibility that there will be local production of this equipment under license;

- Considering the importance of the pilot biomass energy project and its demonstration of energy cost reductions, and to increase the likelihood that a pilot biomass energy project can be implemented in 2015, there is a need to consider alternative financial incentives other than the current buy down of 20%;

- The evaluators are concerned over the sustainability of TT Project efforts to promote biomass energy solutions for the industrial sector:
  - In 2013 and 2014, many of the senior staff left the PMU within NCPO and were replaced by less experienced staff. As such, NCPO capacity to undertake development of renewable energy, energy efficiency and cleaner production is weaker;

- The need for more effective communication between the PMU and a certain subset of government officers within MoIH and MoME as well as the Head of UNIDO operations in Cambodia (HUO) that has not resulted in full institutional cooperation with TT Project personnel;
- Management of the TT Project is almost entirely in the hands of the CTA with no meaningful roles being played by local PMU staff. While this situation is entirely understandable given the difficulties in recruiting qualified personnel, there is a need for UNIDO to develop PMU staff to share in the management of the TT Project. The difficulties in finding assistance for the CTA (to offload some of the management responsibilities of the TT Project at the field level) only raises the risk that biomass energy promotion after the EOP is unsustainable;

- It is difficult to envision the Project making any progress with regards to policy and regulatory framework for biomass energy systems and renewable energy in general. This is on the basis of the aforementioned need for more effective communications between certain government departments (such as the Department of New and Renewable Energy under MoME) and Project personnel, and the lack of clarity on indicators and targets on the regulatory framework aspects (Component 5) on the Project log frame;

- With 10 months remaining on the TT Project, there is insufficient time to set up an operational pilot biomass energy project, train personnel on its insulation operation and maintenance, and assist RGoC in drafting policy on renewable biomass energy.

Recommendations:

Five recommendations are being made to UNIDO including:

1. **As a top priority, all immediate activities of the TT Project should focus on the successful completion and operation of a pilot biomass system for an industrial enterprise with 24-hour energy demands**. Recommended actions to be taken include:
   - Provide support to other biomass energy applications that have been identified by the CTA as being potentially feasible including conventional Rankine cycle co-generation technology with a back pressure turbine; biomass-based vapour absorption technology and ammonia chiller; and wood-based dryers for rubber and cassava processing. This support will include assurances of the techno-economic feasibility of the biomass energy applications;
   - Examine if the current buy-down of pilot equipment of 20% is sufficient or if consideration should be made for a 30 to 40% buy down that would increase the incentives for early entrants;
   - If possible, consider energy performance contracting (EPC) such that the entrepreneur will not need to place any down payment for the system;
   - For rice milling operations that accumulate dangerous amounts of rice husks in an enclosed area[5], promote technologies where these rice husks can serve as biomass fuel at other locations such as garment factories. There are a number of rice milling operations around Phnom Penh that do not have incentives to adopt biomass energy systems resulting in these accumulations of rice husk. Technologies may include the making of rice husk briquettes that can be conveniently transported to other industrial enterprises for fuel to generate steam. Promotion of this technology should be conducted through a pilot project to demonstrate the lifecycle environmental and energy benefits in the making, transport and usage of the briquettes as fuel.

[5] The danger consists of large volumes of rice husks being stored in enclosed dry areas that could easily result in the dust explosion.

2. **Prepare a revised version of the log frame (Project results framework) that provides relevant outputs, SMART indicators and clarity in targets.** This recommendation is made to provide clarity on efforts to achieve intended outcomes related to non-engineering aspects such as strengthened institutional framework and the establishment of legal and regulatory frameworks to support sustained development of biomass energy systems. This recommendation is also made as a precursor to preparing detailed work plans for a no-cost extension (see Recommendation 5). The evaluators have provided guidance on a revised log frame in Appendix E;

3. **Continue support and encourage the facilitation of strategic partnerships between foreign and local equipment suppliers**. Such partnerships are a key to availing more quality equipment for energy generation in Cambodia, and would provide an opportunity for local suppliers to be associated with the sale of quality equipment. In the long term, this may lead to local production of foreign quality equipment under license;

4. **Adjust style of delivery of technology transfer to RGoC stakeholders.** This should be done by (i) improving Project planning documents that can be shared with PSC members and involve them on providing inputs (see next Recommendation 5 on improving management of the TT Project). This would improve local ownership of the TT Project; (ii) involving UNIDO at both the regional and country levels on implementing special efforts that will improve the support base of the TT Project to deliver technical assistance on biomass energy systems with support from both public and private sectors; (iii) **i**mproving outreach of PMU personnel (and by extension NCPO personnel) to improve its collaborative relationships with all relevant government agencies (including those within MoIH, MoME and MoE) by recruiting, if possible, a retired senior civil servant who could assist the CTA in representing NCPO; (iv) wherever possible, encourage and support the formation of a post-project quasi-independent entity that can provide technical assistance to the industrial sector in renewable energy and energy efficiency developments;

5. **Improve management of the TT Project.** This can be achieved through (i) preparation of annual work plans (AWPs) that provide activities against outputs in a revised Project results framework (log frame). Most importantly, this should include detailed profiles of the pilot biomass energy projects to be supported until the end of 2017. AWPs should be prepared for the remainder of 2015 as well as draft AWPs for 2016 and 2017 with the intent of requesting GEF for a no-cost extension until December 31, 2017; (ii) **i**mproving the functionality of the Project Steering Committee that can be used as a forum for Government inputs into the annual work plans and adaptive management of the Project; and (iii) implementing an M&E plan as set in the Project documents and provide quarterly as well as annual progress reports in the prescribed format of a Project Implementation Report (PIR).

Two recommendations are being made to the Royal Government of Cambodia including:

1. **Provide support to TT Project efforts that encourage the facilitation of strategic partnerships between foreign and local equipment suppliers.** This would include general efforts that would encourage the import of quality equipment into Cambodia. Examples of government actions required includes financial incentives (such as tax holidays, and the waiving of VAT and customs and import duties) and enforcement support for the protection of intellectual property (IP)**;** and

2. **Provide support to a post-project quasi-independent entity that can provide technical assistance to the industrial sector for biomass energy systems and energy efficiency.** If local engineering or consulting firms do not develop a new business line of energy auditing services,

NCPO is well positioned to continue the promotion of biomass energy systems and energy efficiency after the EOP. However, NCPO will need to be legalized as a quasi-independent entity that provides independent assessments of energy usage that is supported both by public and private sectors. As such, NCPO would require government certification as a quasi-independent organization complete with a board of directors from both public and private sectors, a mission statement and a strategic business plan. The primary role of RGoC in this new entity will be to ensure compliance to policies, regulations and standards on the development of renewable energy and energy efficiency set by MoME. If a local engineering or consulting firm does develop a new business line for energy auditing services, RGoC will need to ensure these firms are in compliance with the aforementioned policies, regulations and standards.

One recommendation is made to the Global Environment Facility including:

1. **Please consider a 19-month no-cost extension for the TT Project until December 31, 2017** based on work plans submitted by TT Project personnel that have been prepared with the intention of exhausting the remaining USD 1.183 million of GEF Project funds. The proposed work plans and extension to December 2017 would provide sufficient time to develop 2 to 3 operational pilot biomass energy plants and demonstrate reduced production costs for industrial entities, and trained personnel on its operation and maintenance.

1. EVALUATION OBJECTIVES, METHODOLOGY AND PROCESS

This report summarizes the findings of the Mid-Term Evaluation (MTE) Mission for the UNIDO-GEF project entitled "Climate Change Related Technology Transfer for Cambodia: "Using Agricultural Residue Biomass for Sustainable Energy Solutions" (herein referred to as the "TT Project" or the "Project") that is being implemented by the United Nations Industrial Development Organization (UNIDO) with financing support provided by the Global Environment Facility (GEF). The midterm evaluation mission for the TT Project was fielded to Phnom Penh from June 9-24, 2015. The midterm evaluation time frame for this report is August 2012 to May 2015.

1.1 Evaluation information and rationale

The purpose of the mid-term evaluation (MTE) for this Project was to *evaluate the progress towards attainment of global environmental objectives, project objectives and outcomes, capturing lessons learned and suggesting recommendations on major improvements.* The MTE serves as an agent of change and plays a critical role in supporting accountability. As such, the MTE serves to:

- Strengthen the adaptive management and monitoring functions of the Project;
- Enhance the likelihood of achievement of TT Project and GEF objectives through analyzing Project strengths and weaknesses and suggesting measures for improvement;
- Enhance organizational and development learning;
- Enable informed decision-making;
- Create the basis for replication of successful Project outcomes achieved to date;
- Identify and validate proposed changes to the Project document to ensure achievement of all Project objectives; and
- Assess whether it is possible to achieve the objectives in the given timeframe, taking into consideration the speed, at which the Project is proceeding.

This MTE has been conducted in accordance with UNIDO Evaluation Policy and the Terms of Reference (ToRs) as included in Annex 1. This MTE was conducted using a participatory approach, and took place at the end of the third year of implementation (2015) in Phnom Penh. The MTE team consisted of Mr. Roland Wong as International Midterm Evaluation Consultant and Team Leader, and Mr. Kamal Uy as National Midterm Evaluation Consultant.

1.2 Scope and objectives of evaluation

The scope of the MTE covers the entire TT Project and its components as well as the co-financed components of the Project. This MTE assesses Project performance taking into account the status of Project activities, outputs and the resource disbursements made up to May 31, 2015. The MTE follows guidance provided from the ToRs of this MTE (as contained in Annex 1), and is designed to enable the Royal Government of Cambodia (RGoC), the GEF, UNIDO and other stakeholders and donors to:

- Verify prospects for development impact and sustainability through detailed analysis of Project performance according to evaluation parameters defined within UNIDO evaluation policy;
- Enhance Project relevance, effectiveness, efficiency and sustainability by providing recommendations for activities until the scheduled end of project (EOP).

The key issue for the MTE is to what extent is the TT Project achieving the intended results at the time of the MTE including:

- Demonstrating the benefits of biomass based renewable energy generation in terms of local, national and global benefits;
- Sustained transfer of small to medium sized 1-3 MW biomass fuel power and steam generation technologies; and
- Overcoming existing barriers to scaled up adoption of biomass-based technologies through successful implementation of pilot projects.

1.3 Methodology, limitations and validity of findings

This independent MTE has been conducted using a participatory approach through interviewing all key stakeholders of the Project, and keeping them informed and regularly consulted throughout the evaluation period. In addition, the evaluation team has analyzed all available evidence from desk studies, literature reviews, interviews with all key stakeholders and direct observations. This has enabled the evaluation to assess causality and provide reasons for the actual outcomes. These efforts are summarized in Table 1. This MTE report provides recommendations, as appropriate, for follow-up by all relevant stakeholders.

Table 1: Summary of efforts of the mid-term review team

Review tier	Key actions
Macro level	• Review of project documents and progress reports • Review relevant policies and programs/guidelines • Courtesy calls, meetings and interview with policy makers • Meetings and interviews with project staffs • Interviews with national level key stakeholders
Meso level	• Review targets in PPM and project accomplishments • Find out capacity gaps and resource needed to meet the targets
Micro level	• Meetings and interviews with stakeholders, program partners, and industrial sector professionals, asking them if appropriate, on their satisfaction, benefits of participating in project and interacting with project team • Solicit opinions of beneficiaries and government officials whether the Project linkages are working and are relevant and timely. If not what improvements could be done

2. COUNTRY AND PROJECT BACKGROUND

2.1 Country context

Cambodia is located in Southeast Asia and shares borders with Viet Nam to the east, Laos PDR to the north, and Thailand to the north and west. With Cambodia's neighbours experiencing robust economic growth, Cambodia's economic growth has been averaging 7% between 2010 and 2013 after experiencing 10 to 13% growth between 2005 to 2007, notwithstanding the fact that Cambodia is classified as a least developed country (LDC).

Cambodia's healthy economic growth since 2004 can be attributed to growth in garments, agriculture, construction and tourism. This includes growth in rice cultivation and rice milling activities to the extent that Cambodia has become a net exporter in rice since 2009. Moreover, rice production now accounts for over 10% of Cambodia's GDP with further growth expected through the production of organic rice.

Despite this economic growth, Cambodia remains one of the poorest countries in Asia. This is reflected in the fact that over 50% of the RGoC's budget comes from donor assistance. The 2014 income indicators of the RGoC also reflect an estimated 4 million people who live on less than USD 1.25 per day, and more than 35% of Cambodian children under the age of 5 suffer from chronic malnutrition. In addition, 50% of the population is less than 25 years old, out of which more than 50% (mainly in impoverished rural areas) do not have education and productive skills that would contribute to the advancement of the country. The key economic challenge for Cambodia is to sustain the growth of the agricultural and tourism sectors that have potential to reduce poverty and to provide sustain growth to all of its industrial sectors.

2.2 Sector-specific issues and important developments during project implementation

Cambodia's primary energy supplies consist of heavy fuel oil and diesel oil as well as imported hydroelectricity from Viet Nam, Thailand and Laos PDR. The use of imported heavy fuel oil and diesel oil can be attributed to industrial demand and the lack of reliable electricity supplies throughout most of Cambodia. In 2014, the country's first coal-fired power plant (100 MW) was commissioned providing reliable electricity supplies, 90% of which is delivered to Phnom Penh which has a reasonably developed transmission and distribution system. Although this power plant is able to supply electricity to other Cambodian cities as well as rural areas, transmission and distribution systems outside of Phnom Penh are not well developed with little or no improvements in the foreseeable future.

The lack of reliable electricity supplies outside of Phnom Penh has forced all industrial enterprises requiring electricity, heat and steam, to consider other sources of energy including captive power generation. Currently, most captive power generation facilities for industrial enterprises outside of Phnom Penh use heavy fuel oil and diesel oil generators. This exposes these enterprises to uncertain production costs exacerbated by fluctuating global fossil fuel prices. The alternative being proposed by the TT Project is generation of power from agricultural residues such as rice husk.

Since the commencement date of the TT Project of August 1, 2012 to the present, there were two important developments that will affect the intended Project outcomes:

- Cost of electricity to consumers has been reduced by 25% thereby making electricity more competitive with captive power generation for industrial SMEs;

- Electricite du Cambodia (EDC), the national electrical utility, is not approving power purchase agreements (PPA) over USD 0.08 per kWh which is not economically attractive. As such, any feasible biomass power generation facilities to be developed in the near future are likely to be captive.

Despite these developments, industrial SMEs mainly outside of Phnom Penh still require reliable supplies of energy for electricity and thermal power generation (for heat and steam). To this end, there should be interest amongst industrial SMEs (notably those with expected growth in energy demands) in captive power generation from biomass that will contribute to lower production costs. This sustained interest in biomass energy in the industrial sector, however, is challenged by unique issues in the Cambodian business environment that have an impact on the level of adoption:

- The industrial sector is led by many ambitious young and progressive entrepreneurs, many of whom are self-educated with some exposure to practices overseas. However, many of these entrepreneurs are not strong in business planning;
- These entrepreneurs undertake the majority of business decisions including low carbon investments. When there is some doubt on the viability of some of their decisions, they often defer to friends and family for advice and have historically not taken advice from technical professionals. This has led to an outcome of decisions to procure lowest capital cost equipment notwithstanding the associated higher risks of equipment breakdown due to poor quality. This often results in an overall increase in low carbon technology investment costs;
- There are difficulties in acquiring accurate information important to the design of a biomass energy system in an industrial enterprise. For example, energy load profiles of many of the enterprises in the rubber and cassava refining sectors were not properly disclosed or understood. This has resulted in a more optimistic projection of biomass energy systems that could be implemented.

These business environment issues have led to previous attempts in Cambodia to implement biomass energy projects in the investment range of USD 0.5 to 4.0 million. These investments have not been successful:

- Simplon Cambodia Ltd. was started as a subsidiary of Simplon GmbH Switzerland in late 2012 with funds of over USD 600 million for a number of green initiatives in Cambodia including biomass-based power generation projects. The TT Project provided technical assistance to Simplon Cambodia on technology identification, networking with technology suppliers, processes for technical and commercial negotiation, and operation and maintenance training. As of mid-2015 and despite the availability of funds, Simplon Cambodia has not finalized any biomass energy projects on a build-own-operate-transfer (BOOT) basis due to the overall difficulties of finding an enterprise where biomass energy systems are technically and economically feasible. This can be broken down into a number of factors including:

    - The energy demands of many industrial enterprises (notably in the rubber and cassava refining sectors) is usually for less than 10 hours per day, and sometimes less depending on their activities and subsequent energy demands;
    - Seasonal feedstock availability such as the cassava and sugar refining sectors, reducing the annual revenues from energy savings and hence, the rate of return;
    - A 24-hour biomass energy operation economically would be feasible. However, biomass availability for a 24-hour operation is an issue: either there would be insufficient quantities of biomass or the transport of additional biomass from farther sources would be too costly;

- In some cases for potential investments near the Vietnamese border, cheaper electricity is purchased from the Vietnamese sources reducing incentives for rice milling enterprises to convert to biomass energy systems;

- Angkor 2.0 MW Bio Co-generation Rice Husk Power Project[6] that was implemented under CDM as a means to displace the use of diesel oil for rice milling operations through power generated through the conversion of rice husks to energy through boilers. Commercial operations of the plant commenced in October 2011. While the expected annual GHG reductions from this Project was in the order of 51,620 tonnes of CO_2, less than 1,000 tonnes CO_2 was generated during the period of June to December 2012. This was primarily due to the low captive requirement of the rice milling operation in the order of 20 to 25%;

- Green Ventures Company Limited constructed a 1.5 MW biogas plant near Phnom Penh in 2011 for the purposes of replacing heavy fuel oil with biogas generated from various agricultural residues. After the plant was completed, natural gas became available in the area at a low price. This reduced the incentives of the cassava refining enterprises to use costly biogas for their own energy needs. As a result, this biogas plant has remained idle since 2011.

The aforementioned investments and issues only underscore the difficulties under which PMU personnel are operating. With difficulties in acquiring credible energy design information from participating enterprises as well as weak decision-making by industrial entrepreneurs and shifting energy pricing conditions, market transformation towards biomass energy systems can only be expected to be gradual. Significant adoption of biomass energy systems as envisaged by the Project does not appear to be realistic in the view of the evaluators. However, significant awareness raising and a lower level of adoption of biomass energy systems can be realistically achieved by this Project.

2.3 Project summary

The TT Project is designed to promote the sustained transfer of small sized biomass fuel power and steam generation technologies (1-3 MW) from other countries into Cambodia. The biomass fuel for these technologies was to be residues from agricultural waste and forestry. The integrated approach to be employed by the Project was to combine pilot projects to demonstrate feasibility in the Cambodian context as well as building technical support to plan, implement, commission, operate and maintain these pilot facilities. In turn, implementation of these pilot projects will generate lessons that can inform and strengthen existing institutions and policy frameworks and increase the likelihood of sustained technology transfer.

This Project is being directly executed by UNIDO with the National Cleaner Production Office of Cambodia (NCPO) serving as the executing partner based in Phnom Penh, Cambodia. NCPO is hosted by the Ministry of Industry and Handicrafts (MoIH) that was formerly known as the Ministry of Industry, Mines and Energy (MIME). Project funding has been provided through a GEF Grant of USD 1.69 million with co-financing contributions expected from UNIDO (USD 300,000), and Cambodian based stakeholders both public and private (USD 4,265,000).

While the Project was approved in May 2012, actual Project implementation commenced in August 2012 with the current terminal date of May 25, 2016. The Project has been designed to be managed by a UNIDO HQ based project manager, with a Project management unit (PMU) that is housed within NCPO in Phnom Penh. The PMU has been designed to take direction from a Project Steering

[6] http://cdm.unfccc.int/Projects/DB/DNV-CUK1144657688.42/view

Committee (PSC) that currently consisting of more than 12 representatives from various relevant government institutions as well as local academia and the private sector. Dr. Heinz Leuenberger served as the Project Manager for the TT Project from May 2012 to October 2014. He was replaced in December 2014 by Mr. Patrick Nussbaumer. Dr. Permod Gupta has served as the Chief Technical Advisor for the TT Project during its entire duration.

3. PROJECT ASSESSMENT

3.1 Project design

The TT Project has been developed as result of an official request from the Minister of Environment of RGoC to UNIDO in 2010 to assist in the development and implementation of a GEF Climate Change Project on technology transfer of biomass energy systems. UNIDO initiated design and preparation work for the TT Project in 2011 under the former MIME that led to work on the Project Information Form (PIF), submission to the GEF, and their approval of a Project Preparation Grant (PPG). After approval of the PIF and PPG phase in late 2011, the design and formulation of the Project proposal had been finalized through PPG resources made available by the GEF in 2012 to UNIDO. A participatory approach was adopted to formulate the Project.

The TT Project design is provided in the 2012 Project document and is summarized under the Project's log frame which is contained in this report in Annex 5. To achieve the TT Project objective of sustained transfer of cost effective, efficient and biomass fuel energy systems from agricultural waste (to replace fossil fuels for powered generators and boilers) for power generation and thermal energy applications, the Project was designed to achieve 5 outcomes:

1. Transfer of clean and energy efficient low carbon technologies;
2. Supply of national service providers in technology evaluation and technology transfer;
3. Stronger institutional framework in place to ensure long-term support for renewable energy biomass promotion;
4. Increased adoption of energy generation technologies by Cambodian businesses and private investors, creating a market for biomass technologies;
5. Establishment of policy, legal and regulatory frameworks that sustainably promote and support renewable energy generation.

The Project design was prepared with a clear focused objective to bring low carbon biomass fuel energy systems into the energy mainstream to replace fossil fuel powered generators and boilers for power generation and thermal energy applications. The Project was designed to sustain healthy growth and increased competitiveness of Cambodia's industrial sector through the use of locally available biomass that will reduce production costs. The baseline of the Project assumed that higher production costs were manifested by the lack of reliable supplies of electricity and the use of fossil fuels for power generation and thermal energy. This use of fossil fuels then would expose the industrial sector to fluctuating global fossil fuel prices and unpredictable production costs.

The framework of the TT Project design is adequate to address the challenges and removal of barriers to sustained technology transfer of biomass fuel energy systems in Cambodia. The design takes an integrated approach that is similar to many other GEF projects: pilot projects to demonstrate feasibility followed by capacity building, institutional strengthening and established policy and regulatory frameworks all of which are in place to support replication and scale up of technology transfer in the country. The identification of this integrated and participatory approach was developed in close

collaboration with the former MIME as well as other relevant government institutions such as MoE, ITC and the Cambodian Chamber of Commerce during the PPG phase. A significant design issue, however, was the lack of effective consultations with financial institutions during the PPG phase. Moreover, the lack of interest from local financial institutes in financing biomass energy systems has resulted in a lack of uptake of training offered by the Project to financial institutes.

In addition, considering the difficulties in implementing a pilot project, the evaluators surmise that the design aspects of the TT Project may have not been thoroughly analyzed. Notwithstanding the difficult business environment under which the PMU was operating, there was an overestimation of baseline energy usage resulting in TT Project designs with overestimated energy savings and GHG emission reductions.

Although the Project does have a clear thematically focused development objective, the Project log frame lacks a full set of verifiable indicators that are specific, measurable, attainable, relevant and time bound (SMART) as a means of achieving targets. This creates a number of problems for Project monitoring, notably preparing work plans and monitoring reports with clear indicators and targets. Log frame issues identified by the evaluation team includes:

- The lack of indicators that can be used to monitor the intended outcomes of the Project. The reason for this comment is to not only monitor the measures to achieve the outcome, but to also provide a measurement for the effectiveness of these outcomes. One can deliver training or capacity building activities (as provided in the current project log frame); however, the Project will have difficulties to monitor the participant's use of the training in promoting and implementing biomass energy systems, as an example. Output 4.3 provides the only example of an indicator linked to the outcome: "number of contracts received by suppliers through GEF projects". However, there are several examples where most output indicators are focused on Project work to be done with no indication as to the effectiveness of these measures. For example:

    - Output 1.3 indicator is "personnel from participating companies have been trained in operation, maintenance and troubleshooting". This indicator could have been recast as "number of personnel from participating companies involved with operation, maintenance and troubleshooting for biomass energy systems at the end of the project (EOP) ";
    - Output 3.3 indicators are "number of training programs conducted for financial institutions in Cambodia" and "number of experts trained in comprehensive technology evaluation to facilitate financing". These indicators could have been recast as "number of financial experts actively involved in financing biomass energy systems at the EOP" which would have provided a measure of the effectiveness of the training programs for financial institutions;

- There are a number of indicators that are not specific or measurable. Examples include Output 2.2: "network is meeting regularly change/share biomass-based technologies operating in Cambodia"; Output 5.1: "increased role for TT related to energy and environmental policies at national levels" and "biomass-based energy generation opportunities are recognized the utilized for achieving UNFCCC commitments"; and Output 5.2: "increased role for RE-TT project in energy related policies/regulation of RGoC";
- None of the indicators are time bound possibly indicating that there was little consideration to the sequencing of Project activities to achieve certain outcomes;
- Some outputs do not have indicators and matching targets. Examples include Output 2.1 with 3 indicators with only 2 targets, Output 2.3 that has one indicator and two targets, Output 2.4 that has no indicators and targets, Outputs 3.2 and 3.3 each of which has two indicators but four targets,

Output 4.1 that has three indicators and four targets, Output 4.3 that has two indicators but three targets and Output 5.2 which has two indicators but four targets;

- The capacity building activities of Outcomes 2 and 3 appear to overlap. While Outcome 3 is about building stronger institutional frameworks, there are training activities within this outcome for institutional personnel that are similar to those in Outcome 2. Improvements in distinguishing the training activities between Outcomes 2 and 3 need to be made;
- There are outcome targets and indicators which can be removed to simplify the logic of the log frame. Outcomes are to be achieved through delivery of the outputs which also have their separate indicators and targets; and
- The indicators and targets in Outcome 5 to establish a policy and regulatory framework for biomass energy systems are mostly irrelevant to meeting this outcome. The outputs and indicators should all be rewritten to better reflect the Project inputs required to establish the policy and regulatory framework.

To improve the overall usefulness of the Project log frame in preparing AWPs and monitoring reports, the wording in the log frame needs to be simplified to improve its clarity in terms of the indicators and targets that need to be delivered to the Project. A suggested rewritten log frame is provided in Appendix 5.

3.2 Relevance

The relevance of the TT Project to the country's national priorities is **satisfactory.** With respect to Cambodia's national development and environmental priorities and strategies, this Project is strongly aligned with:

- The Energy Sector Development Plan, 2005-2024;
- The National Policy, Strategy and Action Plan on Energy Efficiency in Cambodia (MoME) that was developed in 2013 and lists a number of activities to support industrial energy efficiency including amongst other actions promoting the use of biomass for decentralized production of thermal or electrical energy through gasification or bio-digestion;
- The Strategic Framework of the General Department of Industry (2010-2015) that reflects RGoC commitment through its MoIH and MoME to reduce poverty by developing a dynamic industrial sector that promotes efficiency, equity, employment and growth leading to improved competitiveness of industrial enterprises[7]; and
- The National Strategic Development Plan 2014–2018 that specifically seeks to ensure efficient management and use of energy as well as fostering development of all types of renewable energy such as biomass[8].

The main target groups of the TT Project are owners and operators of industrial enterprises in Cambodia who will benefit from biomass energy systems top reduce production costs. In addition, government institutions and private service providers are also targeted to contribute to sustained development of biomass energy systems in the industrial sector. This would include personnel from MoIH, MoME, MoE and the Institute of Technology of Cambodia (ITC).

The TT Project is fully compliant with the priorities identified for climate change under GEF-4 and with Strategic Objective 2: "To promote energy efficient technologies and practices in industrial production and manufacturing processes" as well as Strategic Objective 5: "to promote the use of renewable energy

[7] http://www.ide.go.jp/English/Publish/Download/Brc/pdf/07_chapter2.pdf
[8] Paras 4.122 to 4.127

for the provision of rural energy services (off grid)". These strategic objectives place a high priority on creating enabling policy and regulatory environment that will promote investment of energy technologies including least developed countries (LDCs) that includes Cambodia, where private and public capital is scarce and access to modern energy services is limited. These strategic GEF objectives will lead to successful outcomes including appropriate policy, legal and regulatory frameworks adopted and enforced; sustainable financing and delivery mechanisms established and operational; and GHG emissions avoided. The design outcomes of the TT Project strongly align with these intended outcomes.

The TT Project is also one of the focus GEF projects under the Poznan Strategic Program on Technology Transfer designed to demonstrate the full cycle of clean technology adoption in developing countries. While historically GEF projects have supported investments of clean technologies, the Poznan Strategic Program on Technology Transfer aims to enhance the likelihood of successful and sustained technology transfer through strengthening technology transfer mechanisms over the entire cycle of project development.

The TT Project fits within UNIDO's mandate of industrial energy efficiency that is aimed at reducing environmental impacts while maintaining economic growth through the promotion of renewable energy that in the long term will reduce energy costs, GHG emissions and production costs. Furthermore, the Project fits within the core of UNIDO's priorities and mandates to provide technical assistance that support adoption of renewable energy systems and policy measures. The Project also strongly aligns with UNIDO's mandate to deliver tailor-made training tools that focus on industrial energy system optimization. UNIDO's mandate is to target all players in the industrial sector including government, regulators, industrial enterprises, service providers and equipment vendors; the design of the TT Project targets all these players.

There have been some changes during the Project period from May 2012, notably improvement in the availability of reliable electricity supplies, mainly in Phnom Penh and vicinity. While this has some effect on stabilizing production costs for industrial enterprises around Phnom Penh, the lack of reliable electrical energy and associated unpredictable production costs are still significant issues for industrial enterprises outside of Phnom Penh. As such, there is still a need for technical assistance for these industrial enterprises to enable them to reduce their energy costs through the development of biomass energy systems and improve their competitiveness within the global trade market. There is no need to reformulate designs on the TT Project in Cambodia.

3.3 Progress

TT Project progress has been unsatisfactory primarily due to the lack of financial closure and implementation of pilot biomass energy system projects. These were designed to demonstrate technical and economic benefits to the industrial sector in Cambodia, and to encourage them to adopt biomass energy systems as a means of reducing imported fossil fuel energy consumption. Overall Project progress of each outcome and output is provided in detail in Table 2.

Table 2: Progress towards results matrix (Achievement of outcomes against EOP Targets as listed in the project log frame of May 2012)

Indicator assessment key

Green= Achieved	Yellow= On target to be achieved	Red= Not on target to be achieved

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
Objective: To bring about sustained transfer of efficient, cost effective and environmentally friendly (low carbon) agro waste biomass-fueled energy systems to replace fossil-fuel powered generators and boilers for power generation and thermal energy applications.	**Achievement Rating: Unsatisfactory:** Targets are not likely to be achieved due to no SMEs adopting biomass energy systems to date. The lack of adoption is primarily due to actual energy demands of these SMEs that render these biomass energy systems to be not technically and economically feasible: i) gasifiers need to operate on a continual basis for best results; ii) no mechanism to sell excess power to the grid; iii) low electricity demand at night when plants are closed; iv) insufficient quantities of biomass for a 24-hour operation; and v) the high cost of gasifiers. Current efforts of the Project are now focused on industrial enterprises that will have 24-hour thermal and electricity demand where co-generation with biomass would be techno-economically feasible.							
	1. Incremental direct CO_{2eq} emission reductions (tons of CO_{2eq})				1. Direct emission reductions: 240,000-325,000 tons CO_{2eq} over period 2012-2022	0		To date, there have been no direct GHG emission reductions due to a lack of adoption of agro-waste biomass energy systems by SMEs. With the 10 months of time remaining on the Project, achievement of the targets would require technology agreements with at least 10 to 15 SMEs to convert to biomass systems to meet this GHG emissions reduction target.
	2. Incremental indirect CO_{2eq} emission reductions (tons of CO_{2eq})				2. Indirect emission reductions: 250,000-300,500 tons CO_{2eq} over period 2012-2023	0		This indicator is difficult to measure, and hence, this should not be included in the log frame. While there is evidence of "indirect" implementation of biomass usage for energy systems to replace fossil-fuel based systems, the target is not likely to be achieved. This includes the sale of rice husk at the Norm Srim Rice Mill to a Chinese-investor who is converting waste rice husk on site to briquettes. These briquettes are sold to garment factories for steam generation, likely to replace fossil-fueled steam generation.

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
	3. Transfer of techno-economically viable RE technologies leading to reduction of fossil fuel consumption for energy generation				3. Annual reduction of fuel used for energy generation 5% over period 2012-2022	0		This is occurring through the provision of technical advice given to industrial enterprises. The issue has been getting the enterprises to understand that it is possible to reduce production costs by adopting biomass energy systems that in the long-term reduce energy costs, and generates more profits for the enterprise. Several examples are available of enterprises taking energy-related advice of the PMU and attempting to implement their own solutions using lowest cost technologies. The outcome of these actions has been short-term benefits followed by equipment breakdown or early retirement.
Outcome 1: Transfer of clean and energy efficient low carbon technologies	**Achievement Rating: Moderately Unsatisfactory**							
	1. 3 Pilot projects for RE-TT demonstration are selected with co-financing commitments				1. Learning to utilize and replicate a given technology including the capacity to choose it, adapted to local conditions and integrated indigenous technologies 2. To develop and standardize energy audit reporting format, worksheets and tools to be used by IEE projects	Unable to rate		SMART criteria for indicator and targets not met. These are intended as outcome indicators which are not necessary given that outcomes are to be achieved by output activities that are already provided in the log frame.

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
	2. Anticipated savings in GHG emissions are estimated				2. Technology performance benchmark and saving potential of GHG emissions reduction.	Unable to rate		SMART criteria for indicator and targets not met. These are intended to be outcome indicators which are not necessary given that outcomes are to be achieved by output activities that are already provided in the log frame.
	3. Personnel from the participating companies have been trained in operation, maintenance & trouble shooting.				3. Compendium of case studies from Pilot projects	0		Indicator not necessary as it is already covered under Output 1.2. Indicator should be removed
Output 1.1: Biomass-based RE-TT projects for 4-5 MWHr power generation replacing > 12,000 TOEs** and related potential economic and environmental savings in 3 pilot enterprises are identified by and appraised by project experts	1. 3 RE-TT projects are implemented with direct support from the GEF project				1. 3 technology transfer projects implemented with direct support from the GEF project	0		Output description too long. It is unclear if the output is the actual RE-TT projects or related potential economic and environmental savings. With regards to the target, no TT projects have yet been implemented with GEF support. Sites originally selected included the rice and rubber sectors where identified technologies selected could not be implemented as they were not techno-economically viable as captive power/co-generation projects. There are ongoing efforts to identify SMEs with more favourable conditions for biomass co-generation; this would include SMEs that have expansion plans and who are using diesel oil for steam generation.
	2. GHG savings T CO_{2eq} achieved annually as well as over the project lifetime				2. Cumulative 12,000 TOEs of fossil fuel (DO) replacement annually and more than 120,000 TOE's over the life period of technology.	0		The indicator's GHG savings with a target of fossil fuel savings. Target or indicator needs to be changed. Since GHG savings are already covered under the objective indicators, having an energy savings indicator to match the target is suggested.
Output 1.2: Results of	Compendium of				Compendium is	0		Not yet commenced since pilot

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
the pilot projects both in economic and environment context are compiled in a compendium for effective dissemination	case studies/success stories is published in English and the local language				compiled printed by end of 3rd year when most of RE-TT projects are either implemented or under implementation.			projects have not yet commenced.
Output 1.3: Personnel from the participating companies have been trained in operation, maintenance & trouble shooting.	1. Develop training modules for technicians and entrepreneurs on: - the operation of technology - maintenance including preventive maintenance of technologies - trouble shooting of technology for effective implementation.				Participants from participating units with technology suppliers are identified and training is carried out both in the classroom and on-the-job during commissioning and operation of the projects	20 TT support experts trained		Indicator of "developing training modules" is not reflective of the actual output which is "personnel…. trained….". In addition, the indicator is not measurable (how does one measure "develop training modules?") Training modules, however, have been conducted but training is not yet complete since pilot projects have not yet commenced.
Outcome 2: Supply of national service providers in technology evaluation and technology transfer	**Achievement Rating: 3 (Moderately Unsatisfactory):**							
	1. A cadre of at least 20 national experts from relevant TT support institutions (the Cleaner Production Centre, technical universities / university departments, EDC, EAC, MIME and independent engineers, are				1. 20 National Renewable Energy generation experts capable of delivering quality services are available	0		Indicator and target not necessary as it is covered under Output 2.1

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
	2. Capacity building of indigenous partners for technology adaptation				2. National IEE network is established.	Unable to rate		Indicator and target does not meet SMART criteria
	3. Web-based guidance tool/ manual on technology transfer like EnTA/Comfar developed				3. Local suppliers of technology are capable of providing IEE services to their clients as well as after sale service.	Unable to rate		Indicator and target does not meet SMART criteria
	4. Technology database and case study database created					Unable to rate		Indicator does not meet SMART criteria and has no target
Output 2.1: 1. A cadre of at least 20 national experts from relevant support institutions (the Cleaner Production Centre, technical universities/ university departments, EDC, EAC, MIME and independent engineers, are trained on technology evaluation and transfer including financial mechanisms	1. Number of renewable energy experts in the Cambodian market				1. 20 biomass-based Technology assessment and selection; identifying technology options what are their strengths and weaknesses, and to do a techno-economic-social-environmental assessment of the options to identify the most suitable one.	20		Training completed in 2012 in collaboration with the UNEP Project on Waste Agricultural Biomass Project (WAB2E)
	2. Number of technology transfer support experts in the Cambodian market					Unable to rate		This indicator does not have a target. With the prospect that no pilot projects will be completed within the next 9 months of the TT project, there is the possibility that there will be no TT experts from this output
	3. Number of RE-TT related seminars and				2. 10 seminars and 12 trainings modules for	10 TT clinics, 3 regional workshops		Training on operation, maintenance and trouble-shooting has been delayed until pilot projects are

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
	trainings delivered				enterprises managers and engineers delivered by national experts trained by the GEF-UNIDO, IEE, RE-TT projects	and 4 training modules		implemented (possibly in 2016)
Output 2.2: Capacity building of indigenous partners for technology adaptation	Network of indigenous partners for technology adaptation is established. Network is meeting regularly to exchange/share biomass-based technologies operating in Cambodia				A registry of local partners/experts is available with MIME and NCPO. A formal network of technology transfer partners & experts is in place	Current roster is maintained by NCPO		Indicator and target lack specificity. Indicator should be "number of local partners/experts registered within an established network for technology adaptation" with the target being a number of local partners/experts (such as 20) The indicator "network is meeting regularly…." is not a SMART indicator and should be removed or replaced with an indicator on the number of experts working on biomass energy related projects at the EOP.
Output 2.3: Web-based guidance tool/manual on RE-TT developed.	Dedicated web portal for technology transfer is in place and populated for training material, information and links with relevant web sites.				GEF –RE-TT project web portal with relevant information is continuously updated and linked with relevant websites. A manual on dynamic technology transfer mechanisms relevant to Cambodian industries is available	0		Indicator can be simplified to "dedicated web portal for technology transfer in place….." with the target simply being the number "1" The target on "a manual on dynamic technology transfer mechanisms…." does not have a corresponding indicator. This should be removed from the log frame.

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
Output 2.4: Technology database and case study database created						Unable to rate		This output has no indicator or target
Outcome 3: Stronger institutional frameworks in place to ensure long-term support for renewable energy (biomass) promotion	**Achievement Rating: 3 (Moderately Unsatisfactory):**							
	1. List of institutional participants trained to promote technology transfer for renewable energy generation.				1. At least 100 participants from Govt. and regulatory agencies are trained in technology transfer and RE applications.	0		Unnecessary and poorly worded indicator that is already covered under Output 3.1. This indicator should be removed
	2. No. of experts trained in preparation of bankable RE-TT proposals				2. 60 personnel from Industry are trained in financial engineering (bankable proposals)	0		Indicator is not necessary as it is already covered under Output 3.2. This indicator should be removed
	3. No of financial institutions participated in financial engineering training				3. Guideline on biomass-based energy generation, operation and maintenance of Boiler, turbine and auxiliaries is available	0		Indicator is fairly irrelevant as it is an outcome indicator that is somewhat covered under the second indicator of Output 3.1. This indicator should be removed.
	4. Guide for the Implementation of biomass-based RE projects is developed.				4. At-least 5 companies get access to finance through GEF project.	0		Indicator and target do not match. As this is an outcome indicator, this indicator should be removed
Output 3.1: Capacity building of relevant Govt. departments to promote biomass-based renewable energy technology	1. Number of intensive training programme conducted				1. 10 Intensive Capacity building programme is conducted during project period.	10 TT clinics, 3 regional workshops and 4 training modules		This indicator seems to overlap with the third indicator of Output 2.1. If there is overlap, one of these indicators should be removed from the log frame
	2. No. of				2. 100 participants	46 trained in		Output lacks an indicator to monitor

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
transfer and assistance in implementation	Government and institutional staff trained in biomass-based energy project implementation support.				trained to promote industrial energy efficiency	Biomass-based energy technology (not industrial energy efficiency)		the effectiveness of the intensive training program. In addition, the evaluator does not know if this indicator overlaps with the indicator of Output 2.1 and the sister GEF "IEE Project"
Output 3.2: Institutions are trained in TT financing using available mechanism like SCCF, LDCF, CDM and preparation of bankable TT project proposals	1.Number of training programme conducted on financial engineering for technology transfer of biomass-fueled energy generation				1.Two training programs conducted in year one and one each in subsequent years	0		Activity has not commenced due to lack of identified biomass energy technology. Some training has already been conducted on financial engineering to be 20 TT support experts.
	2. No. of experts from FIs trained in preparation of bankable RE proposals				2. At least 60 personnel from FIs and Government departments are trained bankable proposal 3. At least 10 proposals for RD technology financing are prepared considered for financing 4. Technology support instruments (e.g.financing subsidies, risk guarantee facilities, banker training and transaction support services) that are helping financers share	0		Targets 3 and 4 do not have an indicator Training for the use of CDM for financing has been dropped Willingness of financial institutions to participate in training has been low, in part due to the lack of an identified technology package for biomass energy systems, and the lack of demand for banking services to finance these projects

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
					risks, buy down transaction costs etc.			
Output 3.3: Capacity building of financial institutions to assess investment proposals in RE	1.Number of training programme conducted for FII's in Cambodia				1. Four training programmes conducted during project period	4		Number of training participants has not been reported
	2. No. of experts trained in comprehensive technology evaluation to facilitate financing				2. At least 20 personnel from development banks and FI's are trained in assessing RE-TT project for financing	Unable to rate		Number of financial sector personnel in training has not been reported. This indicator as well as other indicators in this output can be consolidated with those in Output 3.3.
					3. 10 proposal for RE financing are received and considered for financing	Unable to rate		Target does not have an indicator. An appropriate indicator can be "number of RE financing proposals that have been received and considered for financing"
					4. Build capacity and address various other barriers that make financing energy investment portfolios a challenge.	Unable to rate		Target does not have an indicator. In addition, target is not measurable and should be removed from the log frame
Outcome 4: Increased	**Achievement Rating: Unable to rate due to insufficient progress.**							

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
adoption of biomass-based energy generation technologies by Cambodian businesses and private investors. The creation of a national market for biomass technologies.	1.Tools available for supporting technology transfer for biomass-based energy generation in industry				1. Dynamic and user friendly methodology for technology transfer and biomass-based renewable energy is produced in English and Khmer language 2. Adapt the technology suited to local conditions and integrate as far as possible it with indigenous technologies	0		This is an outcome indicator that should be moved to one of the outputs, preferably Output 4.1 as a fourth indicator
	2. Demand for assistance in RE-TT is created. At least 5 requests are received annually.				3. Identify and fulfill the contractual obligations between various stakeholders such as technology supplier, technology recipient, financier, and the government, giving due recognition to intellectual property rights and patents, national and international rules and regulations.			This is an outcome indicator that should be moved Output 4.3 as a second indicator. Both indicator and target should be very clear with less words.

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
Output 4.1: The results of the pilot projects are compiled and widely disseminated in the most appropriate manner	1. Number technology transfer related assistance experts in the Cambodian market				1. 20 renewable energy generation experts trained 2. utilize and replicate a appropriate technology, including the capacity to choose it	0		This indicator should be removed from the log frame as it is the same indicator as that in Output 2.1
	2. Number of biomass-based energy experts in the Cambodian market				2. 10-20 experts for providing technology transfer support trained	0		This indicator is not very distinguished from the first indicator of this output "20 renewable energy generation experts ….". The indicator is also not very relevant to the output of disseminating results of the pilot project. Overall, Output 4.1 is not useful as it is a small step towards wider dissemination of pilot project information.
	3. Number of TT-RE seminars and trainings delivered				3. 10 seminars and 10 trainings for enterprises managers and engineers delivered by national experts trained by the GEF-UNIDO project	0		Would suggest training delivered in Outcome 2 and this Output 4.1 be integrated as one output somewhere in the log frame.
Output 4.2: Investors and decision-makers understand the potential for biomass energy sources.	1. Number of CEOs/owner attended RE-TT clinics.				1. 100 CEOs attend the 10 RE-TT Clinics organized sector-wise & as per geographic potential areas having biomass	0		Not yet commenced due to lack of identified biomass energy technology

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
	2. Number of companies participating in the RE-TT project seminars/ workshops				2. 100 companies participating in the project seminars and workshops	0		Not yet commenced due to lack of identified biomass technology
	3. Number of potential companies personnel participating in the project trainings				3. Establish mutually beneficial or reciprocal exchanges related to technology transfer and technology support	0		Remove this indicator as it does not have a measurable target and since the benefit to monitor this specific indicator is marginal to the outcome.
Output 4.3: Other stakeholders understand the role they can play to promote the uptake of this kind of technology	1. Number of technology & equipment suppliers participating in the project seminars/training				1. 50 suppliers/ vendors participating in the project seminars and workshops 2. Build partnerships with external experts, or actively support established networks related to RE-TT.	0		Not yet commenced due to lack of identified biomass technology
	2. Number of contracts received by suppliers through GEF projects				2. 10 contract related to RE-TT implementation is bagged by supplier trained by project.	0		Not yet commenced due to lack of identified biomass technology
Outcome 5: Establishment of policy, legal and regulatory frameworks that sustainably promote and support renewable energy generation	**Achievement Rating: Unable to rate due to insufficient progress.**							
	1. Policy conducive to promote technology transfer on Renewable fuel based technologies developed and recommended to				1.At least 2 national Renewable energy policy programs operate and develop smoothly	0		Not yet commenced due to lack of identified biomass technology. Suggest removal of this indicator and target as it is an outcome indicator

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
	MIME.							
	2. Adoption of regulatory measures to support RE implementation and market transformation				2. Technology transfer support system including financial availability, IPR on technologies are developed 3. Technology support instruments to help user by RE policy, regulation and law.	0		Not yet commenced due to lack of identified biomass technology Suggest removal of this indicator as it is an outcome indicator
Output 5.1: Gap analysis performed to assist Govt. in identifying where formulation of appropriate laws, regulations and policy instruments are crucial for the transfer and diffusion of renewable energy technologies.	1. Increased role for TT related energy and environmental policies at national levels				1. Policy document on renewable energy as clean and alternative energy is prepared for RGoC action.	Unable to rate as activities have not started		Indicator is not measurable. Suggest rewording of indicator to include "completed policy document on renewable energy…… for RGoC action". However, the Project has assisted in the drafting of a policy document for a Power Purchase Agreement (PPA) and a Feed-in-Tariff (FiT)
	2. Biomass-based energy generation opportunities are recognised and utilised for achieving UNFCCC commitments.				2. Tools and instruments to calculate GHG reduction from RE technologies projects are in place	Unable to rate		Indicator is not measurable. Suggest rewording of indicator to include "completed guide for calculation of GHG reduction from RE technologies that will be used for UNFCCC reporting commitments"
Output 5.2: Implementation of the missing laws, regulations and policy instruments	1. Increased role for RE-TT project in energy related policies/regulations of RGOC.				1. Reporting/ recording structure is put in place 2. Simple user friendly reporting templates are developed and tested	Unable to rate (see justification for rating)		"Implementation" is not an output. The wording of this output has led to indicators that are not measurable and irrelevant to the output. Suggest output to be reworded in terms of "established laws, regulations and policy instruments to promote biomass energy systems". This indicator can then be changed "number of laws, regulations and policy instruments that promote biomass energy systems"
	2.Structures, tools				3. Website is	Unable to rate		Indicator has poor relevance to the

Project Strategy	Indicator	Baseline Level	Level in 1st PIR (self-reported)	Midterm Target	End-of-project Target	Midterm Level & Assessment	Achieve-ment Rating	Justification for Rating
	and methodologies to monitor, tracking and benchmarking of technology performance				created and continuously updated for success/failure cases. 4. Biomass-fuelled energy Technology performance benchmarking tool is developed and tested	(see justification for rating)		output. Suggestion for a new indicator could be "% decrease in energy consumption from benchmarked biomass energy systems" with a target of "20%".

Indicator Assessment Key

Green= Achieved	Yellow= On target to be achieved	Red= Not on target to be achieved

3.4 Effectiveness

The effectiveness of the TT Project to date has been **moderately unsatisfactory**. The primary reasons for this rating can be attributed to the fact that 40 months into the Project (more than 80% of the 48 month design period of the Project), only 30% of the USD 1.69 million has been expended with the outcome of no pilot projects being implemented.

Despite the aforementioned lack of clarity in the log frame with regards to the outputs, indicators and targets, details on the extent of progress of all the outcomes and outputs of the TT Project are provided in Table 2.

Outcome 1 – Transfer of clean and energy efficient low carbon technologies

The outputs to achieve this outcome (according to the Project log frame) includes 3 operational pilot small power plants fuelled by biomass, dissemination of the lessons learned from pilot plant operation and training for plant personnel in operation, maintenance and troubleshooting. The effectiveness of activities invested to deliver the outputs to achieve this outcome were **moderately unsatisfactory** that can be attributed to:

- The failure of partners who had pledged co-financing resources in the Project document to implement 3 pilot projects. This includes Nikoline Investment Co. Ltd, Hong Vannin Co., Ltd and Yamn Loeung Rice Mill; and
- Training for potential plant personnel on the concepts and design of a Rankine cycle power generation as well as training on O&M, and troubleshooting during plant commissioning. However, without an operational pilot power plant, this training cannot be completed.

In August 2014, Project personnel concluded that the 3 co-financing entities could not implement bioenergy projects. Reasons for this were shared with the PSC in September 2014:

- These enterprises only required intermittent power for 10 hours per day. With gasification being considered to convert to biomass to energy, the gasifier would need to be shut down on a daily basis or the power sold to the grid during the night. Neither option was feasible since gasifiers are designed to be operated on a constant basis and there is only low demand for power at night;
- The available biomass to meet the captive demand of the enterprises was only 40 to 50%. This shortage necessitated the purchase of additional fuel needing to be purchased or stored;
- The lack of policy instruments such as feed-in-tariffs (FiT) and standard formats for power purchase agreements (PPAs) to enable excess power to be sold to the grid;
- Reduced global prices of crude oil diminishing the competitiveness of biomass notably if captive consumption is less than 70%;
- Availability of surplus power during monsoon from hydropower sources reducing electricity unit costs;
- Rise in the unit cost of implementing small power plants from an assumed cost of USD 1.0 million to USD 1.5 million per MW.

Some of these factors only served to diminish the techno-economic feasibility of small power plants using biomass gasification systems. The evaluators believe that the lack of financial closure of the 3 pilot power plants was a combination of changing economic conditions along with design assumptions that carried higher risks including:

- Difficulties in forecasting the availability of less costly energy to the various industrial enterprises especially during the commencement of the TT project in 2012 when energy prices were rising;
- An assumption that most industrial enterprises would adopt captive power generation that would need to be operated on a continual basis;
- Since most industrial enterprises only require intermittent power (10 hours of power on a daily basis), an assumption was also made that excess power generation could be sold to the grid;
- Assumptions were made that RGoC would finalize arrangements for power purchase agreements (PPA) and implement a feed-in-tariff (FiT) for the sale of excess power to the grid during off hours. With the availability of cheaper electricity from thermal and hydropower plants, RGoC did not finalize PPA and FiT arrangements. In addition, biomass energy systems for industrial enterprises only requiring intermittent power, was no longer economically feasible.

Cogeneration opportunity with Medai Enterprises (Ganzberg Brewery) in Phnom Penh:
Medai Enterprise has been in the market for the biomass energy system for 2 years. TT Project personnel had been in discussion with the owner on a cogeneration system using imported turbine and boiler equipment. In 2013, the owner of Medai Enterprises implemented a biomass energy scheme through the purchase and installation of 2 locally manufactured and less costly local wood boilers. The performance of these boilers has been substandard, delivering only 60% of its design heat due to leakage of water from the boiler tubes. The owner is now in discussion again with the TT Project to implement a cogeneration opportunity by adding an imported back-pressure turbine and boiler (that complies with International Boiler Regulation (IBR) Standards) that will meet the owner's required thermal energy demands for now and in the future and part of electrical energy requirement. This would include a high pressure boiler that would use chipped wood/biomass briquettes for improved combustion efficiency that would also allow him to generate 500-600 KW of captive electricity generation from a steam turbine. Medai has received technical and financial offers and a decision on this USD 500,000 investment (excluding land and civil construction costs) will be made in September 2015.

Cogeneration opportunity with LyLy Food Company in Phnom Penh:
Similar to Medai enterprises, the Ly Ly Food Company has also requested and received quotation for high pressure boiler and turbine that will generate 300 kWh annually. Their decision on this USD300,000 investment will also be in early September 2015.

In addition to biomass cogeneration project opportunities, TT Project personnel are currently assessing other potentially economically feasible technology applications that would have the impact of biomass fuelled displacing fossil fuel usage including:

- The use of biomass for drying ovens located in cassava and rubber plantations;
- The use of biomass for absorption chiller units that would replace the use of diesel oil for cooling units.

Project personnel are currently in discussion with industrial enterprises with growth plans and 24-hour energy demands. This would include the food processing sector where the incremental energy costs can be minimized through biomass cogeneration (thermal and electrical) energy solutions.

Outcome 2 – Supply of national service providers in technology evaluation and technology transfer

The outputs to achieve this Outcome (according to the Project log frame) includes training to develop national experts, established network of indigenous partners for technology adaptation, web-based guidance manual for renewable energy development, technology and case study database. The effectiveness of output activities to achieve this Outcome were rated as **moderately unsatisfactory**.

This can be attributed to:

- Study tour to India and Thailand to visit 10 operating power plants as well as boiler and turbine manufacturers and suppliers. Participants included personnel from MoIH, MoME, MoE, and EDC who viewed successful operations of biomass energy plants;
- Training of national experts that commenced in late 2014 on the concepts of technical and financial evaluation of biomass-based cogeneration projects;
- Local indigenous partners have been trained. However, due to the lack of any operational pilot projects, their absorption of technology transfer cannot be assessed. As such, a network for indigenous partners for technology adaptation has not yet been established; and
- Training of national experts in 2015 on a web-based manual for technology transfer of biomass energy systems using the UNIDO-supported COMFAR software for financial engineering;

Clearly, successful and effective delivery of this outcome is dependent on successful implementation of a pilot power plant fuelled by biomass.

Outcome 3 – Stronger institutional framework in place to ensure long-term support for renewable energy (biomass) promotion

Outputs to achieve this outcome (according to the Project log frame) includes strengthened government departments that can promote biomass-based RE technology, trained financial institutions in financial mechanisms for RE, and trained financial institutions to assess investment proposals and RE. The effectiveness of output activities to achieve this outcome were rated as **moderately unsatisfactory.** This can be attributed to:

- Completion of some training modules that commenced in 2014 for relevant Government departments to build their capacity for technology transfer of biomass energy systems using agricultural residue;
- Training of Cambodian financial institutions through training modules in Laos PDR on COMFAR software in September 2014. This training would be complete if there is an operational pilot power plant fuelled by biomass.

Outcome 4 – Increased adoption of energy generation technologies by Cambodian businesses and private investors. The creation of a national market for biomass technologies.

Outputs to achieve this Outcome (according to the Project log frame) includes compiled and disseminated results of the pilot projects, investors and decision-makers with improved understanding of biomass and potential, other stakeholders with improved understanding of adopting biomass technology. The evaluators are **unable to rate** the effectiveness of this component due to no progress towards increased adoption of biomass energy generation systems.

Outcome 5 – Establishment of policy, legal and regulatory frameworks that sustainably promote and support renewable energy generation

Outputs to achieve this Outcome includes policy gap analysis, regulations and policy instruments for biomass energy promotion. The evaluators are **unable to rate** the effectiveness of this component since there is no progress towards the establishment of any policies or regulatory frameworks. Moreover, the outputs and indicators should be rewritten to provide more clarity in terms of how to achieve the desired outcome.

Though the Project has not achieved many outputs to date, the Project objectives remain the same. It is clear that industrial entrepreneurs in Cambodia do consider the importance of developing biomass as a renewable source and least cost option for satisfying their energy demands. Moreover, these entrepreneurs now have an understanding of the potential of biomass energy systems to provide reductions in operational costs to industrial enterprises. If the industrial sector in Cambodia is to experience growth, much of this growth will depend on developing least cost options to meet increasing energy demands from increased production.

The challenge for the remainder of the Project is to develop the first pilot cogeneration power project (1-3 MW) that is fuelled by biomass of the purposes of generating electrical and thermal energy for captive use. Once this pilot plant is operational, progress can be achieved on all outputs of this Project. This would include more dialogue and improved collaboration with relevant Government counterparts to formulate policies and regulatory frameworks for biomass technology transfer, and formalized reporting of GHG emission reductions to the appropriate institutions such as the Climate Change Department under MoE.

3.5 Efficiency

The evaluation team found that the efficiency of the activities supporting the delivery of the outcomes of this Project were **moderately unsatisfactory.**

To date, USD 506,795 has been expended on the TT Project, the equivalent to 30% of total GEF budget of USD 1.69 million that is now 83% or 40 months into the 48-month design period of the Project. Considering the main expenditures made to date have been identification of potential biomass projects, meeting with equipment suppliers and possible investors as well as study tours and training workshops, the outcome has been no finalized investment decisions into biomass energy in the industrial sector on this TT Project. As mentioned in the previous section, Project personnel have struggled to identify cost-effective technologies for the pilot power plant projects. The time expended by Project personnel to identify cost-effective technologies is well beyond the halfway point of the Project. Annual disbursements of the TT Project are provided in Table 3.

The evaluation team has also observed that TT Project personnel do not have much, if any communication with other UNIDO and donor projects[9]. Moreover, the PMU is housed within NCPO, an organization that was established in 2005, long before these other UNIDO and donor projects had commenced. The issue for the evaluators, given the lack of progress on the TT Project, is the lost opportunity for developing synergies with other projects that could result in more positive outcomes for the TT Project.

[9] This would include the UNIDO sponsored Hot-Spot and TEST Project that introduced an integrated approach with selected enterprises to demonstrate the benefits of cleaner production and appropriate environmental management systems; and the UNIDO-GEF project on “Reduction of GHG emissions through the promotion of biogas plants” that seeks to promote investments in biogas-based rural electricity enterprises (commencing operations in August 2015).

Table 3: TT Project disbursements

Outcome	2012	2013	2014	2015*	Total Disbursed	Remainder for Project	Total Remaining
Outcome 1a: Transfer of clean and energy efficient low carbon technologies (Technical assistance)	**0**	**36,624**	**54,270**	**88,725**	179,619	**200,000**	20,381
Outcome 1b: Transfer of clean and energy efficient low carbon technologies (Investment)	**0**	**15,090**	**11,663**	**69,336**	96,089	**850,000**	753,911
Outcome 2: Supply of national service providers in technology evaluation and technology transfer	**886**	**4,738**	**12,710**	**73,287**	91,621	**200,000**	108,379
Outcome 3: Stronger institutional framework in place to ensure long-term support for renewable energy (biomass) promotion	**0**	**31,187**	**0**	**15,083**	46,270	**150,000**	103,730
Outcome 4: Increased adoption of biomass-based energy generation technologies by Cambodian business and private investors	**0**	**10,284**	**7,904**	**26,061**	44,249	**140,000**	95,751
Outcome 5: Establishment of policy, legal and regulatory frameworks that sustainably promote and support renewable energy generation	**0**	**3,763**	**556**	**674**	4,993	**50,000**	45,007
Project Management Unit	**0**	**5,512**	**0**	**38,442**	43,954	**100,000**	56,046
Total (Actual)	886	107,198	87,103	311,608	506,795	**1,690,000**	**1,183,205**
Total (Cumulative Actual)	886	108,084	195,187	506,795			
Annual Planned Disbursement (from AWPs)							
% Expended of Planned Disbursement	**n/a**	**n/a**	**n/a**	**n/a**	Total expenditure to date - - >		**30%**

3.6 Likelihood of sustainability of project outcomes

Sustainability of the TT Project objectives were evaluated in the dimensions of financial resources, socio-political risks, institutional framework and governance, and environmental factors, using a simple ranking scheme:

- *4 = Likely (L):* negligible risks to sustainability;
- *3 = Moderately Likely (ML):* moderate risks to sustainability;
- *2 = Moderately Unlikely (MU):* significant risks to sustainability; and
- *1 = Unlikely (U):* severe risks to sustainability.
- *Overall rating is equivalent to the lowest sustainability ranking score of the 4 dimensions.*

The overall project sustainability rating is moderately unlikely (MU). This is primarily due to:

- From a socio-political perspective, the availability of lower cost electricity in Cambodia from the new coal-fired plant and hydropower during monsoon that will have the impact of reducing competitiveness of biomass energy and lessening the urgency for industrial entrepreneurs to seek renewable energy solutions such as biomass energy;
- From an institutional and governance perspective, existing government capacity to enforce any new institutional framework will be a challenge.

Details of sustainability ratings for the Project are provided on Table 4.

3.7 Assessment of monitoring and evaluation systems

The M&E design in the Project document is adequate with a budget dedicated to ensuring successful implementation of the Project by being able to closely track and review of project activities against indicators and targets provided Project results framework. Moreover, the design also lays out the general conditions for monitoring including the transfer of low carbon technology that leads to GHG emission reduction from energy generation, emission reductions generated from the three pilot projects to be directly supported by the UNIDO GEF project, and emission reductions generated through implementation of other RE investments with the assistance of the GEF project. As such, the M&E design is rated **moderately satisfactory** at entry, in part due to the Project log frame which does not have a full set of SMART indicators and targets.

Implementation of this M&E plan, however, has been **moderately unsatisfactory**. The evaluation team was unable to verify that a formal M&E system was in place and implemented for the TT Project. Project progress has been reported in terms of outcomes but does not link progress with the outputs, indicators and targets in the log frame. The absence of a clear log frame, indicators and targets has not provided the necessary focus to achieve desired outcomes. This is especially true for many of the outputs, notably those in Component 5 where outputs are poorly defined.

The difficulties in monitoring and evaluating the TT Project were compounded by the fact annual work plans were prepared without direct reference to the Project log frame. This was a topic that was brought to the attention of the May 2015 PSC meeting where PSC members were presented what had happened on the Project followed by what the TT Project personnel were going to do. The issue for PSC members was the lack of opportunity to provide inputs into the work plan, which would have the effect of improving RGoC ownership of the Project. This is as an indicator of the lack of effective communication between TT Project personnel with some of the relevant institutional stakeholders such as the Department of New and Renewable Energy. If there are to be any effective contributions by the TT Project to policies, regulations and standards on renewable energy development (Component 5), the involvement of the Department of New and Renewable Energy would appear to be essential

The budgeting and funding for M&E activities has been **moderately unsatisfactory.** The evaluation team has noted that although Project expenditures were subdivided into component expenditures and Project management, specific M&E activities (i.e. measurement and verification of results, preparation of PIRs, PSC meetings, etc.) were not defined. This may also be mainly due to the lack of progress in the identification of a feasible biomass project as well as a Project log-frame that did not have a complete set of SMART indicators.

Table 4: Assessment of sustainability of outcomes

Actual outcomes (as of June 2015)	Assessment of sustainability	Dimensions of sustainability
Actual outcome 1: No transfers of energy efficient low carbon technologies to stakeholders	• *Financial Resources:* Financial resources are available if a techno-economic feasible biomass energy systems can be identified; • *Socio-Political Risks:* The Project is now targeting industrial enterprises that have growth plans and are located in less dense areas. This would minimize risks of local objections to gasification and cogeneration systems that are typically noisy; • *Institutional Framework and Governance:* There is a weak institutional framework in place and poor Government capacity to enforce any biomass energy systems regulations; • *Environmental Factors:* The Project is targeting the development of biomass energy systems in industrial enterprises located in less dense urban areas that will minimize environmental impacts in residential areas. ***Overall rating***	4 3 3 3 **3**
Actual outcome 2: National service providers in technology evaluation and technology transfer have been trained but without the benefit of an operational biomass power plant in Cambodia	• *Financial Resources:* Financial resources outside of the TT Project resources for continued training of national service providers have not yet been identified due to the lack of an identified and fully operational biomass energy project; • *Socio-Political Risks:* No social political risks identified to the training of national service providers; • *Institutional Framework and Governance:* No institutional framework and governance risks identified; • *Environmental Factors:* No environmental factor risks identified. ***Overall rating***	2 4 4 4 **2**
Actual outcome 3: No institutional framework in place to ensure long-term support for renewable energy (biomass) promotion	• *Financial Resources:* Financial resources outside of the TT Project resources for continued strengthening of local financial institutions have not yet been identified; • *Socio-Political Risks:* Lower energy costs from hydropower and the current coal-fired power plant may make biomass energy less competitive; • *Institutional Framework and Governance:* No institutional and governance risks identified; • *Environmental Factors:* No environmental factor risks identified. ***Overall rating***	2 3 4 4 **2**

Table 4: Assessment of sustainability of outcomes

Actual outcomes (as of June 2015)	Assessment of sustainability	Dimensions of sustainability
Actual outcome 4: No adoption of biomass-based energy generation technologies by Cambodian businesses and no market created for biomass technologies	• *Financial Resources:* No willingness to avail financial resources for biomass-based energy generation technologies since there are no successful pilot projects yet to demonstrate its benefits; • *Socio-Political Risks:* The possibility of lower energy prices in Cambodia pose a risk to the competitiveness of biomass-based energy systems; • *Institutional Framework and Governance:* Institutional framework still lacks regulations and standards to the development of biomass-based energy systems and posing risks increased adoption; • *Environmental Factors:* No environmental factors risks identified. ***Overall rating***	2 2 2 4 **2**
Actual outcome 5: No policy, legal or regulatory frameworks have yet been established to sustainably promote renewable energy generation	• *Financial Resources:* No financial resource risk has been identified; • *Socio-Political Risks:* National strategies support the regulatory framework for promoting renewable energy. However, urgency of this issue may be downplayed due to the availability of cheaper electricity from the coal-fired plant and large hydropower plants during the monsoon; • *Institutional Framework and Governance:* Government capacity for enforcement is weak and may take years to be appropriately strengthened; • *Environmental Factors:* No environmental factors risks identified. ***Overall rating***	4 2 2 4 **2**
	Overall rating of project sustainability:	**2**

3.8 Assessment of processes affecting achievement of project results

- **Preparation and readiness / Quality at entry**

Overall preparation and readiness for the TT Project can be rated as **moderately satisfactory**. Project preparations by NCPO as well as implementation of the UNIDO-supported Cleaner Production projects from 2006-2010 provided a sound basis on which to identify industrial enterprises that could potentially benefit from biomass energy systems. Office facilities and staff at NCPO were already set up to manage the other GEF supported IEE Project at Project entry. The execution of the IEE Project by NCPO had also provided valuable insights into the implementation arrangements required for the TT Project.

The evaluators, however, have made comments on design issues of the TT Project at entry in Section 3.1. In summary, the Project objectives were clear; however, the Project log frame lacks a full set of SMART indicators; this has only added to the difficulties of effectively monitoring the Project. In addition, considering the number of outputs related to financial engineering, there was an absence of effective consultations with financial stakeholders during the PPG phase, generating little interest during Project implementation amongst financial stakeholders on developing financial mechanisms for renewable energy projects in Cambodia. Section 3.1 also mentioned the lack of accurate energy load profiling information of partner industrial enterprises that has led to an erroneous assumption that biomass energy systems would be feasible for many industrial enterprises. As such, the rating for the preparation and readiness of the Project was downgraded.

- **Country ownership/drivenness:**

The TT Project concept is in line with the sectoral and development priorities and plans of Cambodia. Key policies and plans of the RGoC are to improve the competitiveness of the country's industrial sector through the use of biomass that would displace the use of imported fossil fuels. This includes:

- The Energy Sector Development Plan, 2005-2024;
- The 2013 National Policy, Strategy and Action Plan on Energy Efficiency in Cambodia (MoME);
- The Strategic Framework of the General Department of Industry (2010-2015)[10]; and
- The National Strategic Development Plan 2014–2018 that specifically seeks to ensure efficient management and use of energy as well as fostering development of all types of renewable energy such as biomass[11].

The intended TT Project outcomes all contribute to national priorities. The most relevant government agencies were involved on the preparation phase of the TT Project including MoIH, MoME and MoE. Although one of the Project activities is to assist in the formulation of policies and legal frameworks to sustainably promote and implement biomass energy systems, the delay of implementing pilot biomass power projects has deferred the commencement of these activities until 2016, if in fact, any pilot project is implemented.

[10] http://www.ide.go.jp/English/Publish/Download/Brc/pdf/07_chapter2.pdf
[11] Paras 4.122 to 4.127

- **Stakeholder involvement:**

The TT Project has involved relevant stakeholders through information sharing and consultation. Project stakeholders have been involved through a series of workshops. During Project preparations, PPG personnel consulted in close collaboration with former MIME and the numerous industrial enterprises regarding their energy costs and willingness to participate in pilot projects for biomass energy systems. These consultations, unfortunately, did not include financial stakeholders.

During Project implementation, stakeholder involvement involved approaches with specific industrial enterprises who would benefit from biomass energy generation systems. However, given that there has been no traction on identifying a techno-economically feasible biomass energy generation system for a pilot project, there have been no further awareness raising workshops for about 12 months. There has been a number of training workshops over the past 12 months for financial institutes and institutional personnel on financial engineering of RE projects and concepts and designs for Rankine cycle power generation. Unfortunately, at the time of this evaluation, there is still no interest amongst local financial institutions on developing financial mechanisms for renewable energy.

Another area of weakness in stakeholder involvement has been full engagement of all relevant government counterparts. As previously mentioned, this concern was raised by the Department of New and Renewable Energy of MoME, noting the lack of effective communication between the Project and participating institutions. A root cause of this issue has been the CTA undertaking all technical decisions, and by extension, field management decisions on the TT Project; as such, he requires more assistance and involvement of local staff to provide the necessary focus on institutional strengthening on the TT Project. The evaluators observe that current NCPO personnel including the Project coordinator appear to only play a supporting role in the promotion and implementation of the TT Project. In addition, there were also several NCPO personnel resignations in late 2014, setting back the capacity of NCPO as an organization to promote and support cleaner industrial production.

As such, stronger support from Cambodian-based personnel is required to assist the CTA in disseminating its technical solutions that will achieve the desired outcomes of the TT Project. This should involve the Project Coordinator and an additional senior engineer who can liaise with the relevant government agencies on renewable energy. The evaluators are of the opinion, however, that despite the excellent potential to develop local capacity to play a prominent managerial role in promoting and developing biomass energy systems for the industrial sector in Cambodia, current NCPO personnel will require another two or more years of training to play a more meaningful managerial role within the PMU.

- **Financial planning:**

The evaluation team was provided with evidence of formal financial planning for the Project in the form of annual work plans (AWPs). Decisions on AWPs were made by the CTA, and shared with UNIDO HQ in Vienna for the timely disbursement of funds. Due diligence in the management of Project funds is undertaken by the Project Manager based in Vienna. The recent difficulties in financially planning TT Project implementation are related to the problems in completing co-financing arrangements with the 3 pilot projects. As a result, TT Project personnel are currently in discussion with other industrial enterprises who can benefit from biomass energy generation in their operations.

- **UNIDO's supervision and backstopping:**

The overall rating of UNIDO's supervision and backstopping is rated as **moderately unsatisfactory.** This is based on:

- Lack of progress into the 34th month of Project operations in setting up biomass energy generation technology pilot plants;
- Ongoing issues in the effectiveness of the working relationship between NCPO and a number of government counterparts. With the Project not having a fully collaborative working relationship with certain personnel within MoME and MoIH (most notably from the Department of New and Renewable Energy) from the commencement of the project in 2012, the effectiveness of Project activities on institutional strengthening is somewhat limited.

Exacerbating these issues has been the poor relationship developed between the Project and the UNIDO Chief in Cambodia since 2010. This may in part be due to the fact that NCPO had been established in 2004, several years before the post of the Office of the Head of UNIDO in Cambodia (HUO) was established. The primary roles of the UNIDO Chief are to serve as a primary liaison between RGoC and UNIDO, and to provide oversight monitoring and coordination of local project teams. There is little if any interaction between NCPO and the HUO, and the TT Project does not fall under the monitoring purview of the HUO.

With the TT Project's lack of an operational pilot biomass energy plant and its lack of working relationships with other UNIDO projects (that fall under oversight monitoring and coordination with the UNIDO Chief), the evaluators observe that synergies with other UNIDO projects are not fully utilized. The outcome of this is a high risk that the NCPO activities in planning and implementing pilot biomass energy projects of being unsustainable. The support of the UNIDO Chief in Phnom Penh can be valuable in terms of attaining more widespread support for NCPO's efforts in finding willing industrial enterprises to pilot biomass energy systems in Cambodia, thus reducing this high risk.

- **Co-financing and project outcomes and likelihood of sustainability:**

There has only been in-kind co-financing on the TT Project to date. Due to the lack of implementation of a pilot biomass energy project, there has been no co-financing in the form of capital investments made to date. With no pilot project financial closure to date, there is a strong likelihood of the TT project being unsustainable. Hence, the importance of implementing the pilot biomass energy systems pilot project cannot be overstated.

- **Delays and project outcomes and sustainability:**

The delays in identification of appropriate biomass energy generation technologies does affect sustainability of this Project. The pilot project was to demonstrate tangible benefits and reductions in production costs to industrial enterprises throughout Cambodia. This would have incentivized these enterprises towards biomass energy development in Cambodia and lead to an outcome of reduce GHG emissions resulting from place use of diesel oil and other imported fossil fuels.

- **Implementation approach:**

The implementation approach of the TT Project has been assessed as **moderately unsatisfactory**. The approach is very similar to that of the IEE Project which was to demonstrate biomass energy systems as a means to increase adoption of these systems by Cambodian industrial enterprises, and to build capacity of all relevant institutions for RE TT within RGoC. The approach adopted to date has been mostly engineering oriented with efforts placed into identification of appropriate technologies and energy systems and meetings with potential enterprises who would benefit from such systems. This has not resulted in any biomass energy investment commitments due to the nature of the energy demands of these enterprises as previously mentioned in Section 2.2.

In late 2013 and 2014, there have been efforts to meet the training obligations of Project including training for private sector, institutional and financial sector personnel. However, with no financial closure on a pilot biomass energy system, training activities on the TT Project are far from complete. Moreover, given the issues raised by MoME with the TT Project (as per PSC meeting minutes February 2015), TT Project personnel will need to make adjustments to improve the collaborative nature with their institutional counterparts to meet institutional strengthening objectives of the Project. This translates into re-scoping and rewriting of the institutional strengthening component of the TT Project (Component 5) which is not very clear to the evaluators.

3.9 Project coordination and management

National management and overall coordination mechanisms were to be undertaken by the Project's PMU based in Phnom Penh. Both UNIDO and NCPO have been providing the PMU with the support required to manage the TT Project. According to the Project document, the PMU was to consist of 6 local staff who were to manage, monitor and evaluate Project activities in accordance with agreed work plans in close collaboration with the Project's part-time international CTA from UNIDO as well as MoIH and MoME (formerly known as MIME) and the CCD under MoE. The other primary role of the PMU was to coordinate all Project activities being conducted in Cambodia including management of national experts as recruited by the Project as well as organizing in-country training seminars and awareness raising activities. In addition, a Project Advisory Committee (PAC) was to be established to meet twice annually to review implementation progress, facilitate coordination between Project partners, and ensuring transparency and ownership to enhance sustainability of the Project results. PAC members were to consist of a wide cross-section of stakeholder representation in Cambodia to be chaired by MoIH as well as the GEF focal point for Cambodia.

The TT Project has been managed nationally by the PMU based in Phnom Penh. Up until late 2014, staffing levels in the PMU were in the order of 6 persons with several part-time consultants. While the role of the PMU staff was to provide management and coordination of TT field activities, this role has largely been undertaken by the CTA. Roles served by PMU staff include the collection of baseline information, information and analysis, monitoring and reporting on implementation and energy savings. The current role of the Project Coordinator has evolved into working directly under the CTA to administer Project activities. The current Project Coordinator has replaced the one who resigned in late 2013; owing to the importance of this position, this PC has been encouraged to take on a greater role on the TT Project with the CTA.

In late 2014, five PMU staff resigned and were replaced by less experienced staff in early 2015. A primary reason for these resignations was the opportunity for these staff to move to better paid assignments. For the PMU and by extension NCPO, however, these resignations represent a loss in Project corporate memory and technical capacity of NCPO to provide technical assistance to industrial enterprises on biomass energy systems. This loss of capacity also impacts the sustainability of the TT Project if it is assumed that NCPO is the only organization in Cambodia that promotes the development of biomass energy systems. The TT Project is in need of a senior officer who can effectively communicate with all levels of government and serve as a bridge between the CTA and local staff building capacity; ideally, this should be a retired government officer from the RGoC or a senior retired engineer who is based in Cambodia.

UNIDO HQ-based management and coordination has been conducted through periodic visits to Cambodia (as often as two times annually) as well as frequent communications through Skype and email. The lack of implementation of a pilot biomass energy plant in the 40th month of the Project places into question the effectiveness of past management and coordination efforts of UNIDO from HQ. The ongoing relationship issue between various institutional counterparts and Project personnel has been allowed to fester well into the 75% of the Project implementation period. The evaluators consider the repair of this relationship to be critical if not to ensure the successful and sustained technology transfer of biomass energy systems after the EOP.

The PAC formed for the TT Project consists of the same PAC for the sister GEF project for Industrial Energy Efficiency (IEE Project). The PAC is now referred to as the Project Steering Committee (PSC). During the implementation period of the TT Project, the evaluators can only confirm that 2 PSC meetings have been conducted (2014 and 2015). PSC meetings for the TT Project were combined with PSC meetings for the sister IEE Project. For the PSC meeting in February 2015 for the TT Project, PSC members discussed the ways forward to successfully set up a pilot biomass energy system. With a number of other technology solutions and applications being identified by the CTA, the Chairman of the PSC motioned to have a technical advisory committee convened to review available pilot project options. To date, TT Project personnel led by the CTA are compiling information that will lead to available technologies for implementing a pilot biomass energy system.

The PMU also prepared work plans for 2013 to 2015. A review of these plans, however, indicated that actions planned were not closely linked with the Project log frame. This would make it difficult to use these work plans to monitor progress with the 5 Project components as well as Project management. Examples include:

- In the 2014 AWP, there is an activity to “establish, promote, operate and keep up-to-date RE-TT website” that is listed under “Project Management”. The evaluators question if this is related to Output 2.3 “Developed web-based guidance tool/manual on RE-TT”;
- In the 2015 AWP, Activity 4 is “consultation workshop (2 Nos) for additional technologies for TT” which can be tied to a number of training activities in the Project log frame including Output 1.3: Trained personnel from participating companies have been trained in operation, maintenance & trouble shooting in biomass energy systems, Output. 2.1: A cadre of at least 20 national experts from relevant support institutions, and Output 3.1: Government officers with improved knowledge to promote biomass based renewable energy systems.

The difficulties in preparing work plans for the TT Project is linked to the need for a simpler Project log frame with more clarity (such as the log frame suggested by the evaluators in Appendix 5). This would facilitate the preparation of more effective annual work plans that can be easily monitored for effectiveness as well as cost expenditures.

Overall Project management and coordination rating of this project is **moderately unsatisfactory.**

3.10 Gender mainstreaming

This Project has not yet made significant contributions to gender mainstreaming. It is noteworthy that almost one half of the industrial SMEs visited during the evaluation were headed by female CEOs. The evaluators also observed that many of the factories had a workforce consisting of greater than 50% female, notably the garment industry which had more than 75% female employees. One of the desired outcomes of this Project was increased competitiveness of industrial enterprises through reduction of energy costs through implementing biomass energy systems. With a pilot biomass energy system, there is potential to demonstrate reduced operational costs of industrial enterprises, increased financial stability of an enterprise that employs a high proportion of females, and increased opportunities for higher-quality jobs for both males and females.

3.11 Procurement issues

To date, there has been little or no procurement on this Project.

4. CONCLUSIONS, RECOMMENDATIONS AND LESSONS LEARNED

4.1 Conclusions

The TT Project suffered a setback in mid-2014 when three co-financing enterprises withdrew their commitments to invest in pilot biomass energy systems as a vehicle to demonstrate the benefits of renewable energy generation to the industrial sector. As of October 1, 2015, the TT Project had only 8 months remaining until its terminal date of May 25, 2016. Any achievements or successes on the TT Project will, to a large extent, be determined on the success of finding an investor for a techno-economically feasible pilot biomass energy cogeneration project. The conditions for a techno-economically feasible pilot project consists of a plant that has a 24-hour energy demand for thermal and electrical energy. Such a pilot project is likely to successfully demonstrate lower production costs for industrial enterprises.

Project personnel, however, are experiencing a number of obstacles in achieving this outcome:

- TT Project plans have been shared with the Project Steering Committee (PSC). However, there has not been full dissemination of this information within the relevant institutions due to a need for more effective communication between TT Project personnel and certain government departments (such as the Department of New and Renewable Energy under MoME). This scenario limits opportunities to network and increase the number of potential pilot projects in biomass energy. The evaluators have not seen any documentation of current biomass energy investment opportunities; however, the CTA has detailed knowledge of these opportunities involving industrial enterprises that includes the use of biomass energy for:
    - Cogeneration for industrial enterprises requiring electricity and thermal energy on a 24-hour basis;
    - Drying ovens located in cassava and rubber plantations; and

- Absorption chiller units that would replace the use of diesel oil for cooling units.

There is an urgent need to strengthen the efforts of the CTA in preparing and promoting biomass energy system opportunities to a wider selection of industrial enterprises in Cambodia. This should include the addition of a senior national energy expert to the PMU to improve the effectiveness of these efforts. The evaluators understand that the Project has been pursuing such a person for the past 18 month but without much success to date;

- There are a small number of foreign equipment suppliers making regular business visits to Cambodia to finalize strategic partnerships that may result in:
  - Cambodian equipment vendors increasing their sales of imported quality equipment such as boilers and gasifiers;
  - a long term possibility that there will be local production of foreign-designed equipment under license;

- Considering the importance of the pilot biomass energy project, its value in demonstrating energy cost reductions, and to increase the likelihood that a pilot biomass energy project can be implemented in 2015 or early 2016, there is a need to consider alternative financial incentives other than the current buy down of 20%;

- The evaluators are concerned over the sustainability of efforts of the TT Project to promote biomass energy solutions for the industrial sector:
  - In 2013 and 2014, many of the senior staff left the PMU within NCPO and were replaced by less experienced staff. As such, NCPO capacity to undertake development of renewable energy, energy efficiency and cleaner production is weaker;
  - The need for more effective communication between the PMU and a certain subset of government officers within MoIH and MoME as well as the HUO that has not resulted in full institutional cooperation with TT Project personnel;
  - Management of the TT Project is almost entirely in the hands of the CTA with no meaningful roles being played by local PMU staff. While this situation is entirely understandable given the difficulties in recruiting qualified personnel, there is a need for UNIDO to develop or recruit PMU staff to share in the management of the TT Project. The difficulties in finding assistance for the CTA (to offload some of the management responsibilities of the TT Project at the field level) only raises the risk that biomass energy promotion after the EOP is unsustainable;

- It is difficult to envision the Project making any progress with regards to policy and regulatory framework for biomass energy systems and renewable energy in general. This is on the basis of the aforementioned need for more effective communications between certain government departments (such as the Department of New and Renewable Energy under MoME) and Project personnel, and the lack of clarity on indicators and targets on the regulatory framework aspects (Component 5) on the Project log frame;

- With 8 months remaining on the TT Project, there is insufficient time to set up an operational pilot biomass energy project, train personnel on its insulation operation and maintenance, and assisting RGoC in drafting policy on renewable biomass energy.

4.2 Recommendations

To UNIDO:

Recommendation 1: As a top priority, all immediate activities of the TT Project should focus on the successful completion and operation of a pilot biomass system for an industrial enterprise with 24-hour energy demands. This will involve PMU personnel as well as personnel at UNIDO in considering the following actions:

- Provide support to other biomass energy applications that have been identified by the CTA including assurances of the techno-economic feasibility of these biomass energy applications including:
  - Conventional Rankine cycle co-generation technology with a back pressure turbine with 70% syngas and 30% diesel offsetting a 100% diesel fuel engine. This was the original biomass energy technology arrangement with the three co-financing entities. However, looking forward, the Project will need to pursue industrial enterprises with 24 hour energy demands;
  - Biomass-based vapour absorption technology and ammonium chiller that can displace imported diesel fuel for vapour compression for chilling. Breweries and ice factories are potential users of this technology application;
  - Wood-based dryers for rubber and cassava processing;
  - High-efficiency biomass gasifiers using 100% syngas for electrical and thermal applications. The issue with this application, unfortunately, is the unit cost reportedly in the order of USD 2.0 million per MW, somewhat prohibitive to the industrial sector in Cambodia; and
  - Partial displacement of coal used as fuel and cement kilns to biomass. The issue for this application is the small-scale of replicability in Cambodia;
- Examine if the current buy-down of pilot equipment of 20% is sufficient. Consideration should be made for a 30 to 40% buy down that would increase incentives for early entrants. In addition, the increased buy-down could be the reward for early demonstration partners which may result in more industrial enterprises coming forward to take advantage of the higher buy-down rates;
- If possible, consider energy performance contracting (EPC) such that the entrepreneur will not need to place any down payment for the system. An EPC can undertake an assessment of a cogeneration opportunity using biomass and propose a system for the industrial enterprise. Remuneration of the EPC will be in the form of energy saved each year. As such, the EPC is bearing the brunt of the risk while the industrial entrepreneur does not need to make any initial payments until energy savings are accrued. The challenge here is to find an organization willing to undertake an EPC arrangement in Cambodia where there is no history of such transactions. Some of the GEF funds could be allocated as a loan guarantee for the EPC entity instead of funds for buy-downs;
- For rice milling operations that accumulate dangerous amounts of rice husks in an enclosed area[12], promote technologies where these rice husks can serve as biomass fuel at other locations such as garment factories. There are a number of rice milling operations around Phnom Penh that do not have incentives to adopt biomass energy systems resulting in these accumulations of rice husk. Technologies may include the making of rice husk briquettes that can be conveniently transported to other industrial enterprises for fuel to generate steam. Promotion of this technology should be conducted through a pilot project to demonstrate the lifecycle environmental and energy benefits in the making, transport and usage of the briquettes as fuel.

[12] The danger consists of large volumes of rice husks being stored in enclosed dry areas that could easily result in the dust explosion.

Recommendation 2 – Prepare a revised version of the log frame (Project results framework) that provides relevant outputs, SMART indicators and clarity in targets. This recommendation is made to provide the required clarity of efforts to achieve intended outcomes related to non-engineering aspects such as strengthened institutional framework and the establishment of legal and regulatory frameworks to support sustained development of biomass energy systems. This recommendation is also made as a precursor to preparing detailed work plan for a no-cost extension (see Recommendation 5). The evaluators have provided guidance on a revised log frame in Appendix E. The Project Manager and PMU staff should make efforts to comprehend the revised log frame, and to provide revisions, if appropriate, to the indicators, targets and their time frames. Any further clarity with regards to describing the indicators and targets should be made as footnotes so as to retain the simplicity of the wording in the actual framework matrix.

Recommendation 3 - Continue support and encourage the facilitation of strategic partnerships between foreign and local equipment suppliers. Such partnerships are a key to availing more quality equipment for energy generation in Cambodia:

- This would provide an opportunity for local suppliers to be associated with the sale of quality equipment;
- The partnership could have a long-term goal of local production of foreign quality equipment under license;
- These partnerships would reduce the likelihood of local production of poorly copied foreign equipment;
- Work closely with MoIH on intellectual property protection to encourage new equipment entrants to the Cambodian market[13].

Recommendation 4 - Adjust NCPO style of delivery of technology transfer to RGoC stakeholders by:

- Improving Project planning documents that can be shared with PSC members and involve them on providing inputs (see Recommendation 5). This would encourage local ownership of the TT Project;
- Involving UNIDO at both the regional and country levels on special efforts that will improve the support base of NCPO with all relevant institutional counterparts. This action should aim to improve the support base of the TT Project with all relevant institutional counterparts to deliver technical assistance on biomass energy systems[14] with support from both public and private sectors. This action will also open new contacts and networks for NCPO to implement other pilot project opportunities;
- **I**mproving outreach of PMU personnel (and by extension NCPO personnel) to improve its collaborative relationships with all relevant government agencies including those within MoIH, MoME and MoE by recruiting, if possible, a retired senior engineer or civil servant who could assist the CTA in representing NCPO;

[13] Technology transfer projects need to address issues related to intellectual property infringement that will protect and encourage foreign equipment suppliers into a developing country. Without such measures to protect foreign equipment suppliers from these risks, difficulties in transferring technologies will be encountered and delay achievement of intended outcomes. Measures to overcome this risk include building strategic alliances between foreign and local manufacturers which need to be started early in a Project to allow sufficient time to build a trusting relationship between two partners.

[14] Consistent with the findings of the Independent UNIDO-UNEP Evaluation on Cleaner Production Programs (2008), pg 179, available on:
http://www.unido.org/fileadmin/user_media/About_UNIDO/Evaluation/Thematic_reports/CP%20Progr%20eval%20report_ebook.pdf

- Wherever possible, encourage and support the formation of a post-project quasi-independent entity that can provide technical assistance to the industrial sector in renewable energy and energy efficiency developments;

Recommendation 5 - Improve management of the TT Project through the following actions:

- The CTA and Project Manager should prepare annual work plans (AWPs) that provide activities against outputs in a revised Project results framework (log frame), similar to the one in Appendix E, complete with estimated budgets (against all Project components) and proposed timelines. These AWPs should be prepared for the remainder of 2015 as well as draft AWPs for 2016 and 2017 with the intent of requesting GEF for a no-cost extension until December 31, 2017. These work plans, most importantly, should include:
  - Detailed profiles of pilot biomass energy projects that will be supported until the end of 2017 including as much information as is available, the name of the enterprise, their location, baseline energy scenario, proposed biomass offset intervention with estimated cost and rate of return, business rationale for the investment, estimated number of months to obtain agreement to implement, estimated number of months from agreement to commissioning of the biomass energy system, and replication potential of the biomass energy application;
  - The estimated timeline to achieve a target of 2 or 3 pilot biomass energy plants based on the available budget;
  - An estimate of budget available to support the development of pilot plants, training plant personnel and policy development;
- Improve the functionality of the Project Steering Committee that is to be used as a forum for Government inputs into the annual work plans and adaptive management of the Project. This would involve different preparations for the PSC meetings than has been done in the past: preparing and submitting work plans to PSC members in advance of the PSC meetings, and soliciting inputs from them during the PSC meetings as well as relevant government agencies. This would improve the effectiveness of the TT Project's efforts to strengthen relevant government institutions and their ownership of the Project, currently identified as an area of weakness in implementation approach; and
- PMU personnel should implement the M&E plan as set in the Project documents and provide quarterly as well as annual progress reports in the prescribed format of a Project Implementation Report (PIR). This reporting format has been standardized by GEF to facilitate effective monitoring and adaptive management of GEF projects.

To the Royal Government of Cambodia:

Recommendation 6: Provide support to TT Project efforts that encourage the facilitation of strategic partnerships between foreign and local equipment suppliers. This would include general efforts to encourage the import of quality equipment into Cambodia. Examples of government actions required includes financial incentives (such as tax holidays, and the waiving of VAT and customs and import duties) and enforcement support for the protection of intellectual property (IP). IP protection provides encouragement to equipment exporters (such as gasifier manufacturers) that certain patented gasifier models will not be copied and sold in Cambodia or elsewhere.

Recommendation 7: Provide support to a post-project quasi-independent entity that can provide independent technical assistance to the industrial sector for biomass energy systems and energy efficiency. If local engineering or consulting firms do not develop a new business line of energy auditing services, NCPO is well-positioned to continue the promotion of biomass energy systems and energy efficiency after the EOP. However, NCPO will need to be legalized as a quasi-independent entity that provides independent assessments of energy usage that is supported both by

public and private sectors. As such, NCPO would require government certification as a quasi-independent organization complete with a board of directors from both public and private sectors, a mission statement and a strategic business plan. The primary role of RGoC in this new NCPO entity will be to ensure compliance to policies, regulations and standards on the development of renewable energy and energy efficiency set by MoME. If a local engineering or consulting firm does develop a new business line for energy auditing services, RGoC will need to ensure these firms are impartial in technology selection, and in compliance with the aforementioned policies, regulations and standards.

To the Global Environment Facility:

Recommendation 8: Please consider a 19-month no-cost extension for the TT Project until December 31, 2017 based on work plans submitted by TT Project personnel that have been prepared with the intention of exhausting the remaining USD 1.183 million of GEF Project funds. The proposed work plans and extension to December 2017 would provide sufficient time to develop 2 to 3 operational pilot biomass energy plants and demonstrate reduced production costs for industrial entities, and train personnel on its operation and maintenance. Without this extension, the remaining GEF funds would not be disbursed with an expected best result of the TT Project being the commencement of the installation of a cogeneration biomass energy plant.

4.3 Lessons learned

- A strong understanding of the present energy consumptive patterns of an industrial enterprise is required to determine its future energy demands using biomass. While this has been difficult in Cambodia due to weak comprehension of energy issues and weak capacity for business planning, the need for a robust understanding of these issues is required to address:
  - The variability of seasonal energy demands;
  - Seasonal availability of agricultural feedstock and transport costs of that feedstock to an energy plant;
  - The cost of building redundancy of cogeneration activities that would address future or peak energy needs; and
  - Estimated cost savings to the business operations.

- Engagement of all relevant stakeholders during Project preparations is extremely important, especially if there are Project components that involve these stakeholders. An example on the TT Project has been the lack of effective engagement and consultations with the financial institutions. The outcome of this has been the failure of the TT Project in developing any interest within the financial community in financial mechanisms for renewable energy in Cambodia.

4.4 Ratings

These are summarized on table 5.

Table 5: MTE ratings & achievement summary table for project

Measure	MTE rating	Achievement description
	Objective: To bring about sustained transfer of efficient, cost effective and environmentally friendly (low carbon) agro waste biomass-fueled energy systems to replace fossil-fuel powered generators and boilers for power generation and thermal energy applications. **Achievement Rating: 2 (Unsatisfactory)**	There are just under 8 months to complete this Project, and the Project hinging with only one deal as a possible breakthrough with regards to technology adoption (Medai GS Enterprises)
	Outcome 1: Transfer of clean and energy efficient low carbon technologies **Achievement Rating: 3 (Moderately Unsatisfactory)**	There has been no implementation of 3 pilot power plants due to a combination of changing economic conditions along with assumptions that carried higher risks. With the availability of cheaper electricity from thermal and hydropower plants, RGoC has not finalized PPA and FiT arrangements that renders biomass energy systems for industrial enterprises as no longer feasible if they only have intermittent power requirements. The Project is now shifting focus towards industries that have 24-hour energy demands. Focus will shift to impending deal with Medai GS Enterprises and if they will purchase new boiler system as well as new deals for biomass cogeneration (thermal and electricity), biomass absorption chillers and biomass dryers for cassava and rubber processing.
	Outcome 2: Supply of national service providers in technology evaluation and technology transfer **Achievement Rating: 3 (Moderately Unsatisfactory)**	Without a functional pilot project, training cannot be completed. In addition, there are no web-based tools for biomass energy systems that are yet completed.
	Outcome 3: Stronger institutional frameworks in place to ensure long-term support for renewable energy (biomass) promotion **Achievement Rating: 3 (Moderately Unsatisfactory)**	Without a functional pilot project, training for government stakeholders and financial institutions cannot be completed.

Measure	MTE rating	Achievement description
	Outcome 4: Increased adoption of biomass-based energy generation technologies by Cambodian businesses and private investors. The creation of a national market for biomass technologies. **Achievement Rating: Unable to rate due to insufficient progress**	Without a functional pilot project, there is no progress in this area. However, if Medai GB Enterprises goes ahead and procures a new biomass boiler with added efficiencies and the ability to generate electricity as a bonus, other enterprises will follow suit.
	Outcome 5: Establishment of policy, legal and regulatory frameworks that sustainably promote and support renewable energy generation **Achievement Rating: Cannot rate due to insufficient progress**	Without a functional pilot project, there is no progress in this area. Outputs within this outcome need to be rewritten to improve the definition of the works required to achieve the desired outcome
Project Implementation approach	**Achievement Rating: 3 (Moderately unsatisfactory)**	Project has had an issue with technology identification and finding appropriate business situation that is techno-economically feasible for the use of biomass to displace fossil fuel
Project M&E design	**Achievement Rating: 4 (Moderately satisfactory)**	An adequate M&E design is provided in the Project document that is based on a weak Project log frame
Implementation of Project M&E plan	**Achievement Rating: 3 (Moderately unsatisfactory)**	No verification of a formal M&E system in place. Difficulties in monitoring and evaluating Project were compounded by work plans being prepared without direct reference to the Project log frame.
Budgeting of M&E activities	**Achievement Rating: 3 (Moderately unsatisfactory)**	Specific budgeting for M&E activities not defined
Sustainability	**2 (Moderately unlikely)**	Currently, there is one SME who if convinced that the purchase of a new biomass boiler can be beneficial to his business, and it is successfully demonstrated as a beneficial investment, other SMEs will follow suit, and change this rating

APPENDIX A. MISSION TERMS OF REFERENCE

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

Title:	International evaluation consultant
Main Duty Station and Location:	Home based
Missions:	Missions to Vienna, Austria and Cambodia
Start of Contract (EOD):	April 1, 2015
End of Contract (COB):	June 30, 2015
Number of Working Days:	21 working days spread over 3 months

1. PROJECT CONTEXT

Energy demand in Cambodia, both electrical in general and thermal specifically in industries, is mostly met through imported fossil fuels. In the Cambodian context, a strong contender as an alternative energy source is locally available biomass. Cambodia has significant biomass energy resources, either as standing biomass, including plantation forests such as rubber and fast growing tropical trees like Glyricidia and Acacia species, or as agricultural residues like rice husk, rice straw, corn cobs, palm oil extraction waste, cashew nut shells etc.

The project aims to promote the sustained transfer to Cambodia of small to medium sized 1-3 MW biomass-fuelled power and steam generation technologies from one or more countries like India, China, Thailand, Malaysia, Indonesia and Vietnam where these technologies are already proven. In all cases, the biomass fuel will be agricultural wastes or other organic residues. The project will address the issue of sustained replicability by using an integrated approach that will
combine technical support in the implementation, commissioning and performance evaluation of the pilot plants, with interventions at the institutional and policy levels and in the market place so as to ensure the development of a technology transfer mechanism that is appropriate for a country like Cambodia.

The project will help to overcome existing barriers by demonstrating through pilot projects that biomass-based technologies transferred from another country can be relevant in the Cambodian context. Specifically, the project will implement three pilot projects with appropriate biomass-based technologies.

Detailed background information of the project can be found the Terms of Reference (TORs) for the terminal evaluation.

2. DUTIES AND RESPONSIBILITIES

MAIN DUTIES	Concrete/ Measurable Outputs to be achieved	Working Days	Location
1. Review project documentation and relevant country background information (national policies and strategies, UN strategies and general economic data); determine key data to collect in the field and adjust the key data collection instrument of 3A accordingly (if needed); Assess the adequacy of legislative and regulatory framework relevant to the project's activities and analyze other background info.	• Adjust table of evaluation questions, depending on country specific context; • Draft list of stakeholders to interview during the field missions; • Brief assessment of the adequacy of the country's legislative and regulatory framework.	3 days	HB

MAIN DUTIES	Concrete/ Measurable Outputs to be achieved	Working Days	Location
2. Briefing with the project managers and other key stakeholders at UNIDO HQ. Preparation of the Inception Report	• Detailed evaluation schedule with tentative mission agenda (incl. list of stakeholders to interview and site visits); mission planning; • Division of evaluation tasks with the National Consultant. • Inception Report	2 days	Vienna, Austria
3. Conduct field mission to Cambodia in April 2015[15].	• Conduct meetings with relevant project stakeholders, beneficiaries, etc. for the collection of data and clarifications; • Agreement with the National Consultant on the structure and content of the evaluation report and the distribution of writing tasks; • Presentations of the evaluation's initial findings, draft conclusions and recommendations to stakeholders in the country at the end of the missions.	5 days	Cambodia
4. Present overall findings and recommendations to the stakeholders at UNIDO HQ	• After field mission(s): Presentation slides, feedback from stakeholders obtained and discussed	1 days	Vienna, Austria
5. Prepare the evaluation report according to TOR; Coordinate the inputs from the National Consultant and combine with her/his own inputs into the draft evaluation report.	• Draft evaluation report.	8 days	HB
6. Revise the draft project evaluation reports based on comments from all stakeholders and edit the language and form of the final version according to UNIDO standards.	• Final evaluation report.	2 days	HB
	TOTAL	21 days	

[15] The exact mission dates will be decided in agreement with the Consultant, UNIDO HQ, and the country counterparts.

MINIMUM ORGANIZATIONAL REQUIREMENTS

Education:
Advanced degree in environment, energy, engineering, development studies or related areas

Technical and functional experience:
- Minimum 10 years' experience in environmental projects
- Knowledge about multilateral technical cooperation and the UN, international development priorities and frameworks.
- Knowledge of and experience in environmental projects management and/or evaluation (of development projects)
- Working experience in developing countries
- Experience in evaluation of GEF energy projects and knowledge of UNIDO activities an asset

Languages:
Fluency in written and spoken English is required.

Reporting and deliverables
1) At the beginning of the assignment the Consultant will submit a concise Inception Report that will outline the general methodology and presents a concept Table of Contents;

2) The country assignment will have the following deliverables:
- Presentation of initial findings of the mission;
- Draft report;
- Final report, comprising of executive summary, findings regarding design, implementation and results, conclusions and recommendations.

3) Debriefing at UNIDO HQ:
- Presentation and discussion of findings;
- Concise summary and comparative analysis of the main results of the evaluation report.

All reports and related documents must be in English and presented in electronic format.

Absence of conflict of interest:
According to UNIDO rules, the consultant must not have been involved in the design and/or implementation, supervision and coordination of and/or have benefited from the programme/project (or theme) under evaluation. The consultant will be requested to sign a declaration that none of the above situations exists and that the consultants will not seek assignments with the manager/s in charge of the project before the completion of her/his contract.

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

Title:	National evaluation consultant
Main Duty Station and Location:	Home-based
Mission/s to:	Travel to potential sites within Cambodia
Start of Contract (EOD):	1 April 2015
End of Contract (COB):	30 June 2015
Number of Working Days:	21 days spread over 3 months

PROJECT CONTEXT

The National Evaluation Consultant will evaluate the projects according to the Terms of Reference under the leadership of the Team Leader (International Evaluation Consultant). S/he will perform the following tasks:

MAIN DUTIES	Concrete/measurable outputs to be achieved	Expected duration	Location
Review and analyze project documentation and relevant country background information (national policies and strategies, UN strategies and general economic data); in cooperation with the Team Leader: determine key data to collect in the field and prepare key instruments in both English and local language (questionnaires, logic models) to collect these data through interviews and/or surveys during and prior to the field missions; Coordinate and lead interviews/ surveys in local language and assist the Team Leader with translation where necessary; Analyze and assess the adequacy of legislative and regulatory framework in Cambodia, specifically in the context of the project's objectives and targets; provide analysis and advice to the Team Leader on existing and appropriate policies for Cambodia for input to the midterm evaluation.	• List of detailed evaluation questions to be clarified; questionnaires/interview guide; logic models; list of key data to collect, draft list of stakeholders to interview during the field missions • Drafting and presentation of brief assessment of the adequacy of the country's legislative and regulatory framework in the context of the project.	5 days	Home-based

MAIN DUTIES	Concrete/measurable outputs to be achieved	Expected duration	Location
Review all project outputs/ publications/feedback; Briefing with the evaluation team leader, UNIDO project managers and other key stakeholders. Coordinate the evaluation mission agenda, ensuring and setting up the required meetings with project partners and government counterparts, and organize and lead site visits, in close cooperation with the Project Management Unit. Assist and provide detailed analysis and inputs to the Team Leader in the Preparation of the Inception Report.	• Interview notes, detailed evaluation schedule and list of stakeholders to interview during the field missions. • Division of evaluation tasks with the Team Leader. • Inception Report.	4 days	Home-based (telephone interviews)
Coordinate and conduct the field mission with the Team Leader in cooperation with the Project Management Unit, where required; Consult with the Team Leader on the structure and content of the evaluation report and the distribution of writing tasks.	• Presentations of the evaluation's initial findings, draft conclusions and recommendations to stakeholders in the country at the end of the mission. • Agreement with the Team Leader on the structure and content of the evaluation report and the distribution of writing tasks.	7 days (including travel days)	Cambodia
Prepare inputs and analysis to the evaluation report according to TOR and as agreed with the Team Leader.	Draft evaluation report prepared.	3 days	Home-based
Revise the draft project evaluation reports based on comments from all stakeholders and edit the language and form of the final version according to UNIDO standards.	Final evaluation report prepared.	2 days	Home-based
TOTAL		30 days	

REQUIRED COMPETENCIES

Core values:
1. Integrity
2. Professionalism
3. Respect for diversity

Core competencies:
1. Results orientation and accountability
2. Planning and organizing
3. Communication and trust
4. Team orientation
5. Client orientation
6. Organizational development and innovation

Managerial competencies (as applicable):
1. Strategy and direction
2. Managing people and performance
3. Judgement and decision making
4. Conflict resolution

MINIMUM ORGANIZATIONAL REQUIREMENTS

Education: Advanced university degree in environmental science, engineering or other relevant discipline like developmental studies with a specialization in industrial energy efficiency and/or climate change.

Technical and functional experience:
- A minimum of five years practical experience in the field of environment and energy, including evaluation experience at the international level involving technical cooperation in developing countries.
- Exposure to the needs, conditions and problems in developing countries.
- Familiarity with the institutional context of the project in the Ministry of Industry and Trade is desirable.

Languages: Fluency in written and spoken English is required.

Absence of Conflict of Interest:

According to UNIDO rules, the consultant must not have been involved in the design and/or implementation, supervision and coordination of and/or have benefited from the programme/project (or theme) under evaluation. The consultant will be requested to sign a declaration that none of the above situations exists and that the consultants will not seek assignments with the manager/s in charge of the project before the completion of her/his contract.

APPENDIX B. MISSION ITINERARY (FOR MAY 19 – JUNE 30, 2015)

The mid-term review mission was conducted by Mr. Roland Wong, International Consultant and Mr. Kamal Uy, National Consultant in accordance with the objectives of the midterm review and obtained data relevant for making judgments regarding Project success and lessons learned.

#	Activity	Stakeholder involved	Place
***May 18, 2015** (Monday)*			
	Arrival of Mr. Roland Wong in Vienna		
***May 19, 2015** (Tuesday)*			
1	Meeting with Mr. Patrick Nussbaumer, Project Manager, TT Project	UNIDO	Vienna
2	Meeting with Mr. Javier Guarnizo, Senior Evaluation Officer for the Office of Independent Evaluation	UNIDO	Vienna
***May 20, 2015** (Wednesday)*			
3	Meeting with Mr. Rene van Burkel, Unit Chief, Industrial Resource Efficiency Unit, Environment Branch	UNIDO	Vienna
4	Meeting with Ms. Hiromi Sigiura, Senior Program Manager and Team Leader, Climate Policy and Networks Unit, Energy Branch	UNIDO	Vienna
***May 21 2015** (Thursday)*			
5	Meeting with Mr. Jossy Thomas, Industrial Development Officer and Project Manager of GEF Biogas Project in Cambodia	UNIDO	Vienna
6	Meeting with Mr. Juergen Hierold, GEF Coordinator and Unit Chief, Partnerships and Results Monitoring Branch and Ms. Anya Onysko, UNIDO LIAISON Officer of Partnerships and Results Monitoring Branch	UNIDO	Vienna
***May 22 2015** (Tuesday)*			
	Departure Mr. Roland Wong from Vienna to Southeast Asia		
***June 9, 2015** (Tuesday)*			
	Arrival of Mr. Roland Wong		
7	Meeting with Dr. Permod Gupta, CTA of TT Project	PMU	In flight
***June 10, 2015** (Wednesday)*			
8	Meetings with Dr. Permod Gupta and,	PMU	Phnom Penh
9	Meeting with Mr. Salil Dutt, Country Manager, Thermax Limited	Thermax Limited, India (foreign equipment supplier)	Phnom Penh

#	Activity	Stakeholder involved	Place
***June 11, 2015** (Thursday)*			
10	Meeting with Mr. Rogier van Mansvelt, Dr. Gupta and Mr. Makaravuth	Simplon Cambodia and PMU	Phnom Penh
11	Field trip and meeting with Mr. Ly Dalin, Assistant Brewery Manager	Medai Enterprises (Ganzberg Brewery)	Phnom Penh
***June 12, 2015** (Friday)*			
12	Meeting with Dr. Sat Samy, Secretary of State	Ministry of Industry and Handicrafts	Phnom Penh
13	Meeting with Mr. Long Rithirak, GEF Operational Focal Point	Ministry of Environment	Phnom Penh
***June 15, 2015** (Monday)*			
14	Visit and meeting with entrepreneur for Norm Srim Rice Mill	Norm Srim Rice Mill	Near Phnom Penh
15	Visit and meeting with Ms. Keo Mom, CEO of Ly Ly Foods	Ly Ly Foods	Phnom Penh
***June 16, 2015** (Tuesday)*			
16	Mr. Lieng Vuthy, Deputy Director of the Department of New and Renewable Energy	Ministry of Mines and Energy	Phnom Penh
***June 17-19, 2015** (Wednesday to Friday)*			
	Statutory holidays in Cambodia. Working on report		Phnom Penh
***June 22, 2015** (Monday)*			
17	Meeting with Mr. Va Chanmakaravuth, Project Coordinator of TT Project	PMU	Phnom Penh
***June 23, 2015** (Tuesday)*			
18	Meeting with Mr. Sok Narin, Head of UNIDO Operations Cambodia	UNIDO	Phnom Penh
19	Meeting with Mr. Va Chanmakaravuth, Project Coordinator of TT Project	PMU	Phnom Penh
***June 24, 2015** (Wednesday)*			
20	Meeting with Dr. Sat Samy, Secretary of State	Ministry of Industry and Handicrafts	Phnom Penh
***June 24, 2015** (Wednesday)*			
	Departure of Mr. Roland Wong from Phnom Penh to Bangkok		
***June 24, 2015** (Wednesday)*			
	Departure of Mr. Roland Wong from Bangkok to Vienna		
***June 24, 2015** (Wednesday)*			

#	Activity	Stakeholder involved	Place
21	Evaluation debriefing meeting with Mr. Patrick Nussbaumer, Project Manager of TT Project, Anya Onysko, UNIDO LIAISON Officer of Partnerships and Results Monitoring Branch, Silvia Alamo, Office of Independent Evaluation	UNIDO	Vienna
June 24, 2015 *(Wednesday)*			
22	Debriefing meeting with Mr. Patrick Nussbaumer, Project Manager of the Project	UNIDO	Vienna
June 24, 2015 *(Wednesday)*			
	Departure of Mr. Roland Wong from Vienna		
September 1-4, 2015			
	Telephone discussions with additional government officials including: Mr. Toch Sovanna, Director, Department of New and Renewable Energy (MoME), Mr. Hang Seiha, Chief of Office (MoIH), Mr. Chong Bou, Chief of Office (MoIH), and Mr. Mr. Chen Sengheang, Deputy Director (Institute of Standards).	Ministry of Mines and Energy Ministry of Industry and Handicrafts Cambodian Institute of Standards	Phnom Penh

Total number of meetings conducted: 22

APPENDIX C. LIST OF PERSONS INTERVIEWED AND DOCUMENTS REVIEWED

This is a listing of persons contacted in Vienna and Phnom Penh (unless otherwise noted) during the midterm review period for the MTR only. The midterm review team regrets any omissions to this list.

1) Mr. Patrick Nussbaumer, Project Manager TT Project, UNIDO;
2) Mr. Javier Guarnizo, Senior Evaluation Officer for the Office of Independent Evaluation, UNIDO;
3) Mr. Rene Van Berkel, Unit Chief, Industrial Resource Efficiency Unit, Environment Branch, UNIDO;
4) Ms. Hiromi Sigiura, Senior Program Manager and Team Leader, Climate Policy and Networks Unit, Energy Branch, UNIDO;
5) Mr. Juergen Hierold, GEF Coordinator and Unit Chief, Partnerships and Results Monitoring Branch, UNIDO;
6) Ms. Anya Onysko, UNIDO LIAISON Officer of Partnerships and Results Monitoring Branch, UNIDO;
7) Mr. Jossy Thomas, Industrial Development Officer and Project Manager of GEF Biogas Project in Cambodia, UNIDO;
8) Mr. Sok Narin, Head of UNIDO Operations Cambodia;
9) Dr. Permod Gupta, Chief Technical Advisor of TT Project;
10) Mr. Va Chanmakaravuth, Project Coordinator of TT Project;
11) Mr. Suon Panha, Cleaner Production and Energy Efficiency consultant, NCPO;
12) H.E. Dr. Sat Samy, Secretary of State, MoIH;
13) Mr. Hang Seiha, Chief of Office, MoIH;
14) Mr. Chong Bou, Chief of Office, MoIH;
15) Mr. Long Rithirak, GEF Operational Focal Point, MoE;
16) Mr. Lieng Vuthy, Deputy Director of the Department of New and Renewable Energy, MoME;
17) Mr. Toch Sovanna, Director, Department of New and Renewable Energy, MoME;
18) Mr. Chen Sengheang, Deputy Director, Cambodian Institute of Standards;
19) Mr. Ly Dalin, Assistant Brewery Manager, Medai Enterprises (Ganzberg Brewery);
20) Ms. Keo Mom, CEO of Ly Ly Foods:
21) Mr. Rogier van Mansvelt, Commercial and Technical Consultant, Simplon Cambodia;
22) Mr. Salil Dutt, Country Manager, Thermax Limited, Myanmar.

Documents reviewed for this MTR includes:

1) Project Document
2) Quarterly Progress Reports for 2013 and 2014;
3) Progress Report for 1st half of 2015;
4) Project steering committee meeting notes for 2014 and 2015;
5) Training modules I and II for 2012
6) Training material on biomass-based power generation technology from

7) Techno-commercial offer for design, engineering, supply and supervision of 1.0 MW biomass-based power plant in Cambodia by N.S. Thermal Energy Pvt., Ltd, India, March 2015;
8) Techno-commercial offer for, engineering, supply and installation of pre-owned 5 MW biomass-based power plant by N.S. Thermal Energy Pvt., Ltd, India, January 2015;
9) NCPO Annual Reports 2012 to 2014.

APPENDIX D. PROJECT PLANNING MATRIX (WITH SUGGESTED REVISIONS IN RED FONT)

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Objective of the project	To bring about sustained transfer of efficient, cost effective and environmentally friendly (low carbon) agro waste biomass-fuelled energy systems to replace fossil-fuel powered generators and boilers for power generation and thermal energy applications.	1. ~~Incremental~~ Tonnes CO_{2eq} of annual direct emission reductions ~~(tons of CO2eq)~~ by EOP 2. % annual reduction of fossil fuel used for energy generation by EOP ~~2. Incremental indirect CO2eq emission reductions (tons of CO2eq)~~ ~~3. Transfer of Techno economically viable RE technologies leading to reduction of fossil fuel consumption for energy generation~~	1. 0 2. 0 ~~1. No direct CO2eq emission reductions~~ ~~2. No indirect CO2eq emission reductions~~ ~~3. Technology transfer mechanism does not exist.~~	1. 24,000 to 32,500 2. 5 ~~1. Direct emission reductions: 240,000-325,000 tons CO2eq over period 2012-2022~~ ~~2. Indirect emission reductions: 250,000-300,500 tons CO2eq over period 2012-2023~~ ~~3. Annual reduction of fuel used for energy generation 5% over period 2012-2022Fossil~~	1. Technology evaluation, implementation support including financial tools established by the project with MIME and NCPO-C 2. End of project Survey 3. Final evaluation	1. Sustained and full Government support to the project. 2. User and generator drive for energy costs reduction and enhanced share of RE energy grows progressively 3. Various ongoing international RE related technical cooperation programs achieve good synergy with the project.
Outcome 1	Transfer of clean and energy efficient low carbon technologies	~~1. 3 Pilot projects for RE-TT demonstration are selected with co-financing commitments~~ ~~2. Anticipated savings in GHG emissions are estimated~~ ~~3. Personnel from the participating companies have been trained in operation, maintenance & trouble shooting.~~	~~1. Limited no of investment related RE projects are in place Technology transfer mechanism for efficient biomass-based generation is yet to be proven~~ ~~2. Co-generation for efficient conversion of energy is still not practiced and technologies are not applied.~~	~~1. Learning to utilize and replicate a given technology, including the capacity to choose and adapt it to local conditions and integrate it with indigenous technologies.~~ ~~To develop and standardise energy audit reporting format, worksheets and tools to be used by IEE projects~~ ~~2. Technology performance benchmark and saving potential of GHG emissions reduction.~~ ~~3.compendium of case studies from Pilot projects~~	~~1. Department of Energy techniques (DOET) MIME, NCPO-C Annual Reports~~ ~~2. Mid-term and end of project Survey~~ ~~3. Final evaluation of project~~	~~1. Sustained Government support to agreed project activities and policies conducive to promote RE technologies.~~ ~~A2. Participating companies can get necessary finance for RE-TT implementation.~~

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Project Component 1: Technology transfer and implementation of 2 pilot plants						
Output 1.1	Operational biomass-based RE-TT projects ~~Biomass-based RE-TT projects for 4-5 MWHr power generation replacing -> 12,000 TOEs** and related potential economic and environmental savings in 3 pilot enterprises are identified by and appraised by project experts.~~	1. Number of operational biomass-based energy system projects by EOP 2. MWh of annual power generation from biomass-based energy systems by EOP 3. TOEs of fossil fuel (DO) saved annually by EOP ~~1. 3 RE-TT projects are implemented with direct support from the GEF project~~ ~~2. GHG savings TCO2eq achieved annually as well as over the project lifetime~~	1. 0 2. 0 3. 0 ~~All companies, selected for RE-TT have their own biomass and potential captive consumption but not the resources (human and/or financial) to develop and implement such projects.~~	1. 3 2. 5 3. 12,000 ~~1. 3 technology transfer projects implemented with direct support from the GEF project~~ ~~2. Cumulative 12,000 and more than 120,000 TOE's over the life period of technology.~~	1. Environmental, financial and/or sustainability reports of Companies partnering in the RE-TT projects. 2 MIME, EAC, participating units & NCPO-C annual report 3. Project report 4.Independent final evaluation of project	1. Timely availability of resources required for activities 1. Subcontracts of Companies partnering with the GEF project with technology suppliers 2. Companies partnering with the GEF project fulfill their co-financing commitments
Output 1.2	Compendium of results from pilot projects for the purposes of dissemination to interested stakeholders ~~Results of the pilot projects both in economic and environment context are compiled in a compendium for effective dissemination~~	1. Number of compendiums published in English and Khmer on pilot projects by EOP ~~Compendium of case studies/success stories is published in English and the local language~~	1. 0 ~~No such information/ document is available in Cambodia on RE-TT both for manufacturing and energy supply private sector entities.~~	1. 1 ~~Compendium is compiled printed by end of 3rd year when most of RE-TT projects are either implemented or under implementation.~~	1. MIME, EAC & NCPO-C annual reports 2. GEF-UNIDO RE-TT Project progress report 3. Final project evaluation report	1. Participating industries are ready to publish and share the results with others.

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Output 1.3	Trained personnel from participating companies ~~have been trained~~ in operation, maintenance & trouble shooting in biomass energy systems.	1. Number of personnel from participating companies trained in operation, maintenance and troubleshooting for biomass energy systems 2. Number of personnel from participating companies involved with operation, maintenance and troubleshooting for biomass energy systems at the end of the project (EOP) ~~Him 1. Develop training modules for technicians and entrepreneurs on:~~ ~~- the operation of technology~~ ~~- maintenance including preventive maintenance of technologies~~ ~~- trouble shooting of technology for effective implementation.~~	1. 0 2. 0 ~~No such training on technology transfer for biomass related energy generation is available in the country to date.~~	1. ?? Set target for number of trainees 2. ?? Set target or number of personnel from participating in working in operation, maintenance and troubleshooting of biomass energy systems ~~Participants from participating units with technology suppliers are identified and training is carried out both in the classroom and on the job during commissioning and operation of the projects~~	1.Participating companies and NCPO-C annual reports 2. GEF-UNIDO RE-TT Project progress report 3. Final project evaluation report	1. It is assumed that right participants are nominated by the participating units. 2. Technology transfer is done and implemented successfully
Outcome 2	Supply of national service providers in technology evaluation and technology transfer	~~1. A cadre of at least 20 national experts from relevant TT support institutions (the Cleaner Production Centre, technical universities / university departments, EDC, EAC, MIME and independent engineers, are~~ ~~2. Capacity building of indigenous partners for technology adaptation~~ ~~**3. Web-based guidance tool/manual on technology transfer like EnTA/Comfar developed**~~ ~~**4. Technology database and case study database created**~~	~~1. No such specific national experts is trained on technology evaluation and transfer including financial mechanisms place~~ ~~2. Limited or no RE TT service is provided by equipment/technology suppliers.~~ ~~3. No ICT based tool is available on RE TT in the country~~	~~1. 20 National Renewable Energy generation experts capable of delivering quality services are available~~ ~~2. National IEE network is established.~~ ~~3. Local suppliers of technology are capable of providing IEE services to their clients as well as after sale service.~~	~~1. Annual reports of NCPO-C and relevant institutions~~ ~~2. Project Survey, visits report during project implementation~~ ~~2. Final evaluation report of project~~	~~1. Sustained Government support to agreed project activities.~~ ~~2. Energy experts, consultants, local equipment supplier and vendors, and other relevant entities recognize the economic potential of the renewable energy market in Cambodia~~

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Project Component 2: Capacity building and development of tools for technology adaptation and transfer						
Output 2.1	1. A cadre of ~~at least 20~~ national experts from relevant support institutions (~~the Cleaner Production Centre, technical universities/ university departments, EDC, EAC, MIME and independent engineers, are~~ (NCPO, academia, relevant government departments, independent engineers) trained on technology evaluation and transfer including financial mechanisms	1. Number of renewable energy experts trained for~~—~~the Cambodian market by EOP 2. Number of RE-TT related seminars and training modules ~~and trainings~~ delivered by EOP ~~2. Number of technology transfer support experts in the Cambodian market~~	1. 0 2. 0 ~~1. No such biomass related high efficiency energy generation experts in the Cambodian market~~ ~~2. No such technology transfer related support system experts in the Cambodian market only few engineering companies and NGO's provide partial services~~ ~~3. RE-TT related seminars and trainings mostly delivered by international experts~~	1. 20[16] 2. 10 seminars and 12 training modules[17]	1. Project progress report of PMU 2. Visit reports, project Survey during execution 3. Final evaluation report of the project	1. Sustained Government support to agreed project activities 2. Drive for energy supply & costs reduction is and will remain strong 3. Technology transfer involving high investments is successfully implemented for on-the-job training

[16] Training should be for biomass-based technology assessment and selection; identifying technology options for strengths and weaknesses; and conduct a techno-economic-social-environmental assessment of the options to identify the most suitable one.
[17] Modules for enterprises managers and engineers to be delivered by national experts trained by the GEF-UNIDO, IEE, RE-TT projects

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Output 2.2	~~Capacity building of~~ indigenous partners for technology adaptation	1. Number of indigenous partners on established network for technology adaptation 2. Number of ~~Network is~~ meetings regularly conducted to exchange/share biomass-based technologies operating in Cambodia	1. 0 2. 0 No such network in Cambodia exists and clients have no access to RE-TT experts.	1. ??[18] set target on number of indigenous partners 2. ?? Set target on number of network meetings ~~A formal network of technology transfer partners & experts is in place~~	1. RE-TT web portal and registry of partners. 2. RE-TT Project report 3. Final evaluation of project	1. Indigenous partners experts recognize the business potential of the biomass-based Re technologies in Cambodia and also in neighboring countries
Output 2.3	Developed web-based guidance tool/manual on RE-TT ~~developed~~.	1. Number of dedicated web portals for technology transfer 2. Number of manuals on dynamic technology transfer relevant to Cambodian industries	1. 0 2. 0 ~~No such ICT based instrument exists on technology transfer in Cambodia.~~ ~~Information on renewable energy experts/technology suppliers local partners do not exist~~	1. 1[19] 2. 1 ~~GEF –RE-TT project web portal with relevant information is continuously updated and linked with relevant websites.~~ ~~A manual on dynamic technology transfer mechanisms relevant to Cambodian industries is available~~	Number of hits on the website and links to other websites. Khmer and English version of RE-TT manual	But for required resources no specific assumption and risk for this output.
Output 2.4	Established technology database and case study database created	Number of databases created for technologies and case studies	0	1	Database printouts	

[18] A registry of local partners/experts should be available with MIME and NCPO.
[19] Should be ~~is in place and~~ populated for training material, information and links with relevant web sites

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Outcome-3	Stronger institutional frameworks in place to ensure long-term support for renewable energy (biomass) promotion	~~1. List of institutional participants trained to promote technology transfer for renewable energy generation.~~ ~~**2. No. of experts trained in preparation of bankable RE-TT proposals**~~ ~~**3. No of financial institutions participated in financial engineering training**~~ ~~4. Guide for the Implementation of biomass based RE projects is developed.~~	~~1. No institutional framework exist to promote high efficiency RE at implementation level.~~ ~~2. Access to finance is a problem due to lack of knowledge in preparing bankable proposals~~ ~~3. Financial institutions evaluates the project on conventional basis rather than incl. all factor including environment, safety and liability in mind.~~ ~~4. No such technology transfer and Renewable energy using biomass Guidance manual exists~~	~~1. At least 100 participants from Govt. and regulatory agencies are trained in technology transfer and RE applications .~~ ~~2. 60 personnel from Industry are trained in financial engineering (bankable proposals)~~ ~~3. Guideline on biomass based energy generation, operation and maintenance of Boiler, turbine and auxilliaries is available~~ ~~4. At least 5 companies get access to finance through GEF project.~~	~~1. Project progress report~~ ~~2. Annual reports of project implementing partners~~ ~~3.Number of RE-TT projects selected for financing~~ ~~4. Total investment made by beneficiaries during project period~~	~~1. Resources allocated and committed are available in time.~~ ~~2. Sustained Government support to agreed project~~ ~~3. Biomass energy promoters, financial institutions recognize the need and economic & environmental saving potential of the RE market in Cambodia~~
Project Component 3: Strengthening of institutional framework for technology transfer						
Output 3.1	Government officers with improved knowledge to promote biomass based renewable energy systems ~~Capacity building of relevant Govt. departments to promote biomass based renewable energy technology transfer and assistance in implementation.~~	1. Number of intensive training programs in biomass energy systems delivered 2. Number of institutional participants trained in promoting biomass energy systems ~~1. Number of intensive training programme conducted on~~ ~~2. No. of Government and institutional staff trained in biomass based energy project implementation support.~~	1. 0 2. 0 ~~No such organized capacity building programme exists in Cambodia. However, seminars /workshops on Rural electrification, renewable energy (mainly solar) are conducted by foreign experts~~	1. 10 2. 100 ~~1. 10 Intensive Capacity building programme is conducted during project period.~~ ~~2. 100 participants trained to promote industrial energy efficiency~~	1. GEF-UNIDO RE-TT Project progress report 2. Annual reports of project implementing partners and PMU 3. Final evaluation of project	1. Government interest & support to build capacity for RE transfer & promotion 2. Policy-level interventions in increasing share of RE are carried out by RGOC 3. RE promoters recognize the need benefits of RE in Cambodia

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Output 3.2	Institutions with increased knowledge of TT financing mechanisms and preparation of bankable TT proposals ~~Institutions are trained in TT financing using available mechanism like SCCF, LDCF, CDM and preparation of bankable TT project proposals~~	1. Number of personnel from Cambodian manufacturing industries were trained in preparing bankable proposals by EOP 2. Number of RE technology proposals considered for financing by EOP 3. Number of operational technology support instruments that assist financers in de-risking transactions and loans ~~1.Number of training programme conducted on financial engineering for technology transfer of biomass fuelled energy generation 2. No. of experts trained in preparation of bankable RE proposals~~	1. 0 2. 0 3. 0 ~~No such facility on comprehensive financial engineering on technology assessment including environmental impacts exist in Cambodia~~	1. 60 2. 10 3. ?? Set target for number of instruments by defining each de-risking instrument ~~1. Two training programmes conducted in year 1 and 1 each in subsequent years. 2. At least 60 personnel from Cambodian manufacturing industries are trained in preparing bankable proposal. 3. 10 proposal for RE technology financing are prepared and considered for financing 4. technology support instruments (e.g., financing subsidies, risk guarantee facilities, banker training and transaction support services) that are helping financiers share risks, buy down transaction costs etc.~~	1. Annual reports from project implementing partners 2. End of project report 3. Final project evaluation	1. Industry drive for energy availability and costs reduction is and will remain strong 3. Renewable Energy promoters, financial institutions recognize the need and benefits of the RE market in Cambodia

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Output 3.3	Financial institutions with improved abilities to assess RE investment proposals ~~Capacity building of financial institutions to assess investment proposals in RE~~	1. Number of personnel from banks and financial institutions trained in assessing RE-TT proposals for financing 2. Number of financial experts actively involved in financing biomass energy systems at the EOP 3. Number of RE proposals approved for financing ~~1.Number of training programme conducted for FII's in Cambodia~~ ~~2. No. of experts trained in comprehensive technology evaluation to facilitate financing.~~	1. 0 2. 0 3. 0 ~~No such organized training on total costing including environmental and social liability in technology assessment for FII's exist in Cambodia~~	1. 20 2. ?? Set target on the number of financial experts who are working in financing biomass energy systems 3. 10? ~~1. Four training programmes conducted during project period~~ ~~2. At least 20 personnel from development banks and FII's are trained in assessing Re-TT project for financing~~ ~~3. 10 proposal for RE financing are received and considered for financing~~ 4. Build capacity and address various other barriers that make financing energy investment portfolios a challenge.	1. Annual reports of project implementing partners 2. Project midterm/ completion report 3. Final project evaluation 4. Annual reports of participating FII's	1. FII's recognize RE as a business opportunity for their lending operations. 2. Industry drive for energy costs reduction is and will remain strong 3. RGOC support industrial development bank/FII's through dedicated fund allocation for RE.
Outcome 4	Increased adoption of biomass-based energy generation technologies by Cambodian businesses and private investors. The creation of a national market for biomass technologies.	~~1.Tools available for supporting technology transfer for biomass-based energy generation in industry~~ ~~2. Demand for assistance in RE-TT is created. Atleast 5 requests are received annually.~~	~~1. No such tools are and will be most likely available during and immediately after the GEF-UNIDO project implementation period~~ ~~2. In perception of high cost and financial availability, no demand for RE-TT project~~	~~1. Dynamic and user friendly methodology for technology transfer and biomass-based renewable energy is produced in English and Khmer language~~ ~~2. Adapt the technology suited to local conditions and integrate as far as possible it with indigenous technologies~~ ~~3. Identify and fulfill the contractual obligations between various stakeholders such as technology supplier, technology recipient, financier, and the government, giving due~~	~~1. Technology transfer related information/case studies dissemination program website~~ ~~2. Project report~~ ~~3. Final evaluation~~	~~1. Availability of finance and other resources are available.~~ ~~2. Sustained Government support to promote RE share in National energy supply.~~

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
				~~recognition to intellectual property rights and patents, national and international rules and regulations.~~		
Project Component 4: Upscaling of biomass-fuelled technologies in Cambodia						
Output 4.1	~~The~~ compiled results of the pilot projects that are ~~compiled and~~ widely disseminated to relevant stakeholders ~~in the most appropriate manner~~	1. Number technology transfer related assistance experts in the Cambodian market 2. Number of biomass-based energy experts in the Cambodian market 3. Number of TT-RE seminars and trainings delivered	1. 0 2. 0 3. 0 ~~1. No such technology system experts in the Cambodian market~~ ~~2. No such biomass based high efficiency generation experts in the Cambodia except few engineering companies, NGO's provide services in biomass gasification~~ ~~3. For RE-TT related seminars/workshop and trainings dependency mostly on international experts~~	1. 20 2. 20 3. 10 seminars and 10 trainings[20] ~~1. 20 renewable energy generation experts trained~~ ~~2. utilize and replicate a appropriate technology, including the capacity to choose it~~ ~~2. 10-20 experts for providing technology transfer support trained~~ ~~3. 10 seminars and 10 trainings for enterprises managers and engineers delivered by national experts trained by the GEF-UNIDO project~~	1. Project progress report including implementation directly outside project support 2. Project mission visits, survey 3. Final evaluation	A1. Sustained Government support for the agreed project activities for the RE generation promotion A2. Industry demand for biomass energy is increasing A3. Availability of feedstock and price of feedstock is economically sustainable to produce energy at affordable price.
Output 4.2	Investors and decision-makers with improved knowledge of the ~~understand the~~ potential for biomass energy sources.	1. Number of CEOs/owner attended RE-TT clinics. 2. Number of companies participating in the RE-TT project seminars/workshops 3. Number of potential companies personnel participating in detailed ~~the project~~ trainings in biomass	1. 0 2. 0 3. 0	1. 100 2. 100 3. ?? Set target on number of personnel participating in detailed training	1. Project progress report and NCPO annual report. 2. List of participants in RE-TT Clinics/Directors meetings,	1. Sustained Government support for agreed project activities 2. Biomass is available at an affordable price 3. A gegenerative

[20] Targeted for enterprises managers and engineers delivered by national experts trained by the GEF-UNIDO project

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
		energy systems including boiler operation and safety	~~1. No such tool for the promoting of renewable energy generation like the RE-TT clinic exists to date.~~ ~~2. Limited trainings on TT/Boiler operation & safety , turbine, CHP are planned though from 2011 National Cleaner production office Cambodia will deliver training on IEE..~~	sessions ~~1. 100 CEOs attend the 10 Re-TT Clinics organized sector wise & as per geographic potential areas having biomass~~ ~~2. 100 companies participating in the project seminars and workshops~~ ~~3. Establish mutually beneficial or reciprocal exchanges related to technology transfer and technology support,~~	training and seminars 3. Final evaluation report	biomass programme is well-developed to ensure biomass supply
Output 4.3	Stakeholders with improved understanding on promoting biomass energy technology uptake ~~Other stakeholders understand the role they can play to promote the uptake of this kind of technology~~	1. Number of suppliers and vendors participating in project seminars and workshops 2. Number of partnerships finalized (need to define what kind of partnerships) 3. Number of finalized contracts for RE – TT implementation ~~1. Number of technology & equipment suppliers participating in the project seminars/training~~ ~~2. Number of contracts received by suppliers through GEF projects~~	1. 0 2. 0 3. 0 ~~No such training/ capacity building done for of technology & equipment suppliers on RE-TT Hardly suppliers get contract for renewable energy generation in Cambodia~~	1. 50 2. ?? 3. 10 ~~1. 50 suppliers/vendors participating in the project seminars and workshops~~ ~~2. Build partnerships with external experts, or actively support established networks related to RE-TT.~~ ~~2. 10 contract related to RE-TT implementation is bagged by supplier trained by project.~~	1. Project progress report and NCPO annual report. 2. Balance sheet/annual report of suppliers. 2. End of project report 3. Final project evaluation	1. Government support in terms of policy regulation and law promoting biomass-based energy generation. 2. All envisaged players have interest in RE-TT promotion.

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Outcome 5	Establishment of policy, legal and regulatory frameworks that sustainably promote and support renewable energy generation	~~1. Policy conducive to promote technology transfer on Renewable fuel based technologies developed and recommended to MIME.~~ ~~2. Adoption of regulatory measures to support RE implementation and market transformation~~	~~1. No such policy program on biomass based energy generation is in place~~ ~~2. No specific regulation to support technology transfer of biomass based energy for captive consumption is in place~~	~~1.At least 2 national Renewable energy policy programs operate and develop smoothly:~~ ~~2. Technology transfer support system including financial availability, IPR on technologies are developed~~ ~~3. Technology support instruments to help user by RE policy, regulation and law.~~	~~1. Policy/ strategy Government regulation/law on renewable energy.~~ ~~2. Incentives for renewable energy equipment viz. reduced or no import duty/accelerated depreciation~~ ~~3. Policy support needs to enhance technology transfer.~~	~~1. Sustained Government support to agreed project activities.~~
Project Component 5: Policies, regulations and mechanism to promote sustainable renewable energy generation.						
Output 5.1	Completed gap analysis to assist Govt. in identifying where formulation of appropriate laws, regulations and policy instruments are crucial for the transfer and diffusion of renewable energy technologies.	1. Number of policy documents on renewable energy as clean and alternative energy by EOP 2. Number of tools and instruments to calculate GHG reductions from RE technologies installed by EOP ~~1. Increased role for TT related energy and environmental policies at national levels~~ ~~2. Biomass based energy generation opportunities are recognised and utilised for achieving UNFCCC commitments.~~	1. 0 2. 0 ~~1. No such policy exists to promote and encourage the implementation of RE TT by Cambodian manufacturing and service sector~~ ~~2. The role of the increased share of renewable energy generation in climate change mitigation from Cambodian industry is not well recognised~~	1. 1 2. 1 ~~1. Policy document on renewable energy as clean and alternative energy is prepared for RGOC action.~~ ~~2. Tools and instruments to calculate GHG reduction from RE technologies projects are in place~~	1.Annual report of NCPO-C, MIME 2.Independent final project evaluation 3.Publication of relevant policies, strategies and guidelines by RGOC	1. Uptake of RE-TT by enterprises and other organisations is constrained by lack of government incentive 2. Proper enforcement of policy/regulation to help uptake of RE-TT

Project Strategy		Objectively verifiable indicators				
		Indicator (quantified and time-bound)	**Baseline**	**Target**	**Source of verification**	**Risks and Assumptions**
Output 5.2	Improved regulatory framework to sustainably support and promote renewable energy generation ~~Implementation of the missing laws, regulations and policy instruments~~	1. Number of RE reporting structures in place 2. Number of websites created for reporting successes and failures 3. Number of developed benchmarking tools for biomass energy technology performance ~~1. Increased role for RE TT project in energy related policies/regulations of RGOC.~~ ~~2.Structures, tools and methodologies to monitor, tracking and benchmarking of technology performance~~	1. 0 2. 0 3. 0 ~~Biomass based energy generation for captive usage has no significant role in Energy Policy in Cambodia to date.~~ ~~No such structured tools and methodologies are in place~~	1. 1 2. 1 3. 1 ~~1. Reporting/recording structure is put in place~~ ~~2. Simple user friendly reporting templates are developed and tested~~ ~~3. Website is created and continuously updated for success/failure cases.~~ ~~4. Biomass fuelled energy Technology performance benchmarking tool is developed and tested~~	1. MIME, MOE-CCD and NCPO Annual Report 2. Internet/Web 3. Project reports and visit reports 4. Final evaluation of project	1. Sustained Government support to renewable energy expansion both for direct users and rural electrification 2. Policy on feedstock usage and export to avoid non-availability for captive users.

APPENDIX E. TRACKING TOOL

Tracking Tool for Climate Change Mitigation Projects
(For Mid-term Evaluation)

Special Notes: reporting on lifetime emissions avoided

Lifetime direct GHG emissions avoided: Lifetime direct GHG emissions avoided are the emissions reductions attributable to the investments made **until the mid-term evaluation**, totaled over the respective lifetime of the investments.
Please refer to the Manual for Calculating GHG Benefits of GEF Projects.

Manual for Energy Efficiency and Renewable Energy Projects
Manual for Transportation Projects

For LULUCF projects, the definition of "lifetime direct" applies. Lifetime length is defined to be 20 years, unless a different number of years is deemed appropriate. For emission or removal factors (tonnes of CO2eq per hectare per year), use IPCC defaults or country specific factors.

General Data	Results at Mid-term Evaluation	Notes
Project Title	Climate change related technology transfer for Cambodia: Using agricultural residue biomass for sustain	
GEF ID	4042	
Agency Project ID	100223	
Country	Cambodia	
Region	EAP	
GEF Agency	UNIDO	
Date of Council/CEO Approval	September 30, 2011	**Month DD, YYYY (e.g., May 12, 2010)**
GEF Grant (US$)	1,690,000	
Date of submission of the tracking tool	March 1, 2011	**Month DD, YYYY (e.g., May 12, 2010)**
Is the project consistent with the priorities identified in National Communications, Technology Needs Assessment, or other Enabling Activities under the UNFCCC?	1	**Yes = 1, No = 0**
Is the project linked to carbon finance?	0	**Yes = 1, No = 0**
Cumulative cofinancing realized (US$)	140000	
Cumulative additional resources mobilized (US$)	-	**additional resources means beyond the cofinancing committed at CEO endorsement**

Objective 1: Transfer of Innovative Technologies		
Please specify the type of enabling environment created for technology transfer through this project		
National innovation and technology transfer policy	0	Yes = 1, No = 0
Innovation and technology centre and network	0	Yes = 1, No = 0
Applied R&D support	0	Yes = 1, No = 0
South-South technology cooperation	0	Yes = 1, No = 0
North-South technology cooperation	0	Yes = 1, No = 0
Intellectual property rights (IPR)	0	Yes = 1, No = 0
Information dissemination	1	Yes = 1, No = 0
Institutional and technical capacity building	1	Yes = 1, No = 0
Other (please specify)		
Number of innovative technologies demonstrated or deployed	-	
Please specify three key technologies for demonstration or deployment		
Area of technology 1	Renewable_Energy	
Type of technology 1	Biomass	specify type of technology
Area of technology 2		
Type of technology 2		specify type of technology
Area of technology 3		
Type of technology 3		specify type of technology
Status of technology demonstration/deployment	1	0: no suitable technologies are in place 1: technologies have been identified and assessed 2: technologies have been demonstrated on a pilot basis 3: technologies have been deployed 4: technologies have been diffused widely with investments 5: technologies have reached market potential
Lifetime direct GHG emissions avoided	-	tonnes CO2eq (see Special Notes above)

Objective 3: Renewable Energy		
Please specify if the project includes any of the following areas		
Heat/thermal energy production	1	Yes = 1, No = 0
On-grid electricity production	0	Yes = 1, No = 0
Off-grid electricity production	1	Yes = 1, No = 0
Policy and regulatory framework	1	0: not an objective/component 1: no policy/regulation/strategy in place 2: policy/regulation/strategy discussed and proposed 3: policy/regulation/strategy proposed but not adopted 4: policy/regulation/strategy adopted but not enforced 5: policy/regulation/strategy enforced
Establishment of financial facilities (e.g., credit lines, risk guarantees, revolving funds)	1	0: not an objective/component 1: no facility in place 2: facilities discussed and proposed 3: facilities proposed but not operationalized/funded 4: facilities operationalized/funded but have no demand 5: facilities operationalized/funded and have sufficient demand
Capacity building	3	0: not an objective/component 1: no capacity built 2: information disseminated/awareness raised 3: training delivered 4: institutional/human capacity strengthened 5: institutional/human capacity utilized and sustained
Installed capacity per technology directly resulting from the project		
Wind	-	MW
Biomass	-	MW el (for electricity production)
Biomass	-	MW th (for thermal energy production)
Geothermal	-	MW el (for electricity production)
Geothermal	-	MW th (for thermal energy production)
Hydro	-	MW
Photovoltaic (solar lighting included)	-	MW
Solar thermal heat (heating, water, cooling, process)	-	MW th (for thermal energy production, 1m² = 0.7kW)
Solar thermal power	-	MW el (for electricity production)
Marine power (wave, tidal, marine current, osmotic, ocean thermal)	-	MW
Lifetime energy production per technology directly resulting from the project (IEA unit converter: http://www.iea.org/stats/unit.asp)		
Wind	-	MWh
Biomass	-	MWh el (for electricity production)
Biomass	-	MWh th (for thermal energy production)
Geothermal	-	MWh el (for electricity production)
Geothermal	-	MWh th (for thermal energy production)
Hydro	-	MWh
Photovoltaic (solar lighting included)	-	MWh
Solar thermal heat (heating, water, cooling, process)	-	MWh th (for thermal energy production)
Solar thermal power	-	MWh el (for electricity production)
Marine energy (wave, tidal, marine current, osmotic, ocean thermal)	-	MWh
Lifetime direct GHG emissions avoided	-	tonnes CO2eq (see Special Notes above)

APPENDIX F. UNEG CODE OF CONDUCT FOR EVALUATORS/MIDTERM REVIEW CONSULTANTS[21]

Evaluators:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

MTR Consultant Agreement Form[22]

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Roland Wong

Name of Consultancy Organization (where relevant)**:** _____

I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

Signed at *Surrey, BC, Canada* on *October 26, 2015*

Signature: 

[21] www.undp.org/unegcodeofconduct
[22] www.unevaluation.org/unegcodeofconduct