UNDP/FAO - GEF Terminal Evaluation

for

Promoting Sustainable Biomass Energy Production and Modern Bio-Energy Technologies

UNDP PIMS ID: 4226
GEF Project ID: 4096

Sri Lanka

Terminal Evaluation Report

Submitted by

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Basic Report Information

Title of the Project	**Promoting Sustainable Biomass Energy Production and Modern Bio-Energy Technologies**
UNDP PIMS No. & GEF Project ID No.	4226 4096
TE Time Frame Date of TE Report	14 Nov – 24 Dec 2018 24 Dec 2018
Region and Countries included in the Report	Asia; Sri Lanka
GEF Operational Focal Area/Strategic Programme	Climate Change Environment and Sustainable Development
National Implementing Partner/ Project Executing Partners	Ministry of Power and Renewable Energy Sri Lanka Sustainable Energy Authority
TE Team Members	Rogelio Z Aldover, TE International Consultant Nihal Atapattu, TE National Consultant

Acknowledgements

The TE Team wishes to thank the management and staff of UNDP and FAO in Sri Lanka for their support during the evaluation. Special thanks are due to the Project Manager and staff of PMU for discussions, facilitating access to all the required information including details of project implementation, office space and effective organization of all the required field visits, meetings and other logistics of the evaluation mission. The TE Mission received excellent cooperation and valuable information and data from a large variety of stakeholders during the course of the TE; in particular from the Secretary, Ministry of Power & Energy; Secretary and staff of the Ministry of Plantation Industries; the senior management and staff of the SLSEA; the General Manager and senior management of the CCB; Heads and Staff of SLEMA, BEASL and the Sri Lanka Carbon Fund; Representative of the partnering plantation companies; and the project consultants. Their contributions towards successful completion of the TE are gratefully acknowledged.

Promoting Sustainable Biomass Energy Production and Modern Bio-Energy Technologies

Terminal Evaluation Report

Executive Summary

1. Project Information Table

Project Title	**Promoting Sustainable Biomass Production and Modern Bio-Energy Technologies**			
GEF Project ID:	4096		***at endorsement (US$)***	***at completion (US$)****
UNDP PIMS ID:	4226	**GEF Financing:**	1,996,250	1,813,723
Country:	Sri Lanka	**IA/EA own:**		
		UNDP	402,000	402,000
		FAO	461,755	400,000
Region:	Asia and Pacific	**Government:**	10,023,863	12,607,959
Focal Area:	Climate Change Mitigation	**Others:**		
		Private Sector	6,181,092	3,318,858
		NGO	85,000	589,369
FA Objectives, (OP/SP)	Climate Change	**Total Co-financing:**	17,153,710	17,318,185
Executing Agency:	Ministry of Environment *(at Endorsement June 2012 & Inception Oct. 2013)* Ministry of Power and Renewable Energy *(reorganized February 2015; implemented as post-MTR October 2015);* Sustainable Energy Authority, Forest Department	**Total Project Cost:**	19,149,960	19,131,908
Other Partners involved:	FAO, Sri Lanka Sustainable Energy Authority	**Project signature (Date project began):**		10 July 2013
		Operational Closing Date:	**Original:** 10 July 2018	**Actual:** 31 December 2018

*Includes expenses up to 30 November 2018 and commitments until 31 December 2018

2. Brief Description of the Project

The project with the title *Promoting Sustainable Biomass Production and Modern Bio-Energy Technologies* (PIMS 4226) in Sri Lanka or hereinafter referred to as the Project, was designed to support the aim of the Government of Sri Lanka to replace imported fossil fuels used in the industry by biomass-derived energy through its plan for renewable energy development. In 2009 when the project was conceived, the major sources of primary energy in Sri Lanka were biomass (47.4%), petroleum oil (43%), hydro-electricity (9.5%), and non-conventional (0.1%), thus depending largely on imported oil and firewood to meet its energy requirements. The main source of energy in the industrial sector was biomass (72%). Due to increasing cost of imported petroleum oil, the demand for biomass for energy production increased considerably. The national policies also favoured the use of biomass, with incentives provided for fuel wood production. The introduction by the Government of a subsidy for furnace oil and kerosene in 2009 suddenly making the subsidized fossil fuels cheaper changed the demand for fuel wood. There were a number of other barriers for popularizing biomass as a primary source of fuel such as policy and regulatory discrepancies, fuel wood supply chain difficulties, and maintenance of technologies used in thermal energy production.

Achieving specific targets set out in the plan without any additional intervention was considered doubtful in view of the identified barriers to renewable energy development. The GEF intervention was expected to support the Government in achieving this target in a two-pronged approach:

1. *Biomass (wood and waste) is promoted as a viable renewable energy source for industrial thermal applications over (imported) fossil fuels;*

2. *Continuous and sustained supply of quality-assured biomass as an industrial fuel is ensured.*

The Project sought to remove the barriers to increase sustainable biomass production, increase the market share of biomass energy generation mix, and adoption of appropriate biomass-based energy technologies. This was to be achieved through four components, viz., 1. providing policy and institutional support for effective fuel switching using fuel wood, 2. increasing sustainable fuel wood production, 3. introducing an enabling environment for fuel wood suppliers, and 4. introducing efficient wood-based energy technologies.

3. Evaluation Objective

This Terminal Evaluation (TE) has been initiated by UNDP Sri Lanka in accordance with UNDP and GEF M&E policies and procedures that require all full and medium-sized UNDP support GEF financed projects to undergo a terminal evaluation upon completion of implementation for the GEF, UNDP, FAO and the Government of Sri Lanka.

4. Summary of Conclusions, Recommendations and Lessons

While focusing on the immediate areas in the selected project demonstration sites on biomass technology application, fuel wood plantations, processing, terminalling, logistics and the surrounding communities, targeting the primarily the industrial and energy sectors, the Project has clearly played a very critical role in the biomass energy market of Sri Lanka which is likely to be sustained also after the project closure. The end in view is upscaling the biomass energy applications and fuel wood supply at the national level. The TE assessed that the Project has contributed in a very significant way to boosting the biomass energy sector (fuel wood supply and utilization) in Sri Lanka and has built capacities and laid the ground work for

institutional and policy infrastructure to ensure its continued growth. A summary of ratings reached on conclusion of the TE is presented in the Table 1.

Table 1: Summary of TE Ratings for the Project

Evaluation Ratings:			
1. Monitoring and Evaluation	***Rating***	**2. IA& EA Execution**	***Rating***
M&E design at entry	**S**	Quality of UNDP/FAO Implementation	**HS**
M&E Plan Implementation	**S**	Quality of Execution - Executing Agency	**HS**
Overall quality of M&E	**S**	Overall quality of Implementation / Execution	**HS**
3. Assessment of Outcomes	**Rating**	**4. Sustainability**	**Rating**
Relevance	**R**	Financial resources:	**L**
Effectiveness	**HS**	Socio-political:	**L**
Efficiency	**S**	Institutional framework and governance:	**L**
Overall Project Outcome Rating	**HS**	Environmental:	**L**
		Overall likelihood of sustainability:	**L**

Following a very slow start after its inception that resulted in the MTR recommending major changes in the project management, implementation arrangements and strategy and results framework, the Project had experienced a notable transformation producing significant results that contributed to achieving its goal. During the intervening period, it has been successful in demonstrating fuel wood plantation models, fuel supply as augmented by waste wood streams and utilization application in small and medium scale industries to boost the biomass energy market and establishing bioenergy technologies within the industrial sector in Sri Lanka at economically and environmentally acceptable levels.

While the Project encountered the initial birth pains noted above, the project implementation and adaptive management strategies adopted after the Mid-term Review (MTR) and the firm resolve of new project management and governance structure to address critical issues in the fuel wood plantation and application sides have compensated for the lost time in terms of the Project Outputs by achieving the desired Project Outcomes with a five-month extension of the of the Target Completion Date of July 31, 2018. Hence, the overall quality of implementation/execution of the Project is **HS (Highly Satisfactory)**. Considering the strength of the results achieved over the Project life the Overall Project Outcome Rating is **HS (Highly Satisfactory)** and the Overall Likelihood of Sustainability is **L (Likely).**

This finding is amply supported by the approval by the Sri Lanka Cabinet as of November 5, 2018 of the follow-up program (or also referred to as Phase II) on “Biomass Energy 2022 for Fueling the Economy” to sustain the policy initiatives, institutional and organizational capacity building, momentum, and outcomes resulting from the Project. A very significant portion of the financial requirements of the Biomass Energy 2022 program will be taken up by the Government of Sri Lanka to be supported by the private sector in terms of the necessary investments.

In marked contrast with the situation during the project design and inception period of low awareness and acceptance of biomass energy, the present biomass market has been transformed into a vibrant one

with active private and bank participation. At the end of the Project, the following highlights the achievements:

- A total of 27 companies comprising 8 large and 19 small and medium industries have installed and operating BETs (vs. target of 12 operating BETs and another 12 completing feasibility).
- 715 companies use modern BETs as per survey conducted by SLSEA in Nov. 2018.
- The total installed capacity of industries operating BETs is 25.42 MWth, i.e. 24.336 by large and 1.084 by SMIs (vs. 20 MWth).
- The resulting yearly fossil Fuel Savings is 355,653 GJ and the Electricity Saving is 7,057.4 MWH/year at EOP (vs. 295,178 GJ and 4,680 MWH of electricity).
- The direct emission reduction (cumulative over 10-year lifetime) is 389.5 $ktCO_2$. The indirect emission reductions are between 1168 $KtCO_2e$ (bottom-up) and 4500 $KtCO_2e$ (top-down). (vs. targeted direct emission reduction of 252 $ktCO_2$ and indirect emission reductions between 756 (bottom-up) and 1,432 $ktCO_2$ (top-down).
- Regulation for biomass pricing drafted by SLSEA and submitted to the Ministry seeking the Cabinet of Ministers approval on 06 September 2018.
- Nine agencies have been identified to be members of Inter-Ministerial Officials Committee on Sustainable Biomass Energy (IMCBE), formerly referred to as Inter-Ministerial Committee on Renewable Energy (ICRE), submitted to Cabinet for approval on June 20, 2018.
- 25 private sector institutions actively involved have been identified to be members in Bioenergy Consortium to be formalized.
- The strategy and action plan contained in the "Sustainable Energy Program 2015-2025- Towards and Energy Secure Sri Lanka Long-Term Strategy Enforcement Plan for the Energy Sector" was endorsed and approved on 10 February 2016 by SLSEA Board. Regional energy development plan designed and implemented based on the strategy and action plan.
- Biomass Cell established, fully staffed and operational under SLSEA Deputy Director General (Strategy) as of Dec. 2015.
- Draft biomass policy briefs covering standards, pricing, logistics, technology and incentive schemes have been developed for submission SLSEA Board.
- Biomass database system formulated as a biomass energy portal including data on supply, demand, technology suppliers, investors and financial institutions in March 2016 and adopted in Feb. 2018. Populating the database on real-time basis using internet-based network commenced from Oct. 2018.
- 3 large supply chains including Terminals (Monaragala, Colombo, and Kurunegala) in operation by Nov. 2018. 3 satellite supply chains including mini wood-chippers will be in operation by EOP.
- Supplier registration completed at the Terminal level. Suppliers will be included in the Portal after verification. Incentive scheme for piloting fuelwood plantations identified by DFCC Bank.
- Ten (10) feasibility studies have been prepared for installing BETs with 06 proposals accepted for funding.
- 31 companies have completed feasibility studies supported by the project by 2017 including 8 large BETs. Twenty (20) Operational BETs established with co-finance from companies.
- 441 Million LKR investments by 7 companies who have undertaken BET investments on their own based on feasibility studies supported by the project. (vs. 40 million LKR).

The following are significant accomplishments towards desired Outcomes:

- Awareness Creation

The Project has significantly improved awareness through the creation of biomass resource information system, disseminating accurate and reliable information for public awareness, clarifying status of biomass energy in National Energy Plan, and overcoming negative image and perceptions.

- Adopted necessary policies supporting Biomass Program

  The policy framework for biomass provides a clear vision and priority as enunciated in the National Energy Policy, 2017, policy briefs on standards, logistics, pricing, technology and incentives, and the report on impact of fossil-fuel subsidies.

  The creation of the Inter-ministerial Committee on Biomass Energy has defined governance and policy making processes to strengthen coordination mechanisms and was proposed for adoption and formalization by the Cabinet.

- Enhanced governance structure and institutional capacity

  The governance structure for the biomass energy sector has been defined with institutional responsibilities among the state, private sector, and community. The government created a Biomass cell in SLSEA and adopted Sustainable Energy Program 2015-2025- Towards and Energy Secure Sri Lanka Long-Term Strategy Enforcement Plan for the Energy Sector.

  The regulatory structure has been transformed from an informal to formal system through recommendations for biomass pricing and SLS 1551.

- Biomass demand Interventions

  The interventions initiated by the Project include a database and exchange system through Biomass Energy Portal, adoption of a technology development program (resulting in 27 BETs supported directly with feasibility studies and 300 other users reached) and promoting new investments in setting up new BETs and improving biomass usage efficiency.

- Biomass supply Interventions

  The Project promoted better understanding of the fuel wood value chain through Baseline studies and Biomass resource surveys in 11 districts, expanding existing and new biomass sources with the help of data, plantation lease procedures and rates, and supplier registration.

  It also developed and promoted technology for planation growing models, harvesting procedures and 14 production models and demo projects covering 1000 ha.

- Capacity Development

  Capacity development and institutional coordination in the biomass energy sector was significantly strengthened through more than 40 training and awareness events conducted by the project.

- Cross cutting issues addressed

  The Project pursued activities that empowered women, spurred local economic development, trained national/local-level officials, and initiated financing mechanisms through drafting the Framework for Sustainable Guarantee Facility and completion of feasibility studies for bankable-proposals.

However, the TE noted the very slow progress in achieving policy and regulatory improvements – perhaps hampered by the policy conflicts relating to the role of state organizations in energy generation and supply. It also observed the failure to leverage funding for the SGF and financing biomass investments.

Major barriers affecting the biomass energy program identified during the design and inception phase of the project have been addressed with a number of barriers successfully removed. The Biomass Energy 2022 Program as a follow-up plan initiated by the Government of Sri Lanka has considered these factors and the lessons learned from the Project in its implementation plan towards continuous strategy to remove related barriers and ensure long-term sustainability of the biomass energy program.

5. Recommendations

Priority

The following are key recommendations that need to be implemented for sustainability and impact in the post-project follow-up planned as the phase II of the Biomass Energy Program:

- Increase promotion and information dissemination to industry groups, banks and financial institutions for the replication program using updated results of the fuel resource potentials, fuel wood plantations, user surveys and digitized fuel supply/demand database and maps
- Develop and implement coordination mechanisms and harmonized rules and regulations with the local government units and authorities to prevent barriers on permitting and transporting that will affect efficient and timely delivery of fuel wood
- Encourage additional energy plantation investors and banks to support them with a Loan Guarantee Facility that would absorb risks and defaults
- Develop and implement the registration and certification systems for fuel wood plantation, biomass terminals and fuel burning equipment and facilities
- Develop and implement integrated national fuel wood processing, logistics, storage and transport plans for high impact users and demand clusters.
- Formalize the Inter-Ministerial Officials Committee on Sustainable Biomass Energy (IMCBE) as recommended to the Cabinet.
- Finalize and formalize the draft policy briefs produced by the Project covering standards, pricing, logistics, technology and incentive schemes that have been developed for submission to and approval by SLSEA Board.

Others

- Formalize the organization and membership towards more active involvement of the private sector institutions in the Bioenergy Consortium to be defined and operationalized without delay
- Mobilize more resources for sustainable energy projects through accessing of possible global funds
- Ensure availability of plantation lands of at least 15,000 ha for replication of fuel wood plantations using intercropping and new areas for expansion
- Develop and formalize standardization of stratified fuel wood supply systems to match specific demand applications by strengthening legal and regulatory components by particularly operationalizing SLS 1551 which remains a voluntary standard
- Explore tri-generation of heat, power and refrigeration for increased efficiency and value added, e.g. in factories, hotels and hospitals
- Take advantage of automation whenever feasible, e.g. fuelwood processing, fuel feeding and combustion control
- Involve more SMEs learning and applying knowledge from the project demos
- Involve ESCOs in the replication program using the financial mechanisms and working closely with the banks

- Prioritize development and enhancement of yield of fuel wood tree varieties through the Forest Research Institute
- Encourage more community-based fuel wood growing and road-side gathering and collection system in combination with the usual home gardening
- Involve more women in various activities, particularly in fuelwood gathering and processing and other suitable ancillary and administrative activities
- Develop educational programs on Biomass energy technologies and fuel wood plantation practices in the secondary, technician, vocational and collegiate levels in coordination with appropriate Education agencies

6. Lessons Learned

There are lessons learned that can be passed on to the next phase of the program and in developing similar projects in the future involving two or more Implementing Agencies:

- The timely and appropriate dissemination of Project's outputs in terms of the stock of knowledge, many experiences and valuable learnings from the project demos is very important to the achievement of overall objectives and should be disseminated to all stakeholders and program participants in the form and level of detail suitable to the target audience which the Project has realized as critical and made provisions in Component 2.
- The possibilities for further strengthening of co-operation with the different Government entities should be explored as a part of the possible follow-up to the project activities as important findings of the project relating to policy and regulatory improvements were slow in finding their way to the key policy and strategy documents of concerned ministries and agencies.
- The need for sufficient consultations and harmonization process during the designing and finalization stages of project development, especially if it will involve two GEF Implementing Agencies which may have varying management, governance and administrative procedures and practices has been recognized.
- Fusing two project concepts that have inherent development timelines and nature of activities, e.g. on one hand, fuel wood plantation taking longer time to prepare and harvest, and on the other hand, fuel wood utilization requiring relatively shorter lead-time, will need to have highly strategic and stronger/committed governance mechanisms in the project design in order to ensure success, which this Project has learned to adapt to in the course of its implementation towards successful results.

Acronyms and Abbreviations

BEASL	Bio-Energy Association of Sri Lanka
BETs	Biomass Energy Technologies
BMICH	Bandaranaike Memorial International Conference Hall
CCB	Coconut Cultivation Board
CPD	Country Programme Document
CRI	Coconut Research Institute of Sri Lanka
EOP	End of Project
ERD	External Resources Department
ESCOs	Energy Service Companies
FAO	Food and Agricultural Organisation
FD	Forest Department (Dept. for Forest Conservation)
GEF	Global Environment Facility
GHG	Green-house Gas
GJ	Giga Joules
GWh	Gigawatt-hour (1000 million watt-hours)
HA	Hectare
ICRE	Inter-ministerial Committee on Renewable Energy
IMCBE	Inter-ministerial Officials Committee on Renewable Energy
$ktCO_2$	1000 tonnes of carbon dioxide equivalent
kWh	Kilowatt-hour
LKR	Sri Lanka Rupee
M&E	Monitoring and Evaluation
MJ	Megajoule (million of Joules)
MOERE	Ministry of Environment and Renewable Energy
MoMDE	Ministry of Mahaweli development & Environment
MoPRE	Ministry of Power & Renewable Energy
MTR	Mid-term Review
MWh	Megawatt-hour (1000 kilowatt-hour)
NERDC	National Engineering Research and Development Centre
NGO	Non-governmental Organization
PB	Project Board
PIF	Project Identification Form
PIR	Project Implementation Review
PM	Project Manager
PMU	Project Management Unit
PPG	Project Preparation Grant
ProDoc	Project document
PSC	Project Steering Committee (=Project Board)
RPCs	Regional Plantation Companies
SALT	Sloping Agriculture Land Technology
SGF	Sustainable Loan Guarantee Facility
SLEMA	Sri Lanka Energy Managers' Association
SLSEA	Sri Lanka Sustainable Energy Authority
SLSI	Sri Lanka Standards Institute
SMI	Small and Medium-sized Industries

TAC	Thematic Advisory Committee
tCO2	Tonne of carbon dioxide equivalent
TE	Terminal Evaluation
ToR	Terms of Reference
UN REDD	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNFCCC	UN Framework Convention on Climate Change
USD	US dollar

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UNDP/FAO - GEF Terminal Evaluation

for

Promoting Sustainable Biomass Energy Production and Modern Bio-Energy Technologies

1. Introduction

1.1. Purpose of the Evaluation

This Terminal Evaluation (TE) has been initiated by UNDP Sri Lanka in accordance with UNDP and GEF M&E policies and procedures that require all full and medium-sized UNDP support GEF financed projects to undergo a terminal evaluation upon completion of implementation. A Terms of Reference (TOR) has been provided by the Project Management Unit (PMU) that sets out the expectations for a TE of the *Promoting Sustainable Biomass Production and Modern Bio-Energy Technologies* (PIMS 4226) in Sri Lanka, hereinafter referred to also as the Project. The Terms of Reference of the evaluation are presented in **Annex A**.

1.2. Scope and Methodology

The ProDoc recommended that an independent Terminal (Final) Evaluation is undertaken in accordance with UNDP, FAO and GEF guidance 3-months prior to the final Project Steering Committee meeting. The TE is expected to focus on the delivery of the project's results as initially planned, and as corrected after the mid-term evaluation, if any such correction took place. It will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals.

An overall approach and method[1] for conducting project terminal evaluations of UNDP supported GEF-financed projects have developed over time. The evaluator is expected to frame the evaluation effort using the criteria of **relevance, effectiveness, efficiency, sustainability, and impact,** as defined and explained in the "UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects (2012)".

Terminal evaluations are defined to have several complementary purposes:

- To promote accountability and transparency, and to assess and disclose the extent of project accomplishments;
- To synthesize lessons that can help to improve the selection, design and implementation of future GEF financed UNDP activities;
- To provide feedback on issues that are recurrent across the UNDP portfolio and need attention, and on improvements regarding previously identified issues.
- To contribute to the overall assessment of results in achieving GEF strategic objectives aimed at global environmental benefit; and

[1] For additional information on methods, see the Handbook on Planning, Monitoring and Evaluating for Development Results, Chapter 7, pg. 163

- To gauge the extent of project convergence with other UN and UNDP priorities, including harmonization with other UN Development Assistance Framework (UNDAF) and UNDP Country Programme Action Plan (CPAP) outcomes and outputs.

Thus, the evaluation was designed in accordance with the most recent UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects by framing the evaluation effort using the criteria of relevance, effectiveness, efficiency, sustainability and impact. In addition, the UNEG Ethical Guidelines for Evaluation have also been fully respected.

As outlined in the ToR of the assignment, the evaluation shall provide evidence-based information that is credible, reliable and useful by following a participatory and consultative approach ensuring close engagement with the key counterparts, in particular the GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Adviser/s and the key stakeholders.

Field visits during the evaluation mission were organized to Biomass energy technology demonstration sites, Fuelwood growing demonstration sites, and organizations and individuals who are key project stakeholders and the beneficiaries. **Annex B** of this evaluation report presents the itinerary of the TE Mission and the **Annex C** a complete list of the persons interviewed. A summary of field visits is presented in the **Annex D**.

The TE Mission reviewed relevant documents such as the UNDP and FAO project documents, project inception report and annual project implementation reviews, mid-term review and related management response, annual financial reports as well as technical reports and documents produced in the frame of the project. A complete list of the reviewed documents is presented in **Annex E** of this evaluation report.

As summarized in the table below, the rating scale suggested in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed projects, was used.

Ratings for Outcomes, Effectiveness, Efficiency, M&E, I&E Execution	***Sustainability ratings:***	***Relevance ratings***
6. Highly Satisfactory (HS): no shortcomings 5. Satisfactory (S): minor shortcomings 4. Moderately Satisfactory (MS) 3. Moderately Unsatisfactory (MU): significant shortcomings 2. Unsatisfactory (U): major problems 1. Highly Unsatisfactory (HU): severe problems	4. Likely (L): negligible risks to sustainability 3. Moderately Likely (ML): moderate risks 2. Moderately Unlikely (MU): significant risks 1. Unlikely (U): severe risks	2. Relevant (R) 1. Not relevant (NR) ***Impact Ratings:*** 3. Significant (S) 2. Minimal (M) 1. Negligible (N)
Additional ratings where relevant:	Not Applicable (N/A) Unable to Assess (U/A)	

1.3. Structure of the Evaluation Report

The structure of the TE report follows the "Evaluation Report Outline" prescribed in Annex F of the ToR of the assignment with some minor modifications. The Executive Summary presents a quick overview on the main project results, ratings, other observations and recommendations for further work.

The rest of the report is outlined as follows:

- Introduction: Purpose, Scope and Methodology
- Project Description and development context
- Findings on
    - Project design and Formulation;
    - Project Implementation; and
    - Project Results.
- Conclusions, Recommendations and Lessons focusing on improving post-project sustainability of results attained; and
- Annexes as cited.

2. Project Description and Development Context

2.1. Project Development Background, Start/Duration, Implementation History and intervening Events

The Project is funded through the Global Environmental Facility (GEF) climate change mitigation portfolio. The 4-year project was started to be implemented by the Ministry of Mahaweli Development and Environment, under collaborative technical implementation of the Sri Lanka Sustainable Energy Authority and the Forest Department. Monitoring and reporting to GEF is the responsibility of both UNDP (for Components 1, 3 and 4) and FAO (Component 2).

The Project experienced a lengthy start-up period. The signing of the Project Agreement by the Government was in April 2013 and by UNDP in July 2013, one year after the CEO endorsement in June 2012. The Implementation and PMU arrangements were finalized October 2013, following the Inception Workshop held on 17 September 2013. The Project has two implementing agencies: UNDP and FAO with respective project documents (ProDoc), basically for energy application and fuel wood supply sides. The Project had its Mid-Term Review (MTR) in July 2015 where recommendations were submitted and formed the basis for the Project Management to update the Project's implementation strategy, in addition to what had been learned in the course of the Project's progress in achieving its goal and objectives.

At the project launch the then Ministry of Environment and Renewable Energy (MoERE) was identified as the National Implementing Partner for this project. The main executing agencies, i.e. the Forest Department (FD) and the Sri Lanka Sustainable Development Authority (SLSEA), were agencies under the purview of MoERE. In February 2015, the subject of renewable energy was transferred to the Ministry of Power and Renewable Energy (MoPRE).

Project Implementation: The Project Management Unit (PMU) was established in the SLSEA. PMU is expected to coordinate the project's operations on a day-to-day basis with the government agencies involved (Forest Department and Sustainable Energy Agency) and report to both UN agencies (UNDP and FAO) on the progress in implementation of the project activities. The provisions in the two ProDocs (UNDP & FAO) differ in regard to staffing of the Project and were resolved after the MTR.

*The Project Board (*PB*):* The key responsibilities of PB are to provide strategic guidance for the project, oversight to budgeting and work-planning, monitoring and evaluation, and using evaluations for performance improvement, and accountability and learning. Initially, the PB functioned as the Project Steering Committee (PSC). It held its 1st meeting in January 2014 chaired by the Secretary, MoERE with 34 members adhering to the 'Terms of Reference' for the PB set out in the ProDoc. After transfer of the project to the MoPRE the PB was set up chaired by the Secretary/MoPRE. It was instrumental in setting up two Thematic Advisory Committees (TACs) on 'Energy Conversion and Technology' and 'Production and Supply' with the participation of 12 Ministries and government agencies enabling the wider range of stakeholders who were not directly a part of the PB. The TACs guided conduct of various studies and provided feedback to improve the quality of project outcomes.

In terms of project execution, SLSEA is largely responsible for Components # 1, 3 and 4, whereas the Forest Department is responsible for Component # 2. SLSEA is expected to examine the policies and regulations and supporting the improvements to the fuel wood supply chains and institute a supporting mechanism to provide incentives for industries converting to fuelwood. Some work in Component # 1 requires the support of FD as well. The role of the Forest Department was expected to be supporting further refinement to, and implementation of the biomass production models identified during project preparation, specifically establishing models in lands coming under the purview of FD. Both agencies were

expected to work in close coordination with the Department of National Planning in making recommendations on existing and future subsidy schemes that support the biomass sector.

Both UNDP and FAO provide technical support for implementation. UNDP funding is channeled in two ways, viz., direct contracting of services such as consultants, and channeling funds through the Government to the Ministry, whereas FAO implantation is by directly implementing activities. Primarily, FAO is to support the Forest Department in the implementation of Component 2 on biomass (fuelwood) production.

According to the UNDP ProDoc the end date of the project was July 2017 whereas the FAO ProDoc set its termination date as January 2019 in consideration of the longer time period required for establishing fuelwood plantations. As the project launch took place more than one year after the CEO endorsement, at the PB Meeting held in May 2017 it was agreed to extend the end-date of the project to July 2018. Furthermore, the PB at its meeting on 14 March 2018 decided to approve a no-cost 5-month extension to the project from August-December, 2018.

The following describes the history, milestones and timelines of the project:

Activity/Milestone	**Date**
CEO Endorsement	11 Jun 2012
Signing of the Project Agreement	
• By the Implementing Partner	17 Apr 2013
• By the UNDP	10 Jul 2013
Inception Workshop	17 Sep 2013
Finalized implementation and PMU arrangements	10 Oct 2013
Mid-Term Review	Jun 2015
Staffing	
• Project Manager	Oct. 2015
• Project Assistants (Government funds)	Two SEA officers- Aug 2014 One MoE officer- Jan 2015
• Project Accountant	May 2014
• Project Specialist (UNDP)	Jul 2014
• Programme Assistant (FAO)	Oct 2014
Steering Committee Meetings	
• 3 Meetings	Jan – Dec, 2014
Project Board Meetings	
• 7 Meetings	Oct. 2015 – Sep. 2018
Completion of PIRs - First	Jul 2014
Last	Jun 2018
Project Completion Date	Jul 2018
Revised Completion with No-Cost Extension	Dec 2018

2.2. Problems that the Project Sought to Address

The goal of the project is to reduce greenhouse gas emissions from the use of fossil fuel for thermal energy generation in the Sri Lanka industrial sector. The goal will be reached by means of removing barriers to the realization of sustainable biomass plantation, increase of market share of biomass energy generation mix and adoption of biomass-based energy technologies in Sri Lanka. The project consists of four components, i.e.: (1.) Policy-institutional support for effective implementation; (2.) Barrier removal for sustainable fuel wood production; (3.) Enabling environment for fuel wood suppliers; and (4.) Wood-based energy technology development.

The project is expected to generate global benefits in directly avoided greenhouse gas (GHG) emissions of almost 252 kilotons of CO_2 due to switching from fossil fuels to wood-based technologies (over the lifetime of 10 years) and almost 756 – 1,432 ktCO_2 as indirect emission reduction impact.

The project aimed to remove barriers that hinder the sector growth, such as policy-to-practice gaps, sustainable biomass plantations, sustainable fuel wood processing and supply-chain development, increased of market share of biomass energy generation mix and adoption of biomass-based energy technologies in Sri Lanka.

The key barriers identified during project preparation are summarized below:

(a) Conducive Policy: During the period 2009-2011, when the PIF and PPG were produced, the government was providing a very large subsidy on furnace oil and industrial kerosene as a protectionist policy to keep industries and agricultural processing competitive. This subsidy made oil and petroleum products cheaper than fuel wood at that time. It actually caused reverse switching of several large industries who had previously converted from oil to biomass through a project managed by the Ceylon Chamber of Commerce during 2007-2009.

(b) Supply of biomass: Sustainable fuel wood supply was identified as a key barrier. This included insufficient information on availability and volumes, problems relating to collection and fair price, storage, handling and transport. A few functioning fuel wood supply chains that had been established in the past had collapsed during 2009-2011 due to the fuel subsidy.

(c) Technology: Industries were not confident of the available technology and were unhappy with the level of maintenance required for gasification systems (including manpower for wood handling, storage and feeding). There were very few technology providers available in Sri Lanka. Only one company was actually fabricating biomass equipment (chippers, gasifiers) in the country. Others were imported.

(d) Finance: Financing opportunities were limited for biomass conversions in the industrial sector. Although the payback period and returns were attractive, financial institutions were uncertain about the sustainability of fuel wood supply and reliability of technology.

(e) Pricing and Marketing: Growing of fuel wood, despite government incentive schemes, was not as widespread as expected. Farmers complained of low price, difficulty of handling, and the cost of transport to collection centres. Investors had problems in accessing suitable land for fuel wood cultivation; availability of planting material was another constraint.

(f) Information: There were many information gaps pertaining to government policy on biomass energy, land availability and accessing land for new plantations, stock taking of currently available biomass, potential species and their yields, existing supply chains and sustainability of supply, technology options and economic benefits of fuel switching. These information gaps hampered the confidence of the financial sector and industrialists.

The set of barriers was found to be valid at the time of the MTR and therefore the project Objective and Outcomes.

2.3. Immediate and Development Objectives of The Project

The goal of the Project is to "reduce greenhouse gas emissions from the use of fossil fuel for thermal energy generation in the Sri Lanka industrial sector". The Project is expected to generate global benefits in directly avoided greenhouse gas (GHG) emissions of almost 252 kilotons of CO_2 switching from fossil fuels to wood-based technologies (over lifetime of 10 years and almost 756 – 1,432 kt CO_2.

The Project's objective is "the removal of barriers to the realization of sustainable biomass plantation, increase of market share of biomass energy generation mix and adoption of biomass-based energy technologies in Sri Lanka."

The Project's objective and outcomes are to be achieved through delivery of the following components:

- **Component 1. Policy-institutional support for effective fuel-switching using fuel wood**

  Outcome 1: Approved and implemented policy instruments that promote and support the use of sustainably produced fuel wood in industrial thermal applications

- **Component 2: Barrier removal for sustainable fuel wood production**

  Outcome 2: Enhanced knowledge of and improved support network for sustainable fuel wood production; Increased sustainable fuel wood production

- **Component 3: Enabling environment for fuel wood suppliers.**

  Outcome 3: Improved confidence among industrial and banking sector on the feasibility, stability and economic benefits of sustainable fuel wood supply chains.

- **Component 4: Wood-based energy technology development**

  Outcome 4: Enhanced knowledge of, access to, and maintenance skills of biomass energy technologies as well as increased number of wood-based gasification projects

2.4. Baseline and Project Success Indicators Established

Focusing on all parts of the country, the project sought to address barriers in policy and legislation, supply, technology and skills, finance, pricing, and, awareness through a comprehensive barrier removal strategy that addresses biomass supply including fuelwood plantation establishment and demand-side biomass technology deployment.

Key indicators of the project's results identified in the project results framework are:

- CO_2 emissions are reduced by switching from fossil fuels in commercial and industrial establishments to biomass (fuel wood) using biomass energy technologies (BETs). Investment in BETs by companies directly supported under the demo scheme with technical assistance by the GEF project will lead to fuel substitution of 230,265 GJ annually, electricity substitution of 4,680 MWH and corresponding CO_2 emission reduction of 252 ktCO_2 over the lifetime of the technology (conservatively assumed to be 10 years);
- A set of approved policy instruments is in place with appropriate incentives for biomass production, transportation and use in industrial and commercial establishments;

- Incentive mechanisms provided by various government agencies, such as CCB (for *Gliricidia* intercropping), SEA (Sustainable Guarantee Facility), and soft loan schemes provided by development banks;
- Hectarage which is under cultivation for fuel wood production and annual fuel wood production, using various schemes, such as dedicated plantations, intercropping with coconut, pepper, vanilla or other plants, home gardens, as part of coffee/tea/cocoa production or as anti-erosion measure on sloping land;
- Number of commercially viable biomass (fuel wood) supply chain developed that can guarantee producers a fair price, be financially viable themselves and can fuel wood users guarantee a reliable and affordable source of biomass supply;
- Number of commercial and industrial establishments that have switched from fossil fuels (diesel, furnace oil, LPG) to biomass fuels (fuel wood or other biomass) using improved biomass energy technologies (gasification, efficient biomass furnaces or boilers).

A detailed set of outcome and output indicators is presented in the project's logical framework.

2.5. Main Stakeholders

The key stakeholders of the project as listed in the ProDoc were as follows:

Ministries, Departments and Corporations

1. Ministry of Environment & Renewable Energy (since February 2015 this Ministry is designated as the Ministry of Mahaweli Development & Environment);
2. Department of National Planning
3. Forest Department
4. Sri Lanka Sustainable Energy Authority
5. Coconut Cultivation Board
6. Mahaweli Development Authority
7. Department of Export Agriculture Crops

Private Sector

8. Plantation Companies
9. Industries involved in fuel switching
10. Supply Chain Managers (e.g. Lalan Group)
11. Silvermill Group

NGOs

12. Practical Action
13. Energy Forum
14. Help-O
15. Arunalu Foundation

Others

16. Bio-Energy Association of Sri Lanka
17. Switch Asia Project[2]

[2] The SWITCH-Asia "Greening Sri Lanka Hotels" project sought to address the issue of high energy, water and resource consumption of the hospitality sector in Sri Lanka, and to improve its environmental performance through promotion of 'Green Concepts'; the project was closed in 2013.

At the time of the Mid-Term Review of the Project in June 2015, the involvement of several state agencies identified as 'main stakeholders' in the ProDoc were found to be minimal or absent. These included the Forest Department, the Coconut Cultivation Board, the Mahaweli Development Authority, and the Department of Export Agriculture Crops. The involvement of the NGOs, Practical Action, Energy Forum, Help-O, and Arunalu Foundation (the latter two co-financiers) was also found to be lacking.

Considering the status at the time of the MTR, several new agencies were recommended to be added as main stakeholders:

18. Ministry of Power and Renewable Energy (mandated for the subject of renewable energy, and the line Ministry of SLSEA)
19. Ministry of Plantation Industries (mandated on policies on plantation management)
20. The Coconut Research Institute of Sri Lanka (research on crop models involving Gliricidia)
21. The Sri Lanka Carbon Fund (private-public partnership to build a new low-carbon business economy and low carbon life patterns)
22. Sri Lanka Energy Managers Association (promote efficiency and rational use of energy in Sri Lanka)
23. The Ceylon Chamber of Commerce (representing the Industry)

Over the post-MTR phase of the project many other stakeholder groups including the following government and non-government agencies and industry groups linked up with the project as key implementing partners.

24. Rubber Research Institute of Sri Lanka (Establishment of fuel wood plantations via intercropping)
25. Ministry of Health and Indigenous Medicine (Establishment of BETs in hospitals)
26. Tourist hotels (Piloting the use of BETs in thermal applications)
27. Food processing Industry (Piloting use of BETs for drying/dehydration)

2.6. Expected Results

The Project Goal as described in the results framework was specified as the reduction of greenhouse gas emissions from the use of fossil fuel for thermal energy generation in the Sri Lanka industrial sector, through achieving the Project Objective of removal of barriers to the realization of sustainable biomass plantation, and adoption of biomass-based energy technologies. There were no changes suggested to the project goal and objective during the Inception Workshop (IW) held 2 years after the initial drafting of the ProDoc. The end of project (EOP) target for the goal and objective-level defined in 3 components were adjusted slightly during the IW. The agreed EOP targets are, at least 12 companies are operating BETs and another 12 companies have detailed feasibility studies completed or started installation of gasifier systems by the end of the project contributing to post-project direct emission reduction, with a total capacity of 20 MWth and 1 MWe resulting in fossil fuel savings of about 295,178 GJ annually and 4,680 MWh of electricity, and direct emission reduction (cumulative over 10 year lifetime) of 252 ktCO2 and Indirect emission reduction impacts between 756 (bottom-up) and 1,472 ktCO2 (top down).

The project results framework provides the details of the following outcome and output specific targets summarized below:

Outcome 1: Approved and implemented policy instruments that promote and support the use of sustainably produced fuel wood in industrial thermal applications., with EOP indicator of Number of approved policy instruments to promote sustainably produced fuel wood in industrial thermal applications. The target for the outcome is drafting and submitting the regulation for biomass pricing for cabinet approval.

The specific outputs defined for Outcome 1 are:

Output 1.1: Established and enforced mechanisms for effective cooperation between various government agencies and private sector involved in (regulating) fuel wood production, supply and use for thermal energy generation,
Output 1.2: Proposed, approved and implemented policies/incentive schemes for fuel switching,
Output 1.3: Enhanced and implemented policies on fuel switching.

The key targets for realizing these output 1.1 were the establishment of an Inter-Ministerial Committee on Renewable Energy (ICRE) with the participation of at least 6 agencies of the government, setting up of a Bioenergy Consortium with the participation of 25 private sector institutions, the establishment of a Biomass Cell and a long-term strategy for biomass by the SLSEA, The output 1.2 was to be achieved by conducting analysis and presenting findings of implications of fossil fuel pricing and establishment of a database on biomass consumption, while the establishment and operation of a Sustainable Guarantee Facility (SGF) was the mechanism identified to achieve the output 1.3.

Outcome 2: Enhanced knowledge of and improved support network for sustainable fuel wood production with the end of 2016 target of establishing 2,229 ha needed for supplying demo projects (outcome 4) with fuel wood through new plantation models. Following a detailed assessment of the funding allocated for the activity and the availability by-products and waste streams for the use in demo projects the hectarage required was revised to 1,000 ha.

The specific outputs defined for Outcome 2 are:

Output 2.1: Prepared and disseminated information and knowledge products on fuel wood growing (models)
Output 2.2: Tested and implemented supportive regulations and policies for sustainable fuel wood production
Output 2.3: Completed awareness raising campaigns and specific training programmes for key stakeholders on growing of species for fuel wood production
Output 2.4: Suitable growing models and species for fuel wood production piloted and demonstrated

Achieving the 4 outputs under the Outcome 2 envisaged conducting biomass resource and land use surveys, publishing biomass growing models, lease procedures, developing criteria for sustainable fuel wood production, and capacity building through training and demonstration of fuel wood production models.

Outcome 3: Improved confidence among industrial and banking sector on the feasibility, stability and economic benefits of sustainable fuel wood supply chains with the specific target of at least six supply chains that are sustainable on the longer term developed by the EOP.

The Outcome 3 comprised of following specific outputs:

Output 3.1: Proposed, approved and implemented policies and incentive schemes for sustainable fuel wood supply improved.
Output 3.2: Completed outreach programmes for key stakeholders and published and disseminated knowledge products
Output 3.3: Six sustainable biomass supply chains established and operational

The specific targets earmarked under the 3 outputs for this outcome envisaged setting up and operation of a supplier registration and an incentive scheme, specification and practice of voluntary guidelines for sustainable biomass supply, setting up biomass supply chains and conducting targeted capacity building.

Outcome 4: Enhanced knowledge of, access to, and maintenance skills of biomass energy technologies as well as increased number of wood-based gasification projects was accompanied by two targets to be achieved by end 2016, i.e. At least 12 companies implement BETs directly supported by the project; and, the number of companies all over Sri Lanka that use BETs as revealed by the baseline and end of project surveys.

There are 3 specific outputs defined for Outcome 4. During the IW, Output 4.2 was expanded to accommodate information exchange system in addition to database development:

Output 4.1: Biomass thermal energy projects including Cogeneration and Trigeneration systems implemented, operational and monitored
Output 4.2: Established information database and information exchange system for biomass energy technologies
Output 4.3: Completed trainings to support fuelwood based sustainable industrial energy supply

To achieve the 3 outputs for the outcome 4 that focused on setting up and operation of biomass energy technologies envisaged conducting feasibility studies and setting up operating BETs and facilitating new investments. Capacity building to ensure availability of trained BET professionals was also expected to be delivered through the project life.

3. Findings

3.1. Project Design / Formulation

The project design/formulation was scrutinized twice since its drafting in 2011, first during the IW and again during the MTR and at both occasions determined to be still valid to support the project goals and objectives. The project document is identifying several barriers to increasing the use of biomass energy in the industrial sector that are considered to be valid over the lifetime of the project. The identified barriers are clearly articulated, and the strategy and approach proposed to address them are well grounded on the prevailing situation. The importance of BET pilots in demonstrating the technical feasibility and financial viability of biomass technologies can be recognized as a very effective approach to achieve the project objectives in the context of Sri Lanka. Furthermore, knowledge build up and improved support for sustainable fuel wood production have been successful in enticing more growers to start fuelwood cultivations. Project interventions to enhance knowledge of, access to, and maintenance of biomass energy technologies have helped to address capacity development in the bioenergy technology application.

As evidenced during the early phase of implementation, the potential disruptions of the project operation due to changes in political-administrative arrangements pertaining to key stakeholders of the project seem to have been underrated at the planning stage. The placing of the project under the jurisdiction of MoERE under whose purview SLSEA came at the time of project clearance was natural. However, given the common practice of reassigning institutions across different Ministries with every Cabinet change, provision should have been made to deal with such change. The long time-gap in moving the project to MoPRE until after the MTR recommendation led to slowing down of project activities in a significant way.

Another area where the project design has failed to fully appreciate the level of effort required to effect change in the country context is the policy and regulatory reform recognized under Outcome 1: Approved and implemented policy instruments that promote and support the use of sustainably produced fuel wood in industrial thermal applications. Due to the high level of disaggregation of agency responsibilities, coordination of policy dialogue and building consensus has been a challenge in the context of Sri Lanka. As a result, achieving this outcome remains work in progress at the EOP mark.

Also, the availability of land and the adequacy of funding to ensure the establishment of fuel wood plantations to supply the planned biomass installations had not been properly assessed. It was appropriately recognized that the establishment of fuel wood plantations would take longer and in actual practice the activity took up even longer time. The funds budgeted fell well short of the requirements thereby compelling the project to devise hurried measures to overcome the potential shortfall. This had no adverse impact on the operation of BETs as there was adequate residual biomass supplies from existing plantations and by-product and waste streams diverted to the supply chain.

3.1.1. Analysis of LFA/Results Framework (Project logic /strategy; Indicators)

The project LF targets at the goal and objective level were defined in terms of 12 operating BETs at EOP and another 12 becoming operational post-project with a total capacity of 20 MWth and 1 MWe resulting in fossil fuel savings, electricity savings and direct and indirect emission reductions. The industry recognized the need to address the growing demand for thermal energy, electricity and space cooling and refrigeration. The EOP objective target of fossil fuel savings of about 295,178 GJ annually and 4,680 MWh of electricity, and direct emission reduction (cumulative over 10-year lifetime) of 252 $ktCO_2$ were to be achieved from those BETs installed by EOP and post-project. As observed, the project managed to have

the targets for the installed BETs and both the fuel saving and emission reduction targets exceeded before the EOP.

The fossil fuel savings forecast in the Project Results Framework were estimated at 295,178 GJ annually and 4,680 MWh of electricity, and direct emission reduction (cumulative over 10-year lifetime) of 252 $ktCO_2$ and Indirect emission reduction impacts between 756 (bottom-up) and 1,432 $ktCO_2$ (top down). As enumerated from MRV estimates the actual achievements were significantly above the expected levels as shown:

- The direct emission reduction (cumulative over 10-year lifetime) is 389.51 $ktCO_2e$. The indirect emission reductions are between 1168 $KtCO_2e$ (bottom-up) and 4500 $KtCO_2e$ (top-down).
- Estimated fossil fuel reduction is 394,478 GJ by the EOP and 3,556,532 GJ over technology lifetime (TL).
- The electricity saving is 7,057 MWh by the EOP and 33,264 MWh over technology lifetime.
- The GHG Reduction is 45.49 $KtCO_2e$ by the EOP and 389.51 $KtCO_2e$ over technology lifetime.

The over-achievement of targets in the Objective-level can be attributed to the success the project achieved in enticing a higher number of BET operators come on board in advance of the predicted timeline. This was achieved from the initial period of project implementation, without the benefit of extended time period.

As suggested earlier, indicators relating to policy and regulatory improvements for Outcome 1 were particularly hard to achieve. Given the recognized complexity of the process in the context of Sri Lanka, perhaps the level of effort identified for this task could have been augmented. The indicators and EOP targets for the Outcome 2 were fine except for the hectarage for sustainable fuel wood expected to be developed which was under-funded, and also not directly linked to supplying demo projects. In fact, because the establishment of fuel wood cultivations took place so late in the scheme, the full requirements of demo projects were likely met from the existing sources, by-products and waste streams. The residual biomass supplies available to be connected to the supply chain have been much greater than the anticipated quantities. The progress in establishing new fuel wood plantations was adversely impacted by the extended drought conditions that affected targeted plantation areas.

Outcomes 3 and 4 had indicators and EOP targets that were well within the reach of the project, except the target relating to approval and implementation of policies and incentive schemes for sustainable fuel wood supply. As previously observed, the Project's ability to secure planned changes in the policy sphere remained challenging. The recognition of fuel wood production and adoption of BETs as viable investment opportunities need to be expedited if the Phase II targets are to be achieved. On the other hand, investments for fuel wood terminal establishments were financed under the business investment practices of the commercial banks.

Even with the flaws discussed above, the project scope, design and implementation approach can be considered sound. The Results Framework is realistic for a medium-sized project raising awareness and facilitating the implementation of pilot projects necessary to build confidence among the key decision makers on biomass energy as technically, cost effective and environmentally friendly alternative to fossil fuels.

3.1.2. Assumptions and Risks

The ProDoc identified total of 8 risks, 3 ranked medium and 5 others rated as low risks, and appropriate mitigation actions. At the IW, the risk ratings of some of them were changed and 4 new risks were added. While the identified risks had not changed in a significant way or mitigated effectively, one risk that had not been properly assessed is the climate-related impacts on the project activities. Such impacts were

reported with respect to establishment of fuel wood plantations and in the launching of fuel wood terminals adversely impacting the timelines of operations. The critical management measures undertaken to deal with organizational, financial, operational, political and other risks were reported and reviewed as a part of the PIR process as well ensuring dedicated attention to risk management.

The assumptions pertaining to the operational environment while not altered in a significant way, assumptions identified as not effectively addressed, i.e. policy and regulatory framework improvement and receptivity of financial institutions to support the supply chain, remained somewhat elusive throughout the project life, for reasons alluded earlier.

3.1.3. Lessons from other relevant projects (e.g., same focal area) incorporated into project design

The project benefitted from the regional and global experiences and lessons UNDP and the FAO gained in supporting other biomass-energy projects, the ProDoc referred to one specific project in Sri Lanka as providing relevant lessons for planning. The Dutch-sponsored 'Promotion of Eco-Efficient Productivity Project' (PEP), which was implemented by the Ceylon Chamber of Commerce, was instrumental in introducing dendro power as an alternative to fossil fuels in industry. It was stated that during the PPG phase of the biomass project, the project development team liaised closely with the PEP project and derived good practices and lessons learned. The project design was informed by the failure of some of the PEP pilots, particularly in identifying risks and barriers.

The approach taken by the Project covering the full range of activities in the biomass value chain from raising awareness and capacity building, biomass growing and processing technologies, introducing new BETs, developing marketing facilities, introducing investment models, contributing to policy and institutional reform in a single project was possibly informed by the global experience of UNDP and FAO. Compared to projects such as PEP previously implemented in Sri Lanka, the approach of the project was therefore unique and a key reason behind its success to produce significant results.

3.1.4. Planned stakeholder participation

As outlined in the Section 14 of the ProDoc, over the project development phase consultations with a wide range of stakeholders including government ministries and departments, private sector, NGOs, industry organizations, and other relevant projects. Although the responsibilities and roles of the various organizations listed out, it fell short of a comprehensive stakeholder analysis by not recognizing roles of other organizations that were not directly partnering in the project, but still had influence on the activities and outcomes, i.e., for example, the Ceylon Electricity Board. The Project Implementation Plan maintained an open approach towards accommodating relevant stakeholders as seen by new partner groups enlisted to implement various activities. The Project Inception Workshop facilitated participation more stakeholder groups by including universities, donors, financial institutes and international organizations in the discussions.

As seen from the implementation reports, the interest of some of the stakeholders who showed an interest at the project inception had changed for reasons not within the control of the project such as political changes. However, they were readily replaced by other stakeholders with similar capacities due to the open-approach maintained by the Project. In fact, change of government during the second year of the project resulted in a major reallocation of the government departments and institutes, placing the SLSEA which was identified as the key implementing partner under the Ministry of Power and Energy from the Ministry of Environment (MoE) to which it was attached to. The Project's funds were continued to be allocated to the MoE. Making necessary amendments to the funds allocation mechanisms to ensure

smooth functioning of the PMU that had been created within the SLSEA, and which was now within a different ministry, had to wait until it was recommended in the MTR. Effective coordination of relevant government ministries has become a major hindrance to project implementation in Sri Lanka due to the presence of large number of ministries as well as various hierarchies as identified by Cabinet, State and Non-Cabinet Ministry portfolios. These coordination issues had to be addressed at the PMU and Implementation Agency levels by adjusting composition of the Project Board to be more inclusive. This resulted in a major delay in deciding the structure of the ICRE that was proposed to be established early in the implementation period and in securing necessary consensus. This was partially overcome by the two TACs that were established with a broad stakeholder participation at the officials-level that is less influenced by the political interests.

3.1.5. Replication approach

Replication of piloted BETs, fuel-wood growing and supply chains, financing models etc. is key to the sustainability and impact of the project. It is particularly so for GEF/UNDP projects of which the real impact is in the ability to multiply the impact by developing initiatives to be replicated post-project. The ProDoc recommended that a post-project action plan for newly-identified approaches be developed under Output 2 that relates to the sustainable fuel wood production. The ProDoc referenced to replication projects that will come on board at a later stage during the project in the context of estimation of bottom-up direct emission reductions and accessing CDM credits. However, no projections were made about the envisaged levels of replication.

The initiative developed by the implementing partners to have it succeeded by a Phase II can be considered the most striking action taken to replicate the results. Under the Phase II, the fuel wood growing, development of supply chains, installation of BETs, developing financing models will all be addressed. This can be taken the real test of validity of sustainability and impact of the project.

3.1.6. UNDP comparative advantage

The two GEF Implementing Agencies involved are UNDP and FAO, with the FAO primarily supporting the FD in the implementation of Component 2 on biomass (fuel wood) production, and the UNDP staying primarily responsible for components 1, 3 and 4 working with the SLSEA. The two agencies have a wealth of global experience in implementing GEF-supported project. They bring a wealth of experience of working with governments to support policy development, human resources development, inclusive institutional strengthening with comprehensive non-governmental and community engagement.

The UNDP was described as having ultimate accountability to project results (ProDoc page 63-Management Arrangements) that will be ensured by working with the PB to provide strategic guidance and making management decisions for the project, in particular when guidance is required by the Project Manager. The project design can be identified to have benefitted fully from UNDP's comparative advantage in Sri Lanka, strongly in line with the Country programme Document priorities of the agency. Sri Lanka follows a UNDAF framework that is designed within the 'One-UN' and 'delivering-as-one' ethic binding all UN organizations operating in Sri Lanka. The FAO as co-implementing agency of the Project provided the crucial support and oversight in the upstream side of the fuel wood plantation and related agro-forestry productive activities that enhanced the sustainability and viability of the very critical and crucial wood growing aspect of the Project towards overall Project goal. Given the combined experience and capacity of the two agencies in Sri Lanka extending over many decades, the UNDP-FAO collaboration in the project serves as a factor that further strengthens project implementation capacity.

3.1.7. Linkages between project and other interventions within the sector

There were no other major initiatives in the renewable energy sector other than the Switch Asia project that were identified in the ProDoc. The design made provision for two-way flow of information between the project and other projects of a similar focus as opportunities arise, but during the project implementation any such collaboration did not materialize as far as the energy sector is concerned. Towards the penultimate months of the project, the 'Enterprise Sri Lanka' initiative launched by the Government opened up possibilities for securing financial support for innovative SMI projects under which some of the fuel wood growing and BET investments could qualify for preferential treatment. Given the late stage at which this initiative was mooted, the Phase II of the project has an opportunity to provide technical and organizational support to link the potential investors and 'Enterprise Sri Lanka'.

3.1.8. Management arrangements

At the Project design, UNDP and FAO, the two GEF Implementing Agencies, the Ministry of Environment, the 'National Implementing Partner' with the Forestry Department (FD) and the SLSEA under the same Ministry as technical partners were expected to be involved in project implementation. As described earlier, FAO was expected to be responsible for Outcome 2 and UNDP for Outcomes 1, 3 and 4.

Both UNDP and FAO provide technical support for implementation. The Project execution modalities differ depending on the funding source. The UNDP funds are used in two ways; viz., direct funding of services contracted by UNDP, and channeling funds through MoPRE for specific activities, currently limited to SLSEA. The Ministry makes periodic cash advances to the SLSEA for project activities. The FAO implements activities directly. Direct implementation of activities by the 'donor' has several implications; there is uncertainty about project ownership, and participation of the state agencies could be minimal.

A small **Project Management Unit (PMU)** hosted by the Planning Division of the Ministry of Environment was to be set up, consisting of staff contributed by the two government technical agencies under the National Implementing Partner. However, the 2 ProDocs by the UNDP and FAO differed on staffing arrangements. Under the Project Board, the PMU was expected to coordinate the project's operation on a day-to-day basis with the government agencies involved (Forest Department and Sustainable Energy Agency) and report to both UN agencies (UNDP and FAO) on the progress in implementation of the project activities.

The transfer of SLSEA under the MoPRE in February 2015, in the second year of the project required a major reorganization. At the time of the MTR in June 2015, MoMDE (and its State Ministry of Environment) was functioning as the designated National Implementing Partner. The National Project Director position was held by the Director for Planning of this Ministry. The position of the Project Manager had been vacant from the beginning. The Project management arrangements set out in the ProDoc had not been fulfilled; in addition to not appointing a Project Manager, the appointment of other staff (remunerated by the Government) has been erratic. The Project Management Unit consists of only the UNDP and FAO-appointed technical officials without any support services. As a result, the project has ambled on without leadership and focus on timeliness of delivery. Notwithstanding these serious shortcomings, the two technical officials (UNDP & FAO) have tried to implement the project to the best of their abilities. In the process, the Government has also failed to demonstrate its ownership of the project.

The MTR made widespread recommendations regarding the re-organization of the project management arrangements that were implemented post-MTR, correcting a major disconnect in the implementation

arrangements that had seriously impacted project implementation. It was observed that a major transformation of the project has taken place with the implementation of these recommendations.

The updated project management structure that is in operation is shown in Fig. 1 below:

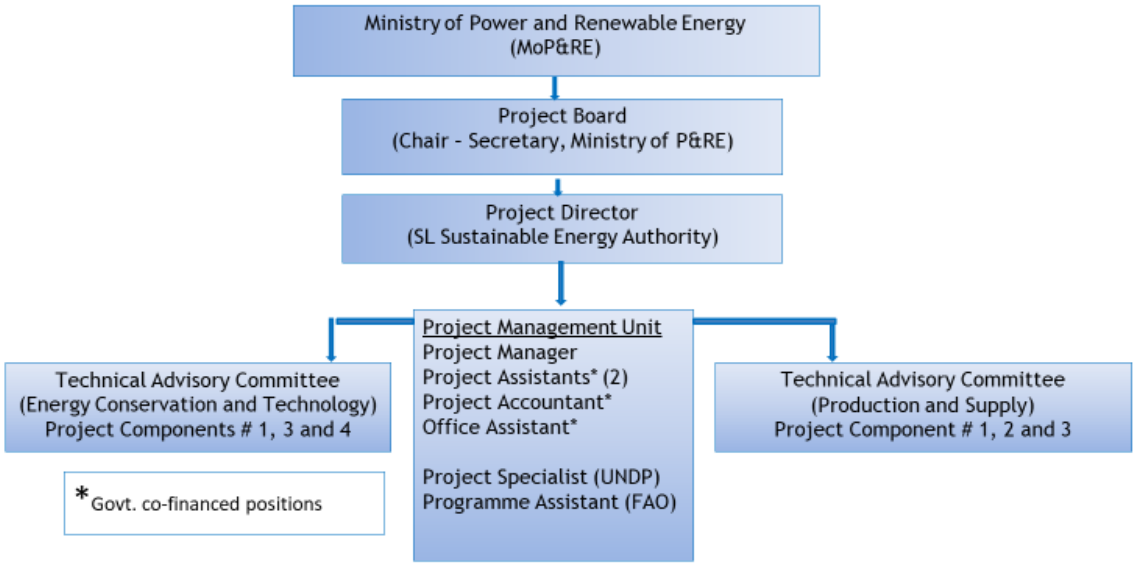


Fig. 1: Updated Project Management Structure

Also, on account of time lost due to the gap between the CEO endorsement of the project and the approval by the government, the effective life of the project had reduced to 48 months, from original 60 months. Subsequently, the GEF extended the project life by one year, from July 2017 to July 2018 to amend this shortcoming. In February 2018, the Project Board approved a 5-month no-cost extension of the project duration till December 2018.

3.2. Project Implementation

3.2.1. Adaptive management (changes to the project design and project outputs during implementation)

As reported in the MTR, there was meagre accomplishment during the first two years of project implementation. The prevailing situation then was characterized by inherent effects of highly subsidized fuel oil, unacceptability of biomass gasification technology, the transition in project execution and administration from the Ministry of Environment to Ministry of Power and Renewable Energy and the on-going integration of implementation approaches from what were complementary, but separate project concepts initiated by the UNDP and the FAO. There were at least four significant technology and people-oriented adaptations during this period after the MTR from what was originally designed. They were (a) on the technology focus, (b) on the project organizational and governance structure, (c) on more appropriate project hosting under the umbrella Ministry of Power where SLSEA is placed since the project is predominantly an energy project, and (d) on strengthened implementation and coordination

mechanisms. Project Management under the new leadership introduced these major changes that needed to be effectively managed on the technical side and on the people side that ensured that the changes are developed, implemented and delivered effectively. The discipline of project management provided the structure, processes and tools to make this happen.

There was firm resolve to address the technical focus of the Project on the fuel growing with innovative plantation practices and employment of fuel processing and logistics models and on the utilization aspects to direct burning of wood fuels and using available more efficient biomass energy technologies (BETs) instead of gasification. While the fuel growing side was still in progress in the first two to three years of the Project, the project management addressed the biomass shortfall by utilizing the by-products and wood waste streams. In fact, this was a major adaptation necessitated by under-estimation of requirement of funds for the fuel wood growing program, but that went on to also prove the value of by-products and waste streams as a source of biomass that can be utilized to meet the raw-material requirements. Several BETs functioned totally using such biomass supplies instead of fuel wood produced for that purpose.

The people side focus as initiated by the Project was to see to it that the technical changes are embraced, adopted and followed by the stakeholders and their collaborators who have to also perform their functions differently through capacity building as a result of the Project activities. Nevertheless, the necessary discipline of change management adhered to by the Project, in close cooperation with the stakeholders and oversight of UNDP and FAO, provided the structure, processes and tools to make this happen. Project implementation enhancements were adopted between UNDP and FAO through more effective dialog, coordination mechanisms and reporting which has transformed to a more focused and objective-oriented PMU.

The Project's adaptive management practices can be summed up as appropriate and highly satisfactory in their implementation. The project exhibited a high-level of adaptive management capacity to effectively adjust the project activities to overcome the key barriers and obstacles that arose during the implementation, while keeping intact the main project targets and objectives. Looking forward, these adaptations could present more challenges if up-scaled at the national level and if the policy, institutional and organizational requirements as well as the supply chains and terminalling are not put in place completely and timely.

3.2.2. Partnership arrangements (with relevant stakeholders involved in the country/region)

The broad partnership arrangements have helped the effective implementation and resource mobilization of the Project which are seen in more participants brought in by the Project and involving them more actively in their respective areas of responsibility. The enhanced partnership arrangements resulted as well to leveraging the Project's resources to achieve the desired Project outputs. The Project Inception Meeting was utilized as a vehicle to reach out to a larger group of stakeholders including private sector businesses such as plantation companies, tourism industry, industry associations and NGO-sector organizations. The MTR recommended identifying opportunities for closer participation of some of the industry and NGO partners that were achieved with strong contribution to project outcomes. Some of the capacity building activities for example, were outsourced to organizations such as SLEMA developing strong local ownership and supporting capacity building of the implementing partner as well. The large number of project-sponsored trainings, seminars, and conferences served as an effective platform in bringing together stakeholders from biomass-energy related businesses, professionals and academics that would not have otherwise come together.

In the implementation of BET pilots, several local suppliers were engaged to design and deliver on turnkey basis ensuring capacity building of domestic technology supply industry, a key requirement in keeping costs down and ensuring wider availability of biomass technology to future clients. One of the technology suppliers even owned a patent for improved burner-technology. Their capacity and commitment to provide after sales services was rated as highly satisfactory by the majority of clients, except in one instance where the level of demand from the client, i.e. Mahir Brothers for the installation of additional units placed a strain on the supply capacity.

The Project was instrumental in designing the framework for a 'Bioenergy Consortium', in support of Output 1.1. Established and enforced mechanisms for effective cooperation between various government and private sector involved in (regulating) fuel wood production, supply and use. This brought together a wide spectrum of stakeholders from the government, non-government, private sector and the industry fostering prospects of partnership and ownership. It can serve a very useful role in coordinating smooth development and functioning of the sector. The activity is earmarked for actual implementation during the Phase II.

3.2.3. Feedback from M&E activities used for adaptive management

With the adaptive management towards the desired changes necessary to accelerate project implementation, the Project through the PMU has regularly adhered to the established M&E activities for GEF Projects which provided the necessary feedback and information. The system of reporting provided necessary knowledge and tools that aided corrective and adaptive management actions and risk management. The risk-based approach of the feedback system enabled the adoption of measures to proactively address the evolving risks by having preventive and alleviative actions among the key participants of the Project. The conduct of the MTR and the implementation of its recommendations was a direct feedback mechanism that ensured the project in overcoming some of the delays experienced during the period up to the MTR. While some of the delays were due to political and administrative changes that were outside of the project influence, the adaptations in the project management had not been implemented in a timely manner. The MTR recommendations grouped under 5 key areas: (1.) Project oversight and management aspects, (2.) Project strategy and the results framework, (3.) Programmatic priority areas for consideration in preparing the modified results framework, (4.) Capacity development, and (5.) Outreach provided guidance to put the project speedily back on track. It was verified during the TE that the MTR recommendations had been implemented with a serious understanding of their relevance and urgency.

3.2.4. Project Finance

GEF Budget

In summary, the project GEF budget and expenses performance was reviewed and found to be adhering to the principle of prudence and accuracy/timeliness in reporting. The disbursements of GEF funds between the different budget lines were in line with the planned project activities as per the amounts originally budgeted and approved in the project document. Overall, all GEF Project budget will be fully spent up to the project closure by December 31, 2018, as summarized in **Table 2**.

Table 2: Project GEF Budget and Expenses Performance

Project Strategy	Total Budget for all Years (As per ProDoc) [A]	Total Expenses up to MTR-01 Jan 2013-30 Jun 2015 (Year 1 -2) [B]	Budgeted (US$) Revised (As per post-MTR)			Actual Expenses (US$) as of November 30, 2018 (including anticipated)			% Actual Total Expenses/ Total Budgeted (%) [B+C]/[A]
			2015 to 2017 (Year 3 -5)	2018 (Revised)	Total Budget for all Years	2015 to 2017 (Year 3 -5)	2018*	Total (01 July 2015-30 Nov 2018) [C]	
Outcome 1	154,814	16,649	139,912	12,800	154,815	139,912	29,319	159,462	113.76
Outcome 2	950,000	20,408	941,977	190,908	950,000	941,977	170,908	909,590	97.89
Outcome 3	276,604	22,106	393,523	33,321	413,352	393,523	81,879	247,739	97.56
Outcome 4	505,582	37,353	373,405	35,879	392,856	373,405	64,144	453,607	97.11
Project Mgt	109,250	65,416	43,982	7,109	84,781	43,982	4,947	41,724	98.07
Unrealized Gain/Loss		593	-		447	-	479	1,601	
Total	**1,996,250**	**162,525**	1,892,799	280,018	1,996,250	1,892,799	351,675	1,813,723	**99.00**

*01 January-30 November 2018 including commitments until December 2018

Co-financing

Overall, the co-financing plan was achieved, though a new set of co-financing partners were actually involved compared to what were listed in the ProDoc. Although the actual co-financing level from the private sector partners was lower than the values indicated in the ProDoc, it was more than compensated by the increased contributions from the government partners. On the other hand, the number of private sector participants increased which manifests the increasing interest by the private sector in biomass energy projects.

Table 3: Project Co-financing Performance

Contributor	Classification	Committed Value of Inputs as indicated in ProDoc (USD)	Actual Co-Financing as of November 30, 2018 (USD)	% Realized	List of Inputs
GOVERNMENT	In-kind and cash	10,023,863	12,607,959	126%	Establishment of the Biomass Cell and hosting PMU and related facilities; Contribution for establishing of the fuelwood growing models, fuelwood nurseries and capacity building of the community; and PMU hosting and related facilities
PRIVATE SECTOR		6,181,092	3,318,858	54%	Co-financing of various biomass-based energy systems such as, biomass boiler, biomass dryer, biomass water heater system, absorption chiller, milk processing system, thermal oil heater,

Contributor	Classification	Committed Value of Inputs as indicated in ProDoc (USD)	Actual Co-Financing as of November 30, 2018 (USD)	% Realized	List of Inputs
					smoke tube boiler, facilitating of biomass energy portal, biomass energy terminal, fuelwood growing models, fuelwood nurseries and capacity building of the community, staff time in project management and operations together with other logistics such as office space, computers, stationary, vehicle and local travel which are not covered by GEF resources, staff time in project management and operations together with other logistics such as computers, stationary and local travel which are not covered by GEF resources and includes expenditures incurred under the other donor funded projects implemented by UNPD who replicated and implemented biomass growing and technologies.
GEF Implementing Agencies					
UNDP	In-kind	402,000	402,000	100%	Staff time in project management and operations together with other logistics such as office space, computers, stationary, vehicle and local travel which are not covered by GEF resources.
FAO	In-kind	461,755	400,000	87%	Staff time in project management and operations together with other logistics such as computers, stationary and local travel which is not covered by GEF resources and includes expenditures incurred under the other donor funded projects implemented by UNPD who replicated and implemented biomass growing and technologies.
Subtotal		863,755	802,000	93%	
TOTAL		**17,153,710**	**17,318,185**	**101%**	

The Project received annual audit examinations and was included with several other projects in an audit conducted by UNDP as per the Harmonized Approach to Cash Transfers (HACT) framework of the United Nations for the year ended 31 December 2017, finding no violations of UNDP financial management and accounting practices that require corrective action. The Auditor General conducted an audit for the year 2017 comprising the Combined Delivery Reports (CDRs) for the year, Statement of Assets and Statement of Cash Position as at end 2017 and a summary of significant accounting policies and other explanatory information, in pursuance of provisions granted under the Constitution and in conjunction with Section

13 of the Project Document. The latter drew attention to the importance of pressing ahead with some of the lagging activities to ensure their timely completion before EOP and in a manner that contributes to achieving project outcomes.

3.2.5. Monitoring and evaluation: design at entry and implementation

The standard risk-based M&E systems being used by UNDP and FAO for GEF projects, namely, the monthly, quarterly and the Annual Project Reports (APR), the Project Implementation Review (PIR) and the MTR was built-in the design of the ProDoc and was found very useful and effective in tracking the progress of project implementation in producing the results towards the expected Project Outcomes. The ProDoc recommended that a Project Board be established under the MoERE (the initial implementing Ministry), chaired by its Secretary. In addition to the Board's permanent members, i.e. SLSEA, FD, NPD, UNDP and FAO, it was expected to co-opt other key stakeholders as deemed necessary. A Project Steering Committee (PSC) was set up under the MoERE with the membership of over 20 agencies at the inception and the MTR recommended that the PSC be formalized and reconstituted to effectively execute its responsibilities. The PSC was reconstituted as the PB with the transfer of the project to MoPRE, chaired by its Secretary. A review of schedule of PB meetings revealed that regular meetings had been held as envisaged in the design and timely circulation of meeting reports and action points had been followed. Overall, Project Board members were satisfied with the way the activities had worked.

The organizational changes brought about by political developments in early 2015 led to a major setback in the implementation arrangements by placing SLSEA under the management of MoPRE which was not the implementing Ministry (MoERE) identified at the design. The full complement of staff identified for the project implementation had not been recruited. The MTR commissioned by the UNDP helped to highlight these drawbacks before above shortcoming made any impairment to the Project. The recommendations of the MTR were used to convince the authorities to rapidly implement the necessary improvements, relocating the Project under the MoPRE, recruiting the full complement of staff and updating the results framework of the project.

The Project was successful in establishing the partnerships necessary for implementation and monitoring activities. In terms of tracking the project impacts from energy generation and GHG reductions resulting from the BETs, the services of Sri Lanka Climate Fund had been enlisted and verified MRV reports had been completed for all BETs implemented, with the remaining reports expected to be delivered by EOP. The verifications had been carried out by post-installation monitoring of industries. As many SMEs did not have baseline data, IPCC guidelines on energy estimation had been used to calculate the emissions for such cases. Where actual baseline data was available, such as the large industries actual data had been used for the estimation, i.e. Jetwing Blue had records of their electricity consumption for their electric chiller prior to replacing with the biomass absorption chiller. The range of criteria where MRV was applied included cost savings, jobs created, quality improvement, increase in production and payback period.

Operationally, the Project used the Atlas system in UNDP. FAO has its own similar system. The two systems were harmonized and operationalized to come up with one set of integrated report combining the UNDP and FAO systems through the PMU as recommended in the MTR. However, the quality control and timeliness of reporting overall did not appear to have been managed in a manner to control progress effectively and manage risks, i.e. achieving policy and regulatory reform in a timely manner.

The performance of the project's monitoring and evaluation: design at entry, plan implementation, and overall quality are assigned with the rating: **S (Satisfactory).**

3.2.6. UNDP and Implementing Partner implementation / execution (*) coordination, and operational issues

The project Implementing Agency (IA) and Executing Agency (EA) role in the project is suggested to be assessed by quality of UNDP/FAO implementation, quality of EA execution, and overall quality of implementation/execution.

The project implementation was overseen by the PB effectively supported by the PMU that received the full complement of staff, including hiring of the PM after the MTR. The recommendations of the two TACs were submitted to the PB before endorsement of actions based on findings of consultancies and other planning activities ensuring proper technical validation of them. The membership of the PB chaired by the Secretary/MoPRE included Country Representatives of the UNDP and FAO, project's Technical Advisor, Project Director, the PM, members of the Biomass Cell in the SLSEA amongst others. Minutes of the PB meetings revealed that the UNDP and FAO had exercised strong due-diligence ensuring effective and evidence-based implementation of project activities. The PB and TAC members interviewed during the TE expressed satisfaction with their functioning.

The IP ratings provided by UNDP-GEF Technical Adviser and UNDP Country Office in the PIR process reflected the significant progress made by the project since the MTR presenting a highly satisfactory rating In the final year of the project. The TE acknowledges the facilitation and management role played by the UNDP and the FAO (to the extent of managing Outcome 2) in the overall project implementation/execution, coordination, and operational issues with the rating **Highly Satisfactory** (**HS**).

3.3. Project Results

The detailed assessment and ratings of the project achievements and shortcomings are provided in **Annex G**, **Table G.1.**

3.3.1. Overall results (attainment of objectives) (*)

With reference to the goal of reducing greenhouse gas emissions from the use of fossil fuel for thermal energy generation in the Sri Lanka industrial sector, the Project has exceeded its targets in terms of the number of operating BETs, total installed capacity and resulting fossil fuel reduction and the resultant cumulative GHG emission reduction vis-à-vis the Baseline situation:

Indicator	Baseline	EOP Values		Observations/ Rating[3]
		Targets	Actual Oct. 31, 2018	
• No. of companies operating BETs by end-of-project (EOP) (i.e. 2017).	• Limited experience with BETs in industry.	• At least 12 companies are operating BETs by the end of the project and at least another 12 companies have detailed feasibility planned prepared or started installation of BET systems at the end of the project (post-project direct emission reduction).	• A total of 27 companies comprising 8 large and 19 small and medium industries have installed and operating BETs by the EOP.	• EOP target for operating BETs exceeded ahead of schedule. 2016 – 14 2017 – 9 2018 – 4 *Rating: HS*
• Total installed capacity and resulting fossil fuel reduction and direct GHG emission reduction of these projects by EOP.		• Total capacity of at least 20 MWth and 1 MWe, resulting in fossil fuel savings of about 295,178 GJ annually, 4,680 MWh of electricity.	• The total installed capacity of industries operating BETs is 25.42 MWth, i.e. 24.336 by large and 1.084 by SMIs). • The resulting fossil Fuel Savings is 355,653 GJ and the electricity saving is 7,057.4 MWh by EOP.	• EOP target for installed capacity exceeded by 27%. • EOP target for fossil fuel savings exceeded by 25%, and target for electricity saving improved by 109%. *Rating: HS*
• Cumulative (including indirect) GHG emission reduction by EOP.	•	• Direct emission reduction (cumulative over 10-year lifetime) of 252 $ktCO_2$ and indirect emission reductions between 756 (bottom-up) and 1,432 $ktCO_2$ (top-down).	• The direct emission reduction (cumulative over 10-year lifetime) is 389.5 $ktCO_2$. The indirect emission reductions are between 1168 $KtCO_2e$ (bottom-up) and 4500 $KtCO_2e$ (top-down).	• Cumulative (including indirect) GHG emission reduction by EOP exceeded by 55%. *Rating: HS*

The number of operating BETs has exceeded the expected level which manifests the interest of the private sector (especially in the large users and the SME sector) as they adopt to efficient utilization of fuel wood and their confidence in biomass energy based on the economic and environmental benefits derived from the business level appreciation in the project demos. The installed capacity of operating BETs is 25.42 MWth, i.e. 24.336 MWth by large and 1.084 MWth by SMIs) compared to the target of at least 20 MWth exceeding by 27%. The resulting fossil fuel savings is 369,600 GJ or an equivalent 25% over the targeted value and the electricity saving is 7,057.4 MWh/year at 109% over the target.

The cumulative direct emission reduction of the Project (over 10-year lifetime) is 389.5 $ktCO_2$. The indirect emission reductions are between 1168 $KtCO_2e$ (bottom-up) and 4500 $KtCO_2e$ (top-down) or surpassing the target by 35%.

[3] As per 'Rating Scale' described in the Annex 4 (TOR).

At the level of Outcomes, the Project achieved Satisfactory (S) in the Outcome 1 in terms of expected results as approved and implemented policy instruments that promote and support the use of sustainably produced fuel wood in industrial thermal applications since the Project has so far developed the Policy Briefs and sought the approval of the necessary policies since September 2018, which is beyond the Project's control. The TE noted the very slow progress in achieving policy and regulatory improvements – perhaps hampered by the policy conflicts relating to the role of state organizations in energy generation and supply. This could be an important post-project commitment that the Government may have to make in the next phase of the Biomass energy program that has been approved by the Cabinet.

Outcomes 2, 3 and 4 have surpassed respective targets. Notable achievements are as follows:

- Regulation for biomass pricing drafted by SLSEA and submitted to the Ministry seeking the Cabinet of Ministers approval on 06 September 2018.
- Nine agencies have been identified to be members of Inter-Ministerial Officials Committee on Sustainable Biomass Energy (IMCBE), formerly referred to as Inter-Ministerial Committee on Renewable Energy (ICRE), submitted to Cabinet for approval June 20, 2018.
- 25 private sector institutions actively involved have been identified to be members in Bioenergy Consortium to be formalized
- The strategy and action plan contained in the "Sustainable Energy Program 2015-2025-Towards and Energy Secure Sri Lanka Long-Term Strategy Enforcement Plan for the Energy Sector" was endorsed and approved on 10 February 2016 by SLSEA Board. Regional energy development plan designed and implemented based on the strategy and action plan.
- Biomass Cell established, fully staffed and operational under SLSEA Deputy Director General (Strategy) as of Dec. 2015
- Biomass database system formulated as a biomass energy portal including data on supply, demand, technology suppliers, investors and financial institutions in March 2016 and adopted in Feb. 2018. Populating the database on real-time basis using internet-based network commenced from Oct. 2018.
- 3 large supply chains including Terminals (Monaragala, Colombo, and Kegalle) in operation by Dec 2017. 3 satellite supply chains including mini wood-chippers will be in operation by Dec. 2018.
- Supplier registration completed at the Terminal level. Suppliers will be included in the Portal after verification. Incentive scheme for piloting fuelwood plantations identified by DFCC Bank
- Ten (10) feasibility studies prepared. 06 proposals have been accepted for funding. Three biomass supply chains established and operated; 3 scheduled to be completed by EOP.
- 31 companies have completed feasibility studies supported by the project by 2017 including 8 large BETs. Twenty (20) Operational BETs established with co-finance from companies.
- 441 Million LKR investments by 7 companies who have undertaken BET investments on their own based on feasibility studies supported by the project. (vs. 40 million LKR).

In terms of the Project Objective of removing barriers to the realization of sustainable biomass plantation, and adoption of biomass-based energy technologies in Sri Lanka, the TE has assessed the status by which these barriers (as identified in the project design in 2013) are removed through the project's activities and outputs:

Barrier (2013)	Status as of TE (11/30/2018) based on Project Results
1. Lack of institutional coordination for biomass production and supply	*Partially Removed*. The Inter-Ministerial Committee on Renewable Energy (ICRE) has been proposed to be established through the adoption and approval by the Cabinet in the next phase of the Project being led by the Government.
2. Fluctuation and uncertainties in fossil fuel and fuel wood prices	*Partially removed*. Government has developed a scheme of transparent pricing structure for fossil fuel and initiated moves to set biomass fuel pricing policies (in progress)
3. Non-availability of land for energy crops	*Removed.* More tracks of land for fuel wood plantations have been identified and included in the next phase to the range of 100,000 ha.
4. Transport regulations under the Forest Ordinance	*Partially removed.* Actions taken by the project are in progress. Certain species have been cleared for fuel purposes
5. Lack of incentives for cultivation of Gliricidia	*Removed.* Government has provided incentives and current fuel wood prices are relatively low vs. petroleum
6. Lack of resource data for developing bio-energy projects	*Partially Removed*. Biomass surveys were completed. Analysis and dissemination of results in progress
7. Limited awareness on additional benefits of Gliricidia.	Removed. Demos in fuelwood plantation and consumption in industrial and commercial applications have produced significant increase in awareness
8. Limited technical expertise and facilities for design, manufacture, promotion, sale, operation and maintenance of modern biomass energy technology	*Partially Removed*. But needs to be increased because of expected increase in demand
9. Lack of exposure of entrepreneurs to modern bioenergy technologies	*Partially Removed*. Still lack of investor interest for undertaking projects.
10. Financial sector reluctant to support bioenergy projects	*Partially removed*. But needs to be increased because of expected increase in demand at the commercial level

11. High initial cost of equipment	*Partially removed*. But needs to be monitored because of expected increase in demand at the commercial level.
12. Limited experience with successful biomass supply chains	Removed. Success in demos in biomass chains has helped significantly

The remaining barriers will be continually addressed by the next phase of the program as the Government implements and financially supports the "Biomass Energy 2022 Program".

From these results, it is evident that the project has contributed significantly to enhance growth of the biomass energy market in Sri Lanka, placing it on a growth trajectory that will continue beyond the project period. Accordingly, the TE appraises the Project's overall results and contribution to the its objective and targets as **Highly Satisfactory** (***Rating: HS).***

3.3.2. Relevance(*)

The TE assessed Project's relevance under key criteria defined in the UNDP guidance of the extents to which the activity is suited to local and national development priorities, and organizational policies, and its alignment with the GEF Operational Programs or the strategic priorities under which the project was funded. Further, the TE looked at the appropriateness of objectives of the intervention and its design given changed circumstances.

As described in the ProDoc, the Project was designed and approved following the GEF strategic objective and program of Climate Change, under the Strategic Objective 6: To support new low-GHG emitting energy technologies, and GEF-4 Strategic Programme (SP): SP 3 – "Promoting market approaches for renewable energy" and SP 4 – "Promoting sustainable energy production from biomass". The applicable GEF expected outcomes were adoption of modern and sustainable practices in biomass production, conversion, and use for modern energy, and with the applicable GEF outcome indicators of tons CO_2eq avoided, MW installed, kWh or W steam generated from sustainable biomass.

Furthermore, it contributes to UNDAF and UNDP CPD Outcomes relating to building national policies, programmes and capacities to ensure environmental sustainability, address climate change, mitigation and adaptation, and FAO's Strategic Framework for 2010-2019 aiming at poverty alleviation and sustainable development. These have been translated to corresponding national priorities for Sri Lanka in the CPD of UNDP and the CPF of FAO covering the period 2013-2017. The specific targets were identified in the project Goal and Objectives of the Results Framework as referred to earlier under the section on overall results (Chapter 3.3.1).

The Project supports Sri Lanka's environment and sustainable development objectives of establishing biomass as a viable renewable energy (National Energy Policy and Strategies of Sri Lanka, 2017). The updated version of the National Energy Policy further amplified the importance of biomass energy in the country's strategy of attaining energy independence.

The stakeholders appreciate the Project's contribution in improving sustained availability of biomass. The Project's design is coherent between the expected results and implementation approach with some enhancements after MTR in matters necessary in achieving goal and objectives. Poverty reduction and gender mainstreaming have been included in the activities and future plans of the communities where

these biomass energy demos have been installed. In recognition to the potential and actual achievements of the project over the long term with the wealth of lessons learned and experiences, The Government of Sri Lanka's Cabinet approved a follow-up long-term biomass program to be taken up by the government in its development agenda.

Thus, the Project is suited to local and national development priorities and organizational policies, including changes over time and it is in line with the GEF Operational Programs or the strategic priorities under which the project was funded.

Rating: R (Relevant)

3.3.3. Effectiveness & Efficiency (*)

The assessment of project's effectiveness is concerned with the extent to which an objective has been achieved or how likely it is to be achieved. The Project implementation and management is effective in achieving its Outcomes as indicated in the actual results vis-à-vis the Project LoG Frame success indicators (Chapter 3.3.1). The strategies that were designed and amplified during the MTR, were implemented, such as building on to existing local knowledge, accommodating a wide range of growing models, providing co-finance to mitigate the financial risks and ensuring long term sustainability of the program as presently ensured with firm action plans embodied in the Biomass Energy 2022 Program launched by the Government. The effectiveness of the project strategy and pragmatic implementing approaches taken were seen the ramifications made to the project design in pursuing the project goal and objectives:

- Focusing on more practical biomass technology needed by industries
- Directing by-products and waste streams to fill the gap in biomass supply
- Identifying supply chains linked to large terminals and a network of satellite supply chains.

Therefore, considering the extent to which the Project's objectives have been or likely to be achieved the effectiveness is assessed to be **Highly Satisfactory** (Rating: **HS**).

The efficiency is concerned with the extent to which results have been delivered with the least costly resources possible; also called cost effectiveness or efficacy. The project management demonstrated good financial management utilizing the full allocation of funds, albeit an extension of 5 months on top of a one-year delay in getting it off the ground. The estimated direct impact of the project in terms of abatement of CO_2e emissions is 178 USD per ton CO_2e at EOP and USD 20 per ton over the 10-year technology time. These levels of impact can be considered reasonable for a project with relatively small, stand-alone RE applications.

The Project's post-MTR implementation and management is efficient considering the following:

- Financial and progress reports are submitted timely with close CO guidance
- Co-financing and participation of partners were realized and additional supporters were leveraged, viz., bank financing and feasibility studies
- Adaptive management was resorted to prevent decline of implementation efficiency due to the project exceeding the original timelines
- Project costs were managed to be within budgeted levels by leveraging more co-financing
- Partnership arrangements between the two IAs (UNDP & FAO) have been greatly improved in terms of communication, coordination and decision making
- Efforts were taken to raise awareness about the project by partnering with other projects and events of comparable interest and utilizing media.

The project was successful in meeting targets relating to the establishment of BET pilots whereas faced difficulties in achieving targets for fuel wood growing. The target scaled down to 45% of the initial estimate due to under-estimation of establishment costs was further delayed due to weather-related and operational delays. In terms of timeliness of other key deliverables, the achievements in concluding some of the policy-related outputs remain delayed. While the studies have been completed and recommendations formulated, having the necessary policy changes in place is still in process.

By taking the progress in delivering the results efficiently, the Project is deemed to have performed satisfactorily. (**Rating: S)**

3.3.4. Country ownership

The project was assessed to be relevant to national priorities of Sri Lanka in terms of supporting its national policy relating to achieving energy independence using renewable energy sources. The extent of project-level and national-level coordination seen during the TE process reflects the country's deep ownership for the Project implementation. Despite the political and organizational changes that the Project Management has to grapple with, there was firm decision to modify the project governance and management structure and effort to resolve inter-ministry issues in order harmonize the individual approaches and come up with harmonized policies and regulations for the common good.

The project objectives are strongly aligned with the priorities of the SLSEA where it was based and became a strong vehicle in operationalizing some mutually-agreeable objectives. This shared interest and country ownership greatly enhanced the efficiency and effectiveness of project implementation facilitating the achievement of project's objectives and goal in the prescribed timeline. The Project benefitted largely from the support systems made available from the government, so the project will function properly, e.g. monitoring and evaluation, partnership and co-financing arrangements, availability of manpower, and prompt resolution of conflicts – all these are indicators of country ownership in active support for the Biomass energy program. The only deficit was in the inability of the government machinery to push ahead with completing some of the policy enactments in a timely manner, due to causes largely outside of the influence of a single Ministry.

3.3.5. Mainstreaming

The project's performance in mainstreaming other UNDP priorities, including poverty alleviation, improved governance, disaster prevention and recovery, and women's empowerment in line with the relevant national UNDAF outcomes was strong. Income generation, waste utilization, employment multiplication, women participation, sustainable forestry, rational land use, industrial productivity, environmental protection and many more social benefits are among the very promising results of the project that will be mainstreamed in developing local economies and markets.

The Project paved way to mainstreaming the project's activities and results of the various demos and support initiatives into the national economic and environmental priorities. As mentioned in earlier sections of this Report, the decision of the Government to pursue, upscale and financially support the Biomass Energy program at the national level in the coming years provided the vehicle to put together the then separate wood-based programs into an integrated Biomass Energy program paving way to carry with it multiple and overarching benefits on a "two-way" direction between the national implementing agencies and the local community level organizations.

The growth in the biomass energy sector will create new employment opportunities through the full value chain from fuel wood cultivation, harvesting, collection, terminal operation, transportation and in the operation of BETs. New opportunities for women employment will be created along every point of the

value-chain but more so in fuel wood growing, harvesting, processing and operating BETs. As witnessed during the TE mission, women were strong partners in planting and maintaining fuel wood plantation both at the community-level operations as well as in the cultivations started by Regional Plantation Companies. Tea plantation workers and Labour Unions have in general resisted any efforts by the management towards diversifying tea land due to the fear of losing opportunities to work. However, with the realization that the planting of marginal tea areas and vacant lands inside plantations in fact lead to increase of work opportunities have led to ending of such concerns. In fact, fuel wood plantation may have another unplanned benefit for the plantation workers and companies. Worrying about illegal felling of trees by workers for domestic fire wood the estate management had been promoting workers to use LP-gas cookers. The expansion in the use of LP gas which is imported is a drain on both government finances and family budgets of workers that may be neutralized due to availability of sustainably-raised fuel wood and fuel-efficient stoves promoted by the Project.

3.3.6. Sustainability (*)

According to the suggested GEF evaluation criteria, overall likelihood of sustainability is to be evaluated following 4 sub-criteria that can be risks to sustainability, i.e. Financial resources, Socio-Political, Institutional framework and governance, and Environmental.

The project partners that had BETs installed found biomass available at costs advantages relative to competing fossil fuels and in quantities required for smooth operation. The advantage of using biomass is skewed so strongly in favor of BETs, the likelihood of financial viability of the BETs being changed by any subsidy changes applying to imported fossil fuels, a decision that has been a politically-driven decision in Sri Lanka is very low. Furthermore, 7 private sector organizations developed BET projects valued at LKR 441 million without the financial support from the Project, thus confirming the positive outlook for biomass BET investments. Therefore, the sustainability from financial aspects is considered **Likely (Rating: L)**.

As seen by the Biomass Resource Survey conducted in 11 districts, the availability of biomass fuel without having to exploit diminishing forest resources in the country is high. At present, the available agro-forestry materials as by-products or waste streams in terms of fuel wood energy equivalent amounts to 16.4 million tons. The overall national potential has been estimated at 69.6 million tons which could be good to digitize the information and map for possible overlay with biomass energy demand mapping. Furthermore, attention has been focused on utilizing other potential wood sources with energy generation potential. One such source is the Invasive Alien flora species of which there are several well-recognized problems. Many of these invasions are spreading in sparsely-used public lands and conservation areas that have been impacted by human intervention. Currently, there are several initiatives being considered for sustainable exploitation of these woody biomass with a plan to convert such land within the wildlife conservation areas back to natural forests. Similarly, there are other streams and tank reservations from where land reclaimed invasions can be managed as fuel-wood plantations, e.g. Area under Mahaweli Authority.

The level of awareness rising about the potential illegal activities for non-sustainable sourcing is very high amongst the population and the institutions responsible for conservation of forest resources. Furthermore, the Project took the initiative to develop a national standard for sustainably-sourced biomass with the involvement of the SLSI, i.e. SLS 1551. Although, it is currently introduced as a voluntary standard, application of it at the level of biomass terminals and other points of the supply chain is under consideration. These developments can be vigorously pursued during the proposed Phase II to inform the public and minimize any non-sustainable activities. The project sustainability from socio-economic risks is considered safeguarded with a rating of **Likely** (**Rating: L**).

The major stakeholders influencing the institutional and governance aspects relating to the project such as the Department of Forest Conservation (FD) has a mandate national in scope, although there is a devolved administrative system in relation to the some of the legislation. Awareness of and adherence to aforementioned procedures such as the SLS 1551 and the potential to process biomass terminals and other value chain actors under the Environment Protection License (EPL) system which is a part of the national legislation that is also implemented in a decentralized manner can be strong deterrents to any activities that lead to environmental risks. Thus, the risks from the institutional framework and governance and the environment are considered manageable with a sustainability rating of **Likely (Rating: L)**.

Sustainability Models

At the project level, several demonstrations on the fuel wood plantation, logistics and utilization models were visited. Some case studies based on the Completion Reports of the Project Demos were reviewed and some samples were selected to illustrate the viability and sustainability of the biomass energy-related businesses. The following Case Boxes illustrate the sustainability models that were supported by the project:

- Case Box 1: Wood Energy as a Modern Energy Source-I: The Modern End Use
- Case Box 2: Wood Energy as a Modern Energy Source-II: The Modern Supplier
- Case Box 3: Biomass Energy Supporting the Vision of a Carbon-Neutral Hospital
- Case Box 4: Biomass Powers Rural Agro-Processors Becoming Big Businesses

Case Box 1: Wood Energy as a Modern Energy Source-I: The Modern End User

Burning wood for energy has existed as long as the human civilization existed. Even though it was the first energy source known to man, with the discovery of energy-packed fuels such as coal, petroleum and LPG the interest on wood as an energy source waned. Technological improvements introduced by the 'Promoting Sustainable Biomass Project' is helping to change that perception and make wood a key factor in expanding renewable energy sources and underpinning economic development.

The biomass-fired steam boiler-absorption chiller used at the Jetwing's Blue Oceanic Hotel in Negombo is demonstrating how the technologically-advanced wood power systems can be a part of the energy-dependent modern facilities. The steam-driven absorption chiller now supplies over 60% of the energy requirement of the five-star beach hotel. It not only helps the hotel to keep the rising energy costs at bay but has increased the hotel's acceptance among the savvy eco-conscious traveler who care about their carbon footprint.

Fig. 2: Biomass-fired Steam Boiler Unit

Fig. 3: Cinnamon Firewood Storage on-site

The boiler-chiller combination permitted the hotel to extend hot water generated for the use of guests and laundry to power the hotel's air-conditioning system by producing 300 tonnes refrigeration. The energy cost saving to the hotel was over 50%, with the total investment of LKR 53 million paid back within 6 months.

The boilers powered by cinnamon wood that is a by-product of the industry has led to the development of a value chain that creates employment for over 40 suppliers and families of hundreds of others employed in collecting and processing wood. Using only 6-10 kg of cinnamon wood daily, the adoption of the technology reduces Green-House-Gas emissions by 551 mt of CO_{2e} annually.

Encouraged by the success experienced at the Blue Oceanic, Jetwing has moved on with an expansion drive installing biomass steam boiler-absorption chillers at several of its properties. The growing hospitality industry which is heavily fuel-dependent can look forward to multiple benefits such as reducing costs and lowering its carbon footprint and creating more jobs through the use of biomass technology.

Case Box 2: Wood Energy as a Modern Energy Source-II: The Modern Supplier

Sustaining the use of biomass as an energy source is making biomass available to a growing number of industries keen on harnessing the wood energy to power their operations. Wood in the form of a sustainably-sourced, quality assured, solid biofuel is the standard required to make it an energy raw material comparable to furnace fuels or LPG. The 'Fuel Wood Terminals' established under the project is moving the fuel wood value chain in a direction that meets this challenge. Sustainably-sourced fuel wood produced by thousands of small producers, through dedicated fuel wood plantations, by intercropping fuel wood trees with many other crops and harvested from live fences and pruning orchards etc. will be received and processed at these 'Terminals' to standards that meet the requirements of different users of wood-based technologies.

Fig. 4: Wellassa, One of the 3 Large Biomass Terminals

Fig. 5: Fuelwood Chopping Machine

The Wellassa Fuel Wood Terminal established in Monaragala district is a good example of how a wood terminal can be add value to local agro-industry. Located in the pepper capital of the country in Badalkumbura, the terminal provides a market to thousands of tonnes of Gliricidia wood that is a by-product from millions of trees providing shade and support to pepper vines. The branches of trees periodically lopped to control shade and height of vines had no means of disposal. Now, the growers have a market nearby for the waste that was only a problem all these times.

At the Terminal, the wood is received, weighed and unloaded in the collection shed. Suppliers are immediately informed what the value of the consignment is which will be deposited in their bank account. The practice has led to a local fuel wood collection industry with a large number of independent operators going around farms buying wood and supplying the Terminal.

At the terminal wood will be cut, chopped or chipped to the standard of different users who currently come from Tea Plantations in the up country and wood-fired boiler users in the Biyagama Industrial Zone near Colombo. With the full capacity utilization of the Terminal which will reach 100 tonnes a day there will be a wider range of buyers needing a variety of types of fuel wood with the range of processed fuel diversified to meet the different needs.

Case Box 3: Biomass Energy Supporting the Vision of a Carbon-Neutral Hospital

Modern hospitals are energy-guzzlers that consume huge amounts of energy. Powering multi-storey buildings with fast-moving lifts, air-conditioned wards, stylish lighting, high-powered medical equipment and refrigeration and food kitchens consumes tonnes of fossil-fuel daily. The modern biomass technology is now helping to make real the vision of a Hospital Director to transform the District Hospital serving over half-a-million patients annually a carbon-neutral entity. Dr. R M D Ratnayake, Director of the Monaragala District General Hospital is leading the way in setting an example, and the biomass-fired water boiler is a key step of the 'green initiatives' operated at the hospital.

Fig. 6: Biomass-fired Water Heater

Powered entirely with waste- coconut shells from the kitchen and firewood gathered from the trees in the hospital garden, the hot-water heater has demonstrated the capacity to use renewable energy in reducing the hospital's massive carbon foot print. The 12-kW heater producing 150 litres of water heated to 100^0C is helping the cooking that produces over 1000 meals a day and cleaning operations in the hospital. Presently, the burner using only 2-3 kg biomass per run has paid up LKR 520,000 investment in 6 months by cutting back LPG and electricity consumption. The boiler is saving 2.52 CO_{2e} Green-House Gas Emissions only, but with the use of hundreds of such units or larger boilers, the impact can be multiplied many-folds. The lesson from this experience has been so convincing, the Ministry of Health has decided to install 20 other hospitals with biomass water heaters. Learning from models demonstrated elsewhere by the 'Sustainable Biomass Project' the hospitals can soon resort to air-conditioning surgical areas and residential wards using absorption chillers powered totally by biomass.

What is most striking is the proving the role biomass can play in achieving the larger goal of becoming carbon-neutral by powering the hospital. Under the visionary leadership of Dr. Ratnayake, in addition to biomass-power the District hospital is utilizing solar power, bio gas, energy-efficient equipment and practices and recycling to move towards the goal of zero carbon emissions. By demonstrating the role biomass-power can play in a facility such as a modern hospital that consists of out-patient and resident clinics, special care units, laboratories, and other specialized departments to achieve nationally-important environmental goals, the project at the Monaragala Hospital is showing the way to others.

Case Box 4: Biomass Powers Rural Agro-Processors Becoming Big Businesses

The high cost of energy has marginalized rural agro-processors hindering the development of post-harvest sector, leading to much loss of food produced and curtailing expansion of domestic and export markets. The use of traditional sun-drying did not allow small processors to main quality, hygiene and consistency demanded by the discerning clientele and export markets. As a result, post-harvest food processing remained confined to major markets in cities and accessible by only a limited group of consumers. Improved wood-fired dryers demonstrated by the Biomass Project has assisted small-scale fruit, vegetable, spice, coconut, milk and fish processors to harness improved technology for processing produce at a scale conforming to local production systems and markets.

'Wasana Products, Nutri Food Packers, Ran Lanka Spices' and 'Wishmitha Dasabala Poshana' use wood-fired hot-air dryers to produce dehydrated fruits, vegetables, spices, and herbal drinks meeting standards of the local and export markets, maintain greater control over the supply process and resort to producing a diverse range of products by scaling-up. Biomass-fired 20 kW hot air dryers have the capacity to dry up to 240 kg/day, increasing the capacity of small producer by more than 10 times. At that scale the potential saving from transferring from electric drying to hot-air drying is over LKR 20,000. The high-quality of produce and the increased scale of operation have attracted export orders for the producers. The technology has been also adopted by other food processors like 'Sathya Cashew' in drying cashew and 'Richme Foods and Dairies' in processing a variety of milk foods including yoghurt.

Fig. 7: Biomass Hot-air Dryer for Drying Herbs and Cashew in Operation

The use of technology in the rural areas greatly increases flexibility of the food-processing industry to develop at a scale that matches local production capacity, realize larger economies of operation by lowering costs of sourcing raw material, and maintain greater control over standards by working directly with primary producers to monitor production practices. The availability of a wide-range of biomass fuel in the form of firewood, agriculture by-products and waste will keep the costs down and can become a part of a solution in waste management. Managing the process as a home-based or community operation also allows more women employment in the sector expanding gainful employment.

The 340,000 SLR investment is paid up in 1.2 years with the environmental benefit of 29 tCO_{2e} Green-House-Gas reductions of per annum. With the experiences from the wide variety of producers using the technology, the potential to expand the practice at the rural level with combined savings in GHGs is tremendous.

There are other models supported by the Project with co-financing arrangements with the owners as can be seen in **Annex D: Summary of Field Visits**, including the following:

Fuel wood plantation models

1. Community Home Garden Fuelwood Model - Pallepola, Matale. Arunalu Foundation
2. Arboretum - Forest Research Institute, Forest Department, Boyagane, Kurunegala
3. Community Fuelwood Plantations - Walapane, Nuwara Eliya
4. Estate Fuelwood plantations – Thalawakele Tea Estates PLC
5. Community Mixed-Fuelwood Plantation - Mahagama, Kurunegala – SLEES
6. Fuelwood Plantations – Kurunegala, Forest Department

Biomass energy applications

1. Biomass Boiler & Absorption Chiller - Jetwing Blue Oceanic Beach Hotel, Negombo
2. Biomass Hot-Air Dryer – Wishmitha Dasabala Poshana, Thalawa
3. Biomass Drier – Wasana Products, Alakolamada Road, Longwill, Rattota
4. Hot-Air Spice Dryer - Mahir Brothers, Katugastota
5. Biomass Water Heater - Teaching Hospital, Kurunegala, Department of Health
6. Biomass Boiler, D.B Welegedara Ayurvedic Hospital, Kurunegala, Department of Indigenous Medicine
7. Biomass Boiler – Hotel Green Palace, Hawa Eliya, Nuwara Eliya
8. Biomass Water Heater – Richme Foods & Dairies (Pvt) Ltd, Dickoya
9. Biomass Water Heater – General Hospital, Monaragala
10. Biomass Dryer =-Sathya Cashew, Vanathawillu, Puttalam

Fuel wood terminals

1. Biomass Terminal -, Maxtherm Lanka, Weuda, Mawathagama, Kurunegala
2. Biomass Terminal - Wellassa Biomass Energy (Pvt) Ltd, Badalkumbura

The project has compiled 31 Demo Project Completion Reports which describe in detail the achievements of the Project in terms of demonstration projects in relation to the overall project objectives.

At the program level, the policy support, organizational structure, institutional capacity, level of awareness and information support program are in place to sustain the Project's Outputs and Outcomes as they are planned to be up-scaled at the national level. A replication plan has been developed which formed the basis for the follow-up program (Biomass Energy 2022) or also referred to as Phase II project, which was approved by the Cabinet for government funding and implementation.

3.3.7. Impact

The project confirmed the potential impact of the biomass energy sector to reduce GHG emissions as highly significant by introducing BETs that produced large reductions in GHGs and exceeding the targets set for GHG reductions over the lifetime of the project. It contributed to ensuring continuing growth of the biomass energy market in Sri Lanka by working with a highly diverse group of clients to demonstrate technical and economic viability of biomass applications and proving that the ultimate impact in terms of reduced GHG emissions can be quite significant. Furthermore, there is a significant replication potential for utilisation of the experiences and lessons learnt from the Project.

4. Conclusions, Recommendations & Lessons

The evaluation ratings for the project were summarized in the Executive Summary in Table 1. In drawing conclusions, recommendations and lessons from the Project, the evaluation paid emphasis to follow up actions to reinforce initial benefits from the project and on proposals for future directions underlining main objectives. By examining the strength of Project practices in addressing issues relating to relevance, performance and success, lessons for the design and implementation of similar projects in future were identified.

4.1. Conclusions

1. While the Project encountered some initial birth pains, the adaptive management strategies and governance structure adopted after the Mid-term Review (MTR) and the firm resolve of new project management compensated for the lost time and resulted in a notable transformation that ensured the project achieving planned Outputs and Outcomes with a five-month extension to December 31, 2018 of the planned target completion date of July 31, 2018.

2. The Project was able to address critical issues in the fuel wood supply and application sides boosting the biomass energy market and establishing bioenergy technologies within the industrial sector in Sri Lanka in economically and environmentally acceptable levels by demonstrating the fuel supply potential through fuel wood plantation models and augmentation of by-product and waste wood streams, and the feasibility of bio-energy applications in small and medium scale industries. Hence, as seen in Table 1, Executive Summary, the overall Project Outcome Rating is **HS (Highly Satisfactory)** and Overall Likelihood of Sustainability is **L (Likely).**

3. This conclusion is amply supported by the approval by the Sri Lanka Cabinet as of November 5, 2018 of the follow-up program (or also referred to as Phase II) on "Biomass Energy 2022 for Fueling the Economy" to sustain the policy initiatives, institutional and organizational capacity building, momentum, and outcomes resulting from the Project. A very significant portion of the financial requirements of the Biomass Energy 2022 program will be taken up by the Government of Sri Lanka to be supported by the private sector in terms of the necessary investments.

The following are significant accomplishments towards desired Outcomes:

- Awareness Creation

  The Project has significantly improved awareness through the creation of biomass resource information system, accurate and reliable information for public awareness, clarify status of biomass energy in National Energy Plan, and overcoming negative image and perceptions

- Adopted necessary policies supporting Biomass Program

  The policy framework for biomass provides a clear vision and priority as enunciated in National Energy Policy, 2017, policy briefs on standards, logistics, pricing, technology and incentives, and report on impact of fossil-fuel subsidies.

  The creation of the Inter-ministerial Committee on Biomass Energy has defined governance and policy making processes and strengthened coordination mechanisms and was proposed by the Project for adoption and formalization by the Cabinet.

- Enhanced governance structure and institutional capacity

  The governance structure for the biomass energy sector has been defined with institutional responsibilities among the state, private sector, and community. The government created a Biomass cell in SLSEA, and adopted Sustainable Energy Program 2015-2025- Towards and Energy Secure Sri Lanka Long-Term Strategy Enforcement Plan for the Energy Sector.

  The regulatory structure is being transformed from an informal to formal system through regulations for biomass pricing and SLS 1551.

- Biomass demand Interventions

  The interventions initiated by the Project include a database and exchange system through Biomass Energy Portal, adoption of a technology development program (resulting in 27 BETs supported directly with feasibility studies and 300 other users reached) and promoting new investments in setting up new BETs and improving biomass usage efficiency.

- Biomass supply Interventions

  The Project promoted better understanding of the fuel wood value chain through Baseline studies and Biomass resource surveys in 11 districts, expanding existing and new biomass sources with the help of data, plantation lease procedures and rates, and supplier registration.

  It also developed and promoted technology for planation growing models, harvesting procedures and 14 production models and demo projects covering 1000 ha.

- Co-Financing

  The co-financing strategy of the project that required partnering BET-stakeholders to bear 50% or more of the investment costs avoided selection of inappropriate, expensive technology. Business and economic considerations played a key role in decision making relating to the choice of technology, scale of operation etc.

- Capacity Development

  It also conducted various capacity development and institutional coordination through more than 40 training and awareness events.

- Cross cutting issues addressed

The Project pursued activities that empowered role of women, spurred local economic development, trained national/local-level officials, and initiated financing mechanisms through drafting the Framework for Sustainable Guarantee Facility and completion of feasibility studies for bankable-proposals.

4. However, the TE noted the very slow progress in achieving policy and regulatory improvements evidently hampered by the policy contradictions among multiple state organizations engaged in energy generation and supply. It also observed the failure to leverage funding for the SGF and financing biomass investments.

5. Many barriers affecting the biomass energy program identified during the design and inception phase of the project have been addressed and others have been successfully removed. The Biomass Energy 2022 Program as a follow-up plan initiated by the Government of Sri Lanka has considered these factors and the lessons learned from the Project in its implementation plan towards continuous strategy to remove related barriers and ensure long-term sustainability of the biomass energy program.

4.2. Recommendations

Priority

The following are key recommendations that need to be implemented for sustainability and impact in the post-project follow-up planned as the phase II of the Biomass Energy Program:

- Increase promotion and information dissemination to industry groups, banks and financial institutions for the replication program using updated results of the fuel resource potentials, fuel wood plantations, user surveys and digitized fuel supply/demand database and maps
- Develop and implement coordination mechanisms and harmonized rules and regulations with the local government units in order to prevent barriers on permitting and transporting that will affect efficient and timely transport of fuel wood
- Encourage additional energy plantation investors and banks to support them with a Loan Guarantee Facility that would absorb risks and defaults
- Develop and implement the registration and certification systems for fuel wood plantation, biomass terminals and fuel burning equipment and facilities
- Develop and implement integrated national fuel wood processing, logistics, storage and transport plans for high impact users and demand clusters Formalize the Inter-Ministerial Officials Committee on Sustainable Biomass Energy (IMCBE) as recommended to the Cabinet
- Finalize and formalize the draft policy briefs produced by the Project covering standards, pricing, logistics, technology and incentive schemes that have been developed for submission to and approval by SLSEA Board.

Others

- Formalize the organization and membership towards more active involvement of private sector institutions in the Bioenergy Consortium to be defined and operationalized without delay
- Mobilize more resources for sustainable energy projects through accessing of possible global funds
- Ensure availability of plantation lands of at least 15,000 ha for replication of fuel wood plantations using intercropping and new areas for expansion
- Develop and formalize standardization of stratified fuel wood supply systems to match specific demand applications by strengthening legal and regulatory components by particularly operationalizing SLS 1551 which remains a voluntary standard
- Explore tri-generation of heat, power and refrigeration for increased efficiency and value added, e.g. in factories, hotels and hospitals
- Take advantage of automation whenever feasible, e.g. fuel wood processing, fuel feeding and combustion control
- Involve more SMEs learning and applying knowledge from the project demos
- Involve ESCOs in the replication program using the financial mechanisms and working closely with the banks
- Prioritize development and enhancement of yield of fuel wood tree varieties through the Forest Research Institute
- Encourage more community-based fuel wood growing and road-side gathering and collection system in combination with the usual home gardening
- Involve more women in various activities, particularly in fuel wood growing and processing and other suitable ancillary and administrative activities

- Develop educational programs on Biomass energy technologies and fuel wood plantation practices in the secondary, technician, vocational and collegiate levels in coordination with appropriate Education agencies

4.3. Lessons Learned

There are lessons learned that can be passed on to the next phase of the program and in developing similar projects in the future involving two or more Implementing Agencies:

- The timely and appropriate dissemination of Project's outputs in terms of knowledge, experiences and valuable learnings from the project demos is very important to the achievement of overall objectives and should be disseminated to all stakeholders and program participants in the form and level of details suitable to the target audience which the Project has realized and made provisions in Component 2.
- The need for sufficient consultations and harmonization process during the designing and finalization stages of project development, especially if it will involve two GEF Implementing Agencies which may have varying management, governance and administrative procedures and practices has been recognized.
- Fusing two project concepts that have inherent development timelines and nature of activities, e.g. on one hand, fuel wood plantation taking longer time to prepare and harvest and on the other hand, fuel wood utilization requiring relatively shorter lead-time, will need to have highly strategic and stronger/committed governance mechanisms in the project design in order to ensure success, which this Project has learned to adapt to in the course of its project implementation towards successful results.

5. Annexes

Annex A: TE Terms of Reference

Annex B: Itinerary

Annex C: List of Key Informants interviewed

Annex D: Summary of field visits

Annex E: List of documents reviewed

Annex F: Evaluation Question Matrix

Annex G: Questionnaire used and summary of results

Annex H: Evaluation Consultant Agreement Form

Annex I: Report Clearance Form

Annex J: TE Audit Trail

Annex K: Terminal GEF Tracking Tool (in separate Excel File)

Annex A: TE Terms of Reference

I. INTRODUCTION

In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support GEF financed projects are required to undergo a terminal evaluation upon completion of implementation. A Terms of Reference (TOR) has been provided by the Project Management Unit (PMU) that sets out the expectations for a Terminal Evaluation (TE) of the *Sustainable Biomass Production and Modern Bio-Energy Technologies* (PIMS 4226), hereinafter referred to also as the Project. Thus, this TE Inception Plan is being submitted as a requirement of the ToR.

The Project is funded through the Global Environmental Facility (GEF) climate change mitigation portfolio. The 4-year project was started to be implemented by the Ministry of Mahaweli Development and Environment, under the technical implementation of the Sri Lanka Sustainable Energy Authority and the Forest Department. Monitoring, and reporting to GEF is the responsibility of both UNDP (for Components 1, 3 and 4) and FAO (Component 2).

The goal of the Project is to reduce greenhouse gas emissions from the use of fossil fuel for thermal energy generation in the Sri Lanka industrial sector.

The Project's objective is "the removal of barriers to the realization of sustainable biomass plantation, increase of market share of biomass energy generation mix and adoption of biomass-based energy technologies in Sri Lanka."

The Project's objective and outcomes are to be achieved through delivery of the following components:

- **Component 1. Policy-institutional support for effective fuel-switching using fuel wood**

  Outcome 1: Approved and implemented policy instruments that promote and support the use of sustainably produced fuel wood in industrial thermal applications

- **Component 2: Barrier removal for sustainable fuel wood production**

  Outcome 2: Enhanced knowledge of and improved support network for sustainable fuel wood production; Increased sustainable fuel wood production

- **Component 3: Enabling environment for fuel wood suppliers.**

  Outcome 3: Improved confidence among industrial and banking sector on the feasibility, stability and economic benefits of sustainable fuel wood supply chains.

- **Component 4: Wood-based energy technology development**

  Outcome 4: Enhanced knowledge of, access to, and maintenance skills of biomass energy technologies as well as increased number of wood-based gasification projects

The Project is expected to generate global benefits in directly avoided greenhouse gas (GHG) emissions of almost 252 kilotons of CO_2 switching from fossil fuels to wood-based technologies (over lifetime of 10 years and almost 756 – 1,432 kt CO_2.

The project agreement between Government of Sri Lanka (GoSL) and UNDP was signed in July 2013. Following that, the project inception workshop was held on 17th September 2013. There were pre-consultation meetings conducted on August 28 to discuss the inception workshop and September 16 to review implementation arrangements and needs. The Project has two implementing agencies: UNDP and FAO with respective project documents (ProDoc), basically for energy application and fuel wood supply sides. The Project had its Mid-Term Review (MTR) in July 2015 where recommendations were submitted and formed the basis for the Project Management to update the Project's implementation strategy, in addition to what had been learned in the course of the Project's progress in achieving its goal and objectives. Hence, this Terminal Evaluation is being conducted as a requirement for all GEF and UNDP/FAO projects.

II. TE TEAM COMPOSITION

The TE Team will be composed of one international consultant and a national counterpart consultant. Both international and national evaluators will work jointly and have regular coordination during the whole evaluation process in coordination with UNDP Sri Lanka and the PMU.

The TE Team will be assisted by the PMU who will be in charge also for the submission of inputs, data and other needed information for the evaluation process and coordination for the site visits. A Focal Person or Coordinator for the purpose of liaising with the TE Team will be designated by the UNDP/FAO in coordination with the Project Manager.

III. OBJECTIVES OF THE TERMINAL EVALUATION

The objectives of the evaluation are to assess the achievement of project results, and to draw lessons that can both improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP/FAO programming.

Evaluation Documentation Approach and Methodology

1. ***Basic TE guidance and Rules***

   The TE process described herein follows the approach and methodology described in the TOR which also refers to the guidance, rules and procedures established by UNDP and GEF as outlined in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects and related FAO evaluation guidelines. Basically, the procedures adapted here are based in the methodologies described in the TOR. The evaluation practice developed over time provides a framework for the evaluation effort using the criteria of **relevance, effectiveness, efficiency, sustainability,** and **impact**. These criteria can apply to assessment and rating the project Outcomes and Outputs and is defined as follows:

   - The extent to which the activity is suited to local and national development priorities and organizational policies, including changes over time.
   - The extent to which the project is in line with the GEF Operational Programs or the strategic priorities under which the project was funded.

   Note: Retrospectively, the question of relevance often becomes a question as to whether the objectives of an intervention or its design are still appropriate given changed circumstances.

   - The extent to which an objective has been achieved or how likely it is to be achieved.
   - The extent to which results have been delivered with the least costly resources possible; also called cost effectiveness or efficacy.
   - The positive and negative, foreseen and unforeseen changes to and effects produced by a development intervention.
   - In GEF terms, results include direct project outputs, short to medium-term outcomes, and longer-term impact including global environmental benefits, replication effects and other local effects.
   - The likely ability of an intervention to continue to deliver benefits for an extended period of time after completion.
   - Projects need to be environmentally, as well as financially and socially sustainable.

2. ***Evidence-based Data Validation of Information and Data on Project Achievements***

   The TE shall provide evidence-based information that is credible, reliable and useful following a participatory and consultative approach ensuring close engagement with government counterparts, in particular the GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Adviser based in the region and key stakeholders. The TE Team shall examine the project reports as part of the regular monitoring of UNDP and GEF such as the Annual Project Reports/Project Implementation Review (APR/PIR), Quarterly Performance Reports (QPR), etc. and other related documents. The list of documents

that are suggested in the TOR to be reviewed by the TE Team are seen in **Annex 1** *(Please note that the annexes (indicated by the annex numbers herein) in this Annex A: TE Terms of Reference can be found in the original TOR issued to the TE Team and therefore not included here as annexes.)*

Among the data on project accomplishments and implementation of activities that the TE will validate and evaluate regarding the quantitative aspects include the Energy Savings, RE generation (toe) and GHG emission Reductions (tons CO_2) Calculations (direct and indirect) may have to be presented in Excel format for ease in verifying what went into the total values, assumptions and formula used. The results of these calculations will be used to verify values indicated in the achievements of success indicators in the Log Frame targets and the EOP GEF Tracking Tool.

3. ***Field Visits and inspection of project demos in fuel supply and bio-energy technology application***
The TE Team will review the project profiles and completion reports of the Project Demo Sites (listed as 51 sites as provided by PMU) and will also conduct field visits and ocular inspection to the selected project demo sites as listed in **Annex 2** which was developed during the preparation for the TE Mission on a schedule and timeline as agreed upon.
4. ***Assessment and Rating of Project Outputs towards Achieving Expected Project Outcomes vis-à-vis Log Frame targets***
An assessment of project performance will be carried out, based against expectations set out in the currently approved official Project Logical Framework/Results Framework or Log Frame (see **Annex 3**), which provides performance and impact indicators for project implementation along with their corresponding means of verification. The Obligatory Rating Scales are seen in **Annex 4.**
5. ***Assessment of Project Financial Performance and Realization of Co-financing commitments***
The Evaluation will assess the key financial aspects of the project, including the extent of co-financing planned and realized. Project cost and funding data will be required, including annual expenditures. Variances between planned and actual expenditures will need to be assessed and explained. Results from recent financial audits, as available, should be taken into consideration. The TE Team will be assisted by UNDP Sri Lanka Country Office (CO) and PMU to obtain financial data in order to complete the GEF funds and project co-financing information preferably in Excel format as illustrated in **Annex 5**. The financial analysis will consider the following:
    - GEF-fund financial report on the comparison of budget vs. actual expenditure at the Output level preferably in Excel format will be appreciated to form the basis of conclusions related to financial efficiency criteria on the use of resources. The cut-off date has to be agreed upon depending on the availability of data and ATLAS monitoring system. Would October 31, 2018 cut-off be acceptable or there is another more recent cut-off date, say November 15, 2018? It is important also the GEF financial data be brought down to the output level as illustrated in **Annex 5.a** so that the results vs. resource inputs can be effectively reckoned especially for outputs that have significant resources attributed to them. Should there be remaining project funds as of cut-off date, the expenditure plan or committed disbursements for the remaining funds should be reported as part of the Exit Strategy or Post-Project Arrangement Plan that can be included in the TE Report.
    - Co-financing resources realized need to be accounted for not only to identify the significant contributions of the project partners but also as an indication of the integrated approach in Bio-energy projects and that even after the Project has been completed, the national Bio-energy Program will be sustained through continuing combination of government and private sector initiatives. **Annex 5.b** presents a suggested format that data will be prepared and presented. This will also be good reference in assessing the effectiveness of the Stakeholder Partnership arrangements that the Project has initiated in aiming to consolidate various efforts of the government and private sectors in line with the national long-term Bio-Energy Program goals and objectives that evolved in the course of the Project's interventions and barrier removal activities.

6. ***Summary of TE findings and Ratings***

The detailed TE findings and ratings will be included in a TE Report showing progress towards results matrix (Achievement of Outcomes against End-of-Project Targets) as suggested in **Annex 3** . Based on the details of evaluation per Component and Output, a summary table will be included in the body and executive summary of the TE Report, as follows:

Table 1: Summary of Ratings

Evaluation Ratings:			
1. Monitoring and Evaluation	***Rating***	**2. IA& EA Execution**	***Rating***
M&E design at entry		Quality of UNDP/FAO Implementation	
M&E Plan Implementation		Quality of Execution - Executing Agency	
Overall quality of M&E		Overall quality of Implementation / Execution	
3. Assessment of Outcomes	***Rating***	**4. Sustainability**	***Rating***
Relevance		Financial resources:	
Effectiveness		Socio-political:	
Efficiency		Institutional framework and governance:	
Overall Project Outcome Rating		Environmental:	
Overall likelihood of sustainability:			

7. ***Assessment of other Project performance aspects***

The assessment summary should also include the following aspects as per GEF guidelines on conducting terminal evaluation for full-sized projects:

- Need for follow-up
- Materialization of co-financing
- Environmental and social safeguards
- Gender concerns
- Stakeholder engagement

8. ***Conclusions and Lessons Learned***

The TE report will include a chapter providing a set of conclusions and recommendations. Conclusions should build on findings and be based in evidence. Lessons should have wider applicability to other initiatives across the region, the area of intervention, and for the future.

9. ***Recommendations and Post-Project Arrangements***

Recommendations should be prioritized, specific, relevant, and targeted, with suggested implementers of the recommendations.

10. ***Preparation of the TE Report***

The TE Report will be based on the overall findings of the above approach and methodology and will follow the prescribed TE Report Outline seen in **Annex 6**.

IV. EVALUATION TIMEFRAME AND SCHEDULE OF DELIVERABLES

The TE Contract will be for an equivalent 25 work-days covering the duration from **13 November 2018** to **24 December 2018.**

The following tables were indicatively prepared to summarize the evolving schedules based on the communications. They will be reviewed during the Inception Meeting and updated as the TE Mission progresses.

The evaluation team is expected to deliver the following:

Deliverable	Content	Timing	Responsibilities
Inception Report	Evaluator provides clarifications on timing and method	No later than 2 weeks before the evaluation mission (17th September 2018)	Evaluator submits to UNDP CO , FAO
Presentation	Initial Findings	End of evaluation mission (02nd October 2018)	To project management, UNDP CO, FAO
Draft Final Report	Full report, (per annexed template) with annexes	Within 3 weeks of the evaluation mission (23rd October 2018)	Sent to CO, reviewed by RTA, PCU, FAO HQ, GEF OFPs
Final Report*	Revised report	Within 2 weeks of receiving UNDP/FAO comments on draft (06th November 2018)	Sent to CO for uploading to UNDP ERC/FAO PIMS

*When submitting the final evaluation report, the evaluator is required also to provide an 'audit trail', detailing how all received comments have (and have not) been addressed in the final evaluation report. See Annex H for an audit trail template.

V. Evaluation Ethics

Evaluation consultants will be held to the highest ethical standards and are required to sign a Code of Conduct (Annex E) upon acceptance of the assignment. UNDP evaluations are conducted in accordance with the principles outlined in the UNEG 'Ethical Guidelines for Evaluations'.

Annex B: TE Mission Itinerary

Terminal Evaluation of the Project on "Promoting Sustainable Biomass Energy Production and Modern Bio Energy Technologies"

Date	Time	Meetings/ Site Visits
15th November 2018 (Thursday)	09.30 am- 10.30 am	Mission Briefing Meeting with Management of UNDP
16th November 2018 (Friday)	Overnight stay in Kurunagala	Jetwing Blue Hotel, Ethukale, Negombo Kurunegala Teaching Hospital, Colombo Rd, Kurunegala D.B Welegedara Ayurvedic Hospital, Colombo Rd, Kurunegala Fuelwood Terminal, Maxtherm Lanka Utility Services (Pvt) Ltd, Marawilla Watta, Molliyagoda, Weuda, Mawathagama Department of Forest Conservation, Boyagane, Kurunegala, Arboretum SLESS community Plantations, Kurunegala
17th November 2018 (Saturday)	Overnight stay in Anuradapura	Forest Department in Galkulama, Puttalam, Fuelwood growing models Sathya Cashew, 12 ½, Mile Post, Vanathavilluwa, Puttalam Wishmitha Dasabala Poshana, 125, Jayaganga South, Thalawa
18th November 2018 (Sunday)	Overnight stay in Kandy	Wasana Products, Alakolamada Road, Longwill, Rattota Community Home Garden Fuelwood Model- Arunalu Foundation, Matale Mahir Brothers, 51, Kurunegala Rd, Katugastota
19th November 2018 (Monday)	Overnight stay in Nuwaraeliya	Community Fuelwood Plantations in Nuwara Eliya and Walapane Hotel Green Palace, 164, Lady Maclum Drive, Hawa Eliya, Nuwara Eliya
20th November 2018 (Tuesday)	Overnight stay in Bandarawela	Fuelwood plantations of the Thalawakele Tea Estates PLC and Forest Department in Thalawakele Richme Foods & Diaries (Pvt) Ltd, 252, Samarawalliya, Dickoya
21st November 2018 (Wednesday)		District General Hospital, Monaragala Fuelwood Terminal, Wellassa Biomass Energy (Pvt) Ltd, Pallampara Road, Pallampara, Badalkumbura Return to Colombo

Date	Time	Meetings/ Site Visits
22 November 2018 (Thursday)- National Holiday		Discussions with the project team-Colombo
23 November 2018 (Friday)	9.00 am - 10.00 am	Mr. Ananda Namal, Director, National Engineering Research and Development Centre of Sri Lanka, 2P/17B, IDB Industrial Estate, Ekala, Ja-Ela
	12.00 pm -1.00 pm	Mr. Ronald Comester, President, Sri Lanka Energy Managers' Association (SLEMA), No 29, Farefield Gardens, Colombo 8
	1.30 pm - 2.30 p.m.	Dr. D B T Wijeratne, Assistant FAO Representative (Programme), Sri Lanka
26 November 2018 (Monday)	8.30 am - 9.15 am	Mr. Vimal Nadeera, Deputy Director General, SLSEA, Mr. Harsha Wickramasinghe, DDG, SLSSEA/ National Project Director and Biomass Cell and staff
	9.30 am - 10.15 am	Presentation of Preliminary Findings to UNDP and FAO Project Teams
	10.45 am- 11.30 am	Mr. G M J K Gunawardene, General Manager, Coconut Cultivation Board (CCB), Deputy General Managers, and Assistant General Managers, CCB, No: 9/428, Denzil Kobbekaduwa Mawatha, Sri Jayawardenepura Kotte
	12.00 pm - 1.00 pm	Mr. Dilantha Seneviratne, Director/CEO Thalawakele Tea Estates PLC, Hayleys Plantation Services PLC, 400 Deans Road, Colombo 10.
	2.00 pm - 2.45 pm	Dr. Thusitha Sugathapala, Senior Lecturer, University of Moratuwa, Katubedda, Moratuwa, and Mr. Parakrama Jayasinghe, Ex-President, Sri Lanka Bio Energy Association
	3.15 pm - 4.15 pm	Dr. Anura Dissanayake, Director and Dr. Wasana Wijesuriya, Director, Rubber Research Institute of Sri Lanka, Thelewala Road, Rathmalana
27 November 2018 (Tuesday)	9.15 am - 10.00 am	Mr. Mahesh Chamara, CEO, Sri Lanka Climate Fund and Staff, Sampathpaya, Rajamalwatte Road, Battaramulla
	10.00 am - 11.00 am	Dr. N D R Weerawardene, Additional Conservator General, Department of Forest Conservation, Sampathpaya, Rajamalwatte Road, Battaramulla.
	11.30 am - 12.30 pm	Mr. J A Ranjith, Secretary, Ministry of Plantation Industries, Additional Secretaries and Plantation Management and Monitoring Division, Ministry of Plantation Industries, Sethsiripaya II, Battaramulla.

Date	Time	Meetings/ Site Visits
	01.30 pm - 02.30 pm	Dr. B.M.S Batagoda, Secretary, Ministry of Power and Renewable Energy, 72, Ananda Coomarswamy Mw, Colombo 07. Presentation of findings and discussion
	5.00 pm - 5.30 pm	Mr. K A I D Silva, Director, Land Resources, Ministry of Mahaweli Development and Environment, Sobadam Piyasa, Battaramulla
28 November 2018 (Wednesday)	9.30 am - 10.30 am	Debriefing meeting with Mr. Jorn Sorensen, Country Director, UNDP and Ms. Nina Brandstrup, FAO Representative, FAO Representation for Sri Lanka and Maldives, FAO Conference Hall
	1.00 pm - 4.00 pm	Final Presentation on Initial Findings to the Project Team, SLSEA, UNDP, FAO and project partners, FAO Conference Hall, UN Compound, Bauddaloka Mawatha, Colombo 7
30 November 2018 (Friday)	10.00 am - 11.00 am	Mr. Mapa Pathirana, Additional Secretary, Environment Projects, Education and Training, Ministry of Mahaweli Development and Environment, Sobadam Piyasa, Battaramulla – Presentation of findings and discussion
12 December 2018	Home Based	Draft Final Report
24 December 2018	Home Based	Final Report

Annex C: List of Key Informants Interviewed

ABANS GROUP
• Kasun, Karunanayake Mr. (Assistant Manager)
BIO ENERGY ASSOCIATION OF SRI LANKA
• Jayasinghe, Parakrama, Mr. (Past President)
COCONUT CULTIVATION BOARD
• Gunawardena, G M J K Mr. (General Manager)
• Weragoda, U W B A Mr. (Deputy General Manager, Model Growers & Nursery Development)
• Wijesinghe, W M A B Mr. (Deputy General Manager, Administration & HRM)
• Wickremasinghe J M K B Mr. (Deputy General Manager, Extension)
• Silva, P A C J Mr. (Deputy General Manager, Finance Management)
• Priyanjith, S K Deepal Mr. (Assistant General Manager, Planning)
• Swarnapali S A D K K Ms. (Manager, Subsidies & Services)
• Jayalath, N S Mr. (Assistant General Manager, Loans & Subsidies)
• Atapattu, S K Mr. (Manager, Credit & Development)
DEPARTMENT OF FOREST CONSERVATION
• Weerawardene, N D R Dr. (Additional Conservator General – Research & Education)
DFCC BANK PLC
• Subasinghe, Kapila Mr. (Vice President, Special Project Lending)
FOOD AND AGRICULTURE ORAGANIZATION
• Brandstrup, Nina Ms. (FAO Representative for Sri Lanka and Maldives)
• Wijeratne, D B T Dr. (Assistant FAO Representative)
• Gunaratne, Roshini Ms. (Programme Officer)
• Amarasinghe, Upula Mr. (Monitoring & Evaluation Assistant)
INDEPENDENT EXPERTS/CONSULTANTS
• Sugathapala, A G Thusitha Dr. (Snr. Lecturer, Univ of Moratuwa, ex. Director General, SEA)
JETWING HOTELS LIMITED
• Munasinghe, Lahiru Mr. (Manager, Energy)
MINISTRY OF MAHAWELI DEVELOPMENT & ENVIRONMENT
• Mapa Pathirana, M P D U K Mr. (Additional Secretary, Environment Projects, Education & Training)
• Silva, K I A D Mr. (Director, Land Resources)
• Liyanage, Deepa Ms. (Director/IR)
• Wadood Rifa, A W M Mr. (Assistant Director/IR)
• Thiranagamage, Wathsala Ms. (Assistant Director)
MINISTRY OF PLANTATION INDUSTRIES
• Ranjith, J A Mr. (Secretary)
• Ranatunga, Dhammika Mr. (Director/Development)
• Priyadarshani, J M C Ms. (Assistant Director)
• Weerasinghe, H M B P Mr. (Assistant Director)

MINISTRY OF POWER AND ENERGY

- Batagoda, B M S Dr. (Secretary)
- Jayawardena, Sulakshana Ms. (Director)

NATIONAL ENGINEERING RESEARCH & DEVELOPMENT CENTRE

- Ananda Namal D D Eng. (Director)

RUBBER RESEARCH INSTITUTE OF SRI LANKA

- Dissanayake, Anura Dr (Head of Advisory Services)
- Wijesuriya, Wasana Dr. Ms (Principal Research Officer, Biometry)
- Gunaratnna, P K K S Mr. (Rubber Advisory Officer)
- Jayasundara, Kalani Mr. (Rubber Advisory Officer)
- Rathnayake, S Mr. (Rubber Advisory Officer)
- Ranawaka, R A D Mr. (Rubber Advisory Officer)

SRI LANKA CLIMATE FUND

- Chamara, Mahesh Mr. (Chief Executive Officer)
- Krishmanthi, Ganesha Ms. (Certification Executive)
- Madusanka, Gayan Mr. (Project Executive)

SRI LANKA ENERGY MANAGERS' ASSOCIATION

- Comester, Ronald Eng. (President)
- Perera, T F Nimal Eng. (Past President)

SRI LANKA SUSTAINABLE ENERGY AUTHORITY

- Wickramasinghe, Harsha Eng. (Deputy Director General, Demand Management)
- Wimal Nadeera, H A Eng. (Deputy Director General, Operations)
- Fernando, Nimashi Ms. (FDO)
- Bulathgama, Athula Mr. (Project Assistant)
- Premadasa, Nuwan Mr. (Project Assistant)
- Dilhari, Thamara Ms. (Project Assistant)

THALAWAKELE TEA ESTATES PLC

- Seneviratne, Dilantha Mr. (Director & CEO)
- Krishna, K Mr. (Assistant Manager, Sustainability)

UNITED NATIONS DEVELOPMENT PROGRAMME, COLOMBO

- Soerensen, Jorn Mr. (Country Director)
- Dissanayake, Tharuka Ms. (Policy Specialist)
- Pathmasiri, M M Ranjith Eng. (Technical Advisor)
- Perera, Sueka Ms. (Programme Analyst)
- Raju, Roshan Mr. (Monitoring & Evaluation Officer)

PROJECT STAFF

- Ranasinghe, Sampath Mr. (Project Manager)
- Karawita, Suranga Mr. (Programme Assistant)
- Subasinghe, Padmasiri Mr. (Programme Assistant)
- Subasinghe, Supunika Ms. (Programme Assistant)

Annex D: Summary of Field Visits

Day	Project Details	Summary of Discussion and Findings
Nov. 16 Friday	**Biomass Boiler & Absorption Chiller, Jetwing Blue Oceanic Beach Hotel, Negombo**	
	Biomass boiler + absorption Chiller (300 TR) Air conditioning/Hot water/ laundry commissioned – OCT/2016 Biomass - Cinnamon wood /Replacing Electric power Thermal Efficiency – 80% Total cost - SLR 16.6 M Project finance - SLR 2 M (12%) Service Provider - Lalan Engineering, Colombo <u>Results:</u> GHG Reduction: 551 tCO_2e./Year GHG abatement cost: 1.25 US$/$tCO_2e$	**Mr. Kalum Kothalawala, Project Engineer, Jetwing** **Mr. Nalin Kumara, Biomass Supplier** The biomass boiler and absorption chiller unit with 300 TR loading capacity serves 2 adjoining Jetwing properties, Jetwing Blue and Jetwing Beach Hotels that have 198 rooms and banquet facilities that can accommodate more than 500 guests. The unit commissioned in 2016 Oct, following initial setbacks due to the chemicals used for chillers has been in continuous operation from 2017 Oct. The project co-financed SLR 2 million for the SLR 16 million investment. The total requirement of hot water for laundry and air conditioning are met using the unit. There is a well streamlined supply network to procure cinnamon sticks as fuelwood, the by-product after cinnamon processing, sourced primarily from the Galle district, over 100 km away. Between 30-40 regular suppliers deliver sticks cut to 4 -feet or less using 3 to 10 ton-capacity trucks. Cinnamon sticks are bought at Rs. 9 /kg. The holding area can stock up to 200 tons of fuelwood at any time. The daily consumption averages about 6-7 tons with the usage increasing to 10 tons on heavy-demand days. The operator trained by the supplier is capable to operate the boiler efficiently. The functioning of the absorption chiller is monitored regularly with multiple readings taken on set intervals. One contractor from Hikkaduwa delivered fuelwood using his own large and small transport trucks. He supplies 13.5 tons of cinnamon wood per week to Blue Oceanic hotel and to the Jetwing Yala Hotel in Hambantota. He employs 3 families at his yard in the village to process raw material collected from area plantations. The sticks are bought on volume basis directly off the processing factories. He stocks 30-40 tons of material at his yard at any time, drying and cutting them before transportation. The other suppliers from the area operate under similar arrangements. With experience from commissioning the boiler, the model has been replicated at several other Jetwing Group properties. The results suggest that the boiler has high replication potential amongst the large hotels.
	Arboretum, Forest Research Institute, Forest Department, Boyagane, Kurunegala	
	Arboretum, Forest Research Institute, Kurunegala Fuelwood Growing Demonstration under the Forest Department	**Ms. Deepani Alawathugoda, Chief Research Officer** The growth rate and wood yield of 16 tree species not widely-used as fuelwood (e.g. Cashew, Tamarind, Karanda et. is tested using a fuelwood growing experiment established in 2016. It is expected to serve as a demonstration site for land restoration and fuelwood cultivation using indigenous and exotic varieties with timber/non-timber uses. Analysis of fuel value of these species will be conducted. Consideration has been given to test the cultivation of Gliricidia mixed with other fuelwood species. This

		is the first experiment with fuelwood cultivation after the establishment of fuelwood plantations using exotic species (e.g. Acacia, Eucalyptus) by the FD in the 1980s that were not harvested as fuelwood. Cultivations established by the FD cultivations are harvested by the Timber Corporation. The experiment should be geared to produce information about the fuelwood supply potential using indigenous varieties as tree species introduced for fuelwood production have been disliked for suspected adverse environmental problems.
	Biomass Water Heater, Teaching Hospital, Kurunegala, Department of Health	
	Biomass water heater (12 kW) commissioned DEC/2016 Biomass – Coconut shell (Kitchen Waste) replacing LPG Thermal Efficiency – 58% Project contribution - 130K SLR, 100% financed Service Provider – Spectra Industries, Colombo <u>Results:</u> GHG Reduction: 2.97 tCO_2e./Year GHG abatement cost: 30.19 US$/$tCO_2e$	**Ms. Kusum Rajapakse, Diet Supervisor** The water heater is used to produce hot water for cooking meals to resident patients and staff numbering over 2000. It produces hot water twice daily, totally using the coconut shells supplied from the kitchen. Between 30-40 kg of coconut shells are used for each run. The boiler has reduced monthly LPG consumption by 6x37.5kg cylinders (225 kg). The introduction of the boiler has speeded up the food production process and increased worker safety. The boiler can have wider application within the hospital sector for cleaning and sterilization of medical instruments and facilities.
	Biomass Boiler, D.B Welegedara Ayurvedic Hospital, Kurunegala, Department of Indigenous Medicine	
	Biomass heater for boiling liquid /medicine commissioned DEC/2016 Biomass – Firewood (Saw logs from area timber mills) replacing LPG Thermal Efficiency – 58% Project contribution – 368K SLR, (2,537$) 100% financed Service Provider – Spectra Industries, Colombo <u>Results:</u> GHG Reduction: 1.23 tCO_2e./Year GHG abatement cost: 205.72 US$/$tCO_2e$	**Dr. (Ms.) Dhammika Gunasekera, Director** The biomass boiler is used to produce hot water for the preparation of food and ayurvedic medicine (liquid extracts) provided to over 200 patients resident in 11 wards and attending clinics. It uses 18-20 kg of coconut shell sourced fully from the hospital kitchen and homes of staff. The boiler has reduced firewood and LPG consumption in preparing meals and Ayurvedic medicine and increased the capacity of the medicine preparation process. The staff is highly satisfied with the convenience resulting from the hot water supply. According to the Director of the hospital many other Ayurvedic hospitals have expressed interest to acquire similar water boiling systems.
	Biomass Terminal, Maxtherm Lanka, Weuda, Mawathagama, Kurunegala.	

	Biomass Terminal for the preparation of chipped-wood Total Investment- SLR 11.5 million Project Finance- SLR 4 million	**Mr. Gaya Siriwardhana, Director (Technical), Maxtherm Lanka (Pvt) Ltd.** The terminal completed at a cost of Rs. 11.5 million awaits final clearance from the FD to commence operation. It is designed to produce 2x2 inch woodchips at 10 tons/hr using 4"x4" logs. The terminal plans to use primarily rubber and Gliricidia fuelwood sourced from the area. The moisture content of chips will be brought down to 20-25% following air drying of logs at the yard on arrival and storage after chipping. The firewood will be bought at Rs. 4.00-4.50 per kg and the processing cost is Rs. 0.50-0.60/kg. The chips will be priced Rs. 7.00/kg ex-factory with loading and transport charged extra. The breakeven level of operation is 15 tons/day. Maxtherm is an energy service provider that supplies boilers to a wide variety of users. They have earmarked some of their existing clients, i.e. garment and tea factories and a brewery in the area that use feeding systems and burners for fuelwood chips as potential clients for the output from the Terminal. The immediate demand is estimated at 150 tons/month. The remote location presents some challenges in transport that is expected to be eased with the completion of the new highway which is 12 km away. The weighbridge is currently located at another site and logistics will be worked out to manage a smooth operation, while it can be a challenge at full capacity operation.
	Community Mixed-Fuelwood Plantation, Mahagama, Kurunegala - SLEES	
	Community Fuelwood plantations – Pepper+Gliricidia etc. Total cost - 5.1 M SLR, (80% co-finance) Project Finance 1.0 M SLR, (20%)	**Mr. Dushan Samaranayake, SLEES Project Officer** **Mr. Sanjaya Athugala, Cultivator** The Sri Lanka Environment Exploration Society (SLEES) promotes the establishment of fuelwood plantations and supply chains with community participation in the Kurunegala district. Dedicated Gliricidia fuelwood plantations, live fences and the cultivation of Gliricidia as supports for Vanilla and Pepper at the spacing of 800 plants/ha are carried out. SLEES has promoted establishment of about 20 ha of new planting. Gliricidia will be lopped at 6-month intervals, starting from 6 months after planting. The growers had prior experience with Vanilla and Pepper cultivation and with the additional income received from fuelwood expects better returns from farming. The expected life of the crop is 25 years. There is a market for fuelwood from the MAS and other factories in proximity to the area and contractors were collecting Gliricidia from home gardens in the area. Gliricidia sticks are bought at Rs. 4.75/kg ex-factory without any grading by size or maturity. The collectors buy Gliricidia at Rs. 200/yard^3 Fuelwood that works out to about Rs. 0.67/kg. Transportation from the village to MAS factory costs Rs. 8,000 per 10-ton truck. The margin kept by the collectors is extremely high and collective transport by growers can bring higher incomes. The introduction of a pricing scheme based on the size and maturity of Gliricidia will encourage more scientific management of the fuelwood crop that is currently lacking. As the Vanilla

		cultivation in the area is making a comeback, the potential to produce sustainable fuelwood and contributing to the rural economic development appear strong.
Nov. 17 Saturday	**Biomass Dryer, Sathya Cashew, Vanathawillu, Puttalam**	
	Biomass fired hot air dryer (12 kW) commissioned MAY/2018 Biomass – wood chips from saw mills/carpentry sheds replacing electricity Thermal Efficiency – 58 % Total cost - 350K SLR Project contribution - 175K SLR, (50%) Service Provider – Saviru Technologies, Kandy <u>Results:</u> GHG Reduction: 26 tCO_2e./Year GHG abatement cost: 2.11 US$/$tCO_2e$	**Ms. Ushani Priyangika, Co-Owner** The introduction of biomass-fired dryer permitted more economical drying of Cashew by saving costs of electricity. Wood chips collected at no cost from saw mills and carpentry shops is used for firing the boiler. The electricity cost saved is Rs. 4-6,000 per month. The factory employs 8 women daily for peeling and cleaning cashew. The availability of thee dryer that is operated 100 days per year has allowed the small-scale processor to increase output by 25% to 30-35,000 kg and employ more women. The improved drying operation reduced weight loss during drying operation by half from 12% to 6%. The produce is supplied to a large wholesale collector in the vicinity and the potential exist to scale-up operation by going for direct retailing with the better control over the processing operation facilitated by the low-cost dryer, if the raw-material financing cost can be managed. There are many other cashew processors who can benefit from adopting biomass-fired air dryers in the area and as the industry is considered to have a strong growth potential due to high prices.
	Fuelwood Plantations – Kurunegala, Forest Department	
	Fuelwood plantation (18.7 ha) Forest Department Total Cost – 17.3 M SLR Project finance – 3.3 M SLR, (19%)	**Mr. Indika Pushpakumara, Beat Forest Officer** **Mr. Danuka Sampath, Field Officer** The Gliricidia and Kaya fuelwood plantation in the Wilpotha-Galkulama forest reserve covering 18.7 ha is the largest fuelwood lot established by FD out of 50 ha established in the 4 districts of Galle, A'pura, Badulla and Puttalam with project co-finance. The planting has been done manually following standards prescribed by the FD, using rooted cuttings of Gliricidia and Kaya seedlings. The planting operation that used 400 man-days providing employment to residents in the area. At young stage slashing weeds using labour will be done twice yearly. Gliricidia is expected to be harvested from 1 year and Kaya at the age of 8 to 12 years. The land had been previously opened up for slash-burn cultivation and the cultivations fuelwood presents a model for alternative land use. The fuelwood cultivation did not face the usual threats faced by forest plantations such as theft of seedlings, while Kaya seedling stems suffered damage by wild animals. Upkeep and harvesting can provide employment to area people. Further guidance on the harvesting and removal of fuelwood from the lot is required as the harvesting of FD plantations is always done by the Timber Corporation. Forest Officers believe this to be a better model to reforest and manage sparsely-used forest lands compared

		to Community-Forestry Models tried previously. As the area under the jurisdiction of the FD available for fuelwood cultivation is very high, this will serve as a valuable model to be watched.
	Biomass Hot-Air Dryer - Wishmitha Dasabala Poshana, Thalawa	
	Biomass fired hot air dryer (12 kW) commissioned JUN/2017 Biomass – wood chips from saw mills/carpentry sheds Thermal Efficiency – 58 % Total Cost - 295K SLR (2,034 $) Project contribution – 147.5 K SLR, (50%) Service Provider – Saviru Technologies <u>Results:</u> GHG Reduction: 21 tCO_2e./Year GHG abatement cost: 2.42 US$/$tCO_2e$	**Mr. Lalith Malan Dabarera – Proprietor** The wood-fired dryer is used to produce dehydrated Moringa and curry leaves to meet demand from exporters and to produce herbal teas marketed under own label. The dryer is run 2-3 days per batch depending on the raw material availability which is a constraint. Mixed fuelwood sourced from the area is used for operating the dryer. It provides employment to 5 people. The processed material is sent to Colombo for packing in sachets due to the lack of a machine. The owner has applied to the (former) Ministry of Primary Industries for assistance to finance a sachet machine. The model can be easily replicated by more small industries. However, the full capacity utilization of the investment will require careful planning
Nov. 18 Sunday	**Biomass Drier - Wasana Products, Alakolamada Road, Longwill, Rattota**	
	Biomass fired hot air dryer (12 kW) commissioned JAN/2017 Biomass – Fire wood replacing electric dryer Thermal Efficiency – 58 % Total Cost – 343 K SLR (1,200$) Project contribution – 171.5 K SLR (50%) Service Provider – Saviru Technologies <u>Results:</u> GHG Reduction: 29 tCO_2e./Year GHG abatement cost: 2.04 US$/$tCO_2e$	**Ms. Shanthi Menike, Proprietor** The Wasana products is a small-scale home-based food-processing business. The biomass-fired dryer uses chips and wood shavings for drying spices (cloves, pepper), fruits (Mango, pineapple, papaya), and other dehydrated food products (jack, breadfruit). Fuelwood is obtained free of charge from the town timber depot. She has been able to double her output after acquiring the dryer. The electricity cost for the production operation decreased from Rs.2000 to Rs. 150 with the commissioning of the dryer, saving more funds for buying raw material thereby increasing output. She has been able to even supply some export orders due to the improvement in quality and the increased scale of operation. Although the dryer can be used to dry up to 10 kg/day, due to seasonality in production and limited raw material availability it is operated at 50% capacity. With better marketing and raw material supply system, the factory can be operated at a much larger-scale. The model-dryer has been proven to be economical compared to electric-powered dryers and improve the quality and dependability of the drying process compared to solar dryers.
	Community Home Garden Fuelwood Model, Pallepola, Matale. Arunalu Foundation	
	Fuelwood growing model	**Mr. Lionel Peiris – President, Arrunalu Foundation**

	Area 20 ha CBO Operated Total Cost - 11.5 M SLR Project finance - 3.0 M SLR, - (21%) Community & NGO co-finance - 79%	**Mr. Lasantha Peiris – Secretary, Arunalu Foundation** Community fuelwood plantations supported by the Arunalu Foundation engaged 89 participants cultivating Gliricidia in 50 ha in the first round. With another 38 small growers participating in the second round, over 200 ha have been planted to Gliricidia, as shade/support for Pepper and live fences (60%). Some growers are using Gliricidia as supports to grow tomato and cucumber vines. The SALT (Sloping Agriculture Land Technology) techniques has been introduced to farmers cultivating hillsides. Several small and medium estates growing spices have also joined the program by rehabilitating older cultivations and undertaking new planting. Project participants were provided with a grant to meet about 25% of the cost of establishing Gliricidia plants. The growing community can supply 20 tons of fuelwood per month. With 600-800 trees planted per ha, each producing 12 kg (8 sticks x 1.5 kg each) harvested twice a year Rs. 150-200,000/ha can be expected from a well-maintained biofuel garden. Currently there is a continuous demand for Gliricidia fuelwood from the Kandalama Hotel in Dambulla and the Tea Factory Hotel in Nuwaraeliya. Cuttings chopped to 3 to 4-inch long pieces and dried to 20% moisture is bought at Rs. 10.50 per kg. The Foundation expects to receive a chipping unit to partly mechanize the fuelwood preparation process. Increased fuelwood supply can give a boost to the brick-making industry practiced in the area.
	Hot-Air Spice Dryer, Mahir Brothers, Katugastota	
	Biomass fired hot air dryer (12 kW) commissioned JAN/2017 Biomass – Fire wood replacing electric dryer Thermal Efficiency – > 65% Total Cost – 2M SLR (13,793 $) Project contribution – 1 M SLR (50%) Service Provider – Saviru Technologies <u>Results:</u> GHG Reduction: 157 tCO_2e./year GHG abatement cost: 2.19 US$/$tCO_2e$	**Mr. Akram Mohammad – Proprietor** Mahir Brothers is a large-scale spice processor whose spice trading business has received a major boost by the introduction of a biomass-fired hot air dryer. The business is engaged largely on marketing pepper and cloves and small quantities of other spices. Using the dryer that can dry 4 tons over 18-24 hrs. per batch, 300 tons of pepper is processed on site annually. Previously, the produce was transported to intermediaries in the dry-zone districts to be sun-dried under unsanitary conditions. The quality and the regularity of supply was highly uneven due to rain. The use of kerosene or LPG-fired hot air dryers was found to be too costly to operate. Firewood is bought as small logs from saw mills in the area and costs about SLR 15,000 per month for continuous operation. The saving from avoided transport cost and preventing the quality loss have improved profits. Upon realizing the economic benefit, the company has installed a second 4-ton capacity dryer by obtaining bank financing and is in the process of installing a 2-ton dryer. The after-sales service from the supplier has been slow forcing the owner to have repairs carried out locally. However, there are no other suppliers for the dryer.
Nov. 19 Monday	**Community Fuelwood Plantations, Walapane, Nuwara Eliya**	
	Fuelwood growing model	**Mr. W H M Dhammika Bandara, President, Sri Rahula Farmers' Society**

	CBO Operated	**Mr. A W P Nanayakkara – Secretary** **Mr. R M Karunatilake, Treasurer** **Mr. Sarath Nandasiri, Forest Extension Officer** **Ms. Kalhara Dissanayake, Forest Extension Officer** Walapane Sri Rahula Death-Donation Society is the community partner for the fuelwood growing operation implemented under the guidance of the Forest Department. The Society has a membership of 117 representing every family in the village. The fuelwood cultivation is carried out in Forest Department (FD) lands that are routinely damaged by forest fires prior to community engagement. The FD has accepted community fuelwood plantation as a programmatic activity and developed business/investment plans and sustainability plans covering harvesting and transport practices. Eucalyptus spp. are planted as fuelwood with lime and fruit trees planted along the border for community use and to encourage them to visit the area. The Forest Extension Officers provide advice on the cultivation practices, protection from damage from animals, establishing fire belts, etc. The villagers are employed by the FD as wage workers for planting and upkeep. From the 3rd year the community will fully take over the maintenance responsibilities. The workers hired from the village are paid SLR 1068 daily wage. Of that SLR 60 is deposited in the Society account. The saving will be paid back in 10 years, shared 80:20 between the member and the Society. As there are many tea factories in the area that buy fuelwood, marketing will not be an issue. Small branches lopped will meet the domestic firewood needs. The fuelwood cultivation program found employment to village people. More women are employed for maintenance work such as slashing weed. The protection of the land due to fuelwood cultivation have yielded other benefits to smallholder tea cultivation and vegetable home-gardening carried out by the villagers by reducing animal damage. Agricultural training has been arranged for them as well. Community partners have also received fuel-efficient stoves to reduce demand for domestic firewood by increasing fuel efficiency in cooking. The community partnership is expected to prevent illegal logging and improve fire prevention. The recognition of the Society has improved in the community as a result of the partnership.
	Biomass Boiler - Hotel Green Palace, Hawa Eliya, Nuwara Eliya	

	Biomass boiler, (300 TR) for cooking and hot water for guest use commissioned JUL/2016 Biomass - Firewood /Replacing Electric power Thermal Efficiency - 58% Total Cost - 263 K SLR (1,818$) Project finance - 133 K SLR (50%) Service Provider – Spectra Industries <u>Results:</u> GHG Reduction: 8.0 tCO_2e./Year GHG abatement cost: 11.82 US$/$tCO_2e$	**Mr. Gamini Jaliyagoda, Manager** **Mr. S T K Jayasekera, Proprietor** The 12 KW biomass-fired boiler is used to meet water needs up to 30 resident guests occupying the 6-room small hotel and up to 400 function attendees, as well as laundry and kitchen use. The daily hot water usage averages 100 litres and consumes 12-15 kg fuelwood. Kitchen waste such as coconut shells and waste wood collected from the local timber store meet the fuel needs. Hot water is a major cost item in providing guest accommodation in Nuwareliya which is cold year-round. The introduction of the biomass boiler reduced the electricity bill to 50%. The high efficiency of the boiler/storage unit allows hot water to be stored for several days with only a slight drop in temperature. The compact size of the boiler/storage unit has permitted to keep the installation concealed in the small garden. The owner is looking to expand the hotel by adding new rooms responding to the improving business environment. With many small hotels and guest houses operating in the city, low-cost biomass boilers can find many users.
Nov. 20 Tuesday	**Estate Fuelwood plantations – Thalawakele Tea Estates PLC**	
	Fuelwood growing model. Land area 124 ha, Total cost - 15 M SLR Project finance - 1.5 M SLR (10%)	**Mr. Wasantha Hewamanne – Forest Officer, Thalawakele** **Ms. Sudharma Menike, Forest Extension Officer** **Mr. Kosala Wijesekera, Deputy GM, Great Wester Estate** Fuelwood plantations have been established in Radella, Great Western and Logie Tea estates managed by the Thalawakele Tea Estates PLC. Eucalyptus spp. (E. Grandis, E. Microcorys) are cultivated in the hilly sections and abandoned tea areas inside the estates under the technical supervision of FD. Worker Cooperative Societies within the estates are collaborating as the community partner under a benefit-sharing arrangement of 50:30:20 among the society, Estate and the Government (FD) at the harvest time after 10 years. The fuelwood cultivation provided more work opportunities to estate workers who resist conversion of tea land in the fear of losing employment. The trees are thinned out periodically (in the 5, 7 and 9 years) for better growth. The market for fuelwood is available locally as the estates are currently buying fuelwood from outside to meet 90% of the requirement. The Great Western Tea Factory with an output of 700,000 kg made tea annually requires 3,500 m^3 fuelwood. The management has undertaken fuelwood cultivations for factory use and promoted the use of LPG cookers to discourage workers illegally felling trees for domestic firewood. As securing approval for harvesting trees for timber and fuelwood for local authorities remain a cumbersome process, the estate management is expecting well-streamlined procedures to be introduced for harvesting of new fuelwood plantations.
	Biomass Water Heater - Richme Foods & Dairies (Pvt) Ltd, Dickoya	

	Biomass heater, (12 kW) Heating milk commissioned MAY/2017 Biomass - Firewood locally-procured, Replacing LPG heaters Thermal Efficiency - >58% Total Cost - 850 K ($) Project finance - 420K SLR (50%) Service Provider – Spectra Industries <u>Results:</u> GHG Reduction – 17.0 tCO_2e./Year GHG abatement cost: 17.25 US$/$tCO_2e$	**Mr. Chathura Munasinghe, Proprietor** The introduction of a biomass-fired 12 KW water heater in to the yoghurt production process has allowed Richme Foods and Dairies to receive multiple benefits by cutting costs, expanding output, improving product quality and preventing waste. With the success of adding a 230-litre biomass heater that enabled the company to double its daily production to 3,000 batches of yoghurt, the company is installing a new 500 litre unit to meet increased demand for its produce. It also added 1 20-foot cooler to accommodate increased production. The introduction of the biomass heater saves SLR 3500 daily from the manufacturing process from savings through LPG replaced and electricity cut-back. Scrap wood procured from an area saw mill and coconut shells provide 15-20 kg of biomass required daily. The water boiling system has increased worker safety, speed and the hygiene of the manufacturing process. The employment has grown from 3 to 20 workers. The owner is looking in to sharing some of the benefits of cost savings with the workers to motivate them. The quality of produce and higher service standards have facilitated the company to dominate the market for yoghurt in the region.
Nov. 21 Wednesday	**Biomass Water Heater - General Hospital, Monaragala**	
	Biomass water heater (12 kW) Hot water for cooking - commissioned DEC/2016 Biomass – Coconut shell (Kitchen Waste) Thermal Efficiency – >58% Project contribution - 520K SLR ($), 100% financed Service Provider – Spectra Industries <u>Results:</u> GHG Reduction: 2.57 tCO_2e./Year GHG abatement cost: 69.79 US$/$tCO_2e$	**Dr. R M D Ratnayake, Director** The Monaragala General Hospital serves over 500,000 patients in a year. Biomass-fired 50-litre water heater supplies hot water required for cooking meals for resident patients and staff numbering over thousands. It is operated with 20 kg coconut shells recovered daily from the hospital kitchen, and firewood collected from the hospital premises. The kitchen staff trained on the operation and maintenance of the boiler ensures trouble-free year-round supply of hot water. The saving to the hospital budget from reducing LPG and electricity consumption is estimated SLR 2.6 million in 2017. Savings obtained from the use of boiler has been communicated to other government hospitals. On recognition of multiple benefits from it, the government has allocated funds to install such units in 20 other hospitals island wide. The commissioning of the biomass-boiler has contributed to the vision of Dr. Ratnayake to adopt an environmental management system that achieves zero waste and zero carbon emission. Under his leadership the hospital is seeking to introduce more biofuel-fired boilers for sterilizing surgical instruments, produce of biogas from waste, carry out organic farming, harness solar power and adopt energy-saving lighting and cooling services to minimize the C foot print of the hospital. It has been presented with a gold award at the 2017 Presidential Environmental Awards, and many other accolades.
	Biomass Terminal - Wellassa Biomass Energy (Pvt) Ltd, Badalkumbura	

	Biomass Terminal for the preparation of chipped-wood Total Investment- SLR 15 million Project Finance- SLR 4 million	**Mr. Kusumsiri Konara, Proprietor** The biomass terminal established at a cost of SLR 15 million relies on securing sustainably-harvested Gliricidia from sprawling pepper plantations and home gardens in the area. The terminal equipped with a weigh bridge, storage area and processing shed can handle 100 tons of fuelwood daily. It is planned to install a wood chipper shortly. Fuelwood is currently supplied to buyers such as Radella Estate (@ SLR 2,400/m^3) and to Tasma Biomass, Biyagama. The transportation of chips is done using 16-ton open trucks and 18-ton container trucks. The management plans to certify the terminal to ensure receipt and delivery of sustainably produced fuelwood and to adopt standards for solid biofuel. The management expects that these procedures will assist to resolve irregularities relating to the administration of regulations on the transportation of permitted and un-permitted fuelwood species. Due to availability of fuelwood from multiple sources, certifications relating to sustainable sourcing of fuelwood will be critical for the smooth and responsible operation of the terminal. Clear guidelines on the application of SLS 1551 standard can help resolve these issues.

Annex E: List of Documents Reviewed

1) Project document signed between UNDP, FAO, Ministry of Environment, and Sri Lanka Sustainable Energy Authority
2) GEF Project Identification Form (PIF)
3) FAO Project Document, GCP/SRL/048/GEF
4) Inception Report, Promoting Sustainable Biomass Energy Production and Modern Bio-Energy Technologies, October 2013
5) Mid-Term Review Report, June 2015
6) Audit reports
7) Finalized GEF focal area Tracking Tool at CEO endorsement, midterm and terminal
8) Project Implementation Reports (PIRs)
9) Six Months Progress Reports of FAO from 2016 to 2018
10) Annual Work plans and quarterly request for advances
11) Project Board Meeting Minutes (Half-yearly meeting reports from 2015 to 2018)
12) Thematic Advisory Committee Meetings (Minutes of meetings from 2016 to 2017)
13) Financial Data including Annual Budget Summary, Combined Delivery Reports (Jan-Dec 2013 to Jan-Jun 2018)
14) Information materials produced by the project activities (press releases, publications, brochures, information strategy, training materials, best practices methods, videos, documents on project website)
15) Project M&E framework
16) Technology Demonstration Completion Reports – 27 Projects supported by the project
17) MRV reports on technology demonstrations supported by the project
18) Co-Finance Status of Projects Supported – Actual vs. Realized
19) National Energy Policy and Strategies of Sri Lanka, 2017
20) Sri Lanka Sustainable Energy Authority Act, No. 35 Of 2007
21) Nationally Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors in Sri Lanka, Links Between Sri Lanka's Energy Sector, NAMA and NDC- Carbon Limits, 2017
22) UNDP Country Programme for Sri Lanka, 2013-2017
23) FAO Country Programming Framework for Sri Lanka, 2018-2022 (CPF)
24) Biomass Energy 2022: fuelling the economy - protecting forests, M/P&RE & UNDP
25) Assessment and Mapping of Biomass Consumption in Sri Lankan Industries, SLSEA, 2015
26) Sri Lanka Country Report on Energy Efficiency Improvement & Conservation, Harsha Wickremasinghe, 2009
27) Fostering Renewable Energy Sector in Sri Lanka via Effective Technology Transfer: Lessons From China And India, Withanaarachchi, A.S, Nanayakkara, L.D.J.F, Pushpakumara, C. AJER, 2016.
28) Improving Gender-Inclusive Access to Clean and Renewable Energy in Bhutan, Nepal and Sri Lanka
29) Gender Review of National Energy Policies and Programmes In Sri Lanka, ADB, June 2015
30) 100% Energy Generation Through Renewable Energy by 2015- Assessment of Sri Lanka's Power Sector, ADB & UNDP, 2017
31) Reports of studies carried out by the project
    a. Economics of Commonly used and Proposed Agro Forestry Models for Fuel Wood Production
    b. Land use, Land Ownership, Approval Procedure and Sample Lease Agreement

c. Fuelwood Growing Models-For Different Fuel Wood Species and Best Growing Approaches & Practices of Sri Lanka

d. Fuelwood Resource Survey in 11 Districts

e. Status Report on Biomass Supply Chains in Sri Lanka

f. Feasibility Studies on Fuel Switching

g. Mapping of Current Biomass Related Activities Project Linkages and Complementaries

h. Utilization of Technology in Biomass Energy Conversion Systems in Sri Lanka

i. Report on the existing stock of BTEGs and the movement of biomass in the two EP zones

j. Report on the efficiency improvement of the thermal generators and biomass movement after quality improvement

k. Report on the information needed for the development of standards for the biomass feed stock for energy

l. Report on recommended efficient technologies for the thermal generators used for major applications in the zones

m. Report on Analysis of Long-term Price Behaviour of Fuelwood and Establishing a Relationship on Fuelwood Price Variation Trends

n. Pilot Biomass Energy Supply Chains

o. Study of the Transport Arrangements of Biomass Energy Resources in Sri Lanka

p. Background Paper on Biomass Energy Related National Policies, Regulations and Laws

q. Barrier Analysis and MCA of GHG Mitigation Options

r. Across the Nation: Promoting Sustainable Biomass Energy production and Modern Bio-Energy Technologies, 2018

Annex F: Evaluation Questions

Table F.1: Evaluation Question Matrix

Evaluative Criteria Questions	Indicators	Sources	Methodology
Relevance: How does the project relate to the main objectives of the GEF focal area, and to the environment and development priorities at the local, regional and national levels?			
• Does the project objectives conform to the UNDP and FAO Country Programme Document (CPD)	• In line with the national priorities mentioned in the UNDP and FAO Country Programme Document	• UNDP Country Programme Document • FAO Country Programme Document • Project document • Relevant UNDAF (United Nations Development Assistance Framework) (2018 – onwards) as updated from October 2012 and FAO Development Framework	• Documents analyses • Interviews with UNDP, FAO and project team on updated development framework relevant to Bio-energy applications
• Does the project support other regional or international conventions?	• Priorities and areas of work of other conventions incorporated in the project design	• Project documents • National policies and strategies • Other international conventions, or related to environment more generally and other international convention web sites	• Documents analyses • Interviews with project team • UNDP, FAO and other partners
• Is the project relevant to the GEF Climate Change Mitigation focal area and how does it support the GEF Climate Change Mitigation focal area?	• Existence of a clear relationship between the project objectives and GEF Climate Change Mitigation focal area; • Alignment with GEF Climate Change Mitigation focal area; • Identify contribution to GEF Climate Change Mitigation focal area	• Project documents • GEF focal areas strategies and documents • UNDAF and FAO development Framework	• Documents analyses • GEF website • Interviews with UNDP, FAO and project team
• Is the project relevant Sri Lanka's environment and sustainable development objectives? ○ Is the project country driven?	• Degree to which the project supports national environmental objectives	• Project documents • National policies and strategies • Key project partners	• Documents analyses • GEF website • Interviews with UNDP, FAO and project team

Evaluative Criteria Questions	Indicators	Sources	Methodology
○ What was the level of stakeholder participation in project design? ○ What was the level of stakeholder ownership in implementation? ○ Does the project adequately take into account the national realities, both in terms of institutional and policy framework in its design and its implementation	• Degree of coherence between the project and national priorities, policies and strategies • Appreciation from national stakeholders with respect to adequacy of project design and implementation to national realities and existing capacities • Degree to which there is country ownership through assessment of human and financial resources • Coherence between needs expressed by national stakeholders and UNDP-GEF criteria • Coherence between data on development trends and programme design		• Interviews with key stakeholders including private sector
• Is the project addressing the needs of target beneficiaries at the local level? ○ Was a needs analysis conducted? If so, at what levels? ○ How does the project support the needs of relevant stakeholders? ○ Has the implementation of the project been inclusive of all relevant stakeholders? ○ Were local beneficiaries and stakeholders adequately involved in project design and implementation?	• Strength of the link between expected results from the project and the needs of relevant stakeholders • Degree of involvement and inclusiveness of stakeholders in project design and implementation	• Project partners and stakeholders • Project documents • Demo project completion reports	• Document analysis • Interviews with relevant stakeholders • Interviews with hosts of the Project Demos

Evaluative Criteria Questions	Indicators	Sources	Methodology

• Is the project internally coherent in its design?
  ○ Are there logical linkages between expected results of the project (log frame) and the project design (in terms of project components, choice of partners, structure, delivery mechanism, scope, budget, use of resources etc.)?
  ○ Is the length of the project sufficient to achieve Project outcomes?
  ○ Whether gender issues had been taken into account in project design and implementation and in what way has the project contributed to greater consideration of gender aspects, (i.e. project team composition, gender-related aspects of growing and technology switching, stakeholder outreach to women's groups, etc.). If so, indicate how
	• Level of coherence between project expected results and project design internal logic
	• Level of coherence between project design and project implementation approach
	• Existence of a gender analysis and evidence that it informed project design
		• Program and project documents
		• Key project stakeholders
		• Gender mainstreaming reports
		• Documents or memos on project extensions and reasons on the necessity for exceeding planned number of years of implementation
			• Document analysis
			• Key interviews with PMU and gender mainstreaming specialist of the implementing government agencies and UNDP/FAO COs

• Does the project provide relevant lessons and experiences for other similar projects in the future? • Has the experience of the project provided relevant lessons for other future projects targeted at similar objectives	• Proposals in pipelines	• Data collected throughout evaluation • Lessons learned reports • APR/PIR reports	• Data analysis • Interview with project staff • Review of lessons learned reports and knowledge management activities
Effectiveness: To what extent have the expected outcomes and objectives of the project been achieved?			

Evaluative Criteria Questions	Indicators	Sources	Methodology
• Has the project been effective in achieving its expected outcomes?	• See indicators in project document results framework and log frame	• Project documents • Project team and relevant stakeholders • Data reported in project annual and quarterly reports	• Documents analysis • Interviews with project team • Interviews with relevant stakeholders and beneficiaries • Field visits
• How is risk and risk mitigation being managed? ○ How well are risks, assumptions and impact drivers being managed? ○ What was the quality of risk mitigation strategies developed? ○ Were these sufficient? ○ Are there clear strategies for risk mitigation related with long-term sustainability of the project?	• Completeness of risk identification and assumptions during project planning and design • Quality of existing information systems in place to identify emerging risks and other issues • Quality of risk mitigations strategies developed and followed	• Project documents • UNDP, project team, and relevant stakeholders • ATLAS risk monitoring and mitigation reports • Follow-up reports on risks mitigation actions identified during the MTR	• Document analysis • Interviews • Review of ATLAS risk monitoring reports • Comparison with MTR findings
• What lessons can be drawn regarding effectiveness for other similar projects in the future? ○ What lessons have been learned from the project regarding achievement of outcomes? ○ What changes could have been made (if any) to the design of the project in order to improve the achievement of the project's expected results?	• Lessons learned in project design	• Data collected throughout evaluation • Lessons learned reports and APR/PIR assessments	• Data Analysis • Interviews with knowledgeable persons on original project design • Review of the project design and its limitations
Efficiency: Was the project implemented efficiently, in-line with international and national norms and standards?			
• Was the project implemented in an efficient way?	• Availability and quality of financial and progress reports • Timeliness and adequacy of reporting provided	• Project documents and evaluations • UNDP Project team • Output level GEF financial reports • Co-financing reports	• Document analysis • Key interviews on challenges and problems met and solutions taken during project

Evaluative Criteria Questions	Indicators	Sources	Methodology
○ Was adaptive management used or needed to ensure efficient resource use? ○ Did the project logical framework and work plans and any changes made to them use as management tools during implementation? ○ Were the accounting and financial systems in place adequate for project management and producing accurate and timely financial information? ○ Were progress reports produced accurately, timely and responded to reporting requirements including adaptive management changes? ○ Was project implementation as cost effective as originally proposed (planned vs. actual) ○ Did the leveraging of funds (co financing) happen as planned? ○ Were financial resources utilized efficiently? Could financial resources have been used more efficiently? ○ Was procurement carried out in a manner making efficient use of project resources? ○ How was results-based management used during project implementation?	• Level of discrepancy between planned and utilized financial expenditures • Planned vs. actual funds leveraged • Cost in view of results achieved compared to costs of similar projects from other organizations • Adequacy of project choices in view of existing context, infrastructure and cost • Quality of results-based management reporting (progress reporting, monitoring and evaluation) • Occurrence of change in project design/ implementation approach (i.e. restructuring) when needed to improve project efficiency • Cost associated with delivery mechanism and management structure compare to alternatives		implementation regarding resource mobilization with co-financing partners along the integrated approach in combining the GEF incremental funds with co-financed resources and their timely availability to support the schedule of planned Outputs. • Interviews on using the guide questions on adaptive management, accounting, co-financing, procurement, etc.

Evaluative Criteria Questions	Indicators	Sources	Methodology
• How efficient are partnership arrangements for the project? ○ To what extent partnerships/ linkages between institutions/ organizations were encouraged and supported? ○ Which partnerships/linkages were facilitated? Which ones can be considered sustainable? ○ What was the level of efficiency of cooperation and collaboration arrangements? ○ Which methods were successful or not and why? ○ To what extent were local partnerships pursued?	• Specific activities conducted to support the development of cooperative arrangements between partners • Examples of supported partnerships • Evidence that particular partnerships/linkages will be sustained • Types/quality of partnership cooperation methods utilized	• Project documents and evaluations • Project partners and relevant stakeholders	• Document analysis • Interviews with Key stakeholders regarding the partnership arrangements and possible areas of improvement and communication linkages regarding monitoring for results and timely execution of agreed action plans
• Did the project efficiently utilize local capacity in implementation? ○ Was a preliminary capacity assessment conducted? ○ Was an appropriate balance struck between utilization of international expertise as well as local capacity? ○ Did the project take into account local capacity in design and implementation of the project? ○ Was there an effective collaboration between institutions responsible for implementing the project?	• Proportion of expertise utilized from international experts compared to national experts • Number/quality of analyses done to assess local capacity potential and absorptive capacity	• Project documents and evaluations • UNDP and FAO reports on consultancy arrangements and sourcing from international and national sources • Interviews with Beneficiaries	• Document analysis • Interviews UNDP and FAO on their experiences in timely sourcing of international and local experts

Evaluative Criteria Questions	Indicators	Sources	Methodology
• What lessons can be drawn regarding efficiency for other similar projects in the future? ○ What lessons can be learnt from the project regarding efficiency? ○ How could the project have more efficiently carried out implementation (in terms of management structures and procedures, partnerships arrangements etc…)? ○ What changes could have been made (if any) to the project in order to improve its efficiency?		• Data collected throughout evaluation • UNDP and FAO experiences	• Data analysis • Interview with UNDP and FAO counterparts
• Has the project been effective in achieving its expected outcomes?	• See indicators in project document results framework and log frame	• Project documents • Project team and relevant stakeholders • Data reported in project annual and quarterly reports • APR/PIR and Tripartite meeting minutes	• Documents analysis • Interviews with project team • Interviews with relevant stakeholders • Interview with UNDP and FAO on implementation and results vis-à-vis long term national development goals
• How is risk and risk mitigation being managed? ○ How well are risks, assumptions and impact drivers being managed? ○ What was the quality of risk mitigation strategies developed? Were these sufficient? ○ Are there clear strategies for risk mitigation related with	• Completeness of risk identification and assumptions during project planning and design • Quality of existing information systems in place to identify emerging risks and other issues • Quality of risk mitigations strategies developed and followed	• Project documents • UNDP, FAO • Project team, and relevant stakeholders • ATLAS reports on risk identification and mitigation and monitoring system	• Document analysis • Interviews with UNDP and PMU on ATLAS Risk system and monitoring results

Evaluative Criteria Questions	Indicators	Sources	Methodology
long-term sustainability of the project			
• What lessons can be drawn regarding effectiveness for other similar projects in the future? ○ What lessons have been learned from the project regarding achievement of outcomes? ○ What changes could have been made (if any) to the design of the project in order to improve the achievement of the project's expected results?		• Data collected throughout evaluation • Lessons learned reports • APR/PIR and Quarterly reports	• Data analysis • Interviews with PMU and stakeholders
Sustainability: To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?			
• Is the Project financially sustainable? ○ Are there financial risks that may jeopardize the sustainability of project outcomes? ○ What is the likelihood of financial and economic resources not being available once GEF grant assistance ends?	• The prospect of an intervention to continue to deliver benefits for an extended period of time after completion	• UNDP, project team, and relevant stakeholders • ATLAS monitoring reports	• Document analysis • Interviews with PMU and stakeholders • Analysis of ATLAS data
• Is the Project environmentally and socially sustainable? ○ Are there ongoing activities that may pose an environmental threat to the sustainability of project outcomes?	• Report on social or environmental threats, if any	• UNDP, project team, and relevant stakeholders • Beneficiary feedback • APR/PIR	• Interviews with PMU and stakeholders • Monitoring data/Progress reports • Data analysis

Evaluative Criteria Questions	Indicators	Sources	Methodology
○ Have there been any intended or unintended social or environmental consequences of the project?			
• To what extent will the stakeholders sustain the project? ○ Are there social or political risks that may threaten the sustainability of project outcomes? ○ What is the risk for instance that the level of stakeholder ownership (including ownership by governments and other key stakeholders) will be insufficient to allow for the project outcomes/benefits to be sustained? ○ What is the level of interest among the key stakeholders see that project benefits continue to flow? ○ Do what degree is there sufficient public/stakeholder awareness in support of the project's long-term objectives? ○ Efficiency of the overall biomass supply value chain	• Degree of political and social support • Extent of stakeholder buy-in to processes and aligned objectives • Amount of collection • Product quality • Price	• UNDP, project team, and relevant stakeholders • Beneficiary feedback • Awareness programs	• Document analysis • Interviews with beneficiaries and stakeholders • Monitoring data/Progress reports • Exit strategy or post project plan formulation • Transition/turn-over plan
Impact: Are there indications that the project has contributed to, or enabled progress toward, reduced environmental stress and/or improved ecological status?			
• Assess the likely permanence (long lasting nature) of the impacts ○ Clarify based on extent: a) verifiable improvement in energy intensity; and/or, b)	• The positive and negative, foreseen and unforeseen changes to and effects produced by a development intervention	• Project documents • UNDP, FAO, project team, and relevant stakeholders	• Document analysis • Interviews with UNDP and FAO, PMU

Evaluative Criteria Questions	Indicators	Sources	Methodology
through specified indicators that progress is being made towards achievement of project objectives, c) regulatory and policy changes at regional, national and/or local levels			

Annex G: Questionnaires Used and Summary of Results

Table G.1: Actual Accomplishments vs. Targets based on the Project Logical Framework

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
Project goal: Reduction of greenhouse gas emissions from the use of fossil fuel for thermal energy generation in the Sri Lanka industrial sector **Project objective**: Removal of barriers to the realization of sustainable biomass plantation, and adoption of biomass-based energy technologies in Sri Lanka	• No. of companies operating BETs by end-of-project (EOP) (i.e. 2017).	• Limited experience with BETs in industry.	• At least 12 companies are operating BETs by the end of the project and at least another 12 companies have detailed feasibility planned prepared or started installation of BET systems at the end of the project (post-project direct emission reduction).	• A total of 27 companies comprising 8 large and 19 small and medium industries have installed and operating BETs by the EOP.	• EOP target for operating BETs exceeded ahead of schedule. 2016 – 14 2017 – 9 2018 – 4 *Rating: HS*	• Project reports: PIR reports, M&E reports • Field verifications • Statistical information • Technology Demo Completion Reports. • MRV Reports.
	• Total installed capacity and resulting fossil fuel reduction and direct GHG emission reduction of these projects by EOP.		• Total capacity of at least 20 MWth and 1 MWe, resulting in fossil fuel savings of about 295,178 GJ annually, 4,680 MWH of electricity.	• The total installed capacity of industries operating BETs is 25.42 MWth, i.e. 24.336 by large and 1.084 by SMIs). • The resulting fossil Fuel Savings is 355,653 GJ and the electricity Saving is 7,057.4 MWH/year.	• EOP target for installed capacity exceeded by 21%. • EOP target for fossil fuel savings exceeded by 21%, and target for electricity saving exceeded by 109% *Rating: HS*	
	• Cumulative (including indirect) GHG emission reduction by EOP.		• Direct emission reduction (cumulative over 10-year lifetime) of 252 $ktCO_2$ and indirect emission reductions between 756 (bottom-up) and 1,432 $ktCO_2$ (top-down).	• The direct emission reduction (cumulative over 10-year lifetime) is 389.5 $ktCO_2$. The indirect emission reductions are between 1168 $KtCO_2e$ (bottom-up) and 4500 $KtCO_2e$ (top-down).	• Cumulative direct emission reduction target surpassed by 35%. Indirect emission reduction targets exceeded by significant margin. *Rating: HS*	

[4] As per 'Rating Scale' described in the Annex 4.

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
Goal and Objective Overall Rating					**HS**	
Outcome 1: Approved and implemented policy instruments that promote and support the use of sustainably produced fuel wood in industrial thermal applications.	1) No. of approved policy instruments to promote sustainably produced fuel wood in industrial thermal applications by EOP.	• Biomass/fuelwood pricing policy does not exist.	• Regulation for biomass pricing drafted and submitted for cabinet approval.	• Regulation for biomass pricing drafted by SLSEA and submitted to the Ministry seeking the Cabinet of Ministers approval on 06 September 2018.	• Regulations are on the way to Cabinet for approval. *Rating: S*	• Project Progress Reports. • Minutes of meetings. • Submission memos.
Output 1.1 Established and enforced mechanisms for effective cooperation between various government agencies and private sector involved in (regulating) fuel wood production, supply and use for thermal energy generation.	2) Number of government agencies that actively participate in ICRE by 2016.	• 0	• At least 6 agencies participating.	• Nine agencies identified to be members of Inter-Ministerial Officials Committee on Sustainable Biomass Energy (IMCBE), formerly referred to as Inter-Ministerial Committee on Renewable Energy (ICRE), submitted to Cabinet for approval June 20, 2018. [5]	• ICRE Agency structure modified to better fit changes in the administration and submitted for Cabinet approval. • Two Thematic Advisory Committees appointed and actively functioning until the IMCBE is appointed. • *Rating: HS*	• Official notifications • Project reports • Minutes of meetings
	3) Number of private sector institutions actively involved in	• 0	• 25	• 25 private sector institutions actively involved have been identified to be members in	• Framework and 25 members for the Bioenergy	• Report on Bioenergy Consortium; • Minutes of meeting;

[5] The ten IMCBE agencies include Ministry of Power and Renewable Energy, Ministry of Mahaweli Development and Environment, Ministry of Industry and Commerce, Ministry of Agriculture, Ministry of Plantation Industries, Ministry of Lands and Parliamentary Reforms, Ministry of Science, Technology, Research, Skills Development & Vocational Training and Kandyan Heritage, Central Environment Authority, Sri Lanka Sustainable Energy Authority, Mechanical Engineering Department of University of Moratuwa.
The Thematic Advisory Committee on 'Energy Conversion and Technology' is composed of: Sri Lanka Sustainable Energy Authority, Ministry of National Policies and Economic Affairs, Ministry of Mahaweli Development and Authority, National Engineering and Development Center, University of Moratuwa, Industrial Technology Institute. The Thematic Advisory Committee on 'Biomass Production and Supply' is composed of Sri Lanka Sustainable Energy Authority, Ministry of National Policies and Economic Affairs, Ministry of Development & Environment, Forest Department, Ministry of Plantation and Industries and Central Environment Authority

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
	Bioenergy Consortium by EOP			Bioenergy Consortium to be formalized before EOP.	Consortium identified. Will be formalized through Project Board. *Rating: S*	website: www.bioenergysrilanka.org
	4) Long term strategy for biomass energy established in SLSEA/MOPE by year 2016	• No strategy.	• Strategy and Action Plan endorsed by SLSEA Board.	• The strategy and action plan contained in the "Sustainable Energy Program 2015-2025- Towards and Energy Secure Sri Lanka Long-Term Strategy Enforcement Plan for the Energy Sector" was endorsed and approved on 10 February 2016 by SLSEA Board. Regional energy development plan designed and implemented based on the strategy and action plan.	• Achieved and contributing to establishing long-term strategy for biomass energy. *Rating: HS*	• Project Implementation Reviews. • Official notification; project progress reports
	5) Establishment of a biomass cell in SEA by year 2015	• No dedicated biomass division.	• A biomass cell established.	• Biomass Cell established, fully staffed and operational under SLSEA Deputy Director General (Strategy) as of Dec. 2015.	• Target achieved and fully functional. *Rating: HS*	• SEA annual report; official notification; • project progress report
Output 1.2: Proposed, approved and implemented policies/incentive schemes for fuel switching	6) Policy analysis conducted by 2014	• 0	• Policy brief on fossil fuel price influence on the biomass energy market. • Report on pros and cons on fossil fuel subsidies published by year 1, resulting in at least one policy paper and presentation to Treasury officials through SLSEA.	• Draft policy briefs covering standards, pricing, logistics, technology and incentive schemes have been developed for submission SLSEA Board before EOP.	• Target was achieved with significant delay. *Rating: MU*	• Official notification, project technical and progress reports

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
	7) Establishment of database at SLSEA on biomass consumption by EOP	• No database	• Database created by 2016 and updated at least once.	• Biomass database system formulated as a biomass energy portal including data on supply, demand, technology suppliers, investors and financial institutions in March 2016 and adopted in Feb. 2018. • Populating the database on real-time basis using internet-based network commenced from Oct. 2018. • http://www.biomassenergy.lk/	• Target achieved by creating the database as a BE portal and timely updating. *Rating: HS*	• Official notifications, newspaper articles, • Project progress reports
Output 1.3: Enhanced and implemented policies on fuel switching.	8) Amounts of loans guaranteed by Sustainable Guarantee Facility (SGF) by EOP.	• Guarantee facility is operational however restricted to other RE (non-biomass).	• Loans to the amount of LKR 400 million are guaranteed;	• No loans guaranteed yet, but a draft Framework for Sustainable Guarantee Facility submitted to SLSEA Board on January 2018. MOPRE is negotiating with finance authorities to secure approval.	• Activity in process and target completion date not set. *Rating: MS*	• Reports of the SGF • Evaluation reports completed by applicants • Project reports
Outcome 1 Overall Rating:					**S**	
Outcome 2: Enhanced knowledge of and improved support network for sustainable fuel wood production	9) Hectarage of sustainable fuel wood production by 2016.	• 0 for supplying demo projects.	• Hectarage needed for supplying demo projects (outcome 4) with fuel wood is 2,229 ha established as new plantation models.	• 1000 ha of new fuel wood plantations directly supported by the project were established by 2018. • 12,950 tons of previously unutilized by-products and waste streams equivalent to 2000 ha directed to BETs in support of sustainable fuel wood supply. • See footnote[6]	• Target achieved with delays. Modification in planting area was required to manage the financial constraint. *Rating: S*	• As given under each output • Publications reports from project and participating project partners • Statistical info

[6] Based on "Assessment and Mapping of Biomass Consumption in Sri Lankan Industries" carried out by SLSEA on Dec. 2015, 2000 ha computed based on Project Board decision dated 26.01.2016. The "Fuelwood Resource Survey" was carried out by the project in March 2016 to validate the availability of fuel wood resources. Corresponding monitoring and evaluation plan was established. A model biomass energy terminal processing fuel-wood grade biomass waste from agriculture and forestry sectors will be operational from Dec. 2018, which will be the basis for establishing 7 biomass-waste energy terminals to meet the remaining fuelwood in terms of densified fuel from waste.

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
Output 2.1: Prepared and disseminated information and knowledge products on fuel wood growing (models)	10) Number of surveys undertaken by 2016.	• Info available at NGOs and governmen t by studies undertaken before 2011.	• Surveys conducted in 11 districts on biomass resources, land and land use.	• Surveys conducted in 11 districts on biomass resources, land and land use by March 2016 and results disseminated through validation workshops in May 2016 and posted in the web. • http://www.biomassenergy .lk/	• Target achieved on time and output utilized for planning and strategy purposes. *Rating: HS*	• Project technical reports (survey results) • Project progress reports • Official statistics
	11) Publication of handbook on sustainable approaches to biomass growing models by 2016.	• 0	• Handbook published.	• Handbook Published in July 2016 and disseminated through workshops and posting in the web.	• Achieved. Handbook published and widely disseminated to potential users. *Rating: HS*	• Project technical and progress reports • Published Handbook
Output 2.2: Tested and implemented supportive regulations and policies for sustainable fuel wood production	12) Number of lease procedures published by 2016.	• 0	• Lease rates, lease procedures and example contracts published.	• Lease rates, lease procedures and example contracts published and disseminated by May 2016.	• Target achieved timely. *Rating: HS*	• Reports / official notification with procedures and sample contracts • Project progress reports
	13) Indicators and criteria for sustainably produced fuel wood developed and piloted by 2017.	• 0	• Indicators and criteria for sustainably produced fuel wood implemented.	• Indicators and criteria for sustainably produced fuel wood (SLS 1551:2016) and corresponding certification scheme completed and presented in the Validation W/S on 20 Feb 2017. • Auditor training completed June 2016 and Oct. 2017.	• Target achieved by developing national standard and validation. *Rating: HS*	• Project technical and progress reports
	14) Post-project action plan in place by 2017	•	• Post-project action plan formulated for replication of the new approaches.	• Post-project action plan and replication program on new approaches and upscaling was prepared through the project as Phase -2 (Biomass Energy 2022: Fueling the Economy-Protecting the Forest) and approved by the	• Achieved in line with the revised project completion dates. *Rating: HS*	• Report with action plan

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
				Cabinet of Ministers on 5 Nov. 2018. http://www.cabinetoffice.gov.lk/cab/index.php?option=com_content&view=article&id=15&Itemid=49&lang=en&dDate=2018-11-05		
Output 2.3: Completed awareness raising campaigns and specific training programmes for key stakeholders on growing of species for fuel wood production	15) Number of trainings and awareness creating events carried out by EOP.	• 0	• About 40 events held in various places in Sri Lanka with 20 participants each and 120 training days at community level (with 40 participants each).	• 61 events completed in 09 districts and 2287 participated. • 121 total training days and 500 participants issued with certificates.	• Target achieved. Training programmes covering the full-range of topics relating to biomass delivered. Evaluations have confirmed relevance and usefulness. Acquisition of knowledge demonstrated through operational BETs and fuelwood plantations. *Rating: HS*	• Workshop proceedings; training materials and completion reports; • Project reports; • Evaluations completed by participants
	16) Rating of training and community level events by EOP.	•	• 80% rate workshops and events as good/excellent.	• Training evaluations completed. 88% rated training and events as good/excellent.	• Achieved exceeding the level of rating expected. *Rating: HS*	
Output 2.4: Suitable growing models and species for fuel wood production piloted and demonstrated	17) No of improved and expanded sustainable fuel wood production models demonstrated by EOP.	• 0	• 5	• 14 sustainable fuelwood production models developed and demonstrated with 1000 ha[7]	• Target achieved by developing more regionally-appropriate fuelwood production	• Reports with technical assistance results • Report with results sustainable fuel

[7] Over 100 ha model fuelwood plantations under FD, 100 ha under RRISL, 240 ha under CCB, 124 ha under Thalawakele PLC and 460 ha under CBOs.

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
				fuelwood plantations established.	models than originally envisaged, and with Improved flexibility from these models encouraging more fuelwood growers. *Rating: HS*	wood growing; documentary videos; • Press releases
Outcome 2 Overall Rating:					**HS**	
Outcome 3: **Improved confidence among industrial and banking sector on the feasibility, stability and economic benefits of sustainable fuel wood supply chains**	18) Number of supply chains strengthened and developed in a feasible way by EOP.	• Supply chains meet constraints (see barrier section).	• At least six supply chains developed that are sustainable on the longer term.	• 3 large supply chains including Terminals (Monaragala, Colombo, and Kurunegala) in operation by Nov. 2018. • 3 satellite supply chains including mini wood-chippers will be in operation by Dec. 2018.	• Achieved. Late completion has prevented assessing sustainability. *Rating: S*	• As given under each output; • Reports from enterprises and financial institutions
Output 3.1: Proposed, approved and implemented policies and incentive schemes for sustainable fuel wood supply improved.	19) Incentive schemes formulated and approved by 2016	• 0	• Supplier registration achieved and incentive scheme approved.	• Supplier registration completed at the Terminal level. • Suppliers will be included in the Portal after verification. • Incentive scheme for piloting fuelwood plantations identified by DFCC Bank.	• Procedures in place and supplier registration achieved. But an effective incentive scheme is not yet in place. *Rating: MS*	• Official notifications • Project progress reports
	20) Number of applicants scheme by 2016.	0	At least 10 applicants to the scheme.	• Not commenced. • PMU will be guiding some applicants to the identified scheme.	• Target not achieved. A firm plan to operationalize the scheme has not been set. Activity might have required modification. *Rating: MU*	• Reports provided by incentive scheme management; • Project progress reports

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
Output 3.2: Completed outreach programmes for key stakeholders and published and disseminated knowledge products	21) Number of training events and rating of stakeholder participation by 2016.	0	Approximately 18 events held with about 450 participants in total of which 30% staff from finance institutes, 40% staff from fuel wood suppliers and industrial end-users and 30% law enforcement officers; 80% of participants rate the training event as excellent.	• 20 events completed with 980 Participants. • 30% from Finance Institutes, 40% from fuel wood suppliers and industrial end-users and 30% law enforcement officers; • 91% participants rated the training event as excellent.	• Training targets achieved, exceeding the number of participants by 100%, but with some delays. Over 90% rating the training as excellent. *Rating: S*	• Training materials, workshop proceedings; • Evaluations completed by participants; • Completion reports; • Project progress reports
	22) Number of companies that use the voluntary guideline on sustainable supply by EOP	• 0	• At least 10 suppliers have used the guidelines in their investment decision.	• 5 companies used the guidelines. • 2 are in the process of using the guidelines.	• By EOP 50-70% target achieved, confirming the validity of the guidelines for use in investment decisions. *Rating: S*	• Project technical report
Output 3.3: Six sustainable biomass supply chains established and operational	23) Number of feasibility studies and bankable proposals prepared by EOP;	• 0	• Ten feasibility studies prepared, of which 8 have resulted in bankable proposals and at least (NEW) 6 biomass supply chains established and started operations.	• Ten (10) feasibility studies prepared. • 06 proposals have been accepted for funding. • Three biomass supply chains established and operated; 3 scheduled to be completed by EOP.	• EOP target achieved wrt feasibility studies, but delays observed in operationalizing supply chains. *Rating: S*	• Activity reports; • Progress reports on supply chain demonstration projects
	24) Information exchange forum established among supply industry by 2016	• 0	• Forum established with at least 15 participating members; 6 of which are newly established suppliers.	• Information exchange forum established in Feb. 2018 with 31 participating members, including 6 newly established suppliers.	• Target achieved with a delay. *Rating: S*	• Project technical report • Project review reports
Outcome 3 Overall Rating:					**S**	
Outcome 4: Enhanced knowledge of, access to, and maintenance skills of biomass energy	25) Number of companies implementing BETs (gasification, fuel switching, EE improvements) by 2016.	•	• At least 12 companies implement BETs, directly supported by the project; • Number of companies all over Sri Lanka that use	• 27 companies implement BETs directly supported by the project. • 300 companies all over Sri Lanka use BETs as reported	• Target wrt operational BETs supported by the project achieved in timely manner and	• As given under each output • Official statistics • Results of survey amongst industrial

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
technologies as well as increased number of wood-based gasification projects			BETs (t.b.d. in 2 surveys, baseline and end of project).	from survey conducted in July 2016. • 715 companies use modern BETs as per survey conducted by SLSEA in Nov. 2018.	exceeded by 100% over the project life. • Companies using BETs increased by 138% over the project life. *Rating: HS*	and commercial establishments
Output 4.1: Biomass thermal energy projects including Cogeneration and Trigeneration systems implemented, operational and monitored	26) Number of feasibility studies completed by 2017.	• 9 larger scale companies have expressed willingness to participate (see co-fin letters).	• About 24 companies have carried out completed feasibility studies, of which have resulted in operational BETs; and improved wood storage in 12 companies and 30 small and medium scale industries in operational BETs.	• 31 companies have completed feasibility studies supported by the project by 2017 including 8 large BETs. • Twenty (20) Operational BETs established with co-finance from companies. • 8 Large and 19 SMIs have project-supported, operational BETs and improved wood storage.	• Target for feasibility studies achieved ahead of schedule and exceeded by 29% by EOP. Operational BETS established with co-finance from the company. • Target wrt operational BETs with improved wood storage reached. *Rating: S*	• Reports with feasibility analysis, construction design; • Financial proposals
Output 4.2: Established information database and information exchange system for biomass energy technologies	27) Technical information provided to industries on available and improved biomass energy technologies by 2014.	• 0	• Manual prepared and disseminated widely through project partners and media, on successful gasification applications and challenges, remedial actions and technical support.	• Manual on technical information and improved biomass energy technologies prepared and disseminated in July 2016. • In addition, reports on Assessment and Mapping, and Leaflets and publicity material prepared and disseminated.	• Target wrt information development and dissemination achieved. *Rating: S*	• Mid-term review • Industrial survey by SLSEA
	28) Number of companies that use the database on BET-using industries, national and international technology	• 0	• At least 15 companies have used the database info in their BET investment decisions.	• 20 Companies have used the database info (on BET-using industries, national and international technology suppliers and service	• Target exceeded. *Rating: HS*	• Project report

Strategy	Indicator	Baseline	EOP Values		Observations/ Rating[4]	Source of verification
			Targets	Actual November 30, 2018		
	suppliers and service providers by EOP.			providers) in their investment decisions.		
	29) About 40 million LKR investments resulting from the matchmaking and training events by EOP.	• 0	• At least 5 companies have taken BET-related investment decisions (in addition to the companies directly supported by the project).	• 441 Million LKR investments by 7 companies who have undertaken BET investments on their own based on feasibility studies supported by the project.	• Target for own investment by BET companies exceeded by 10-folds through matchmaking and training. *Rating: HS*	• Event proceedings; • Project progress reports
Output 4.3: Completed trainings to support fuelwood based sustainable industrial energy supply	30) Number of trainings, workshops held for staff of companies adopting BET by EOP.	• 0	• At least 10 events, organized with a total of 250 participants from technology and service providing companies; At least 80 staff (in particular operators from the participating companies) trained in O&M.	• 12 events conducted with a total of 783 participants from technology and service providing companies. • 106 staff (operators from the participating companies) trained in O&M.	• Target wrt events exceeded by 20% and the number of participants by 213%. • Target for training O&M operators exceeded by 33%. *Rating: HS*	• Workshop proceedings, training materials; • Project progress reports
	31) Number of awareness raising events and trainings organized by 2016	• 0	• About 18 events	• 61 events conducted with 121 training days and 2287 participants by EOP, with 12 events and 61 training days in 2015 and 2016 (Table provided).	• Target achieved with activity expanded 300% to meet identified needs. *Rating: HS*	• Announcements; • Event proceedings and websites; • Training materials
	32) Number of trained officials by 2016.	• 0	• 450 national and local-level officials trained.	• 550 national and local-level officials trained in 2015/2016 with a total of 2287 trained by EOP.	• Target surpassed by stipulated time and increased to 400% by EOP. *Rating: HS*	• Evaluations completed by participants; • Training completion reports
Outcome 4 Overall Rating:					***HS***	
PROJECT OVERALL RATING:					***HS***	

Table G.2: Summary of Financial Performance at the Outcome Level as of November 30, 2018

Project Strategy	Total Budget for all Years (As per ProDoc) [A]	Total Budget for all Years (Revised- as per Post-MTR)	Total Expenses up to MTR-01 Jan 2013-30 Jun 2015 [B]	Budgeted (US$)- Revised (As per post-MTR budget)					Actual Expenses (US$) as of November 30, 2018 (including anticipated)					% Actual Total Expenses/ Total Budgeted (%) [B+C]/[A]
				2015 (Year 3)	2016 (Year 4)	2017 (Year 5)	2018 (Revised)	Total 2015 to 2017 (Year 3 -5)	2015 (01 July 2015-31 Dec 2015)	2016	2017	2018 (01 Jan-30 Nov 2018) including commitments until Dec 2018	Total (01 July 2015-30 Nov 2018) [C]	
Outcome 1	154,814	154,815	16,649	59,431	45,800	34,681	12,800	139,912	34,529	33,960	61,654	29,319	159,462	113.76
Outcome 2	950,000	950,000	20,408	176,000	495,000	270,977	190,908	941,977	127,085	264,717	346,880	170,908	909,590	97.89
Outcome 3	276,604	413,352	22,106	62,188	235,829	95,506	33,321	393,523	14,230	70,236	81,395	81,879	247,739	97.56
Outcome 4	505,582	392,856	37,353	88,955	198,500	85,950	35,879	373,405	105,811	162,915	120,737	64,144	453,607	97.11
Project Mgt	109,250	84,781	65,416	15,950	20,221	7,811	7,109	43,982	(4,048)	15,939	24,887	4,947	41,724	98.07
Unrealized Gain/Loss		447	593					-	77	758	287	479	1,601	
Total	**1,996,250**	**1,996,250**	**162,525**	402,524	995,350	494,925	280,018	1,892,799	277,684	548,524	635,840	351,675	1,813,723	**99.00**

Table G.3: Project Co-financing - Actually Realized vs. Commitment

Contributor	Classification	Committed Value of Inputs as indicated in ProDoc (USD)	Actual Co-Financing as of November 30, 2018 (USD)	% Realized	List of Inputs
GOVERNMENT					
SLSEA	In-kind and cash	3,636,364	9,265,500	255%	Establishment of the Biomass Cell and and hosting PMU and related facilities
Forest Department	In-kind and cash	1,636,364	1,016,669	62%	Contribution for establishing of the fuelwood growing models, fuelwood nurseries and capacity building of the community
Ministry of Mahaweli Development and Environment	In-kind	-	55,000		PMU hosting and related facilities
Coconut Cultivation Board	In-kind	1,818,180	1,068,105	59%	Contribution for establishing of the fuelwood growing models, fuelwood nurseries and capacity building of the community
Rubber Research Institute	In-kind		1,202,684		Contribution for establishing of the fuelwood growing models, fuelwood nurseries and capacity building of the community
Sub total		**10,023,863**	**12,607,959**	**126%**	
PRIVATE SECTOR					
Nilmini Estate	Cash	90,919	42,304	47%	Co-financing of a biomass boiler and dryer installation
Jetwing	Cash		83,544		Co-financing of a biomass boiler and absorption chiller installation
Mahir Brothers,Katugastota	Cash		5,732		Co-financing of biomass dryer installation
Lanka Spice Center, Werellagama	Cash		2,866		Co-financing of biomass dryer installation

Contributor	Classification	Committed Value of Inputs as indicated in ProDoc (USD)	Actual Co-Financing as of November 30, 2018 (USD)	% Realized	List of Inputs
Wishmitha Dasabala Poshana, Thalawa	Cash		846		Co-financing of biomass dryer installation
Nutri Food Packers, Kopay	Cash		921		Co-financing of biomass dryer installation
Sanota Blue Heaven Inn, Nuwaraeliya	Cash		755		Co-financing of biomass water heater system installation
Hotel Green Palace, Nuwaraeliya	Cash		755		Co-financing of biomass water heater system installation
Cultural Heritage (Pvt) Ltd	Cash		83,544		Co-financing of a biomass boiler and absorption chiller installation
Richme Foods & Dairies	Cash		2,436		Co-financing of biomass water heater and milk processing system installation
Ran Lanka Spice	Cash		6,592		Co-financing of biomass dryer installation
Wasana Products	Cash		983		Co-financing of biomass dryer installation
Henatanne Tea Factory	Cash		57,410		Co-financing of biomass boiler installation
Neoprex (Pvt) ltd	Cash		463,152		Co-financing of Biomass Fired Thermal Oil Heater installation
Packwell Lanka (Pvt) Ltd	Cash		54,798		Co-financing of Biomass Fired Smoke Tube Boiler installation
Ansell lanka (Pvt) Ltd	Cash		2,313,720		Co-financing of Biomass Fired Hot Water Boiler installation
Hero Nature (Pvt) Ltd	Cash		34,655		Co-financing of biomass boiler installation
Sathya Cashew	Cash		1,003		Co-financing of biomass dryer installation
IAAM (Pvt) Ltd	Cash		1,003		Co-financing of biomass dryer installation
Kusumsiri Motors (Data Base development)	Cash		2,370		Co-financing of facilitating of biomass energy portal
Maxtherm Lanka Utility Service (Data Base development)	Cash		1,443		Co-financing of facilitating of biomass energy portal

Contributor	Classification	Committed Value of Inputs as indicated in ProDoc (USD)	Actual Co-Financing as of November 30, 2018 (USD)	% Realized	List of Inputs
Kusumsiri Motors (biomass terminal)	Cash		77,583		Co-financing of establishment of biomass energy terminal
Maxtherm Lanka Utility Service (biomass terminal)	Cash		32,482		Co-financing of establishment of biomass energy terminal
Eco Therm Energy Solutions (biomass terminal)	Cash		47,959		Co-financing of establishment of biomass energy terminal
Subtotal		**6,181,092**	**3,318,858**	**54%**	
NGOs					
ARUNALU	In-kind & cash	85,000	65,870	88%	Contribution for establishing of the fuelwood growing models, fuelwood nurseries and capacity building of the community
WANASARANA	In-kind & cash		25,563		Contribution for establishing of the fuelwood growing models, fuelwood nurseries and capacity building of the community
SLEES	In-kind & cash		303,462		Contribution for establishing of the fuelwood growing models, fuelwood nurseries and capacity building of the community
VOICE	In-kind & cash		182,866		Contribution for establishing of the fuelwood growing models, fuelwood nurseries and capacity building of the community
MIHIMAW	In-kind & cash		11,608		Contribution for establishing of the fuelwood growing models, fuelwood nurseries and capacity building of the community
Subtotal		**85,000**	**589,369**	**693%**	
GEF Implementing Agencies					

Contributor	Classification	Committed Value of Inputs as indicated in ProDoc (USD)	Actual Co-Financing as of November 30, 2018 (USD)	% Realized	List of Inputs
UNDP	In-kind	402,000	402,000	100%	Staff time in project management and operations together with other logistics such as office space, computers, stationary, vehicle and local travel which are not covered by GEF resources.
FAO	In-kind	461,755	400,000	87%	Staff time in project management and operations together with other logistics such as computers, stationary and local travel which is not covered by GEF resources and includes expenditures incurred under the other donor funded projects implemented by UNPD who replicated and implemented biomass growing and technologies.
Subtotal		863,755	802,000	93%	
TOTAL		**17,153,710**	**17,318,185**	**101%**	

Annex H: Evaluation Consultant Agreement Form

Evaluation Consultant Agreement Form[8]

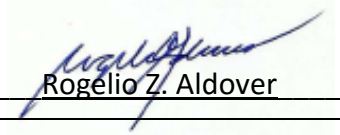
Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Rogelio Z. Aldover

Name of Consultancy Organization (where relevant)**:** Independent Consultant

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

Signed at *United Nations Sri Lanka* on *15 November 2018*

Signature:  Rogelio Z. Aldover

Evaluation Consultant Agreement Form

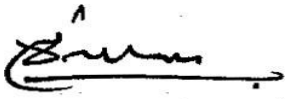
Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Nihal Atapattu

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 *United Nations Sri Lanka* on *15 November, 2018*

Signature: 

[8] www.unevaluation.org/unegcodeofconduct

Annex I: Report Clearance Form

(to be completed by CO and UNDP GEF Technical Adviser based in the region and included in the final document)

Evaluation Report Reviewed and Cleared by:

UNDP Country Office:

Name: Tharuka Dissanaike

Signature: _____ Date: 17.01.2019

UNDP GEF RTA:

Name: _____

Signature: _____ _____ Date: _____

Annex J: TE Audit Trail

To the comments received on 2 January 2019 from the Terminal Evaluation of

Promoting Sustainable Biomass Energy Production and Modern Bio-Energy Technologies (UNDP *PIMS 4096)*

The following comments were provided in track changes to the draft Terminal Evaluation report; they are referenced by institution ("Author" column) and by comment number ("#" column):

Author	#	Para No./ Comment Location	Comment/Feedback on the Draft TE Report	Evaluator Response and Actions Taken
UNDP	1	Summary of Recommendations	Include Evaluation Mission recommendations on the formalizing of the inter-ministerial committee and bi-annual meetings	Agreed. Updated relevant portions (pages vi, viii, 10, 27, 41, and 42) and added a recommendation as suggested
UNDP	2	Recommendations	Recommendations made are quite time sensitive and will not be completed as part of the current project (GEF 04). So please ensure that it is mentioned that the recommendations are for the Phase II project	Agreed. Inserted the phrase: "…in the post-project follow-up plan as the next phase of the Biomass Energy Program" (pages vii and 42). All recommendations have been framed in the context of existence of Biomass-Phase 2 project.
UNDP	3	Rating Summary-Rating on overall likely hood of sustainability	Request to reconsider the Sustainability rating considering the government co-financing committed for the second phase of Rs 550 million as approved by the cabinet.	The sustainability rating originally assigned is 'L' as described in the relevant sections of the text. The typographical error showing 'S' instead of 'L' has been corrected.
UNDP Regional	4	GEF Core Indicators in lieu of TT	GEF Core Indicators in lieu of TT will be needed in MTR and TE for GEF-6 projects. As checked, the Biomass project is GEF-4, so the project doesn't need to replace TT with GEF Core Indicators in the TE.	Agreed. Both TT and GEF Core indicators are available, in any case.

Annex K: Terminal GEF Tracking Tool
(in separate Excel File)