SRI LANKA
SUSTAINABLE ENERGY AUTHORITY

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United Nations Development Programme
Country: Sri Lanka
PROJECT DOCUMENT

Project Title: Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors in Sri Lanka

UNDAF Outcome(s) 2013-2017: Outcome #4: Policies, programs and capacities to ensure environmental sustainability, address climate change, mitigation and adaptation and reduce disaster risks in place at national, sub national and community levels

Expected CPAP Output (s): Output 4.3: Technologies and approaches used by government and private sector towards Climate Change Mitigation (CCM) improved.

Expected Output Indicator(s): Amount of Green House Gas (GHG) emissions reduced as a result of promotion of renewable energy and energy efficiency technologies

Executing Entity/Implementing Partner: Ministry of Power and Energy (MPE)
Implementing Entity/Responsible Partners: Sri Lanka Sustainable Energy Authority (SLSEA), Ministry of Environment (Climate Change Secretariat) and UNDP

Brief Project Description

Sri Lanka is highly dependent on imported oil to meet its energy needs with 49% of the primary energy supply coming from imported fuel, where 12% of the total government budget is used for electricity generation alone. This is leading to a heavy reliance on imported fossil fuels and increased GHG emissions. The National Energy Policy of Sri Lanka seeks to diversify supply mix with renewable energy resources whilst seeking to reduce energy demand through demand side management. The Renewable Energy Resources Development Plan seeks to achieve 20% from renewable energy resources by 2020 and 30% by 2030 as part of the national strategy to reduce GHG emissions through appropriate mitigation actions (NAMA). Energy Management Plan (EnMAP) seeks to achieve energy savings from the promotion of EE measures. Often the GHG savings and the cost-benefits of these low carbon interventions are not systematically quantified and their benefits remain obscure and done on ad-hoc basis. It is difficult for sub-national entities to assess the impact of their NAMA interventions at the sectors and sub-sectors level.

In order to fill these gaps, the development of a robust, transparent and functional NAMA framework along with clear inventory and MRV system with supporting governance and oversight (NAMA Secretariat, NAMA Coordinating Entity, NAMA Implementing Entity, MRV Committee, and NAMA Registry) is needed. Such framework will systematically quantify GHG savings and benefits of the mitigation interventions using a bottom up approach to aggregate from the provincial and sub-sector levels to the national and sectors level. Furthermore, such a transparent framework will open up opportunity to access regional and international climate funding. In order to achieve this, the project will support appropriate climate change mitigation actions in the energy generation and end-use sectors as part of the initiatives to achieve the voluntary GHG mitigation targets of Sri Lanka

To test and verify the framework, this project will seek to overcome the regulatory, institutional, technical, financial and social barriers for the scaling up of RE and EE NAMA through the dissemination of 1,000 bio-digesters, 1,300 high efficiency motors in tea factories, and 205 solar PV net metering systems with battery storage. Furthermore, the project will:

1. Develop a robust provincial inventory system that could be updated periodically and aggregated at the national level using web-based EnerGIS database management system
2. Develop a decision making tools such as MACC tools for analyzing and prioritizing a pipeline of bankable NAMA that could be implemented

3. Leverage public, private and CSOs resources through the NAMA Implementing Entity for the implementation of bankable RE and EE NAMAs based on viable and cost effective business models to incentivize value chain actors to reduce supply risks and create demand and
4. Develop a robust and transparent MRV system that are accurate, reliable and credible and avoid double accounting.

During the implementation, in addition to GEF fund of USD 1,790,411 and UNDP fund of USD 250,000; the project will be supported by in-kind contribution and parallel activities from the government (SLSEA, MPE) to an amount of USD 3,400,000 and USD 230,000 and from private sector with an amount of USD 22,000,000. Thus, total resource for project implementation is USD 27,670,411.

Program Period	: 2015-2018	Total resources required:	$27,670,411
Atlas Award ID	: 00079409	• UNDP (Grant):	$ 250,000
Project ID	: 00089391	• GEF:	$ 1,790,411
PIMS #	: 5232	Other (partner managed sources)	
Start date	: January 2015	• SLSEA (Grant):	$ 3,400,000
End Date	: December 2018	• MoPE (in-kind):	$ 230,000
Management Arrangements	: NIM	• Private sector (Investment):	$ 22,000,000
PAC Meeting Date	:		

Agreed by (Ministry of Power and Energy): _____ Date/Month/Year

Agreed by (UNDP): _____ 10 June 2015 Date/Month/Year

Table of Contents

Acronyms and abbreviations

ADB	Asian Development Bank
APR-PIR	Annual Performance Report / Project Implementation Review
BEASL	Bio Energy Association of Sri Lanka
BUR	Biennial Update Reports
CDM	Clean Development Mechanism
CEB	Ceylon Electricity Board
CFL	Compact Fluorescent Lamps
CCS	Climate Change Secretariat
DFCC	Development Finance Corporation of Ceylon
EE	Energy Efficiency
E-FRIENDS	Environmentally Friendly Solutions Fund
EM	Energy Management
EnMAP	National Energy Management Plan
ESCO	Energy Supply Company
ESD	Energy Service Delivery Project
GDP	Gross Domestic Production
GEF	Global Environment Facility
Gg	Giga gram
GoSL	Government of Sri Lanka
GWh	Gigawatt Hours
HH	Household
HNB	Hatton National Bank
IPP	Independent Power Producers
ITDG	Intermediate Technology Development Group
kg	Kilo Gram
ktoe	Kilo tonne of Oil Equivalent
kWh	Kilo Watt Hours
LECO	Lanka Electric Company
LKR	Sri Lanka Rupees (LKR 130 to 1 USD)
LPG	Liquefied Petroleum Gas
MAC	Marginal Abatement Cost
MACC	Marginal Abatement Cost Curves
MT	Metric Ton
MW	Mega Watt
NAMA	Nationally Appropriate Mitigation Actions
NCRE	Non-conventional Renewable Energy
NDB	National Development Bank
NERDC	National Engineering Research & Development Centre
NGOs	Non-governmental organizations
NRE	National Renewable Energy
PFIs	Participating Financial Institutions
PoA	Program of Activities
PUCSL	Public Utilities Commission Sri Lanka
PV	Photo Voltaic
RE	Renewable Energy
RERED	Renewable Energy for Rural Economic Development
SGF	Sustainable Guarantee Facility
SHS	Solar Home Systems
SLCF	Sri Lanka Carbon Fund
SLSEA	Sri Lanka Sustainable Energy Authority
SPP	Small Power Producers
SPPAs	Small Power Purchase Agreements
TNC	Third National Communication
TOE	Ton of Oil Equivalent
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework and Convention on Climate Change
USD	United State Dollars
WB	World Bank

List of Tables

List of Figures

List of Boxes

List of Annexes

1. SITUATION ANALYSIS

1.1 Introduction to Sri Lanka

With a GDP per capita of US$ 3,194 (2013) and ahead of most South Asia countries, Sri Lanka has become a lower middle-income country in 2010. The country is shifting over the last decade from a predominantly rural-based economy to an urban economy geared towards manufacturing and services that accounted for 30% and 59% of the economy respectively, whilst agriculture only contributed 11%. Growth in Sri Lanka has been relatively inclusive, with poverty rates declining dramatically to 9 percent in 2010 from 22 percent in 2002. Moreover, inequality in per capita consumption expenditure has declined as reflected by a drop in the Gini coefficient from 0.40 to 0.36 between 2002 and 2010. Sri Lanka notably outperforms the South Asia average on progress towards meeting the Millennium Development Goals. While South Asia as a whole is on track or is an early achiever for only nine indicators, Sri Lanka manages this for 15 of the 22 Millennium Development Goal indicators (WDI 2013). Sri Lanka has population (provisional 2013) of 20,483,000 with average literacy rate of 96 %.

Figure 1: Map of Sri Lanka

1.2 Energy Situation in Sri Lanka

Electricity Generation Capacity: Sri Lanka is the only country in the region to have installed adequate generation capacity (presently over 3,300 MW installed capacity generating around 12,000 GWh annually) to meet the demand. However, Sri Lanka's power supply is heavily reliant on fossil fuel-based thermal power plants. The share of fossil fuel-fired power gradually increased from 1995 and quickly reached 54.2 percent in 2000, and has remained over 50 percent.

Energy Demand and Growth: With the increasing demand for energy to provide for the country's economic and social development, the total primary energy demand is expected to increase to about 15,000 ktoe by the year 2020 at an average annual growth rate of about 3%. Electricity and petroleum sub-sectors are likely to record higher annual growth rates of about 7-8%.

Indigenous Energy Sources: Biomass, hydro, solar, wind and biogas are the main indigenous energy sources commercially developed and available in Sri Lanka. The actual use of these sources is limited by technological, socio-economic and political reasons. Of five main renewable resources, Solar could be treated as the most developed, next is Small Hydro Power (mini, micro and pico) and followed by Biogas. The large hydro market is fully developed in terms of technology, equipment, construction, financing, maintenance & operation. Biogas has around 78% success rate especially when the Chinese continuous systems are adopted. The Wind market is rapidly developing, but due to the required grid up gradation to the needed standards, growth has been paused. The Biomass market for power generation and thermal applications of industry and commercial sectors is also not well developed despite its high potential mainly due to fuel supply constraints.

Fossil Fuel: The country has no domestic production of coal, crude oil, or natural gas, and as a result, all the fossil fuel demand is met through imports. Petroleum, among imported sources, provides substantially to the energy supply, while coal also significantly impacts the energy supply with the

commencement of commercial operation of coal power plants. In response to rising power generation costs, the Government approved the construction and operation of two coal-fired power stations with a total capacity of 1,400 MW, of which 900 MW plant in the Norochcholai has already been commissioned.

Primary Energy: At present, the larger share of the total primary energy supply is met with biomass at 46.4% and petroleum at 43.0%. Coal accounts for 3.8%, followed by 5.4% of hydro power and 1.5% of New Renewable Energy (NRE).

Secondary Energy: Electricity remains the main secondary energy source. The total amount of electricity generated during 2013 was 11,962 GWh out of which 28% was from oil burning, 12% from coal power plants and 58% from hydro power plants while the balance 2% was from non-conventional renewable energy (NCRE) sources.

Commercial Energy: The commercially traded forms of energy used in Sri Lanka are limited to electricity, petroleum and coal. Only about 25% of biomass used in the country is commercially traded.

Renewable Energy: Most of the country's hydropower resources have already been developed. Studies have indicated that there is a large potential for wind, solar power and biogas development. Full exploitation of these wind and solar resources is delayed, in view of the severe constraints imposed by the quality of grid, and energy demand profile of the country.

Biomass: Biomass is still the largest energy supply source, satisfying a greater portion of the cooking energy requirements of the domestic sector. Use of fuel wood for cooking is a health hazard in rural homes. In general, the use of biomass, is expected to regain a part of lost share in future, due to increased use by industries for thermal applications.

Solar Net Metering: Solar net metering schemes attracted the attention of electricity users in 2012, resulting in several net-metered installations (over 500) with typical capacities of 2 – 5 kW.

LPG: Penetration of LPG is increasing, displacing a portion of the biomass use in the domestic sector for cooking.

Grid Electricity Coverage: Present level of electrification (coverage of the national grid) is around 96%. In addition, off grid community and household installations are also supplying electricity to remote households, thus reducing the share of un-electrified households to very low levels in comparison with other countries in the region. Government target is to achieve the total coverage before 2016.

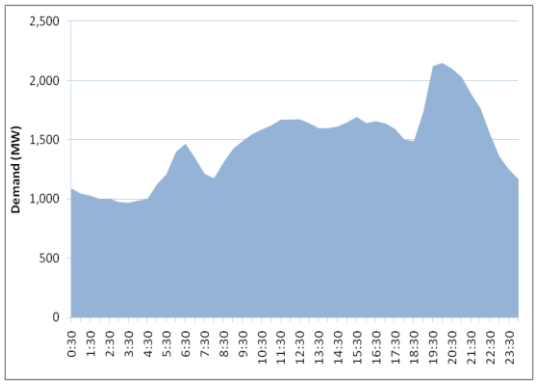
Energy Usage: Largest energy consuming sector is the household, commercial and other sectors, using a share of around 50% of the country's total energy demand. In 2013, transport sector accounted for 28.8% of the national energy demand, and the entire energy requirement of the transport sector was met through imported liquid petroleum (Table 1). The industrial sector energy consumption share was 25.4% compared with the commercial and household sector share of 45.8%. Energy use in agriculture is insignificant.

Table 1: Composition of Energy Usage and the Trend

Energy Use (ktoe, delivered to customers)	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**
Industry	1,679.0	2,011.1	2,072.0	2,175.7	2,272.7	2,261.3
Transport	1,660.6	2,088.6	2,370.3	2,459.7	2,670.2	2,565.7
Household, commercial and others	3,855.7	3,918.2	4,312.9	4,284.9	4,179.2	4,075.5
Agricultural		14.1	10.1	6.8	2.5	3.2
Total Energy Use	**7,195.4**	**8,031.9**	**8,765.5**	**8,927.2**	**9,124.7**	**8,905.7**
Energy Intensity of the Economy						
Primary Energy Intensity (toe per million LKR of GDP)	41.1	37.97	30.61	29.64	27.99	25.55

Commercial Energy Intensity (toe per million LKR of GDP)	13.2	13.12	10.76	10.28	10.38	9.30
Energy use per person						
Energy use (kgoe/person)	389.6	408.38	424.42	427.77	448.87	434.78
Commercial Energy Use (kgoe/person)	153.42	176.68	186.91	191.84	210.43	200.59
Electricity Sold (kWh/person)	294.7	368.76	445.87	478.70	512.06	515.28
Petroleum Sold (kg/person)	166.1	183.85	180.44	198.62	214.21	177.35

(**Source**: Sri Lanka Sustainable Energy Authority, 2014)



(Source: Sri Lanka Sustainable Energy Authority**)**
Figure 2: Daily Load Profile of Electricity Demand

The daily load curve is highly skewed, with a high evening peak lasting for about three hours. This has been an additional burden to the utilities, whereas a flatter load curve would have made existing plants operate more evenly reducing the necessity to add new capacity to serve the high peak.

Household Energy Use: In the case of domestic sector, around 95% of the population is fed by the national grid and 1-2% is fed by off-grid power plants, which are mainly based on renewable energy resources. The un-electrified rural communities have access to biomass (average 131 kg/month/HH) and kerosene (3.6-7.4 liter/month/HH), which are the major sources for cooking and lighting respectively.

Household Income & Expenditure on Energy: An analysis of expenditure on energy (fuel and lighting) per household per month shows a countrywide average of LKR. 1,724 (USD 13.26). However, province-wise expenditure varies widely. Mean household expenditure on Fuel & Lighting in 2012 was 6.8% of non-food expenditure while it was 17.6% for transport & communication. The main source of cooking fuel in the urban and peri-urban population are bottled LPG (8-11 kg/HH/month). These two figures very roughly give an indication of expenditure on energy though the latter also includes the cost of communication.

Cost of Electricity: The high reliance on fossil fuel-fired power, together with growing international oil prices, has pushed up the cost of electricity generation in Sri Lanka as the highest in South Asia.

Grid Emissions: The Grid Emission Factors calculated for 2012 gives the Simple Operating Margin as 0.7035 tCO_2 /MWh, the Build Margin as 0.7665 tCO_2/MWh and the Combined Margin as 0.7193 tCO_2/MWh[1].

[1] http://www.energy.gov.lk/pdf/special_publications/GEF_Web.xls

1.3 Goals for Energy Efficiency and Renewable Energy

Energy Efficiency: Keeping the economic development goals of Sri Lanka in focus and anticipation of a strong growth in the industrial sector, retaining the present levels of energy intensity of economy will not be pursued. However, all possible measures to decouple the economic development from energy demand growth will be made, targeting an energy intensity of economy of 500 toe/XDR million by 2017. This will ensure a 20% saving of energy with respect to 2010 energy consumption. The desired objectives are as follows; (i) A complete mechanism for delivery of energy efficiency services, (ii) A comprehensive capacity development program, and (iii) Energy conscious nation.

Renewable Energy: Sri Lanka places renewable energy development as a high priority and considers it to be one among the nine main elements of the country's national energy policy. In this plan, the target for renewable energy share in the grid electricity generation mix is 20% by 2020, from 10% by 2015. The guiding principle in implementing the government policy will be the offering of incentives to developers/investors of RE-based power generation projects at the early stages of project development and to evolve the power generation industry to work through market based instruments. This will be done continuously until RE-based power generation reaches grid parity, making it a worthy competition to conventional power generation options that are mainly fossil fuel based.

1.4 GHG Emissions

According to the SNC (2011), the total GHG emission for the energy sector has nearly doubled from 5,447 (1994) to 10,430 Gg CO_2e in 2000. The energy sector accounted for 58.9% of the total national GHG emissions (Table 2). The agriculture sector accounted for the second highest GHG emitter at 26.6%, followed by the waste sector (11.5%) and the industrial sector (2.8%). Overall, 60% of the emissions are from the combined energy and energy end use sectors. Of this, about 50% of the emissions are from transport, and nearly 30% are accounted for by the energy industry. The residential/commercial sector accounted for about 11.5% of the emissions from the energy and energy end use sectors. (Figure 3).

Table 2: Sri Lanka GHG emissions in 2000 (Source: SNC, 2011)

Sector	**GgCO_2e**	**%**
Energy	10,430	58.9%
Industry	492	2.8%
Agriculture	4,709	26.6%
Land Use Change & Forestry	45	0.3%
Waste	2,033	11.5%
Total	**17,710**	**100.0%**
Energy and Energy End Use Sector	**GgCO_2e**	**%**
Fuel combustion	10,430	100%
Energy Industry	3,065	29.4%
Industry	842	8.1%
Transport	5,058	48.5%
Household and Commercial	1,196	11.5%
Refinery	268	2.6%

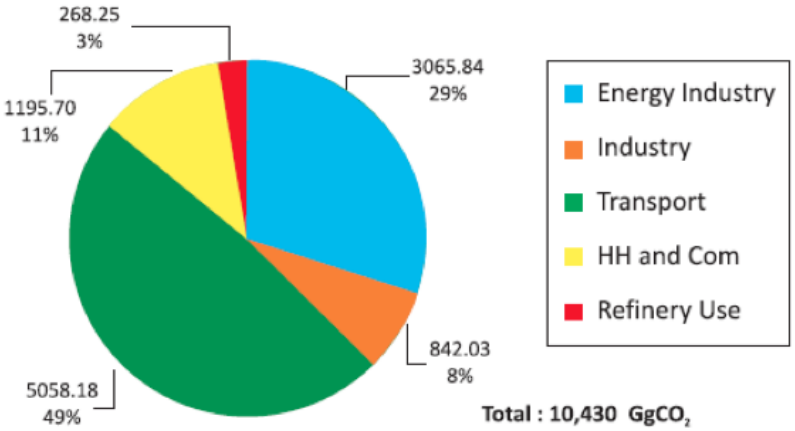


Figure 3: GHG emissions from different sectors of economy in Year 2000
(Source: SNC, 2011**)**

In the area of climate change mitigation in the energy generation and energy end-use sectors in Sri Lanka, the various currently implemented projects and programs are those that are in support of the existing energy policies/plans/programs such as the: National Action Plan for the Haritha Lanka Program (January 2009); Mahinda Chintana (National Development Framework, Vision for the Future) (2010); Renewable Energy Resources Development Plan (RERDP – 1/2012) for the promotion of renewable energy; and Energy Management Plan (EnMAP) for the promotion of energy efficiency; SNC (2011); and Technical Needs Assessment (2011). National voluntary emissions reduction targets set under different policies, are primarily guided by the following: National Energy Concession Plan (NECP); Renewable Energy Road Map (RERM)-2042; and The Haritha Lanka (Green Lanka) Strategy and Action Plan on Sustainable Development (HLP).

There are also a number of plans, initiatives and projects that are under implementation to meet the energy targets that were set through the various established relevant plans, policies and programs. These current initiatives are expected to generate energy savings (from fossil fuel consumption reductions) and consequently bring about GHG emissions reduction, and will contribute in the realization of the targets set by, among others, the EnMAP and the RERDP.

1.5 Availability of funding for renewable energy, energy efficiency and energy conservation

The funding landscape of Sri Lanka in renewable energy projects has witnessed a dramatic change with the introduction of Energy Service Delivery (ESD) project in 1997 with a concessionary credit line (USD 19.7 m) supplemented with a GEF grant of USD 3.8 m. Since then, there had been many funding programs such as; Renewable Energy for Rural Economic Development (RERED) project (2003), Environmentally Friendly Solutions Fund (E-FRIENDS), etc.

Both the ESD Project and the RERED Project were concerned with addressing the issue of providing long term financing support for renewable energy investments. Such measures have served the purpose excellently, with capacity installed often surpassing targets. However, given the magnitude of the task still ahead, the need to formulate a viable long term financing mechanism to augment electricity generation, transmission, distribution and demand management throughout the country, remains a critical need. Although there are some support mechanisms at present, the required financing for EE/RE projects to help achieve the country's energy targets is not proportional to the financing made available through the existing financial tools and incentives to de-risk investment in the country.

Sustainable Guarantee Facility (SGF): SLSEA established the Sustainable Guarantee Facility (SGF) (earlier known as the Sri Lanka Sustainable Energy Fund) to address technical and financial guarantees for the promotion of energy efficiency and allocated an annual budget of US$ 1.5 million to support implementation of projects and programs on the ground. This annual budget will be used for the

implementation of energy efficiency demonstrations under the proposed GEF project and will be part of the co-financing for four years totaling LKR 6.5 million. Participating financial institutes for SGF are Hatton National Bank (HNB), Sampath Bank, Commercial Bank, NDB Bank, DFCC Bank, Seylan Bank, and Bank of Ceylon.

Incentives: All types of incentives ("Financial" and "Non-financial") are available for the promotion and utilization of RE and EE options in Sri Lanka in varying degrees for different target groups. In some cases, these incentives are available as a package while in some cases it is just one of them depending on the need. Some incentives have been introduced with a clear plan of phasing out obsolete technologies with exit strategies.

In the early days, many NGOs such as Practical Action (formerly ITDG) operating in this field offered grants for the developers as well as end users. Soft loans schemes such as ESD, RERED and even E-FRIEND, consisted of grant components. Some Provincials Councils such as "Uva" and "Sabaragamuwa" offered financial incentives to offset the upfront cost of low-income end users of Solar Home Systems and Village Hydro projects. Free services of State, NGO and even private sector are available mostly in the form of training, awareness raising and advisory services.

For the RE and EE interventions to remain viable and sustainable beyond the GEF project, there is a need to develop sound business opportunities with cost effective matching rebate and portfolio partial loan guarantee scheme for incentivizing value chain actors as detailed in Annex B (bio-digesters), C (solar PV net metering), and D (high efficient motors in tea factories).

Private Investment and Enabling Business Environment: It is estimated that over 100 organizations are commercially involved in a rapidly growing RE and EE industry in Sri Lanka, which includes grid-connected, off-grid community and household based renewable energy systems. The stakeholders include microfinance institutions, commercial and development banks, NGOs, project developers, consultants, and equipment suppliers.

Leveraging Carbon Fund: Sri Lankan government is actively seeking to leverage carbon and private sector resources by establishing the Sri Lanka Carbon Fund (Pvt.) Ltd. (SLCF)[2] as a dedicated institution to encourage and facilitate investors to use voluntary carbon market to mitigate country's GHG emissions. SLCF with the help of the Korean Environmental Corporation (KECO) has registered two Program of Activities (PoAs) and has the capacity to serves as Coordinating and Managing Entity (CME) for the PoAs. The two registered PoAs are:

Small Hydro PoA[3]: The government has given priority to develop its renewable energy potentials and taken Non-Conventional Renewable Energy (NCRE) as the fourth resource of the nation's diversification and security of energy strategy[4]. In the renewable energy sector, small hydropower generation has great potential. Sri Lanka has large number of small-scale hydropower projects distributed across the country. However, most of the small hydropower projects are not attractive to investors due to low return on investment. The government encourages investors to use Clean Development Mechanism (CDM) to make these small hydro projects viable. As CDM evolved to PoA, it seems to be a viable approach than project-by-project approach of CDM.

MSW Waste to Energy PoA[5]: This program of activities is to promote MSW (Municipal Solid Waste) - based compost production projects in Sri Lanka and produce bio-compost that will be applied in the agricultural farms. Currently, municipal solid waste is collected from the local authorities and delivered to existing open-dumping type landfills. The MSW that would have been treated in open-dumping landfills will now be used to produce compost. All the produced compost will be marketed for farming activities. This approach will contribute to reduce methane generation from existing dumpsites and avoided use of synthetic fertilizers. CER benefits of this PoA will encourage more Component Project Activities (CPA) development. Each CPA may handle about 15,000 ~ 45,000

[2] *Sri Lanka Carbon Fund (Private.) Limited was established on April 9, 2008 by a Cabinet decision as a private-public partnership company to provide and facilitate technical and financial assistances to the CDM project developers*

[3] *http://cdm.unfccc.int/ProgramOfActivities/poa_db/7NJOKUHPRED018MB536XFCQ9ZILG2Y/view*
[4] *National Energy Policy & Strategies of Sri Lanka, Gazette No. 1553/10 of June 10, 2008*
[5] *http://cdm.unfccc.int/ProgramOfActivities/poa_db/8S6JBIC9Z47DNRH3O2TUVXLYAMWK05/view*

tonnes of waste annually with typical number being about 20,000 tonnes annually and may produce the 4,000 ~ 5000 tonnes of compost.

This GEF funded project will partner with SL Carbon Fund to build on the lessons learned from the two PoAs for developing a functional NAMA framework as Programmatic CDM (PoAs) is closest to the NAMA in concept, and could provide a starting point for conceptualizing a NAMA.

1.6 Stakeholder and Institutional Analysis

During the Project Identification and Preparation stages, stakeholders consisting of relevant agencies, non-Government organizations (NGOs) and private sector groups who could participate in the formulation and contribute to the successful implementation of the Project have been identified (Table 3). To generate buy in and strong project ownership, participatory workshop and individual face-to-face consultations were conducted to assess their needs, identify problems and suggest solutions, clearly define their role/involvement both during the Project preparation and Project implementation and ascertain their commitment to the objectives of the Project. As these stakeholders are also beneficiaries of the Project outcomes, their participation and commitment are ensured which adds assurance to the success of the Project.

The Project Board, which is the highest level of supervision during the Project implementation, will be comprised of representatives from the funding/co-funding agencies, senior representatives of relevant Government agencies and other entities, as appropriate. This will ensure an integrated approach to deal with the challenges and opportunities that consider the interests of all stakeholders, including cross-cutting concerns/activities that incorporate and support gender equality and marginal group participation. The Project Management Unit (see Chapter 4) will be in direct regular communication with all stakeholders while exposing itself through the active participation in relevant occasions and organizing its own workshops and training seminars.

Given below are the key stakeholders along with their role in the project implementation.

Table 3: Key stakeholders along with their expected role in the project implementation

Stakeholder	Role
Ministry of Mahaweli Development and Environment	MMDE is also the National Focal point for UNFCCC and its Kyoto protocol. MMDE is responsible for the policy making and promotion regarding the management of the environment and natural resources of the country. These policies are implemented with the participation of stakeholders, including government agencies, NGO's and communities. Sri Lanka ratified the UN Framework Convention on Climate Change (UNFCCC) in 1993. The Ministry is the focal point for the UNFCCC and also acts as the operational and political focal point for the Global Environment Facility (GEF). MMDE is committed to the management of the environment and natural resources of the country, maintaining the equilibrium between the trends in rapid economic development and use of natural resource base. The ministry has framed key policies for adoption in management of environment and natural resources of the country. These policies are implemented with the participation of stakeholders including government, agencies, NGO's and communities. NAMA institutional and supporting entities will be located at MPE: NAMA Secretariat, NAMA Coordinating Entity and MRV Committee and NAMA Registry.
Ministry of Power and Energy (MPE)	MPE is the executive agency for the overall supervision and management of the project. MPE is involved in project implementation as the responsible party for government of Sri Lanka's policies and regulations related to the energy sector, which encompasses renewable and non-renewable conventional sources of energy. Renewable energy includes small-scale, hydropower, solar power, bioenergy, and wind power. **MPE also oversees the Sri Lanka sustainable Development Authority (SLSEA).** Mandate of MPE is the formulation of policies, programs and projects under the subject of power & energy and all subjects that come under the purview of the

	institutes within the Ministry which are involved in investigation, planning and development of electricity facilities throughout the island including hydropower, thermal power, mini hydro, coal and wind power, transmission & distribution and promotion of energy efficiency. Within the above mandate the Sri Lanka electricity Act No. 20 of 2009 was enacted by the Parliament with the sole objective of implementing the National Policy for the electricity Sector that has been formulated with a view of enabling Sri Lanka to all and to meet the increasing demand for electricity in future.
Ministry of Finance and Planning (MFP)	MFP will be involved in the project implementation as one of the stakeholders, and responsible for formulation of national economic and financial policies and strategies of the country. Formulation of fiscal policy and macro fiscal policy management, preparation of national development plan and management of financial resources, management of national tax policy and effective use of government revenue and coordination with the Central Bank on the formulation of monetary policies and overall macro-economic management are some of its other responsibilities In addition, the coordination of public and private sector activities and facilitation of the private sector for economic development, coordination with international agencies and mobilization of foreign resources ensuring effective use, management and accounting for the consolidate fund and publication of annual accounts of the country on international standards, overall management of revenue agencies and administrative and monitoring functions in respect of state banking and financial institutions are important functions performed by this ministry.
United Nations Development Program (UNDP)	UNDP will serve as the GEF implementing agency for the proposed project and ensure that the project will deliver its objectives. It will carry out monitoring & evaluation, and facilitate the budgetary provisions.
Climate Change Secretariat (CCS)	In order to address the cross sectoral nature of major environmental challenges caused by climate change, and to fulfil the commitments under the UNFCCC & Kyoto Protocol, the Ministry of Environment, which is the National Focal Point for the UNFCCC and Kyoto Protocol has taken the initiative to establish a Climate Change Secretariat under its preview. The Climate Change Secretariat, which is headed by the Director of the Climate Change Division, adopts a comprehensive national approach to address climate change challenges that as these concerns categorized as an environmental concern, which is also a development issue of Sri Lanka.
SLSEA	SLSEA will be a key responsible party and one of the main stakeholders. SLSEA is operating under the Ministry of Power and Energy is positioned as the apex body with wider powers in both regulation and facilitation in the area of sustainable energy, including bioenergy. SLSEA was established in 2007. Its mission is to guide the nation in all its efforts to develop indigenous energy resources and conserve energy resources through exploration, facilitation, research & development and knowledge management in the journey of national development, paving the way for Sri Lanka to gain energy security by protecting natural, human and economic wealth by embracing best sustainability practices. NAMA Implementing Entity for Energy required for each NAMA will be located at SLSEA.
Ministry of Provincial Councils and Local Government (MPCLG)	The project will partner with the Provincial councils and Provincial Ministry of Energy in developing the NAMA framework with user friendly and transparent inventory, MACC and MRV systems for quantifying GHG savings and co-benefits in driving towards a low carbon, climate resilient, gender sensitive and sustainable development trajectory. Sri Lanka has adopted decentralization policy, which have resulted in formal devolution of powers to Provincial Councils. Local Authorities operate across the country in both urban and rural areas. Ministry of Local Government and Provincial Councils is responsible for policy and legislation at the national level.

Ceylon Electricity Board (CEB)	CEB is one of a stakeholder involved in project implementation. It was established in terms of Parliament No.17 of 1969 as the Successor to the Department of Government Electrical Undertakings. It is a national institution charged with the responsibility of generating, transmitting and distributing electrical energy to reach all categories of consumers nationwide. As a national body serving a very vital function, revenue is collected according to a government approved tariff structure.
Financial institutions	Financial institutions will be involved in the project implementation as one of the stakeholders, especially when it comes to the implementation of investment projects planned under the project.
Civil Society Organizations (CSO)	CSOs will be involved in the project implementation as one of the stakeholders, to generate ownership among identified stakeholders for the implementation of biogas, solar PV interventions.
Academic Institutions	Academic institutions will be involved in the project implementation as stakeholders, provide required inputs to the technology (expert opinion), design of NAMAs, and establishment of MRV systems. There are three technical universities that are active when it comes to project focus i.e. Moratuwa, Peradeniya, and Ruhuna Universities.
Sri Lanka Carbon Fund	The Sri Lanka Carbon Fund is a private-public partnership company established under the companies' Act No.7 of 2007 of Sri Lanka. SLCB's effort is to build a new low-carbon business economy and low carbon life patterns. While optimizing carbon emission performance in existing facilities, the company is looking to explore the potential for new effective low carbon solutions through innovative strategies and collaboration with local and International market. As a private-public partnership company it provides and facilitates technical and financial assistances to the CDM project developers. It has registered two PoAs for small hydro and MSW waste to energy project.
Trade Associations	In order to generate strong buy in and project ownership from the private sector, trade association members (e.g. Lanka Biogas Association; Tea Plantation Association; Solar Suppliers/Installers Association) will be engaged to provide peer to peer training, networking facility and finding means to develop viable business by incentivizing the value chain actors.
Tea Research Institute (TRI)	The involvement of TRI as one of the project stakeholders assures confidence of tea estates to go for HEM NAMA during project implementation. The TRI was founded in 1925 under the Tea Research Ordinance enacted by Parliament in order to facilitate research into all matters pertaining to tea and thereby enriching the industry through a professional approach to commercial tea cultivation and processing.

1.7 Baseline Projects

There are also a number of plans, initiatives and projects that are under implementation to meet the energy targets that were set through the various established relevant plans, policies and programs. The proposed project builds on the on-going and planned initiatives that are in line with the **EnMAP** for the promotion of energy efficiency and energy conservation measures in the end-use sectors; and also those that are in line with the **RERDP** for renewable energy generation (Table 4). These current initiatives are expected to generate energy savings (from fossil fuel consumption reductions) and consequently bring about GHG emissions reduction, and will contribute in the realization of the targets set by, among others, the EnMAP and the RERDP.

i. Annual energy mix and consumption in the overall energy generation sector: As of 2012, the primary energy demand in Sri Lanka is at 483 PJ[6], of which biomass contributed 43.5%, petroleum contributed 45.3%, followed by 5.7% from large hydro, 4% from coal and with only 1.6% from new renewable energy (solar, wind). In the absence of the GEF project, this trend is likely to persist under

[6] http://www.energy.gov.lk/pdf/EB_2012.pdf

the baseline scenario, dominated by petroleum and biomass, and with increasing coal usage if fossil fuel price continues to increase.

ii. Energy demand by various sectors of Sri Lankan Economy in 2012: The total demand of primary energy by different sectors of an economy is at 388.4 PJ[7]. About half of this total energy demand is from household and commercial sector (46.7%), followed by 28.8% from the transport, 24.5% from Industry and remaining from the agriculture sector. With increasing disposal income, energy consumption in the domestic, transport and commercial and industrial sectors will continue to increase.

iii. Annual GHG emissions from fuel combustion in Sri Lanka in the year 2012: the overall GHG emissions[8] from fuel combustion are 15,900 ktons CO_2e where 45.3% came from the transport sector and 41.5% from energy industry including industry sector, and 13.2% from the household and commercial sector.

Table 4: Baseline Activities	Co-finance Budget (USD)
National Energy Management Plan - EnMAP (2012 - 2016) SLSEA developed the National Energy Management Plan (EnMAP) for Sri Lanka covering a period of 5 years from 2012 to 2016. It serves as a guide for SLSEA to embark on an integrated and cohesive program of work with a long-term perspective to realize better energy efficiency in all energy consuming sectors of Sri Lanka. Anticipated financial saving as a result of electrical energy saving in all sectors and fossil fuel saving in the industrial sector is estimated to be around LKR 13 billion in the first year and it will exceed LKR 34 billion at the fifth year. Financial benefit of implementing the EnMAP over a period of 5 years is estimated to be around LKR 135 billion for a cost of LKR 1.22 billion. Under EnMAP, SLSEA is currently implementing a nationwide program covering all the energy end-use sectors, namely industrial, commercial, public, and domestic sectors to carry out various projects designed to realize the targets set in this plan. The program includes regulatory interventions such as: energy labeling program (for CFLs and appliances), Code of Practice for Energy Efficient Buildings (Building Code), and Energy Managers & Energy Auditors accredit Scheme, etc. Apart from this, SLSEA is working on energy consumption benchmarks for industries including commercial buildings, introducing the mandatory monitoring of the energy performance of industries and buildings, and mandating the appointment of energy managers for establishments consuming energy in amounts beyond certain set threshold. EnMAP allocated funds to monitor compliance with benchmarks and continue this activity. The monitoring and evaluation of compliance, and benchmarking activities under this program are among the baseline activities of the proposed GEF project. SLSEA established the Sustainable Guarantee Facility (SGF) (earlier known as the Sri Lanka Sustainable Energy Fund) to address technical and financial guarantees for the promotion of energy efficiency. LKR 57 million has been set aside for this purpose.	USD 1,400,000 (2015-2016)
Renewable Energy Resource Development Plan (RERDP) 1/2012 Sri Lanka places renewable energy development as a high priority and considers it to be one among the nine main elements of the country's national energy policy. In this Plan, the target for renewable energy share in the grid electricity generation mix is 20% by 2020, from 10% by 2015. **Implementation of Pilot Projects, RE Demonstration Facilities and Delivery of rural energy services**	USD 2,000,000 (2015-2018)

[7] http://www.energy.gov.lk/pdf/EB_2012.pdf
[8] http://www.iea.org/publications/freepublications/publication/CO2EmissionsFromFuelCombustionHighlights2014.pdf

i. Net Metering Facility: Memorandum of Understanding (MoU) has been signed between SLSEA and with National Development Bank (NDB) for promotion of net metering facility by giving consolatory loans. SLSEA is involving in promoting this program by providing technical support and the target is to install 400 net metering facilities in 2014. **ii. Promotion of Biogas:** Objectives of this program is to establishment of a comprehensive National program to increase the use of biogas in Sri Lanka Specific Outputs of the Project ▪ Develop an economical model for popularization of usage of biogas and implement one pilot project ▪ Implementation of 60 domestic biogas units by 2014 as a promotion ▪ Introduce rules and regulations on safety issue of operation and usage of biogas (O&M instruction) ▪ Establish a soft loan facility through development banks for financing biogas systems. **iii. Updating EnerGIS to ArcGIS 10.1:** To maintain a web-based system that is reliable and can be updated with easy access and sharing of information via intranet and internet, SLSEA is updating the existing EnerGIS, the GIS web, to ArcGIS 10.1 software that is capable of performing resource allocation activities, resource assessment activities, Gazette publication work, and of NRE Development planning. The system will be used for the processing of applications and to verify the details submitted by the project developers. It has a multi-dimensional tool that enables resource assessment, upgrading the resource inventory, developing the Renewable Energy Development Plan, accessing the environment data, upload internet and intranet with latest updates, etc. The latest version of ArcGIS 10.1 is capable to perform multi-criteria analysis, hydrology analysis, 3D analysis, spatial techniques, raster analysis, statistical analysis, network analysis, image analysis. This will allocate room for additional services by SLSEA like transport planning, energy demand spatial analysis. The GEF project will explore the possibility to store the provincial and national inventory and MRV system into this EnerGIS system for database management and synergize with the inventory team of the Third National Communication (TCN). **iv. Rationale for the selection of Uva, Central and Southern Provinces for the demonstration project:** Based on the strong political commitment and pro-activeness of the mitigation actions undertaken by the Provincial councils, these three provinces are selected to demonstrate the implementation of the NAMA framework. Lessons learned from these 3 provinces will be replicated to the remaining 6 provinces. This GEF project will support the provincial council staff to develop a transparent inventory and MRV system for the implementation of the NAMA program.	
Private Sector: Leveraging private sector resources is critical to the success and sustainability of the pilots beyond the GEF project. The private sector companies that have expressed interest to be partners in the dissemination of the bio-digester, High Efficiency Motors (HEM) and Solar Net-metering with battery storage are shown below along with their co-funding amounts. The co-funding letters are shown in Annex G.	
(a) Industrial Solutions Lanka Pvt Ltd. (ISL) Industrial Solutions Lanka Limited, being a leading institution engaged in the development of renewable energy projects in Sri Lanka, is committing a co-funding of USD 18 million towards UNDP GEF by way of investing in a grid connected Solar Energy Generation Project in Sri Lanka with the capacity of 10 MW within the next 4 years in collaboration with M/s Solon International of Germany. This is to complement the resources approved by GEF for the successful implementation of the above project in partnership with the Ministry of Power and	USD 18 million (2015 to 2018)

Energy (MPE) of Sri Lanka and Sri Lanka Sustainable Energy Authority (SLSEA).	
(b) Planters Association of Ceylon (PAC) – USD 4 million PAC members have been actively seeking for solutions to reduce their electricity consumption to improve productivity and competitiveness whilst reducing their carbon footprint. PAC has agreed to invest USD 4 million as cost share to demonstrate the benefits of installing high efficient motors in tea factories. The details of this partnership and demonstration project are described in details in Annex D.	USD 4,000,000 (2015 to 2018)
Total	**USD 25,400,000**

1.8 Barriers Analysis

To have a better understanding of the needs, gaps, opportunities and challenges in developing the NAMA framework, a stakeholders' consultation was conducted in Colombo on 23 July 2014 with 38 participants from the energy, industrial, and members of the climate change mitigation experts' committee attending the workshop. All main stakeholders were consulted several times during the PPG process to ensure that their priorities and experiences within the context of Sri Lanka are fully captured and reflected in the design of the Project. The participants generally agreed that the main problem faced by Sri Lanka regarding its energy generation and end user sectors is the high dependency on imported fossil fuel as the primary source of energy and the need to scale up RE mix as well as reduce energy demand through EE programs.

For the introduction and scaling up of long-term successful renewable energy and energy efficiency technologies, the following regulatory, institutional, technical, financial and social barriers need to be overcome.

i. Energy Efficiency

The major barriers in implementation of energy efficiency improvement projects have been:

1. Lack of financing
2. Lack of end user awareness and commitments
3. Lack of technical capacity among end users and
4. The absence of a transparent regulatory and financial mechanism to instill trust.

Electricity Tariff: The electricity tariff doesn't reflect the true energy cost, especially in the domestic category. The tariffs are built, insulated from the ups and downs of the rising energy prices; therefore, it does not act as an incentive to encourage investments in energy efficiency activities.

Other Priorities: Energy efficiency is not yet a priority for many industries; since there are many other burning issues like rising fossil fuel cost, material supply, labor and productivity related issues, which has a direct bearing on the viability of business.

ESCOs: Sri Lankan ESCOs are not yet capable of handling the entire cycle of a given project, commencing from energy auditing to project implementation. In the area of funding, following barriers exist; (I) Lack of legal and financial infrastructure to support performance contracts between end-users and ESCOs, (II) Limited ability of local ESCOs to obtain bank financing or raise equity capital, particularly a problem for new, small ESCOs that are financially weak, (III) Lack collateral and credit history, (IV) Lack of experience among the banks, both with Energy Efficiency Improvement (EEI) projects, but also with the financial concept of performance contracts and lack of confidence on the part of banks that ESCO performance estimates will turn out to be accurate.

ii. Renewable Energy

Some barriers for the promotion of renewable energy and for the transferring of renewable energy technologies are generic and common to all renewable energy options while some are specific. Often the result of barriers is to put renewable energy at an economic, regulatory, or institutional disadvantage relative to other forms of energy supply. Many of these barriers could be considered "market distortions" that unfairly discriminate against renewable energy, while others have the effect of increasing the costs of renewable energy relative to the alternatives. All barriers could be broadly classified into 5 categories (Policy, Financial, Technical, Information, Market and Institutional) and often they are not mutually exclusive:

Technical and Structural Barriers: Lack of pilot projects to demonstrate proof of concept to generate strong private sector buy in, poor grid conditions (or complete unavailability of the grid) leads to higher costs and inadequate design solutions. Others include poor supply-demand value chains, reliability and sophistication of technology, lack of R&D support.

Box 1: Lessons learned from the Renewable Energy for Rural Economic Development (RERED) Project in Sri Lanka (Source: WB 2014 Loan assessment report)

This project sought to (i) improve the quality of rural life by utilizing off-grid renewable energy technologies to provide energy services to remote communities; and (ii) promote private sector power generation from renewable energy resources for the main grid. The project also sought to reduce atmospheric carbon emission by removing barriers and reducing implementation costs for renewable energy and improving energy efficiency.

***Local participation and involvement, suitably incentivized, is crucial to promoting distributed power generation activities**. Active local participation drove the momentum and successful implementation of the 68 mini-hydro projects and the 173 community-based micro hydro projects supported by the project. The participation came in the form of local political support and the newly-formed village level electricity consumer societies, which were incentivized by opportunities for selling a part of the generation to the grid through 'net metering'.*

***Involving the private sector effectively in a decentralized developmental effort requires flexibility in implementation arrangements and space for adapting to market conditions.** In spite of past lessons informing the design of the project, almost all major aspects – financing and disbursement parameters, procurement policies and approach, SHS business model – had to undergo modifications to keep up the pace of implementation. Without such adjustments, the project would likely have stalled /failed.*

***An appropriate feed-in-tariffs policy and its consistent and transparent application are crucial to spur growth of small scale and non-conventional renewable energy generation.** The low transaction costs enabled by attractive feed-in-tariffs crowded in project developers and investors, as well as commercial/investment banks to develop and invest in a variety of distributed generation projects. Market confidence was enhanced by consistent and transparent application of the policy by the regulator / government.*

***Investments in off-grid electrification could be underutilized or even abandoned in the event of a faster than expected arrival of the electricity grid.** To mitigate this, the expansion of the grid should be coordinated with off-grid investments, and, where warranted, the off-grid facilities should be made grid-compatible to ensure their continued utility. In Sri Lanka, as the electricity grid expanded faster than expected, the decreasing necessity and relevance of off-grid electrification was not foreseen early enough, resulting in some off-grid facilities falling into disuse or neglect. This experience points to the need for planning ahead for a coordinated access rollout, and making policy and technical provision for making the off-grid facilities grid- compatible and economically viable.*

These lessons learned will be taken on board in the design of the RE (biogas and solar PV) and EE NAMA (high efficient motors in tea factories) for overcoming the regulatory, technical, financial and social barriers.

Financial Barriers: Perceived payment risk, financial risk (high interest rate, upfront cost, lack of collateral, exchange rate, high transaction cost) coupled with a lack of risk mitigation tools and inadequate financing support (grants, loans, grace periods, long term interest rates, etc.) makes it difficult to secure finance for RE and EE projects.

Policy Barriers: Low Priority for RE and EE in national planning, lack of viable and cost effective incentives (Taxes & Duties), lack of transparent regulations, cumbersome environmental regulations leading to delays, monopoly of electricity distribution, cost effective tariff, fossil fuel subsidies, restrictions on locations and construction and land issues.

Information Barriers: The lack of knowledge on available technologies, lack of capacity to design, manage, and operate coupled with limited local involvement and public support. Lack of reliable and

accurate baseline inventory data to make informed decisions, lack of training on business and financial skills lack of awareness and poor consumer perception.

Institutional Barriers: Lack of coordination and collaboration between ministries due to silo mentality leading to duplication of efforts and resources; donor driven and technology push project leading to poor ownership and local participation (see Box 1); high institutional memory loss leading to loss of valuable data; lack of capable, competent staff and wrong priority.

Market Development Challenges: These challenges pertain to the lack of innovative business models, local market knowledge and resource availability to address market failures for the implementation of RE and EE solutions.

Baseline Scenario

From the analysis of mitigation actions taken in the energy sector, the lack of a robust and transparent NAMA framework to capture and quantify the cost and benefits of the mitigation efforts is the baseline scenario.

The problem that needs to be addressed through the proposed GEF project is the absence of a systematic approach for: (1) performing provincial level GHG emissions inventory; (2) establishing and updating sectoral and sub-sectoral reference baselines including specific energy consumption data; and (3) measuring, reporting and verifying the impacts and contribution of individual appropriate mitigation action in the energy generation and end-use sectors to the voluntary emission reduction targets of the country.

Although there are various projects and programs (albeit fragmented and non-coordinated) that are being implemented in the energy generation and end-use sectors of the country to mitigate climate change, both the individual and collective impacts of such initiatives are not known. This is because a consistent nationally accepted and established methodology for assessing the results of the climate change mitigation interventions in these sectors, and their contribution to the achievement of the national GHG emission targets is non-existent. The prioritization of some of these interventions is not done in a systematic manner, especially the end-use sectors at the sub-national level due to the lack of data. The major barriers to establishing and updating sectoral and sub-sectoral reference baselines; and for the monitoring, reporting and verification of the results and impacts of implemented appropriate mitigation actions are as follows:

a) There are no sub-national (or provincial) level GHG emissions inventories that can provide useful data for the establishment of sectoral and sub-sectoral reference baselines for the energy generation and end-use sectors. Although there are efforts at the national level towards creating a GHG emissions inventory management system, as part of the national communications to the UNFCCC, initiatives toward the establishment of such system for the energy generation and end-use sectors and sub-sectors simply do not exist. The understanding of the importance and purpose of such system by the government was never realized. In the past, the government simply didn't think this is important. Given the pro-activeness of the three provinces in Uva, Central and Southern in delivering climate mitigation activities, this project will support the provincial councils to develop and improve their inventory system in partnership with SLSEA.

b) The purpose of MAC curves was never recognized apart from unavailability of the data. Therefore, combining these two factors, there is no existing analysis of marginal abatement cost curves of CCM technologies and measures for the energy generation and end-use sectors. The Second National Communications to the UNFCCC detail only some of the potential mitigation options.

c) The importance and purpose of a robust NAMA framework with transparent MRV system was never acknowledged. Because of this, the assessment of various implemented climate change mitigation programs and projects contribution against voluntary emission reduction targets is not happening. This is missing at the moment in the evaluation of the actions taken (i.e., CCM projects) to contribute to the achievement of voluntary emission reduction targets. This was also identified as a major barrier for the effective implementation of the EnMAP. Furthermore, without a coherent and well-

coordinated NAMA framework, the opportunity to leverage regional and international climate funding will not be realized.

d) Continuous non-availability of financing products and services for energy efficiency improvement projects - There are already funding schemes that are operational but some of these have to be refocused or be appropriately redesigned to support CCM interventions in the energy generation and end-use sectors. For example, legal and financial frameworks are non-existent to mitigate the risks and support ESCOs to operate successfully through performance-based contracts.

1.9 Proposed alternative scenario with incremental/additional cost reasoning

To address the above problems, this GEF project ***"Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors in Sri Lanka"*** seeks to establish a robust and transparent NAMA framework for the successful planning, designing, approval, financing, implementation and evaluation of NAMAs in driving towards a low emission, climate resilient, gender-sensitive and green and inclusive economy whilst aspiring to reduce the national poverty and carbon emissions in Sri Lanka. As developing the NAMA framework is an iterative process, feedback mechanisms will be built in for updating and improving the market-readiness process at regular intervals.

The proposed project will support the Government of Sri Lanka's plan and intention to conduct GHG inventories at the provincial level and come up with more comprehensive energy end-use sub-sector reference baselines. Using the information that will be obtained from such inventories, relevant marginal abatement cost curves (MACCs) will be developed for various energy generation technology options and for various end-use sector energy efficiency and energy conservation measures. The selection and prioritization of the technologies and measures will be based on the technology cost effectiveness identified through MACCs and implemented on a demonstration/pilot basis. The process will also demonstrate the application, and usefulness of a monitoring, reporting and verification (MRV) system. The information that will be generated from such an approach is very useful in the energy policy design and energy policy impact assessments of the government. Considering the current limited work under National Energy Management Plan (EnMAP) on this area, most of the envisioned project activities, starting from the demonstration of the assessment and establishment of reference baselines up to the verification of the results and impacts of the implemented appropriate mitigation actions, are considered as incremental. This systematic approach that will be promoted and whose application will be demonstrated under the proposed project will have an impact on the national policy planning, its implementation and other appropriate mitigation actions initiated in the near future by Sri Lanka Sustainable Energy Authority (SLSEA) or ministries that are concerned with climate change.

As Sri Lanka looks to the next wave of investment to move Sri Lanka closer to the objectives of Mahinda Chintana Vision, the NAMA framework will assist Sri Lanka in making well-informed choices that could reconcile economic and environmental objectives.

The basis for the proposed project is Sri Lanka's voluntary emission reduction commitment to reduce GHG emissions in the energy generation and end-use sectors and enabling the country to meet their national goals and strategies through a holistic framework as well as to get 'ready' to access international climate fund (e.g. Green Climate Fund) through new market mechanisms.

i. Overall energy generation sector: With the demonstration of the RE NAMA (solar PV and biogas), it is expected that contribution from new RE will increase and help towards achieving the RE target of 20% by 2020.

ii. Energy demand in end-use sectors: With the scaling of EE NAMA (high efficient motors), it is expected that energy demand in the industrial, household and commercial sectors will be reduced by 316 TJ through the proposed project interventions.

iii. GHG emissions in the overall energy generation and energy end use sectors: As shown Table 5 below, the total GHG savings from the demonstration of RE and EE NAMA (at the end of life) will be 66,639 tCO_2e. With bottom up approach (replications of 3) the total GHG savings will be 199,917 tCO_2e.

In order to bring about the above described **alternative scenario**, the project seek to develop a robust and transparent NAMA framework[9] for overcoming the regulatory, institutional, technical, financial and social barriers of the scaling up of NAMAs at the provincial level. The integrated multidimensional framework will allow a pipeline of bankable NAMAs to be designed, developed, approved, implemented, measured, reported, verified and registered nationally and internationally based on the 7 steps as illustrated in Figure 4:

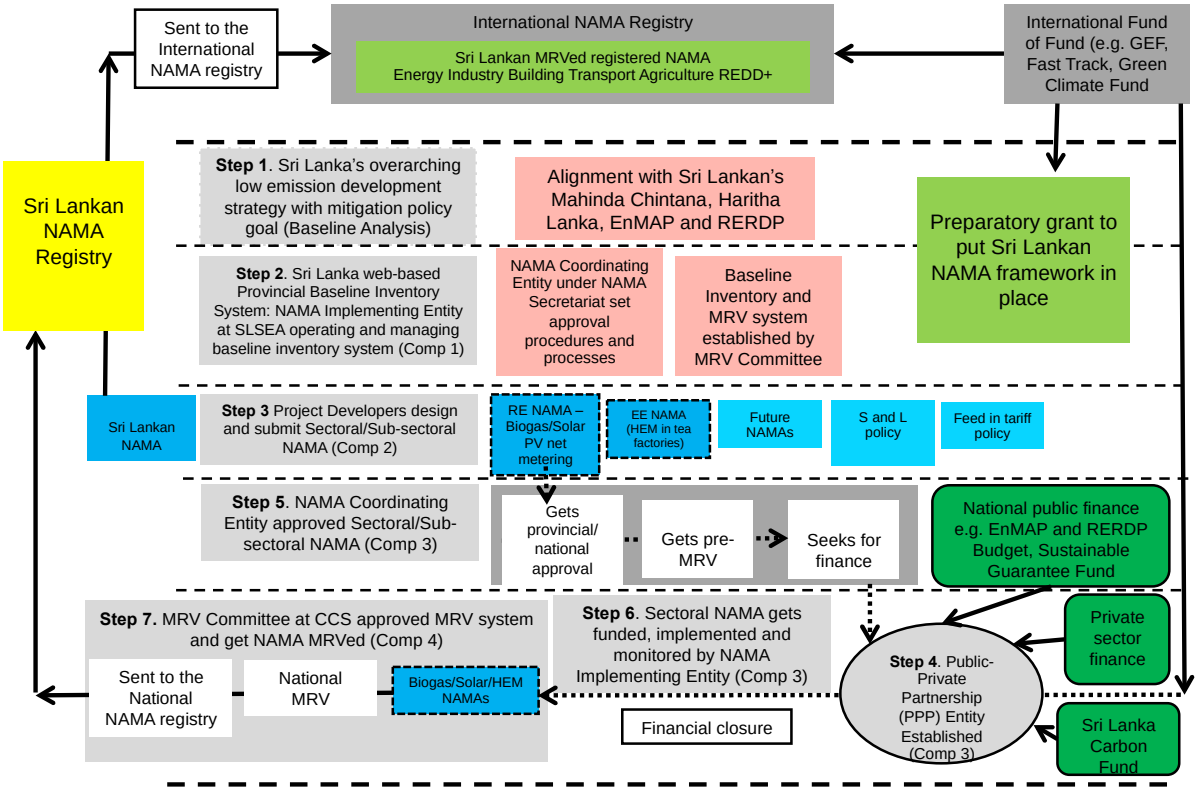


Figure 4: Proposed NAMA Framework

- **Step 1:** Alignment with National Development Framework such as "Mahinda Chintana" and "Haritha Lanka" Environmental Action Plan, and national and provincial energy and climate policy, goals and targets and budgets (Baseline scenario analysis) for meeting MDG goals for securing access to clean energy, safe food, clean water and low carbon transport.

- **Step 2:** (i) SLSEA will support provincial councils in the use of EnerGIS web-based inventory system to develop, collect, analyses, manage and report baseline reference data for energy generation (oil based, coal, hydro, wind, biomass, solar) and end use sub-sectors (energy industry, transport, industry, agriculture, residential and commercial) at the Uva, Central and Southern provincial level (Component 1) and (ii) use of decision making tools such as MACC to prioritize a pipeline of bankable provincial NAMAs (Component 2).

- **Step 3:** Bankable Provincial Sub-sectoral NAMAs get designed, proposed and planned by project developers and NAMA Implementing Entities (NIE) to be located at SLSEA (Component 2). Based on initial MACC and intensive stakeholder consultation, biogas, solar PV net metering with storage battery as RE NAMA and high efficient motors in tea factories as EE NAMA will be demonstrated.

- **Step 4:** In partnership with Sri Lanka Carbon Fund and NAMA Implementing Entity, identify and develop Public and Private Partnership (PPP) Entity and implementing and financial

[9] *Modified from model presented by KPMG (2011).*

structures (Component 3) to provide financial closure (e.g. equity/debt, grant, concessional loans, partial loan guarantee, and carbon credits).

- **Step 5:** Selected bankable Provincial sub-sectoral NAMAs get approved by the NAMA Coordinating Entity (NCE) under the NAMA Secretariat to be located at MPE and get financed (Component 3).

- **Step 6:** Bankable Provincial sub-sectoral NAMAs get funded and implemented by NAMA Implementing Entities (Component 3) based on stringent fiduciary and financial standards. Implementation of the RE NAMA (biogas and solar PV net metering with storage battery) and EE NAMA (high efficient motors in tea sector).

- **Step 7:** NAMA projects get MRVed and approved by MRV Committee based on IPPC principles and guidelines and registered at National NAMA Registry to be managed by MPE for subsequent registration at the International NAMA Registry (Component 4).

The guiding principles in the design of the NAMA framework are:

Strong institutional support and governance: NAMA Secretariat as the focal point to liaise with UNFCCC will be established at CCS at MPE along with NAMA Coordinating Entity for vetting and approving NAMA. The MRV Committee will be established at CCS, MPE to design, approve, monitor and upgrade the MRV standards and register NAMA at the national and international NAMA Registry. NAMA Implementing Entity for the NAMA Energy Sector will be set up at SLSEA.

Best practices and continuous update: The NAMA's fiduciary principles and standards and environmental and social safeguards should be consistently in line with international best practices and standards, and systematically endeavor to reflect the best of the experience and lessons learned by relevant institutions, as well as lessons learned from its own experiences with fiduciary principles and standards and environmental and social safeguards;

Accountability, transparency, fairness and professionalism: The NAMA governance system, procedures and organizational approach will ensure accountability, transparency, fairness and adequate professionalism in the approval process and across all operational procedures, allowing for reasonable levels of quality assurance/control and comparability with regard to the presence and performance of the required institutional capacities;

A dynamic process that is reliable, credible and flexible: The NAMA modalities will pursue rigorous, independent, objective and systematic assessment and review processes, while giving due attention to special circumstances of NAMA Implementing and applicant entities. A dynamic approval process will aim at enabling potential NAMA Implementing Entities to increase their scope of activities as their capacity increases over time;

Coherence and integration with other international climate finance governance: The NAMA's fiduciary principles and standards, environmental and social safeguards, and general approval procedures will be consistent and properly linked with other relevant elements of climate finance governance (e.g. Green Climate Fund), particularly the independent redress mechanism, interim disclosure policy, gender policy and others as appropriate; and preparatory support in the context of direct access to fund and the different capacities and capabilities of countries and institutions to enhance country ownership, with a view to facilitating capacity-building.

Readiness and effectiveness: The approval process will allow for readiness and preparatory support in the context of direct access to climate finance and the different capacities and capabilities of Sri Lanka and supporting institutions.

2. STRATEGY

2.1 Project Rationale and Policy Conformity

2.1.1 Alignment with National Aspirations

The *Haritha* (Green) Lanka Strategy and Action Plan (HLSAP) was prepared through a national consultative process that focused on management of environment and conservation of natural resources to ensure sustainable development. As relevant strategies the HLSAP emphasizes "optimize energy consumption through energy efficiency in enterprises and promoting substitution of fossil fuels by renewable energies in economic and production sectors" and "Promote supply side & end use energy efficiency." Energy efficiency and demand side management was placed on high priority in Sri Lankan since 1982. In keeping with the global concern on sustainable development, the Government of Sri Lanka has taken a number of policy and program initiatives towards sustainable development which in turn help to mitigate the adverse impacts of climate change. Climate change mitigation measures have been promoted in all the sectors including energy (power, transport, industry, household and commercial), land use, forestry, waste etc.

The Government of Sri Lanka is striving to achieve energy saving equivalent to 20% of the total energy consumption of year 2010, by 2020. The ninth mission of the HLSAP is aiming at "Greening the Industries" and it is expected to bring the majority of industries under the green regime by the year 2016. This plan proposes to phase-out the GHG emissions from industries periodically 10% during 2009 – 2010, 30% during 2009 – 2013, and 50% during 2009 – 2016. It is further estimated that percentages of fuel switching from non- renewable to renewable energy sources from 10% (during 2009-2010) to 75% by 2009 – 2016 (75%). EnMAP of Sri Lanka Sustainable Energy Authority (SLSEA) from 2012 to 2016 serves as a national guide to embark on an integrated and cohesive program of work with a long-term perspective to realize better energy efficiency in energy consuming sectors (state enterprises, industrial sector, commercial sector, health sector (private), domestic sector and street lighting) of Sri Lanka and retain the energy intensity of the economy at 500toe/SDR (million) even in 2017. The proposed project is consistent with these national priorities as it also aims to reduce the energy consumption in different sectors of economy, increase energy efficiency and use renewable energy for electricity generation. The achieved GHG emissions reduction through the implementation of pilot demonstrations under the propose project will contribute to the national voluntary emissions reduction target.

Sri Lanka submitted its Second National Communication (SNC) Report to UNFCCC on 16th March 2012 (http://unfccc.int/resource/docs/natc/lkanc2.pdf). The report very much recognizes nine missions of the HLSAP and government's efforts in its implementation. For example, emissions reduction through emphasizing energy efficiency of end-use sectors and shift to renewable energy when it comes to energy generation. The sectors covered by the SNC are different from what the proposed project is intended to cover and also to the level of inventories at sub-national level. The SNC categorizes sectors as (1) Energy (sub-sectors are per energy carrier), (2) Industrial Processes (sub-sectors are specific to those generating GHG emissions from the production process), (3) Agriculture (sub-sectors are on crop production, livestock emissions etc.), (4) Forests and LUCF; and (5) wastes. The proposed project specifically focuses only on electricity generation in the energy sector, certainly contributing the methodology and GHG inventory data produced at the sub-national and sub-sectoral level which are missing at the moment in the development of GHG inventory for the upcoming Third National Communication (TNC) and Biennial Update Reports (BUR) as part of country obligation under UNFCCC. The proposed project will also contribute to scale up and expand the scope of the GHG inventory to all the sectors across and provinces of Sri Lanka under TNC. This activity will be carried out in close coordination with the Ministry of Power and Energy (MPE), which is responsible institution for National Communication process in the country.

The proposed NAMA approach will involve measurement, reporting and assessment of the contribution of identified and prioritized climate change mitigation actions towards the realization of the national climate change targets and goals. Most of the CO_2 emissions reduction that would accrue from these efforts are expected to contribute towards the achievement of the country's voluntary targets. Apart

from reactivation of the SGF for supporting energy efficiency initiatives, feed in tariff scheme will be implemented with renewed focus on renewable energy without impacting related ongoing activities.

2.1.2 Country Ownership and Eligibility

Policy conformity: The proposed project is consistent with the GEF-5 climate change mitigation focal area strategic objective CCM-2 "promote market transformation for energy efficiency in industry and the building sector" (Outcome 2.2: Sustainable financing and delivery mechanisms established and operational); CCM-3 "promote investment in renewable energy technologies" (Outcome 3.2: Investment in renewable energy technologies increased); and CCM-6 "Support enabling activities and capacity building under the Convention". The project aims to remove barriers to the application, implementation, and dissemination of energy efficiency and renewable energy as NAMA.

Country ownership, country eligibility and country drivenness: According to the Instrument for the Establishment of the Restructured Global Environment Facility, Sri Lanka:

- Has ratified the United Nations Framework Convention on Climate Change in 1993;
- Receives development assistance from UNDP's core resources.

The proposed project is consistent with Sri Lanka's energy policies, legislation and country's strategy of promoting renewable energy and energy efficiency measures to reduce reliance on fossil fuels, as described in detail in Section 2):

- Ten Year Development plan
- Sri Lanka's Energy Policy (October 2006)
- National Energy Policy and Strategies of Sri Lanka (2008)
- Renewable Energy Resources Development Plan (RERDP)
- Energy Management Plan (EnMAP)

2.2 Design Principles and Strategic Considerations

In seeking to climate proof national development, this project seeks to develop NAMA framework that would allow the inclusion of GHG mitigation targets and co-benefits to be aligned with national aspirations and post 2015 Millennium Development Goals. A NAMA framework based on integrated approach will provide a good basis for tackling issues of energy scarcity through technology intervention, finance and capacity building. The NAMA will integrate a top-down approach of providing support through policy measures and demand side management (Standards, Testing and Certification), and bottom-up approach of providing financial incentives (matching rebate and partial portfolio loan guarantee schemes, payment by results, output-based approach) and market mechanisms to secure supply and stimulate demand for RE and EE solutions. To enhance the effectiveness of these approaches and to create an enabling environment among the stakeholders and value chain actors in the Project, capacity building and training activities will be conducted to enhance the technical and business capacity of the value chain actors and at the different stages of the project execution.

With regards project design it is important to emphasize that the interrelationship between the different components of the project – and the inter-linkages between the different interventions/phases of the bio-digester, solar PV with storage battery and HEM value chain (whether funded by GEF or other stakeholders) – must be considered in a holistic manner and seen in their entirety to understand why it's essential to approach the problem via a comprehensive value chain approach to maximize mitigation benefits. Numerous studies have confirmed that the optimization of emission reduction benefits can only come from holistically addressing all parts of the RE and EE value chain in an integrated manner; as one study notes: ***"No single intervention, implemented alone, will have a significant impact on reducing GHG emissions. Rather, measures must be implemented together and in a mutually supportive manner along the supply-demand chain if tangible results are to be achieved."*** In this way the project is following established best practices and is integrated with and complementing a series of interventions across the full RE and EE value chain.

2.3 Project Objective, Outcomes, Outputs and Activities

The goal of the Project is reduction of GHG emissions from the energy generation and end user sectors in Sri Lanka by developing a NAMA framework, with the objective to support appropriate climate change mitigation actions in the energy generation and end-use sectors as part of the initiatives to achieve the voluntary GHG mitigation targets of Sri Lanka.

Based on the above strategic considerations, the Project will focus on four major components as follows:

- **Component 1.** Business-as-usual energy generation and end-use sector baselines at national and sub-national level
- **Component 2.** Mitigation options for the energy generation and end-use sectors
- **Component 3.** Implementation of appropriate mitigation actions in the energy generation and end-use sectors
- **Component 4.** MRV system and national registry for mitigation actions in the energy generation and end-use sectors

Each of the above components will have specific activities that are designed to produce outputs that will contribute to the realization of the following outcomes, respectively:

- **Outcome 1:** Established and regular update of renewable energy utilization baseline & energy intensity reference baselines[10] for the energy generation and end-use sectors
- **Outcome 2:** Prioritized Nationally Appropriate Mitigation Actions (NAMAs) in the energy generation and end-use sectors are identified and designed
- **Outcome 3:** Implemented prioritized appropriate mitigation actions through identified private and public sector entities for the achievement of Sri Lanka voluntary mitigation target
- **Outcome 4:** Accurate measurement and accounting of actual GHG emission reduction from mitigation actions in the energy generation and end-use sectors

The objective of this proposed GEF project is:

To support appropriate climate change mitigation actions in the energy generation and end-use sectors as part of the initiatives to achieve the voluntary GHG mitigation targets of Sri Lanka

The Project consists of four components to realize the Project Objective. The Project seeks to develop robust and transparent NAMA framework for the planning, implementing, accounting, registering and management of climate mitigation solutions. The expected outcomes, outputs and activities are described below.

Component 1 Business-as-usual energy generation and end-use sector baselines at national and sub-national level

Outcome 1 Established and regular update of renewable energy utilization baseline & energy intensity reference baselines for the energy generation and end-use sectors (GEF grant = USD 160,000; Co-funding = USD 650,000)

This Component will support the development of the GHG emission inventories and business-as-usual (BAU) baselines of the energy generation and end use sectors. Under this component there will be several activities that will be carried out to deliver specific outputs such as:

(1) A reference scenario of historical and projected GHG emissions at the sub-sectoral and provincial levels. This will constitute the baseline against which mitigation potential will be measured for the design and implementation of NAMAs, and from which emission reduction will be monitored during implementation.

[10] *There are different parameters whose baselines can be set, e.g., generated energy utilization performance and emissions of the energy generation and end-use sectors.*

(2) Established and operational national and sub-national GHG inventory system (GIS) for the energy sector. In partnership with the National Communications project team this system will provide the energy sector data for the National GHG Inventory and will contribute to the National Energy Balance Reports being updated by SLSEA.
(3) Sub-national GHG inventories that will contribute to the better planning and implementation of mitigation actions at sub-national level through the 9 provincial governments
(4) A comprehensive energy balance and detailed end-use energy consumption data. These will be useful for SLSEA and provincial councils in establishing long-term framework.

The design of the inventory system will be guided by the principles as shown in Figure 5.

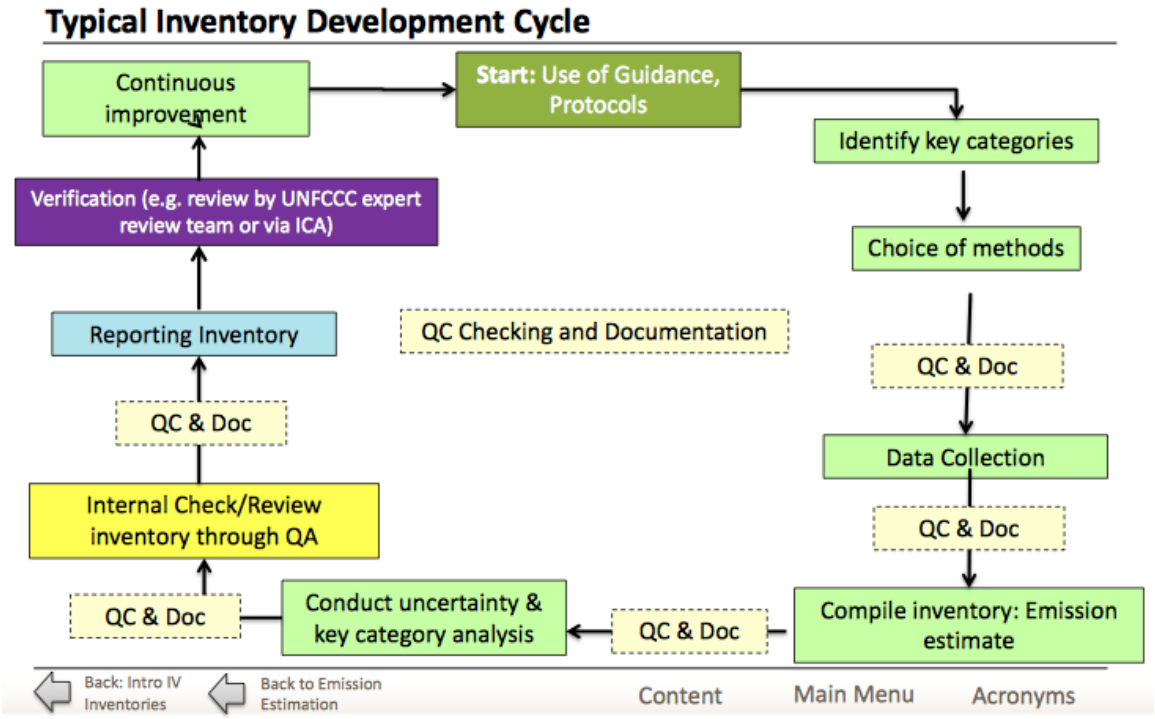


Figure 5: Example of a typical GHG inventory development cycle (MRV Tool, 2013).

The following section describes the activities that will be done under Component 1 to come up with the expected Outputs that will contribute to the realization of Outcome 1:

Outcome	Output	Activities
Outcome 1: Established and regular update of renewable energy utilization baseline & energy intensity reference baselines for the energy generation	Output 1.1 Finalized provincial level inventory tool for energy generation and end-use sectors	Activity 1.1.1 Review EnerGIS database system of SLSEA and existing national communications data inventory system to identify barriers, gaps, needs, and challenges for data collection and compilation Activity 1.1.2 Develop, test, verify and update the inventory system at sub-national level Activity 1.1.3 Identify and select key focal points and define boundary for the development of inventory system for the collection, compilation and management of baseline data at the municipal/urban/Pradeshiya sabha levels in the Uva, Central and Southern Province Activity 1.1.4 Test, verify and deploy web-based data collection for EnerGIS GHG inventory system for energy generation (oil based, thermal, hydro. Coal and RE) and end-use sectors (energy industry, transport, industry, residential and commercial) at Uva, Central and Southern Provinces

and end-use sectors	Output 1.2 Defined and established sectoral and sub-sectoral reference baseline specific energy consumptions for the energy generation and end-use sector and sub-sectors	Activity 1.2.1 In partnership with national communication inventory team, define and develop parameters, reference baseline and emissions boundary for GHG inventory on energy generation sub-sectors (oil based, thermal, hydro, solar, wind, biomass) and end-use sub-sectors (energy industry, transport, industry, residential and commercial) Activity 1.2.2 Collect, compile, quality check and analyze data for Uva, Central and Southern Provinces Activity 1.2.3 Test, verify and establish reference baselines for renewable energy utilization, energy consumption in different end-use sectors and GHG emissions in Uva, Central and Southern Provinces
	Output 1.3 Established, operationalized and updated national and provincial GHG emission inventory system for energy generation and end-use sectors	Activity 1.3.1 Develop and implement steps to regularly update and improve the inventory system Activity 1.3.2 Develop and conduct training programs to data management staff to strengthen the data collection efforts for inventory at sub-national level Activity 1.3.3 Develop knowledge products on the use of the provincial inventory system for provincial inventory data management staff Activity 1.3.4 Develop a strategy for replication to other provinces

Output 1.1 Finalized provincial level inventory tool energy generation and end-use sectors (GEF grant = USD 47,000; Co-funding = USD 250,000)

Activity 1.1.1: Review EnerGIS database system of SLSEA and existing national communication system to identify barriers, gaps, needs, opportunities and challenges in data collection and compilation: This activity involves the review of the EnerGIS database developed and managed by SLSEA and identify needs, gaps, opportunities and challenges in the first and second national communication (SNC) and incorporate the lessons learned into the provincial inventory system and TNC.

The identified barriers will be reviewed and the key findings and recommendations will be consolidated as a preliminary step towards assessing the energy data collection and compilation system in Sri Lanka. Areas of focus for the review could include, but are not limited to, the following:

- The legislative basis for energy data collection: Are data collection and compilation hampered by the lack of appropriate legislation or regulation to support the data collection necessary for the compilation of a comprehensive energy balance and energy end-use data?
- Administrative agreements among key data collectors: Are data collection and compilation hampered by inadequate, ineffective or missing administrative agreements for data sharing among key actors in the energy data collection arena, including government departments, agencies or private sector actors?
- Departmental capabilities: Are data collection and compilation hampered by a lack of data collection and compilation expertise and motivation within key data collection departments or agencies?
- Data needs: Are data collection and compilation activities directed towards identified governmental and non-governmental needs and priorities?

Activity 1.1.2: Develop, test, verify and update the inventory system at sub-national level**:** This activity involves the identification and overcoming of the barriers in how to integrate, synchronize and aggregate the inventory data at the local authority level (municipal, urban, Pradeshiya sabha) to the provincial and national level and their linkages with the Third National Communication. Steps for provincial government to best facilitate integration between national and local government will be developed. The EnerGIS for the energy sector, disaggregated at a sub-sectorial and sub-national level, will allow more consistent and reliable data to be gathered in a timely manner that will enhance and complement the National GHG Inventories and facilitate the preparation biennial update of the data for the energy sector that will be required from December 2014 onward to complete the UNFCCC Biennial Update Reports (BURs). It must be noted that the information presented in the National Communications and BURs are gathered

at the sectoral and national levels. Therefore this project will allow the country to generate much more specific inventories at the sub-sectoral and provincial levels. Key information gaps, bottlenecks and weaknesses in climate change information management of the energy sector will be identified and addressed.

Activity 1.1.3: Identify and select key focal points and define boundary for the development of inventory system for the collection, compilation and management of baseline data at the municipal/urban/Pradeshiya sabha levels in the Uva, Central and Southern Province**:** This activity involves the following: (1) Assessment and improvement of needs, gaps, opportunity and challenges in the current system of data management; (2) Drafting of the framework and development of a robust GHG inventory system that promotes good data collection, monitoring and management; (3) Identification of historical GHG emissions and perform projections using two approaches: (a) detailed bottom-up assessment for the energy sub-sector; and, (b) top-down economy-wide tools such as general equilibrium and emission models, including the use of IPCC protocols and the National Energy Balance developed by SLSEA. The results of these two approaches will then be presented for local validation and assessment to ensure the forecast is realistic.

Activity 1.1.4: Test, verify and deploy web-based data collection for EnerGIS GHG inventory system for the energy generation sub-sectors (oil based, thermal, hydro. Coal and RE) and end use sectors (energy industry, transport, industry, residential and commercial) at Uva, Central and Southern Provinces: This will make use of the inventory system developed under output 1.3 to collect baseline data at the local authority level in the Uva, Central and Southern Provinces.

GEF support will be used for the development of the provincial inventory system and conduct of workshops and expert consultations among the government, industry and other relevant stakeholders. Co-financing will be in terms of in-kind inputs for administrative and logistical support by partner government agencies in the conduct of workshops and consultations and mobilizing support from private companies and industry associations in the development of the inventory system.

Output 1.2: Defined and established sectoral and sub-sectoral reference baseline specific energy consumptions for the energy generation and end-use sector and sub-sectors (GEF grant = USD 55,000; Co-funding = USD 200,000)

Activity 1.2.1: In partnership with national communication inventory team, define and develop parameters, reference baseline and emissions boundary for GHG inventory on energy generation sub- (oil based, thermal, hydro, solar, wind, biomass) and end-use sectors (energy industry, transport, industry, residential and commercial): Using the benchmarking developed under EnMAP and SNC, define and develop parameters, baseline reference and boundary for tracking GHG emissions at the energy generation and end use sectors (residential, commercial and industrial sub-sectors). As data collection can be costly and resource intensive, the inventory system needs to be cost effective and efficient in order to collect, monitor and manage data that are only relevant, accurate, credible and reliable. This activity involves the development of benchmarks that are suitable for each sub-sector and these will be tested under Output 3[11]. The GIS for the energy sector will also facilitate the generation of a formal Emission Grid Factor for Sri Lanka that will be updated and made official on a yearly basis. For this purpose the UNFCCC CDM methodological tool to calculate the emission factor for an electricity system will be used, and a system will be put in place for its yearly update. In addition, a standardized baseline will be established for the on-gird energy generation, including a positive list of additional technologies.

Activity 1.2.2: Collect, compile, quality check and analyze data for Uva, Central and Southern Provinces: Baseline data at the provincial level will be collected, compiled and analyzed using the EnerGIS systems.

Activity 1.2.3: Test, verify and establish reference baselines for renewable energy utilization, energy consumption in different end-use sectors and GHG emissions in Uva, Central and Southern Provinces: The inventory system with reference baselines (e.g. generated energy utilization performance, GHG

[11] For example for biogas project – methane and tCO_2 saved per t human and green wastes or per bio-digester or per t LPG displaced; for tea sector – amount electricity kWh and tCO_2e saved per t of made tea; for tourism – electricity (kWh) and tCO_2e saved per occupied room or m^2.

emissions and carbon intensity) developed under Activity 1.2.1 will be tested, verified and established for the energy generation and end-use sectors at the Uva, Central and Southern Provinces.

GEF will support, drafting of the sub-sector and sectors baseline reference inventory report and procedures for the web-based inventory system, the conduct of workshops and expert consultations in mobilizing necessary inputs and integrating various initiatives among the government, industry and other relevant stakeholders. Co-financing will be in terms of in-kind inputs for administrative and logistical support by partner government agencies in the conduct of workshops and consultations and mobilizing support from public sectors for the operation and maintenance of the inventory system.

Output 1.3: Established and operational national and provincial GHG emission inventory system based on energy generation and end-use sectors inventories (GEF grant = USD 58,000; Co-funding = USD 200,000)

This output will be used to test run the provincial GHG inventory system developed under output 1.1, 1.2 and 1.3 above and implement steps to improve and update the inventory system.

Activity 1.3.1: Develop and implement steps to regularly update and improve the inventory system: This activity involves the development of steps to improve data and information access where there is low analytic capacity at sub-national provincial level. Steps will be taken to build more efficient local capacity and national capacity. The roles of new technology in improving data access and management (e.g. remote data collection, mobile phones etc.) will be assessed.

Current data collection and compilation procedures and practices appear not to meet departmental and governmental needs. An assessment and identification of the possible reasons why the current procedures are not sufficient will be carried out in cooperation with the technical staff of the data collection and compilation unit(s) of SLSEA. Areas to assess could include:

- Staff capabilities: Do current staff have the capabilities and motivation to perform their assigned job functions or descriptions? Are the job descriptions written in such a way that individuals with the appropriate background can be hired? Is there sufficient career path/succession planning to ensure the long term viability of the data collection and compilation unit within the SLSEA?
- Data collection priority setting: Are priorities for data collection and compilation set appropriately, according to identified departmental and governmental needs and priorities?
- Data collection and compilation tools and systems: Are the tools and systems for reliable energy data collection and compilation available and appropriately run for the established data collection and compilation priorities?

Interdepartmental consultation: Is there an appropriate amount and type of dialogue across relevant Ministries and Agencies so that data collection and compilation needs and priorities can be communicated to the proper individuals or department.

Activity 1.3.2: Develop and conduct training programs to data management staff to strengthen the data collection efforts for inventory at sub-national level: A number of training programs will be conducted to relevant provincial staff in close consultation with SLSEA and TNC team. There will be additional modules on MRV, NAMA concept and carbon project protocols that can be implemented in the field.

Activity 1.3.3: Develop knowledge products on the use of the provincial inventory system for provincial inventory data management staff: Lessons learned will be documented and developed as knowledge products (CD, DVD, manual) and the training program will be developed to enhance the capacity of the public, private and CSOs stakeholders and exchange of ideas. To remain sustainable, annual budget will be developed for the management of the inventory system.

For the findings and lessons learned to be useful, these need to be compiled in a logical fashion and accompanied with a set of recommendations on possible solutions that could be implemented to eliminate or minimize the energy data collection and compilation barriers. The report setting out such findings and recommendations should cover:

- Identified barriers and the impact of those barriers on energy data collection and compilation in Sri Lanka;

- Recommendations on how to overcome the barriers; and
- Strategies for implementation of the recommendations.

Activity 1.3.4: Develop a strategy for replication to other provinces: This activity entails the development of steps to overcome the barriers for the replication of the inventory system to the other provinces and for national aggregation and vertical integration.

GEF support will be used for the required TA for a robust, web-based and user-friendly provincial inventory system for aggregation at the national scale. Co-financing will be in terms of in-kind inputs for administrative and logistical support by partner government agencies in the conduct of workshops and consultations and mobilizing support from public sectors for the operation and maintenance of the inventory system.

Component 2: Mitigation options for the energy generation and end-use sectors

This Component will support the Government of Sri Lanka in identifying and prioritizing appropriate mitigation options and implementation mechanisms (actions, instruments and tools) for the identification, approval, registration, development and implementation of NAMAs. A broad assessment of mitigation options at the sub-sectoral level will be conducted across the energy generation and end-use sectors, which will serve as a reference for the design of NAMAs for the energy sector. The detailed sub-sectoral assessment and NAMA design will focus on the sub-sectors selected during the project design phase (biogas, solar PV with storage battery and high efficiency motors for tea factories) to identify the NAMA activities that contribute most effectively to the achievement of the established national voluntary mitigation target and national development goals.

Outcome 2: Prioritized Mitigation Actions (NAMAs) in the energy generation and end-use sectors are identified and designed (GEF grant = USD 210,000; Co-funding = USD 600,000)

Based on the outputs from Component 1, the expected outcome from the delivery of the outputs of this component is the identification and design of prioritized and bankable NAMA in the energy generation and energy end-use sectors for implementation and demonstration under Output 3. These outputs are delivered by baseline and incremental activities that will support the development of marginal abatement cost curves for various energy generation technology options and energy efficiency and energy conservation measures in the end-use sectors. Barriers to the application of the mitigation actions will be identified and steps to overcome them will be assessed. Business models involving public private partnership will be developed for the implementation of the selected mitigation actions.

The following section describes the activities that will be done under Component 2 to deliver the expected Outputs that will contribute to the realization of Outcome 2:

Outcome	Output	Activities
Outcome 2: Prioritized Nationally Appropriate Mitigation Actions (NAMAs) in the energy generation and end-use sectors are identified and designed	Output 2.1 Developed and published detailed marginal GHG abatement cost curves for the energy generation and end-use sector	Activity 2.1.1 Develop MACC using collected data for energy generation (oil-based, thermal, coal, hydro, solar, wind, biomass) and end-use sectors (energy industry, transport, industry, residential and commercial) for Uva, Central and Southern Provinces Activity 2.1.2 Develop training program and annual budget on the use of MACCs Activity 2.1.3 Develop and implement a strategy to upgrade and update the MACCs on a regular basis
	Output 2.2 Completed comprehensive barrier analysis for mitigation options in the energy generation and end-use sector	Activity 2.2.1 Identify and analyze regulatory, technical, financial and social barriers to the implementation of CC mitigation actions in the energy generation and energy end use sectors in the Uva, Central and Southern Provinces
	Output 2.3 Identified and analyzed priority appropriate mitigation actions in the energy	Activity 2.3.1 Develop and implement selection criteria for prioritizing of NAMA in the energy generation and end use sector

	generation and end use sector in Sri Lanka	Activity 2.3.2 Develop a full NAMA design document for each selected NAMAs in the energy generation and end-use sector
	Output 2.4 Categorized identified mitigation actions as supported and voluntary	Activity 2.4.1 Review status and lessons learned in developing voluntary and supported NAMAs in Sri Lanka and other countries in the region Activity 2.4.2 Develop criteria for categorizing NAMA as supported or voluntary Activity 2.4.3 Design the implementation of the RE NAMAs for bio-digesters (domestic, institutional, industrial), and solar PV net metering combined with deep cycle battery Activity 2.4.4 Design the implementation of EE NAMA in tea factories for the application of efficient motors

Output 2.1 Developed and published detailed marginal GHG abatement cost curves for the energy generation and end-use sector (GEF grant = USD 80,000; Co-funding = USD 100,000)

Activity 2.1.1: Develop MACC using collected data for energy generation (oil-based, thermal, coal, hydro, solar, wind, biomass) and end-use sectors (energy industry, transport, industry, residential and commercial) for Uva, Central and Southern Provinces: Based on the provincial GHG inventory system developed under Output 1, MACC will be used to rank and prioritize NAMAs based on the technology cost (CAPEX, OPEX) and their potential GHG abatement as cost-effective solutions.

Activity 2.1.2: Develop training program and annual budget on the use of MACC tools: Training program will be developed to enhance the technical capacity of the provincial experts in the use and management of the MACC tools.

Activity 2.1.3: Develop and implement a strategy to upgrade and update the MACC tools on regular basis: Feedback loop will be developed for improving and upgrading the MACC tools and lessons learned will be documented for sharing with other MACC experts.

GEF support will be for the development and upgrading of the MACC tools, conduct of the training, logistical support for participants and training expert consultation, trainer fees and facilitation and other related expenses. Co-financing will be in terms of in-kind inputs for the government officers' time in evaluating and adopting training designs and plans and for administrative and logistical support. In-cash co-financing will also be provided by government for coordination meetings and expenses in providing staff support.

Output 2.2: Completed comprehensive barrier analysis for mitigation options in the energy generation and end-use sector (GEF grant = USD 45,000; Co-funding = USD 200,000)

It is important to identify what barriers and risks are involved in the scaling up of mitigation actions at the provincial and national level and how these could be overcome cost effectively by the provincial and national authority.

Activity 2.2.1: Identify regulatory, technical, financial and social barriers analysis for energy generation and end use mitigation interventions at the Uva, Central and Southern Provinces: This activity entails the identification of the regulatory, technical, financial and social barriers for scaling up of RE and EE NAMA at the provincial and national levels and means to mitigate them will be developed based on UNDP's de-risking tools.

GEF support will be focus on the identification and overcoming barriers in the scaling up of RE and EE NAMA. Co-financing will be in terms of in-kind inputs for the government officers' time in evaluating and adopting training designs and plans and for administrative and logistical support. In-cash co-financing will also be provided by government for coordination meetings and expenses in providing staff support.

Output 2.3: Identified and analyzed priority appropriate mitigation actions in the energy generation and end use sector in Sri Lanka (GEF grant = USD 40,000; Co-funding = USD 150,000)

Activity 2.3.1 Develop and implement selection criteria for prioritizing NAMA in the energy sector: Review lessons learned and develop selection criteria (regulatory, technical, financial, economic, and social) for prioritization of mitigation solutions in the energy sector. The criteria should allow differentiation and trade-off analysis between options that optimize economic and financial benefits. The former will optimize public goods to account for externality cost whilst the financial return will optimize private goods. The prioritized mitigation options will be implemented under output 3.

The prioritization process will incorporate a multi-criteria assessment (MCA) methodology to ensure the alignment with the national priorities of the country. Weightage of each prioritization parameter will be consulted with government officials from SLSEA, MoPE, MPE and MOF. A complete and comprehensive analysis of the impact of the mitigation options on sustainable development, socio-economic aspects and climate resilience impacts (co-benefits), as well as a full barrier analysis (Output 2.2) will be undertaken for the prioritized mitigation options.

The prioritization process will also make use of UNDP tool "Derisking Renewable Energy Investment" [12] which assists policymakers to quantitatively compare the impact of different public instruments to promote renewable energy. This will allow the identification of actions that can be converted into NAMAs to address the barriers that increase the financing cost of renewable energy in Sri Lanka and to lower life-cycle costs, making renewable energy technologies more competitive. This analysis will strengthen the selection of adequate instruments for the implementation of renewable energy connected to the grid NAMAs.

Activity 2.3.2 Develop a full NAMA design document for each selected NAMAs in the energy sector: Full NAMA Design Documents will be prepared for the four selected NAMAs, using the NAMA template proposed by the UNFCCC, UNEP Risoe and UNDP in the Guidance for NAMA Design recently published (November 2013). The proposed NAMA design template includes the following sections:

- A.1 Summary
- B.1 Information of NAMA Proponents - Provide details of each NAMA proponent separately by copying this Section B.
- B.2 NAMA Collaborator(s) - Provide details of the agencies / institutions collaborating with NAMA proponent(s) in NAMA design, development, implementation and financing (domestic institutions or international Donor).
- C.1 Policies and Regulations - Provide an overview of the prevailing policies and regulations in the sector chosen for the NAMA
- C.2 Current level of activities (Baseline) - Provide all relevant information and details of the on-going activities for establishing a credible baseline
- C.3 Baseline activity and emissions - Provide a brief of business as usual scenario of the sector / sub-sector and latest emissions data set with sources
- C.4 Barriers - Provide a brief description of the barriers faced by the sector / sub-sector to achieve any or additional GHG emission reduction in the absence of the NAMA.
- C.5 Proposed activities - List the activities and expected outcomes with a tentative time-schedule under the NAMA
- C.6 Estimation of annual GHG emission reduction - Provide an approximate estimate of annual GHG emission reduction anticipated to be achieved under the NAMA from all the proposed activities on a cumulative basis.
- C.7 Overall benefits - Describe the overall expected benefits (both quantitative and qualitative) for the stakeholders from the implementation of the proposed activities under the NAMA in the targeted sector / sub-sector.
- C.8 Life time and Crediting Period - Provide the technically defined life time of project and the proposed crediting period for generation of GHG emission reduction. For crediting period more than 10 years indicate (If possible) whether the baseline will be adjusted before the start of second crediting period

[12] *http://www.undp.org/content/undp/en/home/librarypage/environment-energy/low_emission_climateresilientdevelopment/derisking-renewable-energy-investment/*

- C.9 Measuring, Reporting & Verification - Provide a brief summary of MRV concept and approach for the proposed activities under the NAMA to be developed under output 4
- C.10 Costs (USD) - Provide an estimate of the transaction costs for NAMA development and indicate the means of financing
- C.11 NAMA Investment & Means of Finance (USD) - Provide an estimate of the NAMA project activity (fill up the columns as applicable)
- D.1 Other information - Provide details of any other information relevant to the NAMA implementation

GEF support will be focus on the identification and prioritization of a pipeline of bankable NAMAs. Co-financing will be in terms of in-kind inputs for the government officers' time in evaluating and adopting training designs and plans and for administrative and logistical support. In-cash co-financing will also be provided by government for coordination meetings and expenses in providing staff support.

Output 2.4: Categorized identified mitigation actions as supported and voluntary (GEF grant = USD 45,000; Co-funding = USD 150,000)

In terms of funding, there are essentially two ways of financing a NAMA: unilateral or supported NAMAs. While this project will focus on developing unilateral NAMAs with the use of domestic resources, opportunity to attract international funding to develop supported NAMAs will be explored.

Activity 2.4.1: Review status and lessons learned in developing voluntary and supported NAMA: This activity involves the review of the status and lessons learned in the development and implementation of the voluntary, supported or credited NAMA.

Activity 2.4.2: Develop criteria for categorizing NAMA as supported or voluntary: Lessons learned will be used to formulate criteria for the categorizing of NAMA as voluntary, supported or credited NAMA for the RE and EE sector. This set of criteria will help allocate and mobilize national budget where resources are most needed.

GEF support will be focus on the development of the voluntary and supported NAMA. Co-financing will be in terms of in-kind inputs for the government officers' time in evaluating and adopting training designs and plans and for administrative and logistical support. In-cash co-financing will also be provided by government for coordination meetings and expenses in providing staff support.

Based on the MACC tools, NAMA Factsheet and feedback from public, private and CSO stakeholders gathered during PPG phase, this output laid down the rationale for the choice of the technology and the sectors. In view that Sri Lanka Carbon Fund has already registered two PoAs for small hydro and MSW Waste to Energy project, these sub-sectors will not be considered here but lessons learned will be drawn upon heavily.

Activity 2.4.3: Design the implementation of the RE NAMAs for bio-digesters (domestic, institutional, industrial), and solar PV net metering combined with deep cycle battery: Based on the MACC tool and recommendations from the stakeholders and partners, the NAMA Implementing Entity at SLSEA will develop the national biogas program and solar PV project. The final output will be implemented under Output 3.3. The concept note is presented in Annex B and C.

Activity 2.4.4: Design the implementation of EE NAMA in tea factories for the application of efficient motors: This activity involves the design of the implementation of the HEM in tea factories as EE NAMA using the AMS II.D methodology. The concept note is presented in Annex D.

GEF resources will be used for the design of the RE and EE NAMA through the MACC tools and implementation mechanisms. Co-financing will be in terms of in-kind inputs for the government officers' time in evaluating and adopting training designs and plans and for administrative and logistical support. In-cash co-financing will also be provided by government for coordination meetings and expenses in providing staff support.

Component 3: Implementation of appropriate mitigation actions in the energy generation and end-use sectors

Outcome 3: Implemented prioritized appropriate mitigation actions through identified private and public sector entities for the achievement of Sri Lanka voluntary mitigation target (GEF grant = USD 1,510,000; Co-funding = USD 23,940,000)

From the results of Component 2, selected prioritized mitigation actions designed into NAMAs will be further structured into full operational NAMAs, including the establishment of the instruments to be used for their implementation and the formalization of the institutional arrangements. The best policy, regulatory and financial tools and instruments mix to support the implementation of the identified mitigation actions will be established.

The approach to market transformation for the adoption of bio-digester, solar PV and HEM is to use a value chain approach that develops customized solutions and incentives to induce change in each stage of the value chain and prioritize interventions that maximize emission reduction and deliver developmental co-benefits. Specifically on financial mechanisms, the project will partner with local banks to build upon the lessons learned and develop viable matching rebate for 400 bio-digester and solar PV and explore portfolio partial loan guarantee scheme for the dissemination of RE and EE solutions. The project will also work closely with Sri Lanka Carbon Fund to build upon the lessons learned in designing, registering and implementing the two registered PoAs for small hydro and MSW Waste to Energy.

The following section describes the activities that will be done under Component 3 to produce the expected Outputs that will contribute to the realization of Outcome 3:

Outcome	Output	Activities
Outcome 3: Implemented prioritized appropriate mitigation actions through identified private and public sector entities for the achievement of Sri Lanka voluntary mitigation target	Output 3.1 Identified and established fully capable and qualified private and public sector entities in the implementation of climate change mitigation programs and sourcing of funds	Activity 3.1.1 Develop criteria for the selection of public and private stakeholders as potential partners Activity 3.1.2 Define and develop business and financial modality, roles and responsibilities of the NAMA Implementing Entity under SLSEA and PPP in the implementation of the each NAMA (bio-digester, solar PV with battery storage, HEM) in partnership with Sri Lanka Carbon Fund and other relevant institutions. Activity 3.1.3 Review and suggest sources of potential funding for voluntary and supported NAMA and develop investment platform
	Output 3.2 Updated financial tools that support the implementation of the mitigation actions program in the energy generation and end-use sectors, including sustainable energy guarantee fund, fiscal incentives, feed in tariffs and other options available in Sri Lanka	Activity 3.2.1 Review lessons learned and develop best practices in the use of financial instruments (matching rebate, partial loan scheme) for the scaling up of RE and EE solutions. Activity 3.2.2 Develop and implement financial instruments to support end users for the purchase of bio-digesters, solar PV and high efficiency motors (HEM) as part of the PPP structure using matching rebate and viable business model
	Output 3.3 Implemented NAMA projects	Activity 3.3.1 Implement HEM application in the tea sector and solar PV with battery storage NAMA project in private sector funded modality Activity 3.3.2 Implement biogas projects in the Uva, Central, Southern and North Western Provinces in PPP modality

Output 3.1 Identified and established fully capable and qualified private and public sector entities in the implementation of climate change mitigation programs and sourcing of funds (GEF grant = USD 84,731; Co-funding = USD 250,000)

The design of NAMAs, operational arrangements and corresponding MRV systems (Output 4) will require a strong capacity and readiness of large set of diverse stakeholders, including civil society, the private sector, professional associations, academics, sub-national governments and public institutions. The participation of these stakeholders in the NAMA development process is essential to ensure that the NAMAs are designed with full consideration of national circumstances. To deliver this output, capacity building will be carried out for the relevant stakeholders in the design and implementation of mitigation programs and in the identification of funding sources and options, as well as MRV requirements.

Activity 3.1.1: Develop criteria for the selection of public and private as potential partners: Based on value chain analysis, the public, private and CSO actors and service providers will be identified, as well as how these will work together in scaling up the identified and prioritized NAMA.

Activity 3.1.2: In partnership with Sri Lanka Carbon Fund and other relevant institutions, define and develop business and financial modality, roles and responsibilities of the NAMA Implementing Entity under SLSEA and PPP in the implementation of the each NAMA (bio-digester, solar PV with battery storage, HEM): To ensure smooth implementation and operation, the roles and responsibility of the various public and private actors and service providers for the implementation of the demonstration project under output 3 will be defined and developed. Implementation arrangement is described in Annex B, C and D.

This activity entails the identification and setting up of the project developers with clear roles and responsibility. Viable and cost effective business model developed under output 2.5 above to incentivize all value chain actors will be used where implementation arrangement and the roles and responsibility of the various public and private stakeholders are clearly defined and adopted. Public sector resources will be mobilized to provide technical assistance in the form of raising public awareness to stimulate demand to remove country risks whilst the private sector resources will be used to overcome delivery and project risks for developing viable business. A strong PPP within a NAMA framework must be built upon a culture of trust and integrity supported with good governance and oversight. The implementation mechanisms for the RE and EE NAMA are explained in details in Annex B, C and D.

The NAMAs Design process will be both systematic and practical; presenting a framework that will put together the main NAMA elements in a realistic and operational way, useful and attractive to the end-user (i.e., assisting the implementers in meeting the NAMA funding and implementation targets, and proving an effective mean of engaging all the stakeholders mentioned above). This systematic, step-wise approach is strongly advisable, and is found in successful mitigation programs and NAMA design exercises around the world. Furthermore, a very practical, hands-on approach that is focused on the daily challenges faced by those who will work on the ground will be paramount to ensure a successful implementation.

GEF support will be used to develop the PPP structure and viable business model and setting of the NAMA Implementing Entity.

Activity 3.1.3: Review and suggest sources of potential funding for voluntary and supported NAMA and develop investment platform: In partnership with Sri Lanka Carbon Fund, a review of all various sources of climate funding such as national budget, private investors, impact investors and public climate bonds, Green Climate Fund will be carried out. Recommended strategy to attract these funds as grants or concession loan through an investment platform and SLCF will also formulated.

GEF support will be focus on the development of the public private partnership encompassing both financial and business models and identify sources of potential funding, Co-financing will be in terms of in-kind inputs for the government officers' time in evaluating and adopting training designs and plans and for administrative and logistical support. In-cash co-financing will also be provided by government for coordination meetings and expenses in providing staff support.

Output 3.2: Updated financial tools that support the implementation of the mitigation actions program in the energy generation and end-use sectors, including sustainable energy guarantee fund, fiscal incentives, feed in tariffs and other options available in Sri Lanka (GEF grant = USD 110,000; Co-funding = USD 200,000)

Activity 3.2.1: Review lessons learned and develop best practices in the use of financial instruments (matching rebate, partial loan scheme) for the scaling up of RE and EE solutions: To overcome the financial barriers (lack of access, lack of collateral, high upfront cost, high interest rate, high import tax) for the scaling up of RE and EE NAMA, and together with PFIs and MFIs a review will be carried out of the provincial, national, regional and international financial tools and best practices so that lessons learned could be applied and pitfalls avoided for ensuring program sustainability and replicability beyond the GEF project. The output from this will support SLSEA and PFIs in the design of cost-effective, sustainable and viable financial tools for the coordination and implementation of the RE and EE NAMA. Work on the reactivation of the Sustainable Guarantee Facility (SGF) and the use of the RERDP fund will be carried out. In addition, technical assistance to PFIs will be provided for strengthening their confidence in developing loan products and services for the scaling up of RE and EE solutions.

To re-activate the SGF, a portfolio of partial loan guarantee scheme for the implementation of RE and EE NAMA will be designed. There is a need to overcome the prevalent lack of trust between ESCOs, suppliers and owners and lack of a coherent and transparent institutional and financial capacity and framework, whereby certified ESCOs will be able to provide their services. To ensure excellent after sales guarantee and services, performance-based incentives scheme could be deployed whereby ESCOs will only receive payment upon hitting the quarterly target of electricity savings. The financial assistance could either be used to i) subsidize the interest rate of the loan offered by PFIs (NDB, DFCC) or ii) be held in trust in a commercial bank and set aside as a partial loan guarantee to cover for any eventual loan defaults. There is a need to ensure long-term financial sustainability, to wean the value chain actors away from the addiction and mentality of subsidy dependencies and to avoid market distortion. Furthermore, this will allow a timely, robust and transparent PPLG framework to be developed whereby SGF could be re-activated and become operationalized. The details of the implementation mechanisms, business model and financial sustainability of the portfolio partial loan guarantee scheme will be developed.

Activity 3.2.2: Develop and implement financial instruments to support end users for the purchase of bio-digesters, solar PV and high efficiency motors (HEM) as part of the PPP structure using matching rebate and viable business model: This activity entails the design, coordination and implementation of matching rebate scheme by SLSEA for the dissemination of 10 solar PV and 1,000 bio-digesters for the residential, institutional and industrial sectors as RE NAMA for qualified end users. Instead of providing a blanket rebate scheme, a sliding scale rebate will be designed whereby the rebate amount is reduced as the volume of installation increase. To ensure excellent after sales services, performance-based payment will be deployed whereby installers are only paid based on certified performance. The details in the implementation mechanisms, business model and financial sustainability of the matching rebate scheme are explained in Annex B.

Financial support will be provided to the owners and installers in the form of matching rebate grant based on a set of eligibility criteria, including: (a) commitment of owners/installers to participate in NAMA program; (b) installers is a certified company with SLSEA and offer certified solar PV and biogas system and active in the Sri Lanka market; and (c) the owners/installers expressed interest to participate as beneficiaries of NAMA project. The specific GEF financial assistance arrangements for solar PV and biogas were determined and agreed during PPG phase as explained in Annex B. The financial assistance proposals are indicative of the owners need. This will be confirmed at the start of project implementation and shall be coordinated very closely in terms of coverage, scheduling and specific financial support that will be shared between GEF and owners. The amount of GEF financial assistance that will be provided to owners shall be the incremental cost that will be incurred in the purchase of the solar PV with battery storage and bio-digester.

GEF resources will be used as TA for the design of the matching rebate for the purchase of bio-digester, solar PV system and HEM, training on its application and actual usage by the selected owners. The industry will shoulder in-kind inputs in terms of operation, maintenance and staff support.

Output 3.3: Implemented NAMA projects (GEF grant = USD 956,269; Co-funding = USD 23,940,000)

Activity 3.3.1 Implement HEM in the tea sector and solar PV with battery storage NAMA project in private sector funded modality: It is critical to leverage private resources for the promotion of clean technologies in reducing GHG emissions. This activity involves the test run of the development of EE NAMA to be operated and managed by the private sector. A total of 220 units of HEM will be installed in 22 tea factories by certified ESCOs as detailed in Annex B based on matching rebate scheme as developed under Activity 3.2.1 above. This will monitor the potential energy and GHG savings of the HEM solutions and their cost benefits analysis will be carried out. This will help to demonstrate the HEM and spur other tea factories to adopt this HEM technology.

GEF resources will be used to support tea factories for the purchase of HEM as matching rebates. Co-financing will be in terms of in-kind inputs for administrative and logistical support by partner government agencies in the conduct of workshops and consultations and mobilizing support from private companies and industry associations for the implementation of the EE NAMA.

Activity 3.3.2: Implement biogas projects in the Uva, Central, Southern and North Western Provinces in PPP modality: As biogas programs are already being scaled up as Programmatic CDM for the compliance and voluntary market in Asia, this activity entails the implementation of the dissemination of 500 bio-digesters as a PoA using the approved UNFCCC methodology and protocol – AMS. This activity entails the development of the PoA and CPA design documents based on methodology. The stringent M and E plan for the biogas PoA will be adopted and form part of the MRV to be developed under Output 4.

GEF resources will be used for the implementation of the demonstration projects and lessons learned captured as knowledge products. Co-financing will be in terms of in-kind inputs for administrative and logistical support by partner government agencies in the conduct of workshops and consultations and mobilizing support from private companies and industry associations for the operation of the NAMA system.

Component 4: MRV system and national registry for mitigation actions in the energy generation and end-use sectors

Outcome 4: Accurate measurement and accounting of actual GHG emission reduction from mitigation actions in the energy generation and end-use sectors (GEF grant = USD 184,000; Co-funding = USD 480,000)

The expected outcome from the outputs that will be delivered under this component is “accurate measurement and accounting of actual GHG emission reduction from mitigation actions in the energy generation and end-use sectors”. The current policy design and planning processes do not consider the importance and the advantages of a Measurement, Reportable and Verifiable (MRV) methodology for ongoing projects and programs and how useful and beneficial such procedure can be in assessing the contribution of NAMA implementation to the overall national voluntary GHG emission reduction targets. The project outputs will be delivered by both baseline and incremental activities which will ensure these elements are included as part of the planning process of appropriate mitigation actions. To avoid mistakes made under CDM, the MRV system should include metrics that can measure and/or quantify the sustainable development benefits of the actions, for instance in terms of poverty reduction of local communities, improved health conditions, higher social inclusion, etc.

The following section describes the activities that will be done under Component 4 to generate the expected Outputs that will contribute to the realization of Outcome 4:

Outcome	Output	Activities
Outcome 4: Accurate measurement and accounting of	Output 4.1 Established and operational NAMA supporting entities and mechanism for	Activity 4.1.1 Identify and select focal point as NAMA Supporting Entities (NAMA Secretariat, NAMA Coordinating Entity (NCE), NAMA National Registry, MRV Committee, NAMA Implementing Entity)

actual GHG emission reduction from mitigation actions in the energy generation and end-use sectors	mitigation actions in the energy generation and end-use sectors	Activity 4.1.2 Define roles and responsibilities of these supporting entities Activity 4.1.3 Review best practices and recommend institutional arrangement for the setting up of these supporting entities Activity 4.1.4 Develop steps to monitor, evaluate, upgrade these supporting entities
	Output 4.2 Defined key parameters (quantitative/qualitative) to be monitored for the selected appropriate mitigation actions	Activity 4.2.1 Based on the inventory system developed under output 1.3, establish monitoring framework by defining key parameters for bio-digesters, solar PV and HEM NAMA to be measured, monitored, recorded and updated on the web-based EnerGIS platform (based on Quality Control and Quality Assurance principles)
	Output 4.3 Designed and implemented MRV system for the selected appropriate mitigation actions	Activity 4.3.1 Develop best practices in MRV standards and methodologies for RE (solar PV and biogas) and EE NAMA (HEM) based on established CDM methodologies and IPCC guidelines and principles Activity 4.3.2 Design and test the MRV system for bio-digesters, solar PV and HEM NAMAs Activity 4.3.3 Adopt and develop best practices in monitoring plan for RE (solar PV and biogas) and EE (HEM in tea factories) NAMAs
	Output 4.4 Completed capacity development program for strengthening all public, private (value chains actors) and CSO stakeholders involved in the operation and management of the NAMA program	Activity 4.4.1 Review and document lessons learned for the development of gender sensitive knowledge products (CD, DVD, training manuals) and gender sensitive training program for all NAMA staff in operation and management of the Inventory, MRV system and implementation of the NAMAs

Output 4.1 Established and operational national registry mechanism for mitigation actions in the energy generation and end-use sector (GEF grant = USD 50,000; Co-funding = USD 100,000)

As shown in Figure 4 that illustrates the steps for the development of the proposed NAMA framework, it is critical that a National Coordination Entity (NCE) be legally established and recognized with the mandate to coordinate, implement and manage the NAMA approval and processing activities. Likewise, a National NAMA Registry will also need to be established to record and manage the national GHG savings entry that meet international standard. This output will be helpful for SLSEA in setting up the NAMA Secretariat, NAMA CE and NAMA Registry.

Activity 4.1.1: Identify and select focal point as NAMA Secretariat, NAMA Coordinating Entity (NCE) and as NAMA National Registry: As part of the process of establishing NAMAs, the SLSEA, as the governing body in Sri Lanka for climate change, will be in charge of setting a national registry mechanism for mitigation actions. The registry will be linked to the database of potential mitigation actions that will be established through the Component 2 and will be integrated and coordinated with the EnerGIS database. A specific section of the registry will be for actions implemented in the energy sector. Close coordination will be carried out between the MPE and the MPE in the establishment of the registry of mitigation actions for the energy generation and end-use sector.

An MRV committee will be established for NAMAs in the energy sector, with the responsibility of defining protocols and providing guidance on measuring, collecting and verifying data, and ensuring the functionality of the national registry. The committee will also identify the specific needs for capacity development of local technical professionals in order to ensure the quality of the MRV of the NAMAs.

Activity 4.1.2: Define roles and responsibilities of the NAMA Secretariat, NCE, NAMA Registry, MRV committee, NAMA Implementing Entity: The roles and responsibility of the NAMA NCE and Registry will be defined under this activity and if needed new mandates may need to be added to existing legislation to gain legal status.

Activity 4.1.3: Review best practices and recommend institutional arrangement for the setting up of the NAMA Secretariat, NCE and NAMA registry: This activity involves the review of lessons learned in the setting up and implementation arrangement of national NAMA registry and adopt best practices to optimize resource use and to avoid pitfalls. The procedures and processes for project/program vetting, review and approval will be clearly defined.

Activity 4.1.4: Develop steps to monitor, evaluate, and upgrade these supporting entities: Steps will be developed to monitor and evaluate the performance of the NCE and Registry so that further improvement can be made. Further, it is important to set out clear steps the procedures for the integration and registration of MRVed NAMA to the international NAMA registry. In order to ensure sustainability, it is critical to set aside annual budget for the operation and management of the NCE and Registry. Furthermore, the capacity of the national experts will need to be upgraded through regular training and expose to regional and international conference for the exchange of knowledge and lessons learned. The GEF project will support the establishment of the MRV network where the MRV costs will be embedded in the RE and EE program as part of cost recovery. *GEF assistance will be for setting up of the NAMA institutional framework with supporting systems.*

Output 4.2: Defined key parameters (quantitative/qualitative) to be monitored for the selected appropriate mitigation actions (GEF grant = USD 50,000; Co-funding = USD 100,000)

Activity 4.2.1: Based on the inventory system developed under output 1.3, establish monitoring framework by defining key parameters for bio-digesters, solar PV and HEM NAMA to be measured, monitored, recorded and updated on the web-based EnerGIS platform (based on Quality Control and Quality Assurance principles): Based on the MACC tools developed under output 2.1, the key parameters to be monitored for RE and EE NAMA will be developed with clear project/program boundary using web-based platform. Steps to improve and update the data will be developed. Key parameters to be monitored will be selected, both quantitative and qualitative as defined in the approved AMS methodology. This will allow the precise monitoring of the mitigation benefits of the three implemented NAMAs in terms of energy savings, GHG emission reduction, and additional parameters will be selected to evaluate the co-benefits. A monitoring plan including these parameters will be designed and implemented for the RE and EE NAMA under Activity 4.6.1 in conjunction with the implementation of the mitigation actions through the Component 3. The monitoring template in excel will include how the monitoring will be done, its frequency and by whom, and the quality assurance (QA) and quality control (QC) procedures.

Output 4.3: Designed and implemented MRV system for the selected appropriate mitigation actions (GEF grant = USD 34,000; Co-funding = USD 100,000)

Activity 4.3.1: Develop best practices in MRV standard and methodologies for RE (solar PV and biogas) and EE NAMA (HEM) based on established CDM methodologies and IPCC guidelines and principles: In order to ensure consistency, accuracy and reliability, a national MRV guideline and methodology standard will be developed and updated to guide MRV Committee members and national experts in the implementation of the MRV system. This activity entails the review of regional and international lessons learned and adopt best practices and principles for the development of clear and user-friendly MRV guideline and standard for the biogas, solar and HEM in tea factory and other sectors. The standard will be developed according to IPPC guidelines and principles. National MRV guidelines and standard methodologies for the selected NAMAs will be developed based on the following guidance and the approved methodologies:

- Key indicators – Guidelines on how to select and provide specific and adequate indicators (quantitative or qualitative), and the associated target that will be used to assess the progress towards the results expected of each activity.
- Responsible entity – Guideline on how to define the roles and responsibilities of the entity in charge of applying the indicators for each activity.

- Frequency and measurement details – Guideline on how to define periodicity of monitoring for each indicator, as well as the description of the monitoring procedure.
- Reporting – Guideline of how NAMA activities and results will be reported, proposing reporting forms coherent with the verification process.
- Verification – Guidance on verification of the results achieved by the NAMAs and preparation for third-party verification.
- Where appropriate, GPS and cellular technology that allows for low cost and efficient gathering and processing of data and allow end users to independently report poor performance, document malfunctions, and trace the maintenance performance of the private providers will be developed. The decentralized administration of the system will build upon existing service networks and community arrangements for the provision of data, supported by periodic independent field visits by SLSEA verifiers to ensure compliance.

Based on regional and international experiences and knowledge sharing, steps to improve and update the guideline and standard will be developed along with training program so that the guideline and methodology standard are used professionally and efficiently. *GEF assistance will be for the development of the MRV standard and methodologies.*

Activity 4.3.2: Design, test run and update the MRV system for bio-digesters, solar PV and HEM NAMAs: Based on the guideline and methodology standard developed under output 4.4, the MRV system will be designed, tested and updated under output 3.4 using the chosen RE (biogas, solar net metering) and EE technology (HEM in Tea factories) to avoid double accounting.
GEF assistance will be for testing the MRV systems for the RE and EE NAMA.

Activity 4.3.3: Adopt and develop best practices in monitoring plan for RE (solar PV and biogas) and EE (HEM in tea factories) NAMAs: In order to ensure accuracy and credibility, it is important to develop a stringent monitoring plan so that methodologies (indicators and milestones) and standard are followed closely. The stringent monitoring plan with detail quality assurance and quality control on the parameters to be collected and monitored for determining baseline and project GHG emissions as developed under Output 3.2 according to the approved PoA methodology for solar PV, biogas and HEM will be adopted. These parameters for the calculation of baseline and project GHG emissions are shown in Annex G, H, and I. *GEF assistance will be for design and implementation of the monitoring plan.*

Output 4.4: Completed capacity development program for strengthening all public, private (value chain actors, MFIs) and CSO stakeholders involved in the operation and management of the NAMA program (GEF grant = USD 50,000; Co-funding = USD 180,000)

This output will ensure that all public, private and CSO stakeholders involved in the NAMA programs are fully trained in the operation and management of the Inventory and MRV Systems.

Activity 4.4.1: Review and document lessons learned for the development of gender sensitive knowledge products (CD, DVD, training manuals) and gender sensitive training program and study tours for all NAMA public, private and CSO stakeholder in operation and management of the Inventory, MRV system and implementation of the NAMAs: Lessons learned in the operation and implementation of the NAMA program with inventory and MRV system will be collected and documented as gender sensitive knowledge products (CD, newsletter, DVD, leaflet, manual). Gender sensitive and participatory training and study tour will be organized for key public, private and CSO stakeholders in the operation and management of the Inventory, MRV system and implementation of the NAMAs. MRV training and study tours will enhance technical capacity and ensure the availability of capable and qualified local technical professionals to conduct MRV for NAMAs in the energy sector. Furthermore, this activity also includes the assessment of the suitability of the new NAMA evaluation tool[13] released by UNDP for evaluating the sustainable development performance indicators and sustainable development results achieved over the lifetime of the NAMA. The tool is linked to the proposed Sustainable Development Goals (SDGs) and shall allow policy makers to track the effects of the NAMA on environmental conservation, economic growth, poverty reduction and public welfare. NAMA sustainable development benefits are quantified using Nationally Appropriate Improvements (NAIs) and are calculated for each indicator to evaluate the co-benefits of each intervention for a specific monitoring

[13] *http://www.undp.org/content/undp/en/home/librarypage/environment-energy/mdg-carbon/NAMA-sustainable-development-evaluation-tool/*

period. *GEF support will be used to document lessons learned as knowledge products for use in training. Co-financing will be in terms of in-kind inputs for administrative and logistical support by partner government agencies in the conduct of workshops, study tours and consultations.*

2.4 Cost Effectiveness

At the end of the Project, approximately 16,126 tCO_2e emissions will be avoided directly, through the dissemination of 1,000 bio-digesters, 1,300 high efficiency motors and 205 solar PV systems. Throughout the life of the same bio-digesters, HEM and solar systems, and without the benefit of additional installations, the cumulative GHG mitigation is expected to be at least 66,639 tCO_2e. Towards the end of the project implementation, it is expected that more similar NAMA initiatives will be implemented as influenced by the successful implementation and results of the NAMA interventions of the project that would lead to investments commitment. This will result in a direct post-project emissions avoided from the implemented bio-digester, HEM, and solar PV NAMAs will be 268,633 tCO_2e. These include the committed investments for these NAMAs from the start up to the end of the 4-year project plus the GEF incremental funds that were used to facilitate (through enabling environment creation and removal of barriers). Considering the lifetime direct and direct post-project GHG emissions reduction, the unit abatement cost of the project is US$ 5.34/tCO2e. The project's cost effectiveness will be tracked using the Tracking Tool for Climate Change Mitigation Projects. Tables below summarize project direct (i.e. by end of the project), lifetime direct, and lifetime direct post-project GHG emissions avoided along with energy savings achieved due to these NAMA interventions.

Table 5a: Project direct GHG emissions reduction from bio-digester, HEM, and solar PV by the End of the Project (EOP)

Description	Bio-digester	High Efficiency Motors (HEM)	Solar PV	Total
Quantity of electricity saved (MWh)	121	6,069	617	6,806
Quantity of energy saved (MJ)	1,327,713	66,754,512	6,784,414	74,866,639
GHG emissions mitigated (tCO_2e)	11,317	4,365	444	16,126

Table 5b: Lifetime direct GHG emissions avoided from bio-digester, HEM, and solar PV

Description	Bio-digester (10 years)	HEM (10 years)	Solar PV (20 years)	Total
Quantity of electricity saved (MWh)	1,281	24,882	3,466	29,629
Quantity of energy saved (MJ)	4,609,820	273,704,112	38,126,494	316,440,425
GHG emissions mitigated (tCO_2e)	46,248	17,898	2,493	66,639

Table 5c: Lifetime direct post-project GHG emissions avoided from bio-digester, HEM, and solar PV

Description	Bio-digester (10 years)	HEM (10 years)	Solar PV (20 years)	Total	Abatement cost (USD/tCO_2e) = GEF grant/(Lifetime direct and direct post-project GHG emissions)
Quantity of electricity saved (MWh)	597	74,328	259,121	334,046	
Quantity of energy saved (MJ)	6,564,213	817,610,112	2,850,328,800	3,674,503,125	
GHG emissions mitigated (tCO_2e)	28,783	53,464	186,386	268,633	= 1,790,411/(66,639+268,633)= 5.34

2.5 Sustainability

The concept of NAMAs as a means to engage non-Annex 1 countries in mitigation efforts is entrenched in the UNFCCC discussions and negotiations, providing further stability to the project context. Therefore, the conceptual framework of the project is highly likely to be sustainable, as NAMAs will

continue to form a part of UNFCCC discussions and Sri Lanka is committed to achieve its voluntary targets.

With regards to the energy sector NAMA identification, priority setting, and design process, the project will undertake an extensive sector assessment from the GHG abatement perspective, strengthening links to national development priorities and identifying cost effective opportunities for NAMA development. This process will define clear links between GHG reduction opportunities and national energy sector priorities, serving as a roadmap for all NAMA activities in the energy sector. There are two key components for the sustainability of this roadmap, which are the capacity to mainstream CC mitigation actions within the energy sector and the capacity to continuously revalidate and reassess priorities. The project directly addresses these two issues.

The NAMA design process will involve key stakeholders from the energy sector and include assessment parameters that are directly linked to national priorities and ongoing or planned programs. The NAMAs will be structured, to the extent possible, within existing institutional frameworks rather than resorting to the creation of new committees. GHG abatement measures will be linked to the government's ongoing procedures and programs, strengthening the mitigation aspects of these programs instead of developing new ones.

The establishment of priorities and definition on sector wide NAMAs is not expected to be a static process that established a rigid work plan. The project will create a framework in which the establishment of NAMAs is an ongoing and iterative process and can adapt to the country's changing circumstances. The established targets are clear, and, once NAMAs are designed and under implementation their basic framework should not change significantly. However, the process of establishing new NAMAs and adjusting the sector level strategy to achieve its goals should be fluid and allow for the incorporation of new experiences, changes in national conditions, and other unexpected circumstances. The project will seek to establish the conditions for such a continuous planning exercise to ensure that the relevance of the establish energy sector roadmap is maintained across time.

With regards to NAMA implementation, the sustainability of the NAMA activities will be a key parameter both at the design and piloting phase. A factor that strongly favors sustainability is that MRV is the key aspect to the success of any NAMA. Therefore, the establishment of strong MRV systems, linked to performance based payments when appropriate, will be a key element for NAMA implementation. Furthermore, the project will prioritize the implementation of NAMAs that are linked to ongoing or planned government programs, strengthening their GHG emission reduction potential and their capacity to perform MRV. By aligning NAMAs to national priorities, the project will mainstream its actions within a broader development context, which strongly favors sustainability.

2.6 Replicability

The challenge is to ensure that the robust and transparent inventory, MRV and NAMA framework developed at the provincial levels for the bio-digesters, solar PV net metering combined with battery storage, and HEM for tea factories, could be replicated to other provinces and for the other RE and EE applications in other sub-sectors. This will be achieved through the development of a user friendly system where the needs of the end users are assessed and their feedback used to improve and refine the system. Capacity development program will be put in place to ensure that the technical capacities of the staff are up to date. Required annual budget will be secured to support institutional and technical capacity and that there are adequate resources for training and manpower supply.

The project is designed to establish a sustainable framework for energy sector NAMA design and implementation. This is intended to trigger the process of implementing NAMA activities in the country and to foster the replication of such activities in Sri Lanka. The project can expect replication at the following three levels:

i. Pilot NAMA implementation: The project will pilot the implementation of 3 NAMA activities within its implementation period. These NAMA activities are expected to have a longer lifespan, and their scope is expected to grow over time. As an example, the project will support the implementation of a robust MRV framework and the operation of a performance based payment system. It is expected that these NAMA activities will continue its operation with additional public/private RE and EE programs supported by SLSEA.

ii. Additional NAMA implementation: The project invests heavily in identifying and designing NAMAs for the energy sector, of which only 3 will receive direct support by the project. However, there will be a number of NAMAs that can be supported to the design level and ready for implementation. Such NAMA activities are expected to be implemented with the national and international support as appropriate. A key indicator of the project's replication success, included in the results framework, is an assessment of how many NAMA activities designed by the project are in the implementation phase by the end of the project lifetime.

iii. Definition of new NAMAs: As described in the sustainability section above, the project aims to develop a NAMA planning framework that allows for the development of new NAMA activities in the energy sector. The voluntary targets established by the Government of Sri Lanka for the energy sector are ambitious and require significant changes within the sector to be achieved. As such, the establishment of a well-defined institutional setup to prioritize actions and design NAMAs is essential to strengthen the country's efforts to achieve its targets. Likewise, the project's support for the establishment of MRV mechanisms will be replicable across NAMAs and will allow for quality reporting of the country's mitigation efforts. Finally, the project will contribute, along with the other ongoing NAMA design and development efforts (described in the context and baseline sections of this document) to establish a common cross-sectoral NAMA design and implementation framework, including the establishment of procedures, protocols, and institutional arrangements. This collective effort will ultimately result in the mainstreaming of NAMAs in Sri Lanka's national development process, which is the decisive factor for the project replication and for steering Sri Lanka towards a low carbon development path.

2.7 Global Environmental Benefits

The activities of the Project consisting of the dissemination of 1,000 bio-digesters and 1,300 high efficient motors in tea factories as well as the demonstration of 205 solar PV systems with battery storage will result in the reduction of GHG emissions amounting to approximately 66,639 tCO_2e throughout the life of the installations and 16,126 tCO_2e end of the project through methane avoidance, fossil fuel (LPG) and electricity savings. Refer to Annex B (biogas), C (Solar PV) and D (HEM) for detailed assessment of energy savings and related emissions reduction from each NAMA intervention.

2.8 Cross Cutting Issues

2.8.1 Gender Equity Issues in Energy Access and Use

Women's participation, representation and access to resources and benefits will be a key focus of this project that aims to provide access to improved household energy needs through clean solar PV and bio-digesters and increased productivity through HEM in tea factories. The project will contribute towards social, economic governance transformations to empower women through specific activities that: promote participatory and consultative planning for decision-making; improve women's capabilities through their involvement and their technical capabilities in setting up and maintaining energy-related investment (biogas, solar panels etc.), as consumers and producers in pilots and as role models; and, advance their influence in decision-making as well as control over natural resources. The project will have specific gender goal indicators, which will include the collection of gender-disaggregated data and a strong monitoring and evaluation mechanism to operate and advance gender mainstreaming and social equity.

Based on the need assessment, the project will take into consideration the perspective of women and men on access to energy and usage of energy, especially in implementing Component 3. This will mean specifically;

1) Allocation of project and baseline resources to carryout activities gender sensitive manner
2) Develop substantiate indicators to capture women participation, representation, access to benefits access to energy and usage of energy

Fuel wood use for domestic purposes is synonymous with women in Sri Lanka. Although women may share the task of collecting fuel wood with men, they are entirely responsible for cooking in the households. The Project will therefore affect the time of women in wood collection, ease of operation of biogas stoves and will contribute to improving the health of women who spend significant time in the kitchen. Women also regularly maintain the biogas stoves to keep them in a condition that will ease their operation. It is therefore imperative that the NAMA include women as an important target group in its activities conducted at the community level.

In addition, women entrepreneurs are constrained by family and traditional obligations and have usually lack of access to credit, technology and low business skills. Development efforts do not sufficiently addressed the multi-dimensional constraints to women's active participation in the economy in the country. There is no cohesive approach to gender mainstreaming in the economy within the government, NGO, or donor sectors and the business developing and training of the Project will have specific focus on developing businesses run by women.

2.8.2 Socio-economic benefits (including Poverty and MDG)

The NAMA Project is expected to provide socio-economic benefits to communities using clean biogas stoves, solar PV and HEM. Local government officials will acquire coordination capacity in working with the private sector. Increased access to financing for EE appliances locally.

Bio-digesters: The Project is expected to contribute to poverty reduction through savings on women's time and better health of people by reducing indoor pollution. Consequently, villagers will have less days of sickness thereby enhancing their productivity. The delivery of bio-digesters and solar PV will also create employment at the village level. Villagers like skilled masons, including women, will be targeted as trainees for constructing the bio-digesters.

Under the project, bio-digesters will be constructed out of locally available materials but the design would require certain level of skills. The project will train village women and local masons in constructing bio-digesters so these people could then disseminate the bio-digesters in the villages. There is therefore potential for employment of these trained bio-digester technicians supplementing their income through payment for bio-digesters building activities. The Project will introduce improved bio-digester at a cost. The bio-digester will be delivered at a rebate but owners will have to mobilize the remaining cost of the bio-digester. The rural poor with no or few means of earning cash would find it difficult to mobilize money to pay for the cost of the bio-digesters. Although provision of credit through the MFI has been considered under the project, the poor would still not be able to access credit because of the need for collateral as a pre-requisite for taking loans. The poor would therefore risk to be excluded from the Project benefits. A means of managing this risk is by linking poor owners in the first stage of the roll-out of bio-digesters (when rebate rates are higher) with micro-finance institutions that are currently being initiated through the GoSL's support.

Solar PV: Households, commercial and industrial sectors will have the opportunity to reduce their electricity bills from a RE source and gain access to financing facility for the purchase of solar PV with battery storage.

HEM: The use of HEM will reduce electricity consumption and improve productivity in the tea factories and help towards the development of 'low carbon tea' brand. There will be increased awareness and knowledge of local government, Tea sector and consumers on the benefits of energy efficient products.

3. SRI LANKA NAMA PROJECT RESULTS FRAMEWORK

This project will contribute to achieving the following Country Program Outcome as defined in CPAP or CPD: Outcome #4: Policies, programs and capacities to ensure environmental sustainability, address climate change, mitigation and adaptation and reduce disaster risks in place at national, sub national and community levels
Country Program Outcome Indicators: Number of national and sectoral policies approved by Government **Baseline: 2** **Cumulative Target: 5** **Country Programme Output (4.3) Indicator:** Amount of Green House Gas (GHG) emissions reduced as a result of promotion of renewable energy and energy efficiency technologies.
Applicable GEF Focal Area Objective: GEF-5 CCM-2 "promote market transformation for energy efficiency in industry and the building sector" (Outcome 2.2: Sustainable financing and delivery mechanisms established and operational) and CCM-3 "promote investment in renewable energy technologies" (Outcome 3.2: Investment in renewable energy technologies increased).

Objective/ Outcomes	Indicators	Baseline	Targets	Source of verification	Critical Assumptions
Goal: Reduction of GHG emissions from the energy generation and end user sectors in Sri Lanka	Cumulative GHG emissions by end of project (EOP), tCO_2e Cumulative energy savings achieved by end of project (EOP), MJ	0 0	16,126; 74,866,639	AMA Project implementation reports; MRV Registry, Mid-tern and Terminal reports	Continued support and participation from co-financing institutions, MPE, SLSEA and other stakeholders
Objective: Support appropriate climate change mitigation actions in the energy generation and end-use sectors as part of the initiatives to achieve the voluntary GHG mitigation targets of Sri Lanka	No. of implemented NAMAs in the energy generation and end use sectors by EOP	0	3	AMA Project Documents; NAMA Project implementation and Mid-term evaluation and Terminal reports	Selected project proponents get required loan accessed through bank and continued favorable business environment
Outcome 1: Established and regular update of renewable energy utilization baseline & energy intensity reference	• No. of provinces that regularly conduct sub-sectoral GHG emission inventories of their energy	0	3	Periodic sub-sectoral GHG emission inventory reports from provinces	Strong support and buy in from the provincial councils and provincial

baselines for the energy generation and end-use sectors	generation and end-use sectors by Year 4 • No. of provinces that have established and operational sub-sectoral GHG emission inventory system by Year 4	0	3	Mid-term report, Documentation on the established sub-sectoral GHG emission inventory system of each province	energy ministries throughout the project
	• No. of provinces that utilize the functioning web-based EnerGIS GHG inventory system by year 1	0	1	Web-based GHG inventory systems Review and evaluation reports	
Outcome 2: Prioritized Nationally Appropriate Mitigation Actions (NAMAs) in the energy generation and end-use sectors are identified and designed	• No. of provinces that established MAC curves for energy sector by year 1 • No. of NAMA EE/RE projects that are designed based on the prioritized NAMA projects and the detailed MAC curves for the energy generation and end-use sector by Year 4	0 0	3 3	Mid-term and Terminal report, Documentation on the established MACC report of each province	Continued support and participation from co-financing institutions, MPE, SLSEA and other stakeholders Availability of reliable and accurate baseline data
Outcome 3: Identified private and public sector entities implemented prioritized appropriate mitigation actions for the achievement of Sri Lanka voluntary mitigation target	• No. of identified fully capable and qualified private and public sector entities that are interested in funding prioritized NAMA projects by Year 2 • No. of NAMA EE/RE projects that are designed and implemented based on detailed MAC curves for the energy generation and end-use sector by Year 2 • No. of individual projects that constitute the country's NAMAs by Year 4	0 0 0	2 3 1,000 biogas systems 1,300 tea factories 205 solar systems	MOU signed between project developers and SLSEA	Strong support and buy in from the private sector Capable public department/ministry agencies serve as National Implementing Entity (NIE) for selected NAMAs

	• No. of operational Private-funded NAMA projects by EOP	0	1 (high efficient motors in tea factories)		
Outcome 4: Accurate measurement and accounting of actual GHG emission reduction from mitigation actions in the energy generation and end-use sectors	• No. of NAMA projects with GHG ERs correctly verified by the established and operational MRV systems for mitigation actions by Year 4 • No. of projects in the energy generation and end use sectors that are registered in the National NAMA registry by EOP	0 0	3 3	Mid-term and Terminal report, Documentation on MRV system	The Government of Sri Lanka maintains its policy of achieving its voluntary emission reduction targets through the systematic implementation of NAMAs in the energy sector Competent staff operate, maintain, and upgrade the MRV system on regular basis

4. TOTAL BUDGET AND WORK-PLAN

Award ID:	00079409	Project ID(s):	00089391
Award Title:	Appropriate mitigation actions in the energy generation and end use sectors in Sri Lanka		
Business Unit	LKA 10		
Project Title	Appropriate mitigation actions in the energy generation and end use sectors in Sri Lanka		
PIMS No.	5232		
Implementing Partner (Executing Agency)	UNDP (NIM Project)/Ministry of Energy & Renewable energy (MPE)		

Outcomes	Responsible Party (Implementing Agency)	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount (USD) Year 1	Amount (USD) Year 2	Amount (USD) Year 3	Amount (USD) Year 4	Amount (USD) Total	Notes
Outcome 1: Established and regular update of renewable energy utilization baseline & energy intensity reference baselines for the energy generation and end-use sectors	MPE	GEF 62000	71200	International Consultants	20,000	20,000	5,000	5,000	50,000	1
			71300	Local consultants	15,000	10,000	10,000	5,000	40,000	2
			72100	Contractual Services-Companies	15,000	15,000	13,000	10,000	53,000	3
			71600	Travel	1,500	1,000	1,000	1,000	4,500	4
			74200	Audio Visual & Print Prod Costs	1,000	1,000	1,000	1,000	4,000	5
			75700	Training, workshop, meetings	1,500	1,000	1,000	1,000	4,500	6
			74500	Miscellaneous	1,000	1,000	1,000	1,000	4,000	7
	Total Outcome 1				55,000	49,000	32,000	24,000	160,000	
Outcome 2: Prioritized Appropriate Mitigation Actions (NAMAs) in the energy generation and end-use sectors are identified and designed	MPE	GEF 62000	71200	International Consultants	30,000	20,000	10,000	10,000	70,000	8
			71300	Local consultants	10,000	10,000	10,000	10,000	40,000	9
			72100	Contractual Services-Companies	20,000	20,000	20,000	15,000	75,000	10
			71600	Travel	1,000	1,000	1,000	1,000	4,000	11
			74200	Audio Visual & Print Prod Costs	1,000	1,000	1,000	1,000	4,000	12
			72400	Communication & Audio Visual Equip	1,500	1,000	1,000	1,000	4,500	13
			75700	Training, workshop, meetings	1,000	1,000	1,000	1,000	4,000	14
			72200	Equipment & Furniture	1,500	1,000	1,000	1,000	4,500	15
			74500	Miscellaneous	1,000	1,000	1,000	1,000	4,000	16
	Total Outcome 2				67,000	56,000	46,000	41,000	210,000	

Outcome 3: Implemented prioritized appropriate mitigation actions through identified private and public sector entities for the achievement of Sri Lanka voluntary mitigation target	MPE	GEF 62000	71200	International Consultants	20,000	20,000	10,000	10,000	60,000	17
			71301	Local consultants	10,000	10,000	10,000	10,000	40,000	18
			71600	Travel	1,000	1,000	1,000	1,731	4,731	19
			72100	Contractual Services - Companies	30,000	30,000	20,000	10,000	90,000	20
			72600	Matching rebate (biogas)	32,000	91,200	88,800	82,400	294,400	21
			72600	Matching rebate (High Efficiency Motors)	44,000	120,000	105,600	112,000	381,600	22
			72600	Matching rebate (Solar PV with battery storage)	76,615	192,115	11,538	0	280,269	23
	Total Outcome 3				213,615	464,315	246,938	226,131	1,151,000	
Outcome 4: Accurate measurement and accounting of actual GHG emission reduction from mitigation actions in the energy generation and end-use sectors	MPE	GEF 62000	71200	International Consultants	30,000	20,000	10,000	10,000	70,000	24
			71300	Local consultants	10,000	10,000	10,000	14,000	44,000	25
			72100	Contractual Services-Companies	14,000	10,000	10,000	10,000	44,000	26
			71600	Travel	2,000	1,000	1,000	1,000	5,000	27
			74200	Audio Visual & Print Prod Costs	1,000	1,000	1,000	1,000	4,000	28
			72400	Communication & Audio Visual Equip	1,500	1,000	1,000	1,500	5,000	29
			75700	Training, workshop, meetings	1,000	1,000	1,000	1,000	4,000	30
			72200	Equipment & Furniture	1,000	1,000	1,000	1,000	4,000	31
			74500	Miscellaneous	1,000	1,000	1,000	1,000	4,000	32
	Total Outcome 4				61,500	46,000	36,000	40,500	184,000	
Project Management	MPE	GEF 62000	71300	Local consultants	15,000	15,000	15,000	15,000	60,000	33
			71600	Travel	1,000	1,000	1,000	1,726	4,726	34
			72200	Equipment & Furniture	1,000	1,000	1,000	1,000	4,000	35
			74500	Miscellaneous	1,000	1,000	1,000	1,000	4,000	36
			74500	UNDP Cost Recovery Charges	3,200	3,200	3,200	3,085	12,685	37
	Total Project Management				21,200	21,200	21,200	21,811	85,411	
TOTAL Project					418,315	636,515	382,138	353,442	1,790,411	

Notes

1 International Expert (Inventory expert) will be hired to design the provincial and national inventory systems

2 National Expert (Inventory and MRV expert) will be hired, to assist in the design of the provincial and national inventory systems

3 Local company contracted to develop the national and provincial inventory systems

4	The travel costs cover the visits of local consultants to selected parts of the country as part of their TOR as well as their DSA
5	Printing and reproduction of legal and technical documentation
6	Organize workshops and training for provincial and SLSEA staff
7	Miscellaneous
8	International Expert (MACC and NAMA expert) will be hired to develop the MACC tools and design the NAMA framework
9	National Expert (MACC and NAMA expert) will be hired, to assist in the design of the MACC tools and NAMA framework
10	Local company contracted to develop the MACC and NAMA system
11	The travel costs cover the visits of local consultants to selected parts of the country as part of their TOR as well as their DSA
12	Printing and reproduction of legal and technical documentation
13	Purchase of audio visual equipment for workshop/training
14	Organize workshops and training for public, private and CSO stakeholders
15	Office equipment and furniture
16	Miscellaneous
17	International Expert (NAMA expert) will be hired to assist in the implementation of the NAMA project
18	National Expert (NAMA expert) will be hired to assist in the implementation of the NAMA project
19	The travel costs cover the visits of local consultants to selected parts of the country as part of their TOR as well as their DSA
20	Local company contracted to implement the NAMA projects
21	Matching rebate for the purchase of biogas
22	Matching rebate for the purchase of high efficiency motors
23	Matching rebate for the purchase of solar PV system
24	International Expert (MRV and NAMA expert) will be hired to design the MRV and NAMA systems
25	National Expert (MRV and NAMA expert) will be hired to assist in the design of the MRV and NAMA systems
26	Local company contracted to develop the MRV and NAMA systems
27	The travel costs cover the visits of local consultants to selected parts of the country as part of their TOR as well as their DSA
28	Printing and reproduction of legal and technical documentation

29	Purchase of audio visual equipment for workshop/training
30	Organize workshops and training for public, private and CSO stakeholders
31	Office equipment and furniture
32	Miscellaneous
33	Hiring of national project coordinator
34	The travel costs cover the visits of local consultants to selected parts of the country as part of their TOR as well as their DSA
35	Office equipment and furniture
37	UNDP Direct Project Services charges for procurement services (including consultants) – please see Annex H for details

Outcome wise summary details of GEF grant and co-financing budget:

Project Outcomes	Sub-components (Output)	GEF ($)	UNDP ($)	MoERE ($)	SLSEA ($)	Planters Association of Ceylon	Industrial Solution Lanka	Total
Established and regular update of renewable energy utilization baseline & energy intensity reference baselines for the energy generation and end-use sectors	Output 1.1 Finalized provincial level inventory tool for energy generation and end-use sectors	47,000	-	50,000	200,000	-	-	297,000
	Output 1.2 Defined and established sectoral and sub-sectoral reference baseline specific energy consumptions for the energy generation and end-use sector and sub-sectors	55,000	-	-	200,000	-	-	255,000
	Output 1.3 Established, operationalized and updated national and provincial GHG emission inventory system for energy generation and end-use sectors	58,000	-	-	200,000	-	-	258,000
	Sub-Total	**160,000**	**0**	**50,000**	**600,000**	**0**	**0**	**810,000**

Prioritized Nationally Appropriate Mitigation Actions (NAMAs) in the energy generation and end-use sectors are identified and designed	Output 2.1 Developed and published detailed marginal GHG abatement cost curves for the energy generation and end-use sector	80,000	-	-	100,000	-	-	180,000
	Output 2.2 Completed comprehensive barrier analysis for mitigation options in the energy generation and end-use sector	45,000	-	-	200,000	-	-	245,000
	Output 2.3 Identified and analyzed priority appropriate mitigation actions in the energy generation and end use sector in Sri Lanka	40,000	-	-	150,000	-	-	190,000
	Output 2.4 Categorized identified mitigation actions as supported and voluntary	45,000	-	-	150,000	-	-	195,000
	Sub-Total	**210,000**	**0**	**0**	**600,000**	**0**	**0**	**810,000**
Implemented prioritized appropriate mitigation actions through identified private and public sector entities for the achievement of Sri Lanka voluntary mitigation target	Output 3.1 Identified and established fully capable and qualified private and public sector entities in the implementation of climate change mitigation programs and sourcing of funds	84,731	-	50,000	200,000	-	-	334,731
	Output 3.2 Updated financial tools that support the implementation of the mitigation actions program in the energy generation and end-use sectors, including sustainable energy guarantee fund, fiscal incentives, feed in tariffs and other options available in Sri Lanka	110,000	-	-	200,000	-	-	310,000
	Output 3.3 Implemented NAMA projects	956,269	250,000	-	1,240,000 (bio-digesters)	4,000,000 (HEM)	18,000,000 (Solar PV)	24,446,269

	Sub-Total	**1,151,000**	**250,000**	**50,000**	**1,640,000**	**4,000,000**	**18,000,000**	**25,091,000**
Accurate measurement and accounting of actual GHG emission reduction from mitigation actions in the energy generation and end-use sectors	Output 4.1 Established and operational NAMA supporting entities and mechanism for mitigation actions in the energy generation and end-use sectors	50,000	-	-	100,000	-	-	150,000
	Output 4.2 Defined key parameters (quantitative/qualitative) to be monitored for the selected appropriate mitigation actions	50,000	-	-	100,000	-	-	150,000
	Output 4.3 Designed and implemented MRV system for the selected appropriate mitigation actions	34,000	-	-	100,000	-	-	134,000
	Output 4.4 Completed capacity development program for strengthening all public, private (value chains actors) and CSO stakeholders involved in the operation and management of the NAMA programme	50,000	-	80,000	100,000	-	-	230,000
	Sub-Total	**184,000**	**0**	**80,000**	**400,000**	**0**	**0**	**664,000**
5. Project Management	**Project Management, Consultants ***	**85,411**	**0**	**50,000**	**160,000**	**0**	**0**	**295,411**
Total Project Cost		**1,790,411**	**250,000**	**230,000**	**3,400,000**	**4,000,000**	**18,000,000**	**27,670,411**

5. PROJECT IMPLEMENTATION SCHEDULE

Activities	Responsibility	Schedule																Partners involved
		Year 1				Year 2				Year 3				Year 4				
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Output 1.1 Finalized provincial level inventory tool for energy generation and end-use sectors																		
Activity 1.1.1 Review EnerGIS database system of SLSEA and existing national communications data inventory system to identify barriers, gaps, needs, and challenges for data collection and compilation	PT, SLSEA	X	X	X	X													Uva , Central and Southern Provincial staff
Activity 1.1.2 Develop, test, verify, and update the inventory system at sub-national level	PT, SLSEA, (National Inventory Expert (NE)	X	X	X	X	X	X	X	X									Uva , Central and Southern Provincial staff
Activity 1.1.3 Identify and select key focal points and define boundary for the development of inventory system for the collection, compilation and management of baseline data at the municipal/urban/Pradeshiya sabha levels in the Uva, Central and Southern Province	PT, SLSEA	X	X															Uva , Central and Southern Provincial staff
Activity 1.1.4 Test, verify, and deploy web-based data collection for EnerGIS GHG inventory system for energy generation (oil based, thermal, and hydro. Coal and RE) and end-use sectors (energy industry, transport, industry, residential and commercial) at Uva, Central and Southern Provinces	PT, SLSEA	X	X	X														Uva , Central and Southern Provincial staff
Output 1.2 Defined and established sectoral and sub-sectoral reference baseline specific energy consumptions for the energy generation and end-use sector and sub-sectors																		

Activity 1.2.1 In partnership with national communication inventory team, define and develop parameters, reference baseline and emissions boundary for GHG inventory on energy generation sub-sectors (oil based, thermal, hydro, solar, wind, biomass) and end-use sub-sectors (energy industry, transport, industry, residential and commercial)	PT, SLSEA	X	X	X	X													Uva, Central and Southern Provincial staff, CEB, LECO
Activity 1.2.2 Collect, compile, quality check and analyze data for Uva, Central and Southern Provinces	PT, SLSEA		X	X	X													Uva, Central and Southern Provincial staff, CEB, LECO
Activity 1.2.3 Test, verify and establish reference baselines for renewable energy utilization, energy consumption in different end-use sectors and GHG emissions in Uva, Central and Southern Provinces	PT, SLSEA		X	X	X													Uva, Central and Southern Provincial staff, CEB, LECO
Output 1.3 Established, operational and updated national and provincial GHG emission inventory system for energy generation and end-use sectors																		
Activity 1.3.1 Develop and implement steps to regularly update and improve the inventory system	PT, SLSEA	X	X	X														Uva, Central and Southern Provincial staff, CEB, LECO
Activity 1.3.2 Develop and conduct training programs to data management staff to strengthen the data collection efforts for inventory at sub-national level	PT, SLSEA, Inventory Expert (IE, NE)	X	X	X	X	X												Uva, Central and Southern Provincial staff, CEB, LECO
Activity 1.3.3 Develop knowledge products on the use of the provincial inventory system for provincial inventory data management staff	PT, SLSEA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Uva, Central and Southern Provincial staff
Activity 1.3.4 Develop a strategy for replication to other provinces	PT, SLSEA														X	X	X	Provincial staff from other provinces

Output 2.1 Developed and published detailed marginal GHG abatement cost curves for the energy generation and end-use sector																		
Activity 2.1.1 Develop MACC using collected data for energy generation (oil-based, thermal, coal, hydro, solar, wind, biomass) and end-use sectors (energy industry, transport, industry, residential and commercial) for Uva, Central and Southern Provinces	PT, SLSEA, MACC Expert (IE, NE)	X	X	X	X	X												DNA, CEB, LEKO
Activity 2.1.2 Develop training program and annual budget on the use of MACC	PT, SLSEA		X	X			X				X				X			DNA, CEB, LEKO
Activity 2.1.3 Develop and implement a strategy to upgrade and update the MACC on a regular basis	PT, SLSEA, NE	X	X				X				X				X			DNA, CEB, LEKO
Output 2.2 Completed comprehensive barrier analysis for mitigation options in the energy generation and end-use sector																		
Activity 2.2.1 Identify and analyze regulatory, technical, financial and social barriers to the implementation of CC mitigation actions in the energy generation and energy end use sectors in the Uva, Central and Southern Provinces	PT, SLSEA, NAMA Expert (IE, NE)		X	X	X													PMU, DoE, TA
Output 2.3 Identified and analyzed priority appropriate mitigation actions in the energy generation and end use sector in Sri Lanka																		
Activity 2.3.1 Develop and implement selection criteria for prioritizing of NAMA in the energy generation and end use sector	PT, SLSEA, IE, NE		X	X	X	X												NCE, Public, private and CSO partners
Activity 2.3.2 Develop a full NAMA design document for each selected NAMAs in the energy generation and end use sector	PT, SLSEA, IE, NE		X	X	X	X												NCE, Public, private and CSO partners
Output 2.4 Categorized identified mitigation actions as supported and voluntary																		
Activity 2.4.1 Review status and lessons learned in developing voluntary and supported NAMAs in Sri Lanka and other countries in the region	PT, SLSEA		X	X	X													NCE, Public, private and CSO partners
Activity 2.4.2 Develop criteria for categorizing NAMA as supported or voluntary	PT, SLSEA			X	X	X	X											NCE, Public, private and CSO partners

Activity 2.4.3 Design the implementation of the RE NAMAs for bio-digesters (domestic, institutional, industrial), and solar PV net metering combined with deep cycle battery	PT, SLSEA		X	X	X	X												Uva, Central and Southern Provinces
Activity 2.4.4 Design the implementation of EE NAMA in tea factories for the application of efficient motors	PT, SLSEA		X	X	X	X												Central and Southern Provinces
Output 3.1 Identified and established fully capable and qualified private and public sector entities in the implementation of climate change mitigation programs and sourcing of funds																		
Activity 3.1.1 Develop criteria for the selection of public and private stakeholders as potential partners	PT, SLSEA		X	X	X													NCE, Public, private and CSO partners
Activity 3.1.2 Define and develop business and financial modality, roles and responsibilities of the NAMA Implementing Entity under SLSEA and PPP in the implementation of the each NAMA (bio-digester, solar PV with battery storage, HEM) in partnership with Sri Lanka Carbon Fund and other relevant institutions,	PT, SLSEA, IE, NE		X	X	X													NCE, Public, private and CSO partners
Activity 3.1.3 Review and suggest sources of potential funding for voluntary and supported NAMA and develop investment platform	PT, SLSEA		X	X	X													NCE, Public, private and CSO partners
Output 3.2 Updated financial tools that support the implementation of the mitigation actions program in the energy generation and end-use sectors, including sustainable energy guarantee fund, fiscal incentives, feed in tariffs and other options available in Sri Lanka																		
Activity 3.2.1 Review lessons learned and develop best practices in the use of financial instruments (matching rebate, partial loan scheme) for the scaling up of RE and EE solutions.	PT, SLSEA, Climate Finance Expert (IE, NE)		X	X	X													PFIs, MFIs, ESCOs, value chain actors
Activity 3.2.2 Develop and implement financial instruments to support end users for the purchase of bio-digesters, solar PV and high efficiency motors (HEM) as part of the PPP structure using matching rebate and viable business model	PT, SLSEA, Climate Finance Expert (IE, NE)		X	X	X													PFIs, MFIs, ESCOs, value chain actors

Output 3.3 Implemented NAMA projects																		
Activity 3.3.1 Implement HEM application in the tea sector and solar PV with battery storage NAMA project in private sector funded modality	PT, SLSEA, IE, NE			X	X	X	X	X	X	X	X	X	X	X	X	X	X	PFIs, Tea factories, ESCOs, service providers, TRI
Activity 3.3.2 Implement biogas projects in the Uva, Central, Southern and North Western Provinces in PPP modality	PT, SLSEA, IE, NE			X	X	X	X	X	X	X	X	X	X	X	X	X	X	PFIs, Lanka Biogas Association
Output 4.1 Established and operational national registry mechanism for mitigation actions in the energy generation and end-use sectors																		
Activity 4.1.1 Identify and select focal point as NAMA Secretariat, NAMA Coordinating Entity (NCE) and as NAMA National Registry	PT, SLSEA, MRV Expert (IE, NE)		X	X	X	X												NCE, Public, private and CSO partners
Activity 4.1.2 Define roles and responsibilities of the NAMA Secretariat and NCE and NAMA Registry	PT, SLSEA, IE, NE		X	X	X	X												NCE, Public, private and CSO partners
Activity 4.1.3 Review best practices and recommend institutional arrangement for the setting up of the NAMA Secretariat, NCE and NAMA registry	PT, SLSEA, IE, NE		X	X	X	X												NCIE, Public, private and CSO partners
Activity 4.1.4 Develop steps to monitor, evaluate, upgrade the NAMA National Registry and integrate with International NAMA registry	PT, SLSEA, IE, NE		X	X	X	X												NCE, Public, private and CSO partners
Output 4.2 Defined key parameters (quantitative/qualitative) to be monitored for the selected appropriate mitigation actions																		
Activity 4.2.1 Based on the inventory system developed under output 1.3, establish monitoring framework by defining key parameters for bio-digester, solar PV and HEM NAMA to be measured, monitored, recorded and updated on the web-based EnerGIS platform (based on Quality Control and Quality Assurance principles)	PT, SLSEA, MRV Expert (IE, NE)		X	X	X	X												NCE, MRV Committee

Output 4.3 Designed and implemented MRV system for the selected appropriate mitigation action																		
Activity 4.3.1 Develop best practices in MRV standards and methodologies for RE (solar PV and biogas) and EE NAMA (HEM) based on established CDM methodologies and IPCC guidelines and principles	PT, SLSEA, IE, NE		X	X	X	X	X											NCE, MRV Committee
Activity 4.3.2 Design and test the MRV system for bio-digesters, solar PV and HEM NAMAs	PT, SLSEA, IE, NE		X	X			X				X				X			NCE, MRV Committee
Activity 4.3.3 Adopt and develop best practices in monitoring plan for RE (solar PV and biogas) and EE (HEM in tea factories) NAMAs	PT, SLSEA, IE, NE				X	X	X	X	X	X	X	X	X	X	X	X	X	NCE, MRV Committee
Output 4.4 Completed capacity development program for all public, private and CSO stakeholders involved in the operation of the NAMA program																		
Activity 4.4.1 Review and document lessons learned for the development of knowledge products (CD, DVD, training manuals) and training program for all NAMA staff in operation and management of the Inventory, MRV system and implementation of the NAMAs	PT, SLSEA, IE, NE					X					X				X			NCE, MRV Committee
Project Management	Project coordination and management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Project coordinator, PMU
	Mobilization and hiring of personnel	X																UNDP CO, SLSEA
	Inception workshop	X																Project coordinator, PMU
	Progress report		X		X		X		X		X		X		X		X	Project coordinator, PMU

	Annual reports (APR/PIR)				X				X				X				X	Project coordinator, PMU
	Mid-term Report									X								International consultant
	Terminal Report															X		International consultant
Note: IE - International Expert; NE - National Expert																		

6. Management arrangement

This Nationally Appropriate Mitigation Actions (NAMA) project will provide the Government of Sri Lanka with a good opportunity to strengthen the institutional, technical, and financial and organization capabilities of its agencies in the development and implementation of a robust and transparent inventory, NAMA and Monitoring Reporting & Verification (MRV) systems for meeting national Green House Gas (GHG) targets. The prime beneficiaries will be the Sri Lanka Sustainable Energy Authority (SLSEA), Climate Change Secretariat (CCS), Provincial Government and Local Authorities who will act as key partners, under the tutelage of the Ministry of Power and Energy (MPE) and SLSEA. The MPE, CCS and SLSEA are the best combination of entities for driving this project forward and to establish a technical competency center in the area of coordinating and implementing Renewable Energy (RE) and Energy Efficiency (EE) NAMAs.

The proposed project organization structure is depicted below:

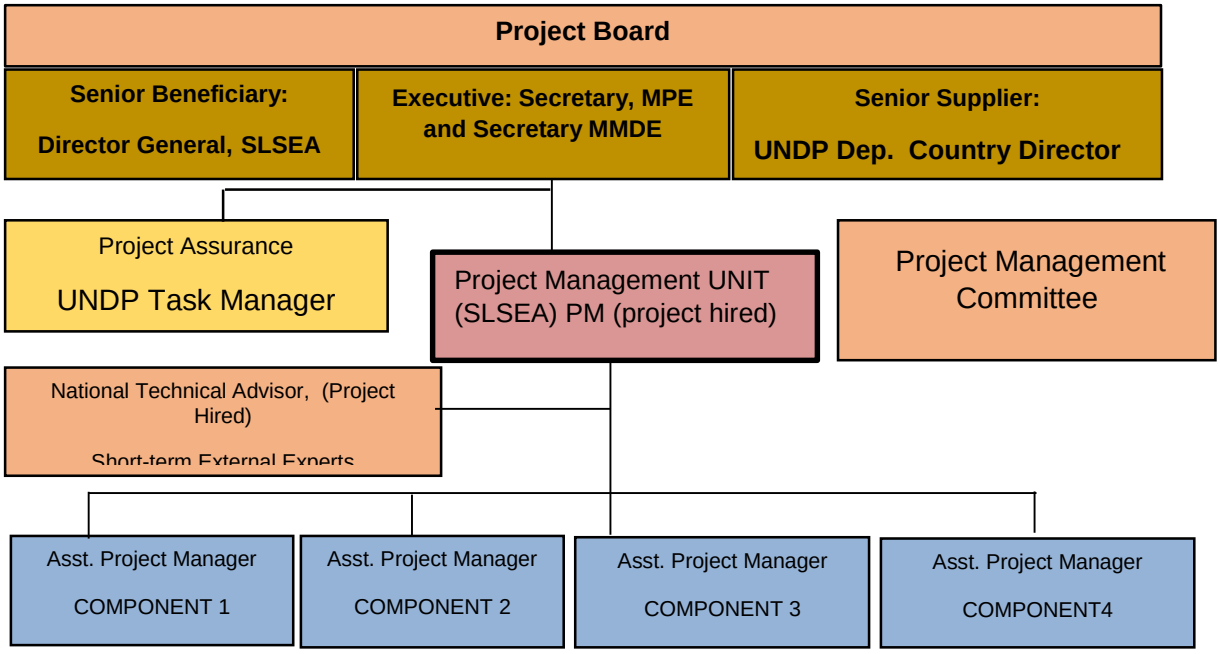


Figure 6: Project Organizational structure

The project will be implemented over a period of four years, starting in the year 2015. The project will be nationally executed under UNDP's National Implementation Modality (NIM) according to the Standard Basic Assistance Agreement between UNDP and the Government of Sri Lanka, and the Country Program Action Plan (CPAP). The lead Executing Agency for this Project will be the Ministry of Power and Energy, which has the governmental mandate to coordinate the formulation and implementation of land degradation policies and related programs and strategies.

The above project organizational structure will be reviewed at the inception workshop in view of the changes in Ministries and Departments since January 2015. The exact structure of the Project Management Unit and the staffing requirement will be defined at the Inception Workshop and will be flexible to allow augmenting of capacity of government entities while implementing the project.

Project Board: The **Project Board** will be established at the inception of the project. The composition of this is presented above in Figure 6 and will be co-chaired by Secretary of Ministry of Mahaweli Development and Environment and the Secretary of Ministry of Power and Energy. The Board will meet at least biennially and it will be convened and supported logistically by the NAMA Secretariat to be established at CCS, MPE. The Board may meet more frequently, if required. This will be chaired by the Secretary to the MPE, and will provide overall guidance for the project throughout its implementation.

Specifically the Board will be responsible for: (i) achieving co-ordination among the various government agencies; (ii) guiding the program implementation process to ensure alignment with national and local statutory planning processes and RE and EE resource use and policies, plans and strategies; (iii) ensuring that activities are fully integrated between the other relevant developmental initiatives; (iv) overseeing the work being carried out by the different agencies, monitoring progress and approving plans and reports; (v) overseeing the financial management and production of financial reports; (vi) monitor the effectiveness of project implementation; and (vii) providing guidance to district and local committees as needed.

The proceedings of all Project Board meetings will be recorded and shared amongst all the members and also with the Provincial Facilitation Committees. The Board will undertake annual project reviews (or as otherwise deemed necessary by the Project Board) – including the review of annual Project Implementation Review (PIR) sheets that the project has to submit to UNDP and the GEF. In case a consensus cannot be reached, final decision shall rest with the UNDP Resident Representative, in consultation with MPE. The extent to which the UNDP Program Officer will be delegated quality assurance responsibilities will be determined during the first Project Board meeting and will be indicated in writing.

Secretaries of the Ministries of Mahaweli Development and Environment (MMDE) and Power and Energy (MPE) will serve as the Executive and will have ultimate responsibility for the project, supported by the Senior Beneficiary and Senior Supplier. As part of the responsibilities of the Project Board, the Executive will ensure that the project is focused, throughout the project cycle, on achieving the results noted in the project's Strategic Results Framework in the most innovative, cost effective, catalytic and replicable manner. The Board will provide strategic guidance to the project and will ensure that risks are being tracked and mitigated as effectively as possible. The Senior Executive will be responsible for approving and signing the Annual Work Plan (AWP) for the following year on behalf of the Implementing Partner as well as approving and signing the Combined Delivery Report (CDR) at the end of the year. The Senior Executive will be responsible for delegating authority in writing to a Responsible Officer within the Ministry for signature of the Funding Authorization and Certificate of Expenditures (FACE) form as well as any other project related documentation.

The UNDP Deputy Country Director (Program) will represent the interests of those designing and developing the project deliverables and providing project resources. The primary function of the Senior Supplier will be to provide guidance regarding the technical feasibility of the project. The Senior Supplier will have authority to commit or acquire supplier resources as required. As part of the responsibilities of the Project Board, Senior Supplier will advise on the selection of the strategy, design and methods to carry out project activities. Quality assurance and oversight roles include ensuring that standards defined for the project are met and used to good effect, monitoring potential changes and their impact on the quality of deliverables and monitoring any risks in project implementation. Within the context of the Project Board, the Senior Supplier will also be responsible for ensuring that progress towards outputs remains consistent, contributing the supplier's perspective and opinions on implementing any proposed changes and arbitrating on and ensuring resolution of input/resource related priorities or conflicts.

The Director General of the SLSEA will serve as the Senior Beneficiary with the primary function of ensuring the realization of project results from the perspective of project beneficiaries. As part of the responsibilities for the Project Board, the Senior Beneficiary will be responsible for ensuring that specification of the Beneficiary's needs are accurate, complete and unambiguous, implementation of activities at all stages is monitored to ensure that they will meet the beneficiary's needs and are progressing towards identified targets, impact of potential changes is evaluated from the beneficiary point of view, risks to the beneficiaries are frequently monitored, providing the opinion of beneficiaries of implementation of any proposed changes, and helping to resolve priority conflicts.

Project Management Committee (PMC): The Project Management Committee (PMC) will be setup under the Project Board, which will meet at least once a month to guide the Project Management Unit (PMU) to make key management, functional and operational decisions. Its specific responsibility includes;

- Approve the appointment and responsibilities of the Project Manager and delegate its project assurance responsibilities

- Based on the approved Annual Work Plan, approve quarterly execution plans and also approve any essential deviations from original plans
- Provide technical and operational guidance to the project
- Ensure the quality assurance of project processes and deliverables
- Ensure the required resources for the successful implementation of the project
- Monitor and evaluate the progress of project activities
- Use the evaluations for performance improvement, accountability and learning
- Arbitrate on any conflicts within the project or negotiate solutions to problems if any with external bodies

The composition of the Project Management Committee will be as follows;

- **Co-chairs** – Director, Climate Change Secretariat and DG, SLSEA
- **Members** (Representing) - UNDP, Ceylon Electricity Board (CEB), Sri Lanka Carbon Fund (SLCF), Tea Research Institute (TRI) and Provincial Ministry of Energy
- **Convener** & **Secretary** – Deputy Director General, Sri Lanka Sustainable Energy Authority (Project Manager) supported by National Technical Advisor

Depending on the need, PMC could invite relevant private sector project beneficiaries as well as sector specialists for consultations at its regular meetings.

Project Management Unit (PMU): The Project Management Unit will be physically established and hosted within SLSEA of the MPE except the Component No 4 (MRV), which will be setup at CCS as this unit will have to take charge of multi sector MRVs not confining to RE and EE. SLSEA will play the key role in project execution.

Compliance to UNDP Standards: As delegated by the Project Board, the designated UNDP Program Officer, supported by the UNDP Program Associate will assist the Project Board in its role of Project Assurance. In undertaking this role, the UNDP Program Officer will take action to address as well as alert the Project Board of issues with regard to project quality assurance such as alignment with the overall Country Program, availability of funds, observation of UNDP rules and regulations and adherence to Project Board decisions. The UNDP Program Officer will assist the Project Board by performing some oversight activities, such as periodic monitoring visits and "spot checks," ensuring that revisions are managed in line with the required procedures, RMG monitoring and reporting requirements and standards are maintained, Project output(s) and activities, including description and quality criteria, risks and issues are properly recorded and are regularly updated in Atlas. The UNDP Program Officer will also assist the Project Board in ensuring that the project follows the approved plans, meets planned targets as well as project Quarterly Progress Reports are prepared and submitted on time, and according to standards. During project closure, the UNDP Program Officer will work to ensure that the project is operationally closed in Atlas, financial transactions are in Atlas based on final accounting of expenditures and project accounts are closed and status set in Atlas accordingly.

The Assurance role will support the PMC by carrying out objective and independent project oversight and monitoring functions. During the implementation of the project, this role ensures (through periodic monitoring, assessment and evaluations) that appropriate project management milestones are managed and completed. The assurance will:

i. Ensure that funds are made available to the project;
ii. Ensure the project is making progress towards intended outputs;
iii. Perform regular monitoring activities, such as periodic monitoring visits and spot checks;
iv. Ensure that resources entrusted to UNDP are utilized appropriately;
v. Ensure that critical project information is monitored and updated
vi. Ensure that financial reports are submitted to UNDP on time, and that combined delivery reports are prepared and submitted to the PMC;
vii. Ensure that risks are properly identified, managed, and monitored on regular basis.

An independent external review may be conducted through resource persons/groups to feed into this process. The UNDP official responsible for the Project Assurance and the PM will meet on a quarterly basis to assess progress of the decisions taken in the PMC.

Project Staff

The TORs for each post are explained in detail in Annex E.

Project Manager (PM): The Project Manager (PM) is the chief executive officer of this project and will be responsible for overseeing the overall project implementation and ensuring that the project objective and outcomes (results specified in the project document) are achieved in a timely and cost effective manner to the required standard of quality. The PM will report to the Project Management Committee on project progress and plan, and seek its guidance to resolve emerging issues. The Deputy Director General of SLSEA will be the Project Manager (an ex-officio position).

A full time **National Technical Advisor (NTA)** to be hired for the project to support the Project Manager to run the project on a day-to-day basis on behalf of the Implementing Organization under the strategic direction and the guidance of both Project Board and Project Management Committee. The duties will cover: planning and implementing activities, preparing annual work plans and monitoring progress against quality criteria; monitoring events and updating the Monitoring and Communication Plan; liaising with any suppliers to mobilize goods and services to support project activities; monitoring financial resources and accounting to ensure accuracy and reliability of financial reports; managing requests for the provision of financial resources using advance of funds, direct payments, or reimbursement using the FACE (Fund Authorization and Certificate of Expenditures); managing, monitoring and updating the project risks as initially identified and submitting new risks to the Project Board for consideration and decision on possible actions; managing issues and requests for change by maintaining an Issues Log; preparing the Project Quarterly Progress, Annual and Final Reports and submitting reports to the Project Board and UNDP Program Officer and managing and facilitating transfer of project deliverables, documents, files, equipment and materials to national beneficiaries at project closure. The NTA will be supported by the 4 full time Assistant Managers for each component and the part time International Technical Advisor.

Part time Deputy Project Managers (DPM): SLSEA and CCS of MPE will take charge of all 4 Components of the Project. The operation of these components will be led by component Deputy Project Managers deployed by SLSEA (For Components 1, 2 and 3) and CCS (For Component 4) on part time basis.

Part time Deputy Project Manager (Finance): Deputy Project Manager (Finance) will be responsible for all financial and administrative matters of the project and will also be a part time position.

Full time Assistant Project Managers (APM): Each component will have an Assistant Project Manager, which is a full time position and will be responsible for carrying out all the day to day management of the respective component under the supervision of the National Technical Advisor and guidance of the Deputy Project Manager.

Part time Project Officer: A Project Officer on part time basis only for the Component 4 will be an officer from CCS to assist the respective Assistant Project Manager for Monitoring Reporting and Verifications (MRV).

Full time Project Assistant: Project Assistant will provide secretarial assistance to the project staff and assist the Deputy Project Manager (Finance) for administrative and financial matters.

Part time International Technical Advisor (ITA): A part-time ITA will be engaged to provide overall technical guidance, advice and back supporting to NTA and project team in the planning and implementation and monitoring of the project.

Short-term External Experts: Both international and local short-term experts (STEs) may be engaged to provide technical assistance to support the different activities and aspects of the Project implementation. The selection and hiring of STEs will be done through competitive offers and in accordance with UNDP and the GoSL requirements.

NAMA Supporting Entities

- To be established at **CCS** of MMDE
  - NAMA Secretariat to act as NAMA Focal Point and liaise with UNFCCC
  - NAMA Coordinating Entity under the NAMA Secretariat to approve and manage NAMA projects
  - NAMA MRV Committee to design and oversee MRV procedures
  - NAMA Registry to register NAMA and to liaise with International NAMA Registry

- To be established at **SLSEA** of MPE
  - NAMA Implementing Entity for Energy

Financial Procedures

Funding for this project is from GEF resources with co-funding from UNDP and government agencies. Under the Harmonized Cash Transfer system (HACT) introduced by the UN EXCOM Agencies (UNDP, UNICEF, WFP and UNFPA) as part of the UN reform commitment to reduce transaction costs on implementing partners, four modalities of payments are foreseen for nationally implemented projects. They include: 1) Prior to the start of activities against agreed work plan cash transferred (direct cash transfer) to the Treasury, Ministry of Finance and Planning, for forwarding to the Implementing Partner; 2) Reimbursements after completion of eligible activities by the Implementing Partner; 3) Direct payment to vendors or third parties for obligations incurred by the Implementing Partners on the basis of requests signed by the designated official of the Implementing Partner; 4) Direct payments to vendors or third parties for obligations incurred by UN agencies in support of activities agreed with Implementing Partners.

In order to receive the funds advanced by UNDP, the Implementing Partner must either: a) Open a bank account, under the name of the project, to be used only for receiving UNDP advances and to make payments of the project; or b) In agreement with UNDP's Program Manager, identify an existing bank account under the Implementing Partner's name, that would be used solely for the purposes of receiving UNDP advances to the project and making payments with these advances. Under no circumstances will the Direct Cash Transfer Modality be used to advance funds to any individual inside or any entity or individual outside of the Implementing Partner or to any account other than the identified official project bank account. It will be the responsibility of the Project Manager and NTA to liaise with the UNDP Program Associate to prepare a consolidated financial report, in the required format, and provide it to UNDP at regular and necessary intervals.

Under the project's national implementation arrangement (NIM) Government guidelines for competitive procurement of goods and services (advertising, tender bidding, evaluation, and approval) in line with international standards will apply for all project-related activities. Upon specific request of the implementing partner UNDP can in line with UNDP procurement policy provide procurement and recruitment services to the implementing partner including:

- Identification and recruitment of project and program personnel
- Identification and facilitation of training activities
- Procurement of goods and services, including contractual services to implemented agreed field activities

As per the letter of agreement between the Government of Sri Lanka and UNDP for the provision of support services signed on 5th July 2002, UNDP shall recover the cost of providing the support services outlined above. A cost recovery rate will be charged for the value of the amount of the contracts of the services to be procured or obtained through UNDP. Charges will also be incurred for all financial transactions processed on behalf of the project by UNDP Finance Unit. The charges will be subject to

the Universal Price List used corporately by UNDP to determine costs associated with UNDP administrative services.

It will be the responsibility of the beneficiary line ministry or government institution to ensure the settlement of all duties/taxes/levies/Value Added Tax on imported goods and services at the point of clearing from Sri Lanka Customs as well as all VAT and other statutory levies applicable and payable on local procurement of goods and services. The UNDP bears no responsibility whatsoever in the settlement of Government of Sri Lanka duties/taxes/levies/VAT on all imported and local procurement of goods and services. The Implementing Partner will be audited periodically as per the annual audit plan prepared by the government coordinating authority in consultation with the UNDP Sri Lanka. The Implementing Partner/Ministry of Power and Energy will be responsible for ensuring that all audit requirements are met. Project auditing will follow UNDP Financial Regulations and Rules and applicable audit policies. Agreement on the intellectual property rights and use of logo on the project's deliverables: In order to accord proper acknowledgement to MPE, GEF and UNDP for providing funding, logos should appear on all relevant project publications as applicable and adhere to the branding guidelines of the aforementioned agencies.

6.1 Monitoring Framework and Evaluation

The project will be monitored through the following M& E activities. The M& E budget is provided in the table below.

Project start:

A Project Inception Workshop will be held within the first 2 months of project start with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and program advisors as well as other stakeholders. The Inception Workshop is crucial to building the necessary strong local ownership for the project results and to plan the first year annual work plan.

The Inception Workshop should address a number of key issues including:

a) Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and Bangkok Regional Hub (BRH) staff vis-à-vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.
b) Based on the project results framework and the relevant GEF Tracking Tool if appropriate, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.
c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
d) Discuss financial reporting procedures and obligations, and arrangements for annual audit.
e) Plan and schedule Project Board meetings. Roles and responsibilities of all project organization structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 12 months following the inception workshop.

A detailed Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly review:

- Progress made shall be monitored in the UNDP Enhanced Results Based Management Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of value chain actors are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).

- Based on the information recorded in ATLAS, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs can be used to monitor issues, lessons learned etc. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annual Review:

- Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (1 July to 30 June). The APR/PIR combines both UNDP and GEF reporting requirements.

  The APR/PIR includes, but is not limited to, reporting on the following:
  - Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
  - Project outputs delivered per project outcome (annual).
  - Lesson learned/good practice.
  - AWP and other expenditure reports
  - Risk and adaptive management
  - ATLAS Project Progress Report (PPR)
  - Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

Periodic Monitoring through site visits:
UNDP CO and the UNDP BRH will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP BRH and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of project cycle:
The project will undergo an independent Mid-Term Review at the mid-point of project implementation (early 2017). The Mid-Term Review will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term review will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term review will be prepared by the UNDP CO based on guidance from the BRH and UNDP-GEF. The management response and the review report will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC). The relevant GEF Focal Area Tracking Tools will also be completed during the mid-term evaluation cycle.

End of Project:
An independent Terminal Evaluation (TE) will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. The TE will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term review, if any such correction took place). The TE will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the BRH and UNDP-GEF. The TE should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC). The relevant GEF Focal Area Tracking Tools will also be completed during the TE.

During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Learning and knowledge sharing:
Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.

The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.

Finally, there will be a two-way flow of information between this project and other projects of a similar focus.

Communications and visibility requirements:

Full compliance will be undertaken with UNDP's Branding Guidelines. These can be accessed at http://intra.undp.org/coa/branding.shtml, and specific guidelines on UNDP logo use can be accessed at: http://intra.undp.org/branding/useOfLogo.html. Amongst other things, these guidelines describe when and how the UNDP logo needs to be used, as well as how the logos of donors to UNDP projects should be used. For the avoidance of any doubt, when logo use is required, the UNDP logo needs to be used alongside the GEF logo. The GEF logo can be accessed at: http://www.thegef.org/gef/GEF_logo. The UNDP logo can be accessed at http://intra.undp.org/coa/branding.shtml.

Full compliance is also required with the GEF's Communication and Visibility Guidelines (the "GEF Guidelines"). The GEF Guidelines can be accessed at: http://www.thegef.org/gef/sites/thegef.org/files/documents/C.40.08_Branding_the_GEF%20final_0.pdf . Amongst other things, the GEF Guidelines describe when and how the GEF logo needs to be used in project publications, vehicles, supplies and other project equipment. The GEF Guidelines also describe other GEF promotional requirements regarding press releases, press conferences, press visits, visits by Government officials, productions and other promotional items.

Where other agencies and project partners have provided support through co-financing, their branding policies and requirements should be similarly applied.

6.2 M & E Work Plan and Budget

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
Inception Workshop and Report	▪ Project Manager ▪ UNDP CO, UNDP GEF	Indicative cost: 10,000	Within first two months of project start up
Measurement of Means of Verification of project results.	▪ UNDP GEF RTA/Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members.	Indicative cost: 20,000	Start, mid and end of project (during evaluation cycle) and annually when required.
Measurement of Means of Verification for Project Progress on *output and implementation*	▪ Oversight by Project Manager ▪ Project team	Indicative cost: 5,000 (to be determined as part of the Annual Work Plan's preparation)	Annually prior to ARR/PIR and to the definition of annual work plans
ARR/PIR	▪ Project manager and team ▪ UNDP CO ▪ UNDP RTA ▪ UNDP EEG	None	Annually
Periodic status/ progress reports	▪ Project manager and team	None	Quarterly
Mid-term Review	▪ Project manager and team ▪ UNDP CO ▪ UNDP BRH ▪ External Consultants (i.e. evaluation team)	Indicative cost: USD 30,000	At the mid-point of project implementation.
Final Evaluation	▪ Project manager and team, ▪ UNDP CO ▪ UNDP BRH	Indicative cost: 30,000	At least three months before the end of project implementation

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
	▪ External Consultants (i.e. evaluation team)		
Project Terminal Report	▪ Project manager and team ▪ UNDP CO ▪ local consultant	0	At least three months before the end of the project
Audit	▪ UNDP CO ▪ Project manager and team	Indicative cost per year: 3,000	Yearly
Visits to field sites	▪ UNDP CO ▪ UNDP BRH (as appropriate) ▪ The Government representatives	For GEF supported projects, paid from IA fees and operational budget	Yearly
TOTAL indicative COST Excluding project team staff time and UNDP staff and travel expenses		US$ 107,000 (+/- 5% of total budget)	

Project monitoring and evaluation will be conducted in accordance with established UNDP and GEF procedures and will be provided by the project team and the UNDP Country Office (UNDP-CO) with support from UNDP/GEF. The Logical Framework Matrix in Section 4 provides *performance* and *impact* indicators for project implementation along with their corresponding *means of verification*. These will form the basis on which the project's Monitoring and Evaluation system will be built.

The following sections outline the principle components of the Monitoring and Evaluation Plan and indicative cost estimates related to M&E activities. The project's Monitoring and Evaluation Plan will be presented and finalized at the Project's Inception Report following a collective fine-tuning of indicators, means of verification, and the full definition of project staff M&E responsibilities.

6.3 General

(i) UNDP support services

MPE has entered into an agreement with UNDP for direct project support services in the form of procurement of goods and services during the project implementation process (see Annex H). In such a case, appropriate cost recovery will be charged as per UNDP rules and regulations. The support services will be outlined in the form of Letter of Agreement signed between MNRE and UNDP. The table below indicates the cost of UNDP direct project services (DPS) anticipated over the project implementation period of four years.

TABLE 6: ESTIMATE OF DIRECT PROJECT SERVICES (DPS) (US$)					
Year	**2015**	**2016**	**2017**	**2018**	**Total (US$)**
ISS (support for recruitments, procurement, selection & awarding of sub-contracts, approvals, etc.)	3,200	3,200	3,200	3,085	12,685
Total (US$)	3,200	3,200	3,200	3,085	12,685

(ii) Prior obligations and prerequisites

No prior obligations or prerequisites have been identified.

(iii) Audit Clause

Audit will be conducted according to UNDP Financial Regulations and Rules and applicable Audit policies. The Government of Sri Lanka will provide the UNDP Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds expended on the project according to the established procedures set out in the appropriate UNDP programming and finance manuals. The audit will be conducted by the legally recognized auditor of the Government of Sri Lanka, or by a commercial auditor engaged by the Government.

(iv) Agreement on the intellectual property rights and use of logo on the project's deliverables

In order to accord proper acknowledgement to GEF for providing funding, a GEF logo will appear on all relevant GEF-supported project publications, including among others, project hardware, if any, purchased with GEF funds. Any citation on publications regarding projects funded by GEF should also accord proper acknowledgement to GEF. The UNDP logo should be prominent – and separated from the GEF logo. Alongside GEF and UNDP logo, the MPE logo may also feature as the Implementing Partner of the project.

(v) Assets

The ownership of the assets procured under the project from GEF grant money lies with the UNDP Resident Representative until the end of the project. At the end of the project, the assets would be transferred to the implementing Ministry of the Government of Sri Lanka (MPE and SLSEA) following UNDP applicable rules and regulations.

7. LEGAL CONTEXT

This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the Standard Basic Assistance Agreement (SBAA) and all CPAP provisions apply to this document.

Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

The implementing partner shall:

- Put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
- Assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP/GEF hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

The UNDP Resident Representative in Sri Lanka is authorized to effect in writing the following types of revision to this Project Document, provided that he/she has verified the agreement thereto by the UNDP Regional Coordination Unit and is assured that the other signatories to the Project Document have no objection to the proposed changes:

- Revision of, or addition to, any of the annexes to the Project Document;
- Revisions which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of the inputs already agreed to or by cost increases due to inflation;
- Mandatory annual revisions which re-phase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility; and
- Inclusion of additional annexes and attachments only as set out here in this Project Document

Standard text has been inserted in the template. It should be noted that although there is no specific statement on the responsibility for the safety and security of the executing agency in the SBAA and the supplemental provisions, the second paragraph of the inserted text should read in line with the statement as specified in SBAA and the supplemental provision, i.e. “the Parties may agree that an Executing Agency shall assume primary responsibility for execution of a project.”

8. ANNEXES

ANNEX A: Project Risks and Assumptions

The project design took into consideration the success factors that would make the realization of the Project goal and achievement of project objective within controllable and manageable limits. These are described as internal factors and should be within the control and authority of the Project Team. However, there are factors beyond the control of the Project and therefore the success of the project in attaining its goal and targets relies on the assumptions that certain desired situations or conditions will exist or happen. However, these assumptions if worded in the negative sense are considered as the risks of the project implementation.

The Project Results Matrix (Section 3) shows a detailed overview of the project's assumptions for successful project implementation. To address these risks, the project has to establish effective means to monitor and to the extent possible mitigate these risks. Mitigation measures include a strong emphasis on hands-on and adaptive project management and participation of each stakeholder, mobilizing private sector participation and a continuous dialogue between the project's donors, implementing Partner, executing agency, and government agencies. The different risks that were identified during the NAMA project formulation and the recommended mitigation measures and risk rating are the following:

Table A.1: Project Risks and Mitigation Measures

#	Description	Date Identified	Risk Type	Risk Level	Risk Management
1	*Insufficient, discontinuous and/or uncommitted support from government and coordination among line Ministries and the RE (biogas, solar PV) and EE (high efficient motors) industry*	July 2014	Political	Shifting of government energy program priorities leading to reduced technical and budgetary support to NAMA program; poor coordination among line ministries and RE and EE industry may lead to slow policy execution and poor implementation of the program. *Risk Level: Low*	- The policies and action plans of the energy generation sector has clearly indicated the promotion of renewable energy and energy efficiency. Similarly energy efficiency in end-use sectors is also given high priority through EnMAP. - Institutional framework in place for the implementation of renewable energy and energy efficiency projects. - Government commitment to the project will be clearly established and confirmed. - Regular coordination meetings among relevant line ministries and biogas, solar PV and high efficient motors in tea sector. - Government issuing policies and allocating budget and acting lead role on RE and EE program.
2	*Lack of support, participation and commitment from local RE and EE value chain actors (suppliers, installers,*	July 2014	Regulatory, Institutional	Private sector not participating adequately in the project, due to lack of interest, disruption to operation and business priorities. Financing of	- The SLSEA has planned to encourage the private sector through incentive scheme (matching rebate, partial loan guarantee, and performance based payment) to promote renewable energy and

#	Description	Date Identified	Risk Type	Risk Level	Risk Management
	service providers)			investments for the purchase and installation to modify their production facilities may not be available. *Risk Level: Moderate*	energy efficiency applications. - There are existing incentives for the end-users, for example net metering policy, which needs to be fine-tuned in the context of the end-user. - Industry trade associations, professional organizations, and private individuals will be consulted and involved in the annual project work planning. - Working relationships household, with industry and commercial sector associations will be further enhanced to ensure cooperation. - Commitment and active participation of RE and EE value chain actors - Awareness and interest by the public in adopting RE and EE technologies will be facilitated
3	*RE and EE Technology Risk*	July 2014	Technology	• Failure of RE and EE products (equipment and appliances) to perform as claimed by installers and manufacturers resulting to customer dissatisfaction. • Proliferation of illegally traded and unreliable RE and EE appliances. • Lack of testing procedures and standards to govern RE and EE installation and operation • Intellectual property rights on RE and EE technologies may not be	• Serious implementation and compliance to RE and EE standards, labelling and warranty and after sales services • Consumer education activities focus on use and application of RE and EE technologies as well as consumer protection programs of the government. • Testing and certification institutions to be strengthened and equipped

#	Description	Date Identified	Risk Type	Risk Level	Risk Management
				easily dealt with to facilitate timely technology transfer *Risk Level: Low*	
4	*RE and EE Market & Financing Risk*	July 2014	Institutional	• Unwillingness of consumers to buy RE and EE due to bad experiences in the past and high initial cost may lead to failure of the project to induce increased sales and widespread use of EE RAC. • Awareness and interest by the public in using RE and EE technologies because low-cost continue to be available in the market *Risk level: Moderate*	• Assisting and empowering consumers to make real time, informed decision making when buying RE and EE products. • Promotion of suitable financing, incentives will be developed and the implementation facilitated under the project. • Providing ample technology and market information on economic and environmental benefits of RE and EE technologies

ANNEX B: ASSESSMENTS AND PROPOSED IMPLEMENTATION MODALITIES FOR THE BIOGAS DEMONSTRATION PROJECTS

1. Concept note for Bio-digesters as Program of Activities

This section describes the incremental reasoning for choosing biogas as the RE NAMA as summarized in Table B.1.

Table B.1: Baseline and Incremental value of GEF Biogas project

Barrier Type	Baseline scenarios	Incremental values
Regulatory barrier	- No mandate to treat wastes - SLSEA is developing and investing in a commercially viable and market based national biogas program to convert septic, kitchen and green and livestock wastes into methane biogas for cooking, lighting and thermal use.	- Assist SLSEA and Uva province to develop biogas as a RE NAMA - Partner with Lanka Biogas Association to update the bio-digester Standard and improve the after sale service and guarantee agreement
Technical barrier	- Chinese fixed dome and improved continuous Chinese model based on Sri Lanka model - No monitoring and evaluation of co-benefits	- Opportunity to use GEF investment to facilitate the installation of 1,000 bio-digesters in the residential, institutions, commercial and dairy farms due to the following: • Develop RE NAMA using MRV system that will be developed under the project • Test the rebate scheme • Although SLSEA is planned to install over 10,000 bio-digesters, the proposed project will select only 1,000 units that are designed for sustained service delivery and cost-effective operations - To introduce new technology - floating dome and composite fiberglass bio-digester - Develop a robust and transparent standardized baseline, inventory and MRV system linked with SLSEA's web-based EnerGIS database system
Financial barrier	- SLSEA and the Provincial Council of Uva provide 50% subsidy to qualified end users - This may not be sustainable in the long term	- To overcome dependence on subsidy and to ensure financial sustainability, matching rebate with sliding scale will be promoted where rebate will be reduced from 50% to 20% as volume of sales increased to incentivize early movers - To partner with MFIs to develop loan products and services where sliding scale matching rebate are given based on payment by results to ensure excellent after sale guarantee and services

2. Justification for the selection of biogas for demonstration

Objectives: Implementation of Biogas as RE NAMA to reduce GHG Emissions in residential, institutions, commercial and dairy livestock sub-sectors through the use of AD to convert septic, kitchen and green wastes into methane for cooking, lighting and productive thermal use.

The rationale for the selection of the Biogas as RE NAMA are based on the followings:

- Work on biogas in Sri Lanka started in the 1980s. Many governmental and non-governmental organizations have been active in this area at various periods of time.
- Although unconfirmed data suggests that there are nearly 5,000 biogas units constructed throughout the country, survey results by Practical Action estimated that only 28.5% are still in operation.
- Many of these initiatives lacked sustainability and the high redundancy rates are caused various barriers that SLSEA is keen to overcome.
- Realizing the multiple mitigation and adaptation benefits of AD and based on the successful biogas program in China, Vietnam, Nepal, Indonesia, India, Pakistan and Bangladesh, SLSEA is seeking to revive the biogas industry to develop a successful national biogas program using commercially viable and market-based bottom up business approach for overcoming the following technical, regulatory, financial and social barriers and avoid past failures by:
    - Using market based approach to identify, train and incentivize all value chain actors (installers, suppliers, end users)
    - Instead of using 'top down technology push', SLSEA will partner with provincial government, women group and CBOs to create 'market demand pull' for AD through social marketing, awareness raising and visits to demonstration site to raise end users' confidence
    - Potential masons and installers will be trained in technical and business skills and certified as social entrepreneurs with access to start up grant and credits/loans
    - In order to overcome the lack of competitive credit and loans, SLSEA will partner with PFIs and MFIs to develop affordable value chain financial products and services e.g. matching rebate or startup grant for early movers, partial loan guarantee for installer with no collateral
    - To overcome high upfront cost, the subsidy mentality and high material costs, installers will be trained and certified and use of bulk order to reduce material cost, bio-digester and installation cost
    - After sale guarantee and services through standard and certification will be developed to provide on quality assurance and boost consumer confidence
    - Installers will be paid based on the performance of the bio-digesters as part of the MRV system
    - To provide peer to peer training and to revamp the Lanka Biogas Association as a platform to strengthen networking between installers, suppliers and end users and continual improvement of the AD technology for meeting local needs
    - To improve revenues of the end users to offset high upfront cost, productive thermal use of the biogas for cottage industry (crop/spices drying, rice processing) and bio-slurry as organic fertilizer will be developed and marketed
- The above approach also takes cognizance of the lessons learned in the WB's current "RE for Rural Economic Development Project" (WB, 2014)[14]: i) Local participation and involvement, suitably incentivized, is crucial to promoting distributed power generation activities; ii) Involving the private sector effectively in a decentralized developmental effort requires flexibility in implementation arrangements and space for adapting to market conditions; iii) A consistent and transparent application of policy (e.g. feed-in tariff) are crucial to spur growth of small scale and non-conventional renewable energy generation to build market confidence; and iv) Investments in off-grid electrification could be underutilized or even abandoned in the event of a faster than expected arrival of the electricity grid.
- A study on the potential of biogas from biomass sources (Human waste, Municipal solid waste, Landfills, Livestock waste, Agricultural waste, plantation industries) in Sri Lanka carried out by Practical Action estimates a total power generation potential of 288 MW of which includes 86 MW from livestock waste.
- The practical potential number of bio-digesters (with access to water) that could be built in Sri Lanka is over 1 million as shown in Table B.2.
- SLSEA is supporting Uva province to scale up the biogas program - only 1,600 units have been installed from 2001 to 2014.
- Uva province is targeting to install 400 units in 2015 and 600 units in 2016 with a total of

[14] *http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/06/30/000442464_20140630134905/Rendered/PDF/885470PPAR0P070C0disclosed060260140.pdf*

10,000 units

- Uva province is promoting AD to treat sewage and organic waste for the peri-urban households, institutional and commercial & livestock farms
- Biogas are used for cooking to displace LPG (from 50 to 100%) and lighting and ironing
- Households are provided with 50% subsidy from the provincial budget that will not be sustainable in the long term
- To make the biogas business sustainable, this GEF project will develop matching rebate with a sliding scale (reducing rebate as uptake of technology increases)
- Currently there is no monitoring and evaluation of the economic, social and environmental benefits
- This GEF project will assist SLSEA to develop a Biogas PoA that could be turned into a NAMA based on a Standardized Baseline and MRV system

Table B.2: Practical potential number of bio-digesters in Sri Lanka

Sub-Sectors with access to water	Number of bio-digesters	Remarks
A. Dairy farm with livestock shed under 'cut and carry' system	**72,500**	
Wayamba Province	30,000	With increasing demand for dairy products, AD provides a means to manage the livestock waste and avoid dumping into water course. Bio-slurry could be developed into organic fertilizer
Central Province	15,000	
Sothern Province	10,000	
Sabaragamuwa Province	7,500	
Uva Province	5,000	
North & East Province	5,000	
B. Hotels and restaurants	**10,000**	Convert food wastes into cooking fuels
C. Domestic	**1,000,000**	Only 2% has centralized sewage system. Using human, green and septic wastes as feedstock
D. State Institutions (hospitals, schools, army camps, prisons)	**2,000**	Convert human and green waste into cooking fuel
Total	**1,084,500**	

Recovery of investment: The cost of bio-digester and simple payback periods is provided by Mr. Chathura Welivitiya, owner of HELP-O, the leading supplier of bio-digesters in Galle, Southern Province (Table B.3). Simple payback ranges between 2 to 4 years depending on size of the bio-digester and capital cost.

Description of the small scale Program of Activities (Biogas PoA): The objective of the proposed small-scale CDM Program of Activities is to reduce GHG emissions from fossil fuels used and avoidance of methane from human, green and livestock waste by installing biogas digesters in households, institutions (schools, prisons, hospitals, army camps), commercial (hotels, restaurants) and dairy farms in Sri Lanka. The PoA will be coordinated and managed by the Provincial authority (NAMA focal point) in partnership with SL Sustainable Energy Authority (SLSEA).

Table B.3: Cost of bio-digester and simple payback calculations (Source: Chathura, HELP-O, leading bio-digester supplier)						
Capacity (m^3)	Yield of Methane (m^3)	LPG Usage (kg/month)	Approximately Monthly Saving (LKR/month)	Total CAPEX Costs (LKR)	Simple Payback Period (Months)	Simple Payback Period (Years)
8	2.00	1.000	6,212.50	150,000.00	24	2.0
10	2.50	1.200	7,455.00	230,000.00	31	2.6
12	3.00	1.500	9,940.00	350,000.00	35	2.9
15	3.75	1.850	11,182.50	625,000.00	56	4.7
18	4.50	2.250	13,667.50	775,000.00	57	4.7
22	5.50	2.750	17,395.00	1,150,000.00	66	5.5
35	8.75	4.375	26,092.50	1,350,000.00	52	4.3
44	11.00	5.500	33,547.50	1,772,000.00	53	4.4
65	16.25	8.125	48,457.50	2,255,500.00	47	3.9

Policy/Measure or Stated Goal of the Biogas PoA: The PoA will contribute to the development of the commercial and structural deployment of domestic biogas in Sri Lanka in the following way:

- Promote the long-term utilization of biogas systems as a source of renewable energy production in an environmentally compatible and economically viable way. For this purpose the construction and operation of biogas systems will be facilitated
- Increase the awareness of prospective peri-urban households, institutions, commercial, industrial sectors and dairy livestock farmers and extension workers on the full extent of the potential costs and benefits of domestic biogas installations
- Strengthen the supporting human capacity regarding all aspects of marketing, construction, after sales service and quality management of domestic biogas installations
- Support the development of a commercially viable, market oriented domestic biogas sector in Sri Lanka
- Strengthen the institutional and financial infrastructure for coordination and implementation of sustained dissemination of domestic biogas at national, provincial and district level.

The co-benefits of a successful biogas business will be:

i) Economic benefits:

- The expenses for domestic energy (LPG, fuel wood) are significantly reduced
- The labor required to maintain traditional energy systems (such as firewood collection) can be used in more directly economically productive ways
- Substitution of petroleum products will reduce the country's foreign exchange demand
- Application of bio-slurry increases the yield and reduces the need` and expenses for synthetic fertilizer
- A vibrant biogas sector creates significant employment and related economic activities, particularly in rural areas.

ii) Social benefits:

- The reduction in domestic workload, particularly for women and children, increases opportunities for education and other social activities.
- Respiratory illnesses resulting from indoor air pollution and gastro-enteric diseases as a result of poor sanitary conditions reduce significantly.
- In rural areas, biogas digesters often initiate innovation (education, sanitation, agriculture). Increase awareness of alternative farming and animal husbandry practices and environmental impacts of behavior.

iii) Environmental benefits:

- Substituting conventional fuels and synthetic fertilizer, and changing traditional manure management systems, biogas installations reduce the emission of greenhouse gasses significantly.
- Bio-slurry improves soil texture, thus reducing degradation, and reduces the need for further land encroachment.
- Reduction of firewood use contributes to checking deforestation and reduces forest encroachment.

- Improved manure management practices reduce ground and surface water pollution and odor and improve aesthetics.

The PoA will be a voluntary action by SLSEA and provincial government. Moreover, there are currently no national or regional regulations prescribing the implementation of biogas facilities in residential, institutions, commercial, industrial and small farm holders' households. At present such regulations are not foreseeable.

Proposed Pilot Project: To demonstrate the use of the bio-digesters as a RE NAMA, the NAMA Project will disseminate 1,000 units of bio-digesters in four provinces as shown in Table B.4. During the implementation stage, a detailed feasibility study will be conducted in collaboration with Provincial authority in partnership with the Lanka Biogas Association to finalize the selection of installers and site conditions, determine the detailed specifications of the bio-digester technology, formalized the business model and incentive schemes and study the detailed economic and financial performance of the demonstration project (Output 3.2). The matching rebate scheme for the dissemination of 1,000 bio-digesters is described below. The owners will contribute a portion of the cost of the system through a cost sharing mechanism, while the NAMA Project will provide matching rebate to cover a portion of the equipment cost based on the standard and certification scheme. In addition, 68 bio-digester installers will be trained and certified.
Consumers could receive matching rebate from 50% to 20% of the total cost of installation be selected (to ensure the genuine interest and the ownership) through a competitive selection process for the demonstration if they fulfil other basic requirements such as the availability of land, access to water, willingness to allow other consumers in the locality to observe the facility when the system is in operation, etc.

Table B.4: Dissemination program for the bio-digesters in Sri Lanka

REGION/DISTRICT	Number of Households	Average household size	Year 1	Year 2	Year 3	Year 4	Total	Total number of experts to be trained
Sri Lanka	**5,191,445**	**3.8**						
i. Bio-digester								**Number of installer**
			64	**228**	**296**	**412**	**1,000**	**68**
UVA PPROVINCE	**326,358**	**3.65**	**16**	**57**	**74**	**103**	**250**	**17**
Badulla	**206,456**	**3.7**	10	37	44	63	**154**	10
Monaragala	**119,902**	**3.6**	6	20	30	40	**96**	7
CENTRAL PROVINCE	**645,806**	**3.77**	**16**	**57**	**74**	**103**	**250**	**17**
Kandy	342,115	3.8	6	27	30	45	**108**	7
Matale	127,578	3.6	5	15	24	28	**72**	5
Nuwaraeliya	176,113	3.9	5	15	20	30	**70**	5
SOUTHERN PROVINCE	629,113	3.7	**16**	**57**	**74**	**103**	**250**	**17**
Galle	269,362	3.8	6	27	30	45	**108**	7
Matara	203,763	3.9	**5**	15	24	28	**72**	5
Hambantota	155,988	3.7	5	15	20	30	**70**	5
NORTH WESTERN PROVINCE	639,393	3.65	**16**	**57**	**74**	**103**	**250**	**17**
Kurunegala	437,687	3.6	10	37	44	63	**154**	10
Puttalam	201,706	3.7	6	20	30	40	**96**	7

Financial Schemes for the Dissemination of Bio-digesters

Rationale for incentivizing energy access: World experiences have shown that subsidizing the price of LPG or kerosene fuel could lead to the following 'unintended' consequences: (a) possible diversion of the fuel for non-cooking uses, such as transport, can occur (this is more likely to happen with kerosene than LPG); (b) difficulties in limiting benefits to low-income households or crafts and professions; and, most important (c) the subsidy burden to the Government is likely to become unmanageable in the future. As shown worldwide, 'addiction to subsidy' can be extremely difficult to withdraw or even reduce once they become critical to consumer choices for fuel use (e.g. Nigeria, Indonesia). Furthermore, subsidy can distort the market and crowd out private sector participation whilst deterring end users to pay the full market price and the incentive to adopt more resources efficient production system or services.

It is often more effective, with fewer undesirable side effects, to incentivize access rather than consumption. Incentivizing bioenergy access calls for programs that part rebate the equipment or production system that are needed for early movers and adopters to champion a 'tipping point' for market transformation to resources efficient products and services and fuel switch (e.g. new stove purchases, deposits for LPG cylinders, bio-digesters) by removing supply risks, improving demand and facilitating fuel logistic and market support but keeping fuel prices at market levels. This will create a level playing field for new bioenergy entrants to compete fairly, bolstered through a transparent and coherent standard, certification and label programs. The financial exposure of the Government for an equipment rebate program can be determined annually in advance, unlike fuel subsidy programs that are entirely subject to the vagaries of fuel market fluctuations and exposure to corruptions. The Government may terminate the equipment rebate program at almost any time with minimal public inconvenience.

The rationale for the development of matching rebate for bio-digesters, are shown in Table B.5 for overcoming the financial and social barriers that exist in the country.

Table B.5: Indicative cost of bio-digesters and rationale for their funding schemes

	Bio-digester ($15\ m^3$)
Current cost of appliances (average), USD	600
Total cost of new appliances (estimated), USD	1,000
Cost of current appliance as a percentage of total cost of new appliance	60%
Demonstration units	1,000
Funding schemes	Rebate for households, schools, prisons and hospitals to purchase bio-digesters
Rationale	Lack of income and the need to create demand to reduce supply risks

Matching Rebate Scheme for the Purchase of Bio-digesters: The current prices that the households are paying for their traditional technology are shown in Table B.5 above. The Baseline Survey and investigations conducted during the PPG stage revealed that it is necessary to provide some form of matching rebate to cover for the incremental cost of purchasing the new appliances.

Using the principle of matching rebates, the fiscal support that will be provided to the residential and institutions (schools, prisons, and hospitals) will be reduced as the volume of the uptake of the bio-digesters increases. This gives incentives for the potential households and institutions to make an early decision and "try" the new system. The early batches of bio-digesters are needed to create a demonstration effect and all other potential users and institutions to observe the benefits of the

promoted technologies. As the benefits are experienced by the early users and seen by the neighbors and other potential users, the true value of the system are no longer perceived but becomes known and hopefully appreciated. This will help to reach a critical mass and ensuring a strong "gravitational pull" will play an important role in the development of the marketplace: as the market grows, critical mass and gravitational effect will attract more buyers and more suppliers. The process of making the rebate payable once the quality has been checked, certified and approved as a performance-based payment scheme, works as a powerful mechanism to ensure quality control. Matching rebate will be disbursed to qualified household and commercial end users and institutions against an agreed work plan and SMART results to be achieved over a period of up to 3 years.

It is proposed that a matching rebate of 50% of the full cost of the bio-digester will be given to owners and institutions who belong to the first 40% of the targeted number of bio-digester to be disseminated. This rebate will be reduced to 40% for owners and institutions who belong to the next 50% of the target group, and finally, to 20% for users who belong to the last 20% of the target group. An indicative sliding matching rebate scheme is presented in Table B.6.

At the end of the Project, it is expected that the bio-digesters will be sufficiently demonstrated to allow market mechanism to prevail without or with minimal matching rebate. It is also hoped that at the end of the Project the procedures for the construction of bio-digesters installation will be more streamlined, and combined with better economy of scale, the price of bio-digesters would be reduced, making it more affordable for households, commercial and institutions to purchase even without the benefit of matching rebates. The same matching rebate principles apply to HEM.

Table B.6: Sliding scale matching rebate for bio-digester and HEM

Year	1	2	3	4
Percentage uptake of targeted volume in each Phase of roll-out	>0-40%	>40-60	>60-80%	>80-100%
Matching rebate as % of the cost of the appliance on a sliding scale	50%	40%	30%	20%
Amount of matching rebate for bio-digester, USD	500	400	300	200
Amount of matching rebate for HEM, USD	500	400	300	200

To have equity and ownership among the users of bio-digesters and to have a fair treatment for all districts in the different phases of the roll-out of these bio-digesters, the principle of introducing higher rebate at the beginning and phasing it out as the uptake increases will be applied similarly in each of the four phases of the bio-digesters dissemination. Using the distribution plan in Table B.7 as the basis for calculating the rebates at each year of the project implementation, the resulting amount of rebates according to year for bio-digesters is shown in Table B.8.

Table B.7: Target distribution according to phases of implementation

Description	Bio-digester	High Efficiency Motor	Storage Battery	Total Appliances
Phase 1 Districts	***160***	***220***	***100***	***480***
Year 1 (40%)	**64**	**88**	**0**	***152***
Year 2 (60%)	**96**	**132**	**0**	***228***
Year 3 (0%)	**-**	**-**	**-**	**-**
Year 4 (0%)				
Phase 2 Districts	***220***	***280***	***100***	***600***
Year 1 (0%)	**-**	**-**	**-**	**-**
Year 2 (60%)	**132**	**168**	**100**	**400**
Year 3 (40%)	**88**	**112**	**0**	**200**
Year 4 (20%)				

Phase 3 Districts	***260***	***300***	***5***	***565***
Year 1 (0%)	**-**	**-**	**-**	**-**
Year 2 (0%)	**-**	**-**	**-**	**-**
Year 3 (80%)	**208**	**240**	**5**	**458**
Year 4 (20%)	**52**	**60**	**0**	**112**
Phase 4 Districts	***360***	***500***	***0***	***860***
Year 1 (0%)	**-**	**-**	**-**	**-**
Year 2 (0%)	**-**	**-**	**-**	**-**
Year 3 (0%)	**-**	**-**	**-**	**-**
Year 4 (100%)	**360**	**500**	**0**	**860**
Total	**1,000**	**1,300**	**205**	**2,505**

Table B.8: Amount of matching rebate for biogas, solar PV and high efficient motors

Description	Bio-digester	High efficient motors	Solar PV with Storage battery	Total Cost
Year 1				
No. of appliances	64	88	100	**252**
Full cost of appliances	64,000	88,000	95,769	**247,769**
Amount of matching rebate	32,000	44,000	76,615	**152,615**
Amount of cost-share	32,000	44,000	19,154	**95,154**
Year 2				
No. of appliances	228	300	100	**628**
Full cost of appliances	228,000	300,000	384,231	**912,231**
Amount of matching rebate	91,200	120,000	192,115	**403,315**
Amount of cost-share	136,800	180,000	192,115	**508,915**
Year 3				
No. of appliances	296	352	5	**653**
Full cost of appliances	296,000	352,000	57,692	**705,692**
Amount of matching rebate	88,800	105,600	11,538	**205,938**
Amount of cost-share	207,200	246,400	46,154	**499,754**
Year 4				
No. of appliances	412	560	0	**972**
Full cost of appliances	412,000	560,000	0	**972,000**
Amount of matching rebate	82,400	112,000	0	**194,400**
Amount of cost-share	329,600	448,000	0	**777,600**
Total number of appliances	***1,000***	***1,300***	***205***	**2,505**
Total cost of appliances	***1,000,000***	***1,300,000***	***537,692***	**2,837,692**
Amount of matching rebate	***294,400***	***381,600***	***280,269***	**956,269**
Total cost-share	***705,600***	***918,400***	***257,423***	**1,881,423**

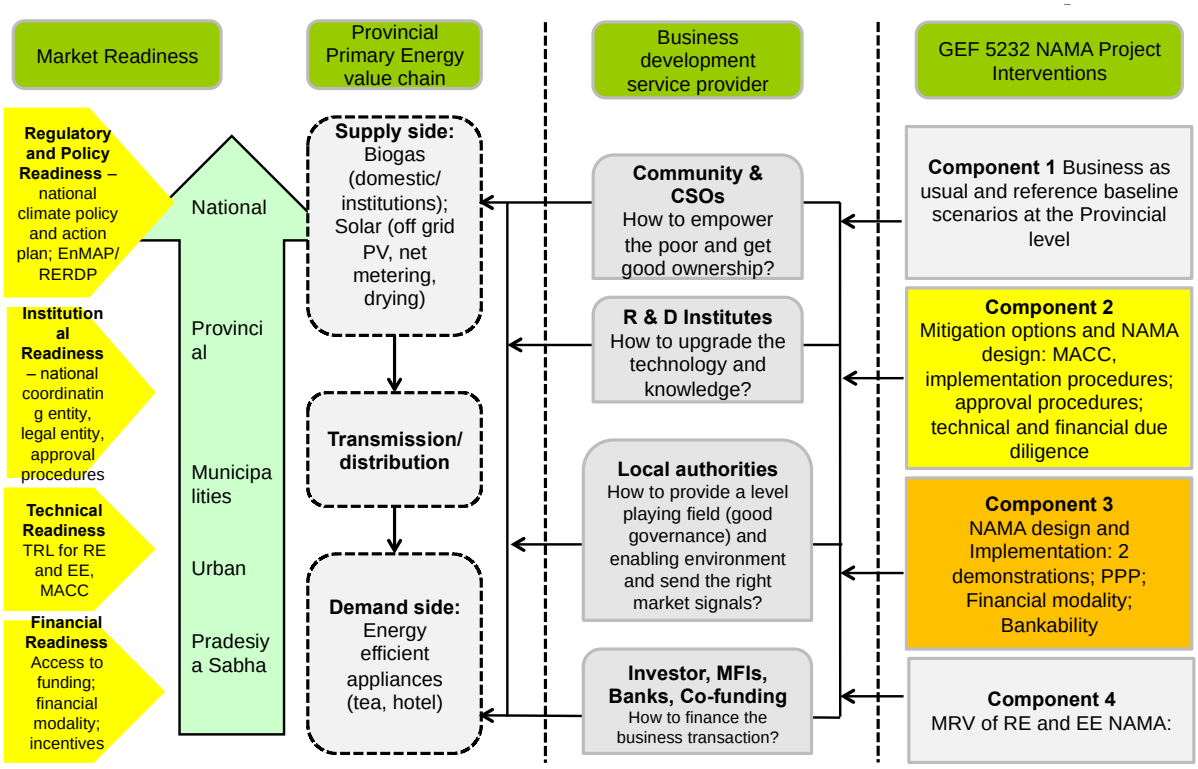


Figure B.1: Value Chain Framework for Assessing Provincial NAMA Public Private Partnership

Indicative modalities and procedures for distribution of bio-digesters

During the early part of the Project implementation, the activities related to the promotion of output based and market mechanisms will focus on the identification of installers and suppliers and the CBOs in the different targeted villages and districts. The detailed modalities and procedures will be agreed with these entities during the Project implementation (Figure B.1). These modalities and procedures will include aspects such as:

- Procedures for procurement of raw materials
- Pricing of bio-digesters
- Payment mechanisms
- Amount and mechanics of matching rebate
- Roles and responsibilities of different parties
- Quality control and assurance
- Content of the training program

Financial Sustainability: This biogas demonstration seeks to establish a demand side pull for biogas technology before the supply side support could come into effect. Since GEF will be directly subsidizing most of the initial bio-digesters no financial mechanism is needed outside the matching rebate to the end users. It is also hoped that at the end of the Project the procedures for the construction of certified bio-digesters will be more streamlined, and combined with better economy of scale, the price of certified bio-digester would be reduced, making it more affordable for end users to purchase even without the benefit of rebates. At the end of the Project, it is expected that the new bio-digesters will be sufficiently demonstrated to allow market mechanism to prevail without or with minimal rebate. Increase in earnings for participating groups would further improve affordability in purchasing the new technologies. In partnership with MFI, Output 3.1 has an activity to develop a commercial financing scheme for bio-digesters as an exit strategy by the end of the project for ensuring replication.

Approach for Developing Standardized Baseline (SB) in Project Area: The availability of a standardized baseline will avoid the need assess the baseline for every carbon project/program thus a huge saving on transaction cost. The approach for developing a reliable and tested biogas baseline that is replicable across the districts in Sri Lanka based on practical site specific input is shown in Table B.9.

The **system boundary** within which the project activity takes place has been determined and comprises those emission sources that are significant, measurable and under the control of project participants in the pilot districts. The emissions that would have taken place within the system boundary without the carbon project have been described, making it possible to determine a baseline scenario and additionality. Justification for **physical boundaries** is based on carbon impact of biogas activities and relative ease of measuring emission levels. The **aggregation levels** for the standardized baseline have been set for both accuracy and cost-effectiveness and will be based on analysis of methane yield; cross-comparison of efficiencies among different *ecological zones*, *duration* of anaerobic digestion and time series analysis with regards to *technology evolution.* To facilitate monitoring and ensure accuracy of the SB, there will be need to identify and establish **Performance Benchmarks**, which will be carefully tracked using suitably defined key performance indicators (KPIs). The KPIs will typically comprise easily observable and measurable outcomes resulting from proposed project activities.

Steps for developing SB are summarized in Table B.9. Key performance indicators (KPIs) for the SB will be measured and evaluated through the monitoring of:

- Feedstock types and composition and AD technologies
- Change in cultural practice to include better preparation of feedstock (waste to water ratio) prior to AD
- Rate of absorption of technology
- Amount of methane per unit of feedstock or bio-digester capacity (m^3)
- Income generated from methane sales/thermal use and organic fertilizer sales
- Revenue generated including revenue to the district governments in form of taxes. This may also include revenue from auxiliary activities depending on the system boundary adopted, which in turn is dependent on the practicality as well as cost-effectiveness of data collection.
- Emission reduction levels based on registered PoA methodology

Table B.9: Summary of Steps for Developing Standardized Baselines

Crucial Elements	Activities	Data Requirements	Remarks/Comments
Establishment of System Boundary	Baseline and situational analysis in the pilot districts	Methane production, feedstock, conversion technology, relevant policy, stakeholder analysis, etc.	Data updating on-going. Piloting of technology and full value chain will firm up existing data/information
Justification for Physical Boundaries Selected	Relative carbon impact of biogas related activities	Relative ease of measuring emission levels/impact of the different activities	Detailed analysis of the relationships between different activities to be carried out
Aggregation level: Criteria for identification of peers for the emission performance comparison	Analysis of methane production process; cross-comparison of efficiencies among different ecological zones; AD time; Time series analysis with regards to technology evolution	Data on feedstock source and preparation; AD method; recovery efficiency; historical analysis of available technology	Manageable levels of aggregation which are amenable to monitoring will be adopted.
Key Performance Indicators (KPI)	Monitoring of: Efficient AD conversion Change in cultural practice to include better preparation of feedstock Rate of absorption of technology		

	Amount of methane per unit of feedstock; Income generated And genera revenue to the district Emission level		

GHG Emission Mitigation from Biogas System

There are two potential sources of GHG emission mitigation in the implementation of the biogas system: i) avoidance of methane generation from otherwise de-composting human, green and livestock wastes ([through anaerobic lagoon, liquid slurry mainly from swine/dairy cattle]; septic tank, solid storage, dry lot, pasture, daily spread or open burning for non-dairy cattle or buffalo) that would now be used as fuel in the biogas system and ii) conversion of the human, green and animal wastes into clean energy for cooking and lighting to replace the use of LPG, electricity and non-renewable fuel wood. The GHG calculations will be based on the UNFCCC-approved AMS III - D methodology as detailed in Annex C. This methodology can be used for calculation biogas system for residential, institutions, commercial and dairy farms by changing the inputs and parameters of the waste streams.

a. Lifetime Direct GHG Emissions Avoided

The 1,000 bio-digesters (10 to 20 m3) will be disseminated in different phases and at different years. Lifetime direct emissions avoided attributable to the investments made during the projects supervised implementation period, totaled over the respective lifetime of the investments is presented in Table B.10 and B.11. The summary of the expected annual and cumulative waste avoided and GHG mitigation as a result of using the bio-digesters is shown in Table B.10. Table B.11 shows the wastes avoided and GHG mitigation from the first four years of operation of the bio-digesters. The life of the bio-digesters supported in this Project is expected to be about 10 years. Thus, giving an average of 10 years from the end of Year 2, the bio-digesters that are supported by the Project by utilizing the institutional and financing scheme set up within the Project, and disseminated through its roll-out mechanism, are expected to mitigate GHG emissions by the end of the project as summarized in Table B.10.

Table B.10: SUMMARY - Total Lifetime direct GHG emission reduction and energy savings through the use of bio-digesters	
Description	**Biogas (10 years)**
Quantity of electricity saved (MWh)	1,281
Quantity of energy saved (MJ)	4,609,820
GHG emissions mitigated (tCO_2e)	46,248

Table B.11 Total lifetime direct GHG emission mitigation of bio-digesters						
	GHG emission baseline / HH per unit		8.60	tCO_2eq/plant/y		
	GHG emission project + leakage / HH per unit		2.78	tCO_2eq/plant/y		
	GHG savings per plant per year		5.82	tCO_2e/plant/y		
	Avoided LPG, Kerosene, and non-renewable biomass use per plant per year		1.33	GJ/plant/y		
Year	End of year	Cumulative	End of year	Cumulative	Annual Energy savings	Cumulative
	(# of plants)	(# of plants)	(tCO_2e/y)	(tCO_2e)	GJ/y	GJ
1	64	64	373	373	85	85
2	228	292	1,700	2,073	303	388
3	296	588	3,423	5,496	393	781
4	412	1,000	5,822	11,317	547	1,328
5	-	1,000	5,822	17,139	547	1,875
6		1,000	5,822	22,961	547	2,422

7		1,000	5,822	28,783	547	2,969
8		1,000	5,822	34,604	547	3,516
9		1,000	5,822	40,426	547	4,063
10		1,000	5,822	46,248	547	4,610

Lifetime direct post-project GHG emissions avoided from bio-digesters:

The total co-financing expected for the implementation of bio-digesters under the project is US$ 1,200,000 million over a period of 4 years. About 1,000 bio-digesters will be implemented with a total cost of US$ 1,000,000, where US$ 705,600 is from co-financing and US$ 294,400 is from GEF grant in the form of rebate. From the remaining co-financing amount committed, possible number of plants will be 494 numbers. Considering the same assumptions as above under Table B.11, the possible energy savings will be 6,564,213 MJ (1.33 GJ/plant/y over 10 years), and possible direct post-project GHG emissions reduction will be 28,783 tCO_2e (5.82 tCO_2e/plant/y over 10 years) over the technical lifetime of intervention.

b. Project indirect GHG emission mitigation

Based on interviews with biogas experts, it is estimated conservatively that the technical potential of biogas generation from bio-digesters that could be developed in Sri Lanka is about 1 million (Table B.2). The indirect GHG emission reduction for bottom-up (by a factor of three) and top down (25% market growth rate, but GEF causality factor of 40% of 25% is 10%) calculations are shown in Table B.12 and B.13 respectively. Assuming that, due to activities and support attributable to the Project, the bio-digester technologies up-scaling are replicated so that the number of bio-digesters is increased at a modest rate of 10% per year (directly attributed to GEF grant support), in 10 years after the end of the Project. Thus, the number of bio-digesters would have reached around 1,772 from a baseline number of 1,000 bio-digesters. The GHG emission reduced through this replication process (Project indirect GHG emission mitigation) is presented in Table B.14.

Table B.12: Project indirect GHG emission mitigation of bio-digester, solar PV and HEM (Bottom-up)

Description	Total Post project indirect			
	Bio-digester	HEM	Solar PV	Total
Replication factor	3	3	3	
GHG emissions mitigated (tCO_2e)	225,092	214,086	566,636	1,005,814

Table B.13: Project indirect GHG emission mitigation of bio-digester, solar PV and HEM (Top-down)

Description	Total Post project indirect			
	Bio-digester (10 years)	HEM (10 years)	Solar PV (20 years)	Total
Quantity of electricity saved (MWh)	1,024	26,612	7,042	34,679
Quantity of energy saved (MJ)	11,268,527	292,736,107	77,463,328	381,467,962
GHG emissions mitigated (tCO_2e)	49,410	19,142	5,065	73,618

Table B.14: Annual indirect project GHG emissions at 10% growth rate (top-down)

Year	Annual LPG saved (t/y) [15]	Cumulative	Bio-digester growth (10%)	Annual GHG reduction (tCO_2e/y)	Cumulative GHG reduction (tCO_2e/y)	Manure avoided (t/y)	Cumulative	Fuel wood avoided (t/y)	Cumulative	Annual Energy savings (GJ/y)	Cumulative (GJ)
1						938	938	75	75		
2						3,343	4,281	267	342		
3						4,340	8,621	347	689		
4	30.6	30.6	1,000		-	6,040	14,661	483	1,172		
5	33.6	64.2	1,100	6,404	6,404	6,644	21,305	531	1,704	1,460	1,460
6	37.0	101.1	1,210	7,044	13,448	7,309	28,614	584	2,288	1,607	3,067
7	40.7	141.8	1,331	7,749	21,197	8,040	36,654	643	2,931	1,767	4,834

[15] **15 m^3 = 45.6 kg CH_4/y (25% bio-digester efficiency)**

8	44.7	186.5	1,464	8,524	29,721	8,844	45,498	707	3,638	1,944	6,778
9	49.2	235.7	1,611	9,376	39,097	9,728	55,226	778	4,416	2,138	8,916
10	54.1	289.9	1,772	10,314	49,410	10,701	65,926	856	5,272	2,352	11,269

Table B.15: Parameters from livestock farm are used for the GHG calculations.					
Relevant Section	**Reference**	**Description - Based on AMS III.D methodology**	**Data**	**Unit**	**Source/formula**
	Ns,r	Number of bio-digesters implemented (2015 to 2018)	1,000	No.	
A. Baseline emissions					
i. Methane avoidance from livestock manure or human and green wastes (kitchen and garden wastes)					
TIER 1 approach					
	GWPCH4	Global Warming Potential (GWP) of methane	21.00		IPCC
	N(T)h	The number of cattle/cows	3.38		National Directorate of Statistics, 2010
	N(T)h	The number of buffalo	0.55		National Directorate of Statistics, 2010
	EFawms,T	Emission factor for the defined livestock population category T	0.03	tonnes CH_4/head/yr	(1) IPCC default values;
	EFawms,T	Emission factor for the defined livestock population category T	0.002	tonnes CH_4/head/yr	(1) IPCC default values;
	BECH4,y	Total Baseline Emissions from methane avoidance under the VPA	2.22	tCO_2/yr/hh	([N(Tc)h * EFawms,Tc]+[N(Tb)h* EFawms,Tb])*GWPCH4
	Daily Manure production	For cattle/cows	32.47	kg/day	12 kg/day at 80% collection
	Daily Manure production	For buffalo	7.70	kg/day	20 kg/day at 70% collection
	Daily human waste production	From household or institutions or industry		kg/day	21 kg/day at 60% collection
	Daily green wastes	From kitchen/garden wastes			
ii. Fuel substitution for cooking or productive use					
LPG	BGLPG,BL	Annual LPG consumption of household in baseline scenario	0.000033	Gg	HELP-O, 2012
	NCVj	Net calorific value of fossil fuel j	47.30	TJ/Gg	IPCC default value
	EFFF,j	CO2 emission factor of fossil fuel j	63.10	tCO_2/TJ	IPCC default
	BEVPAl,y	Baseline Emissions during the year y per household	0.10	tCO_2/ yr/hh	BGLPG,BL* NCVj * EFFF,j
Kerosene	BGKER,BL	Annual kerosene consumption of household in baseline scenario	0.000065	Gg	Baseline Survey Report by SEA, 2011
	NCVj	Net calorific value of fossil fuel j	43.80	TJ/Gg	IPCC default value
	EFFF,j	CO2 emission factor of fossil fuel j	71.90	tCO2/TJ	IPCC default
	BEVPAk,y	Baseline Emissions during the year y per household	0.20	tCO2 / yr/hh	BGKER,BL * NCVj * EFFF,j
	BEVPA,y	Baseline Emissions during the year y	0.30	tCO_2 / yr	BEVPAl,y + BEVPAk,y
Biomass	fNRB,b,y	Fraction of biomass used in year y for baseline scenario b that can be established as non-renewable biomass	0.90	%	Estimated
	By	Average quantity of biomass consumption of household in baseline scenario	4.02	tonnes/HH/year	SEA Baseline Fuel Wood Survey, 2011
	NCVbiomass	Net calorific value of the non-renewable biomass that is substituted	0.02	TJ/tonne	IPCC default

	EFprojected_fossil fuel	Emission factor for the biomass consumption in the baseline.	112.00	tCO_2/TJ	IPCC default
	BEbiomass,y	Baseline Emissions produced per HH	6.07	tCO2 / yr/hh	fNRB,b,y * By * NCVbiomass * EFprojected_fossil fuel - see formula below
	BEbiomass,y	Baseline Emissions produced	6,070.68	tCO2 / yr	BEbiomass,y * Ns,r
	BECO2,y	Total Baseline Emissions from fuel substitution	6.37	tCO2 / yr	BEVPA,y + BEbiomass,y
	BECO2,y	Total Baseline Emissions	8.60	tCO2 / yr	BECH4,y + BECO2,y
B. Project emissions					
i. Methane avoidance					
TIER 1 approach	GWPCH4	Global Warming Potential (GWP) of methane	21.00		IPCC
	N(T)h	The number of cattle	3.38		National Directorate of Statistics, 2010
	N(T)h	The number of buffalo	0.55		National Directorate of Statistics, 2010
	EFawms,T	Emission factor for the defined livestock population category T	0.03	tonnes CH4/head/yr	(1) IPCC default values;
	EFawms,T	Emission factor for the defined livestock population category T	0.002	tonnes CH4/head/yr	(1) IPCC default values;
	PLy	Physical leakage of the bio-digester (through measurement or application of 10% default)	0.10		
	η new stove	Combustion efficiency of the used type of biogas stove	0.50		HELP-On Report, 2012
	PECH4,y	Total Project Emissions from methane avoidance	1.22	tCO2 / yr/hh	Calculated
ii. Fuel substitution			0.00011		
LPG	BGLPG,BL	Annual LPG consumption of household in project scenario (27.8% of baseline)	0.000009	Gg	HELP-O Biogas User Survey, 2012
	NCVj	Net calorific value of fossil fuel j	47.30	TJ/Gg	IPCC default value
	EFFF,j	CO2 emission factor of fossil fuel j	63.10	tCO2/TJ	IPCC default
	PEVPA,y	Project Emissions during the year y per household	0.03	tCO2 / yr/hh	Calculated
Kerosene					
	BGKER,BL	Annual kerosene consumption of household in project scenario (27.8% of baseline)	0.00002	Gg	HELP-O
	NCVj	Net calorific value of fossil fuel j	43.80	TJ/Gg	IPCC default value
	EFFF,j	CO2 emission factor of fossil fuel j	71.90	tCO2/TJ	IPCC default
	PEVPA,y	Project Emissions during the year y per household	0.06	tCO2 / yr/hh	Calculated
	PEVPA,y	Project Emissions during the year y	0.08	tCO2 / yr	Calculated
Biomass	fNRB,b,y	Fraction of biomass used in year y for baseline scenario b that can be established as non-renewable biomass	0.90	%	Forestry Survey, 2012
	By	Average quantity of biomass consumption of household in project scenario (20% of baseline)	0.80	tonnes/HH/year	(1) HELP-O Biogas User Survey, 2012
	NCVbiomass	Net calorific value of the non-renewable biomass that is substituted	0.02	TJ/tonne	IPCC default

	EFprojected_fossil fuel	Emission factor for the biomass consumption in the baseline	112.00	tCO2/TJ	IPCC default
	PEbiomass,y	Project Emissions produced per HH	1.21	tCO2 / yr/hh	Calculated
	PECO2,y	Total Project Emissions from fuel substitution	1.30	tCO2 / yr	Calculated
	PETotal,y	Total Project Emissions	2.52	tCO2 / yr	Calculated
C. Leakage					
	LECH4,y	Total Leakage Emissions from methane avoidance	-	tCO2 / yr	Calculated
	LECO2,y	Total Leakage Emissions from fuel substitution	0.25	tCO2 / yr	Calculated
	LETotal,y	Total Leakage Emissions	0.25	tCO2 / yr	Calculated
D. Emission reduction					
	ERCO2,y	Total Emission Reduction from methane avoidance	1.00	tCO2 / yr/hh	Calculated
	ERCH4,y	Total Emission Reduction from fuel substitution	4.82	tCO2 / yr	Calculated
	ERTotal,y	Total Emission Reduction under the VPA	5.82	tCO2 / yr	Calculated

Formulas for GHG ER calculations:

a. Baseline emissions

$$BE_y = GWP_{CH4} \times D_{CH4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{Bl,j} \quad \text{Equation (1)}$$

Where:

BE_y = Baseline emissions in year *y* (t CO_2e)

GWP_{CH4} = Global Warming Potential (GWP) of CH_4 applicable to the crediting period (t CO_2e/t CH_4)

D_{CH4} = CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure)

LT = Index for all types of livestock

j = Index for animal manure management system

MCF_j = Annual methane conversion factor (*MCF*) for the baseline animal manure management system j

$B_{0,LT}$ = Maximum methane producing potential of the volatile solid generated for animal type *LT* (m^3 CH_4/kg dm)

$N_{LT,y}$ = Annual average number of animals of type *LT* in year *y* (numbers)

$VS_{LT,y}$ = Volatile solids production/excretion per animal of ~~for~~ livestock *LT* in year *y* (on a dry matter weight basis, kg dm/animal/year

$MS\%_{Bl,j}$ = Fraction of manure handled in baseline animal manure management system *j*

UF_b = Model correction factor to account for model uncertainties (0.94)[16]

[16] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

(a) The maximum methane-producing capacity of the manure (B_o) varies by species and diet. The preferred method to obtain B_o measurement values is to use data from country-specific published sources, measured with a standardised method (B_o shall be based on total as-excreted *VS*). These values shall be compared to IPCC default values and any significant differences shall be explained. If country specific B_o values are not available, default values from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 can be used, provided that the project participants assess the suitability of those data to the specific situation of the treatment site;

(b) Volatile solids (*VS*) are the organic material in livestock manure and consist of both biodegradable and non-biodegradable fractions. For the calculations the total *VS* excreted by each animal species is required. The preferred method to obtain *VS* is to use data from nationally published sources. These values shall be compared with IPCC default values and any significant differences shall be explained. If data from nationally published sources are not available, country-specific *VS* excretion rates can be estimated from feed intake levels, via the enhanced characterisation method (tier 2) described in section 10.2 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10. If country specific VS values are not available IPCC default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10 A-4 to 10 A-9 can be used provided that the project participants assess the suitability of those data to the specific situation of the treatment site particularly with reference to feed intake levels;

(c) Project participants may adjust default IPCC values for *VS* for a site-specific average animal weight. If so, it shall be well explained and documented. The following equation shall be used:

1..1.1.1.1.1.1

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) \times VS_{default} \times nd_y \qquad \text{Equation (2)}$$

Where:

W_{site} = Average animal weight of a defined livestock population at the project site (kg)

$W_{default}$ = Default average animal weight of a defined population, this data is sourced from IPCC 2006 (kg)

$VS_{default}$ = Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day)

nd_y = Number of days in year *y* where the animal manure management system is operational

(d) B_o or *VS* values applicable to developed countries can be used provided the following four conditions are satisfied:

(i) The genetic source of the livestock originates from an Annex I Party;

(ii) The farm uses formulated feed rations (*FFR*) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;

(iii) The use of *FFR* can be validated (through on-farm record keeping, feed supplier, etc.);

(iv) The project specific animal weights are more similar to developed country IPCC default values.

(e) In the case of sequential treatment stages, the reduction of the volatile solids during a treatment stage is estimated based on referenced data for different treatment types. Emissions from the next treatment stage are then calculated following the approach outlined above, but with volatile solids adjusted for the reduction from the previous treatment stages by multiplying by (1 - *RVS*), where *RVS* is the relative reduction of volatile solids from the previous stage. The relative reduction of volatile solids (*RVS*) depends on the treatment technology and should be estimated in a conservative manner. Default values for different treatment technologies can be found in the table in appendix 1;

(f) Methane Conversion Factors (*MCF*) values are determined for a specific manure management system and represent the degree to which B_o is achieved. Where available country-specific *MCF* values that reflect the specific management systems used in particular countries or regions shall be used. Alternatively, the IPCC default values provided in table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 can be used. The site annual average temperature is taken from official data at the nearest meteorological station, or from data available from historical on site observations;

(g) The annual average number of animals ($N_{LT,y}$) is determined as follows:

$$N_{LT,y} = N_{da,y} \times \left(\frac{N_{p,y}}{365} \right)$$ Equation (3)

Where:

$N_{da,y}$ = Number of days animal is alive in the farm in the year *y* (numbers)

$N_{p,y}$ = Number of animals produced annually of type *LT* for the year *y* (numbers)

2. If option in paragraph 15(b) is chosen, baseline emissions are determined based on directly measured quantity of manure and its specific volatile solids content, as follows:

$$BE_y = GWP_{CH4} \; x \; D_{CH4} \; x \; UF_b \; x \sum_{j,LT} MCF_j \; x \; B_{0,LT} \; x \; Q_{manure,j,LT,y} \; x \; SVS_{j,LT,y}$$ Equation (4)

Where:

$Q_{manure,j,LT,y}$ = Quantity of manure treated from livestock type *LT* and animal manure management system *j* (tonnes/year, dry basis)

$SVS_{j,LT,y}$ = Specific volatile solids content of animal manure from livestock type *LT* and animal manure management system *j* in year *y* (tonnes/tonnes, dry basis)

MCF_j = Annual methane conversion factor (MCF) for the baseline animal manure management system *j*, as per paragraph 16 above

$B_{0,LT}$ = Maximum methane producing potential of the volatile solid generated for animal type *LT* (m^3 CH_4/kg dm), as per paragraph 16 above

b. Project activity emissions

Project activity emissions consist of:

(a) Physical leakage of biogas in the manure management systems which includes production, collection and transport of biogas to the point of flaring/combustion or gainful use ($PE_{PL,y}$);

(b) Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$);

(c) CO_2 emissions from use of fossil fuels or electricity for the operation of all the installed facilities ($PE_{power,y}$);

(d) CO_2 emissions from incremental transportation distances;

(e) Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$).

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y}$$ Equation (5)

Where:

PE_y = Project emissions in year *y* (t CO_2e)

$PE_{PL,y}$ = Emissions due to physical leakage of biogas in year *y* (t CO_2e)

$PE_{flare,y}$ = Emissions from flaring or combustion of the biogas stream in the year *y* (t CO_2e)

$PE_{power,y}$ = Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year *y* (t CO_2e)

$PE_{transp,y}$ = Emissions from incremental transportation in the year *y* (t CO_2e), as per relevant paragraph in AMS-III.AO

$PE_{storage,y}$ = Emissions from the storage of manure (t CO_2e)

3. Project emissions due to physical leakage of biogas from the animal manure management systems used to produce, collect and transport the biogas to the point of flaring or gainful use is estimated as:

(a) 10% of the maximum methane producing potential of the manure fed into the management systems implemented by the project activity:[17]

(i) If option in paragraph 15(a) is chosen, it is determined as:

$$PE_{PL,y} = 0.10 \times GWP_{CH4} \times D_{CH4} \times \sum_{i,LT} B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{i,y} \quad \text{Equation (6)}$$

Where:

$MS\%_{i,y}$ = Fraction of manure handled in system *i* in year *y*

If the project activity involves sequential manure management systems, the procedure specified in paragraph 16(e) shall be used to estimate the project emissions due to physical leakage of biogas in each stage.

(ii) If the option in paragraph 15(b) is chosen, it is determined as:

$$PE_{PL,y} = 0.10 \times GWP_{CH4} \times D_{CH4} \times \sum_{i,LT} B_{O,LT} \times Q_{manure,LT,y} \times SVS_{LT,y} \times MS\%_{i,y} \quad \text{Equation (7)}$$

(b) Optionally, the relevant procedure in the methodological tool "Project and leakage emissions from anaerobic digesters" may be followed. In such a case, $PE_{PL,y}$ is equivalent to $PE_{CH4,y}$ in the tool

4. In the case of flaring of the recovered biogas, project emissions are estimated using the procedures described in the methodological tool "Project emissions from flaring". If the recovered biogas is combusted for electrical/thermal energy production or for other gainful use, the methane destruction efficiency can be considered as 100%. However, this use of the recovered biogas shall be included in the project boundary and its output shall be monitored in order to ensure that the recovered biogas is actually destroyed, even if the emission reduction from this component are not claimed.

5. Project emissions from electricity and fossil fuel consumption are determined by following the methodological tool "Project and leakage emissions from anaerobic digesters", where $PE_{power,y}$ is the sum of $PE_{EC,y}$ and $PE_{FC,y}$ in the tool.

6. Project emissions on account of storage of manure before being fed into the anaerobic digester shall be accounted for if both condition (a) and condition (b) below are satisfied:

(a) The storage time of the manure after removal from the animal barns, including transportation, exceeds 24 hours before being fed into the anaerobic digester;

(b) The dry matter content of the manure when removed from the animal barns is less than 20%.

7. The following method shall be used to calculate project emissions from manure storage:

$$PE_{storage,y} = GWP_{CH_4} \times D_{CH_4} \times \sum_{LT,l} \left[\frac{365}{AI_l} \sum_{d=1}^{AI} (N_{LT,y} \times VS_{LT,d} \times MS\%_l \times (1 - e^{-k\ (AI_l - d)}) \times MCF_l \times B_{0_{LT}}) \right] \quad \text{Equation (8)}$$

Where:

$PE_{storage,y}$ = Project emissions on account of manure storage in year *y* (t CO_2e)

[17] 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 guidelines specify a default value of 10% of the maximum methane producing potential (Bo) for the physical leakages from anaerobic digesters.

AI_l = Annual average interval between manure collection and delivery for treatment at a given storage device *l* (days)

$VS_{LT,d}$ = Amount of volatile solid production by type of animal *LT* in a day (kg VS/head/d)

$MS\%_l$ = Fraction of volatile solids (%) handled by storage device *l*

K = Degradation rate constant (0.069)

D = Days for which cumulative methane emissions are calculated; d can vary from 1 to 45 and to be run from 1 up to AI_l

MCF_l = Annual methane conversion factor for the project manure storage device l from Table 10.17, Chapter 10, Volume 4

c. Leakage

It is determined by following the relevant procedure in the methodological tool *"*Project and leakage emissions from anaerobic digesters*"*.

d. Emissions reduction

8. The emissions reduction achieved by the project activity will be determined ex post through direct measurement of the amount of methane fuelled, flared or gainfully used. It is likely that the project activity involves manure treatment steps with higher methane conversion factors (*MCF*) than the *MCF* for the manure treatment systems used in the baseline situation, therefore the emissions reduction achieved by the project activity are limited to the *ex post* calculated baseline emissions minus the project emissions using the actual monitored data for the project activity (i.e. $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_l$, AI_l, as well as $VS_{LT,y}$ in cases where adjusted values for animal weight are used). The emissions reduction achieved in any year are the lowest value of the following:

$$ER_{y,ex\ post} = \min[(BE_{y,ex\ post} - PE_{y,ex\ post}),(MD_y - PE_{power,y,ex\ post})] \quad \text{Equation (9)}$$

Where:

$ER_{y,ex\ post}$ = Emissions reduction achieved by the project activity based on monitored values for year *y* (t CO_2e)

$BE_{y,ex\ post}$ = Baseline emissions calculated using equation 1 (for projects using option in paragraph 15(a)) using ex post monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$. For projects using option in paragraph 15(b), the ex post monitored values for $Q_{manure,j,LT,y}$ and $SVS_{j,LT,y}$ are used

$PE_{y,ex\ post}$ = Project emissions calculated using equation 5 using ex post monitored values of $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_l$, AI_l, $Q_{res\ waste,y}$ and if applicable $VS_{LT,y}$

MD_y = Methane captured and destroyed or used gainfully by the project activity in year *y* (t CO_2e)

$PE_{power,y,ex\ post}$ = Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year *y* (t CO_2e)

9. Biogas flared or combusted, (MD_y) shall be determined using the flare efficiency and methane content of biogas.

$$MD_y = BG_{burnt,y} \times w_{CH4,y} \times D_{CH4} \times FE \times GWP_{CH4} \quad \text{Equation (10)}$$

Where:

$BG_{burnt,y}$ = Biogas flared or combusted in year *y* (m^3)

$w_{CH4,y}$ = Methane content in biogas in the year *y* (volume fraction)

FE = Flare efficiency in the year *y* (fraction)

10. The method for integration of the terms in equation above to obtain the results for one year of measurements within the confidence level, as well as the methods and instruments used for metering, recording and processing the data obtained, shall be described in the project design document and monitored during the crediting period.

11. Alternatively, if project activities utilize the recovered methane for power generation, MD_y may be calculated as follows, and based on the amount of monitored electricity generation, without monitoring methane flow and concentration.

$$MD_y = \frac{EG_y \times 3600}{NCV_{CH4} \times EE_y} \times D_{CH4} \times GWP_{CH4} \qquad \text{Equation (11)}$$

Where:

EG_y = Total electricity generated from the recovered biogas in year *y* (MWh)

3600 = Conversion factor (1 MWh = 3600 MJ)

NCV_{CH4} = NCV of methane (MJ/Nm^3) use default value: 35.9 MJ/Nm^3)

EE_y = Energy conversion efficiency of the project equipment, which is determined by adopting one of the following criteria:

Specification provided by the equipment manufacture. The equipment shall be designed to utilize biogas as fuel, and efficiency specification is for this fuel. If the specification provides a range of efficiency values, the highest value of the range shall be used for the calculation;

Default efficiency of 40 %

12. Project proponents shall provide evidence to a validating DOE that only the biogas recovered through the project manure management system is used for power generation; no other gas or fuels except a start-up fuel[18] are used.

13. In case of project activities covered under paragraph 6, the relevant procedure in AMS-III.H shall be followed.

14. Project activities where a portion of the biogas is destroyed through flaring and the other portion is used for energy may consider applying the flare efficiency to the portion of the biogas used for energy, if separate measurements of the respective flows are not performed. When the amount of methane that is combusted for energy and that is flared is separately monitored, or when only the biogas flow to the flare is monitored and the biogas used for energy is calculated based on electricity generation, a destruction efficiency of 100% can be used for the amount that is combusted for energy.

15. Where applicable, the proper soil application (not resulting in methane emissions) of the residual waste shall be monitored.

16. The monitoring plan should include on-site inspections for each individual farm included in the project boundary where the project activity is implemented for each verification period.

17. If the option in paragraph 15(a) is chosen for baseline emission determination,

(a) The PDD shall describe the system used for monitoring the fraction of the manure handled in the animal manure management system ($MS\%_{i,y}$), the average weight of the livestock (W_{site}) and the livestock population ($N_{LT,y}$) taking into account the average number of days the animals are alive in the farm in a specific year. The consistency between these values and indirect information (records of sales, records of food purchases) shall be assessed. Significant changes in livestock population and average weight shall be explained;

(b) If developed country *VS* values are being used the following shall be monitored:

(i) Genetic source of the production operations livestock originate from an Annex I Party;

(ii) The formulated feed rations (*FFR*). If equation 2 is used to estimate the value $VS_{default}$ (kg-dm/animal/day), the default average animal weight of a defined population (kg) shall be recorded and archived.

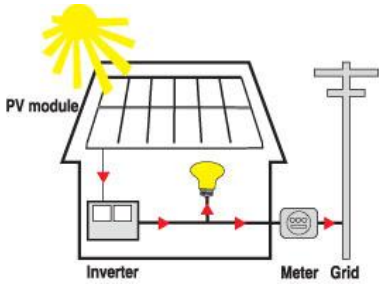
[18] If a fuel is defined as a start-up fuel, it should not represent more than 1% of the total fuel utilized in the process, on energy basis.

ANNEX C: ASSESSMENTS AND PROPOSED IMPLEMENTATION MODALITIES FOR THE SOLAR PV WITH STORAGE BATTERY DEMONSTRATION PROJECTS

Supplement Solar Net-metering systems with Deep Cycle Storage Batteries as a Nationally Appropriate Mitigation Action / Technology (NAMA) to reduce GHG Emissions in power generation using non-renewable resources.

What is "Net-metering": This is where an electricity consumer is able to generate electricity at his own premises and able to synchronize the generator with CEB system and able to consume/export energy to the CEB. The consumer is not paid for export of energy, but is given credit (in kWh) for consumption of same amount of energy later. There will be metering for his consumption as well for his export of energy to CEB network. Each month import and export of energy from and to CEB network will be compared. If the export is more than import in any billing period, the customer shall receive a carry forward export energy credit in kWh, and it shall be credited towards his future consumption, up to 10 years.

If the amount imported is higher than export, he is charged for the net amount of imports (import - export) as per the applicable CEB tariff for the level of consumption. Net metering involves a 10-year contract, a generation facility with a limit of 10 MW or the contract demand of the premises and any renewable resource for power generation. The net metering would be limited to a capacity 13 kW for single-phase consumers. Though this arrangement is applicable for generating facilities using any source of renewable energy[19], the focus in this project is confined to Solar PV.



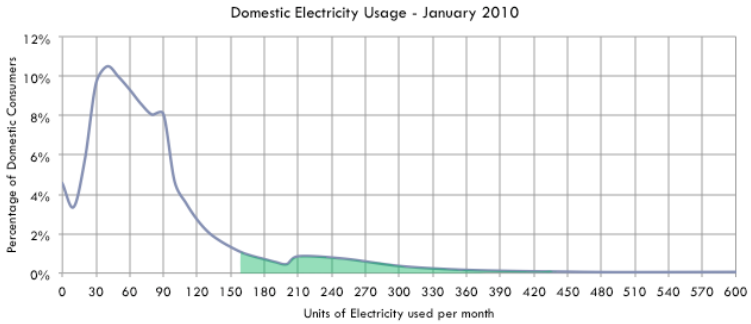
Net-metered solar photovoltaic (PV) systems are gaining popularity among the general public. The basic requirements of a net metering system are a solar PV panel, a micro grid-tied inverter and careful integration of the system together. The inverter output requires to be connected to the household supply, accompanied with necessary protection and isolating equipment, while a smart (two way) meter is installed in the house by the electricity service provider.

Justification for the selection of Solar "Net-metering": For the selection of solar net-metering out of many competing and eligible technologies for GHG mitigation, the following aspects have been taken into consideration:

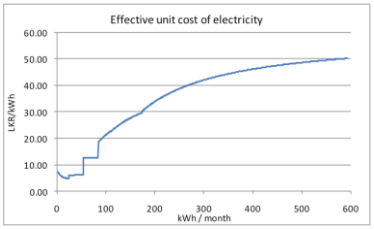
- This scheme was introduced to Sri Lanka in 2009. During the past 5 years, penetration has been insignificant.
- Lanka Electric Company (LECO) has installed around 250 units in the metro Colombo region (out of around 500,000 consumers of Kotte & Nugegoda areas) and it is believed that the Ceylon Electricity Board (CEB) also has installed a similar number[20] throughout the country making the total of around 500 units out of around 5 million electricity consumers giving a penetration level of MPE 0.01%.
- Most of the above systems have been acquired by high-end consumers of CEB & LECO (those who consume over 250 kWh per month) and a very few industrial and commercial users. Even in this category, penetration is as low as 0.2%.

[19] Any renewable resource like hydro, wind, solar and biomass can be net-metered.

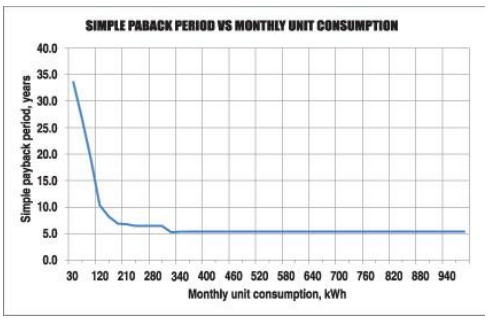
[20] Area Engineers of CEB are entrusted with the task of providing the Net-metering services. All Area Engineers (around 60) need to be contacted to find out total number of installations to date and their capacities, electricity generated, etc. as this information is not centrally available at the head office of CEB. Indirect way of getting this information is from regional "Meter Laboratories" as two-way meters for net-metering systems are supplied by these units to respective Area Engineers. There are 4 regions and each region has a "Meter Laboratory".



- Out of around 4.9 million domestic consumers, high-end consumers are less than 5% but they contribute 35% of the revenue to CEB.
- As most of these users fall into the category of domestic users, they are “daytime generators” and “night-time users” and hence the biggest burden of CEB to satisfy the night peak demand will not be eased but further aggravated.
- Another alarming trend of such users is that due to the reduced electricity bills, they tend to add more and more electricity consuming devices to their systems.



- Net-metering systems are financially attractive only to high-end domestic consumers whose tariff is above the CEB generating cost (Around LKR 24/kWh).



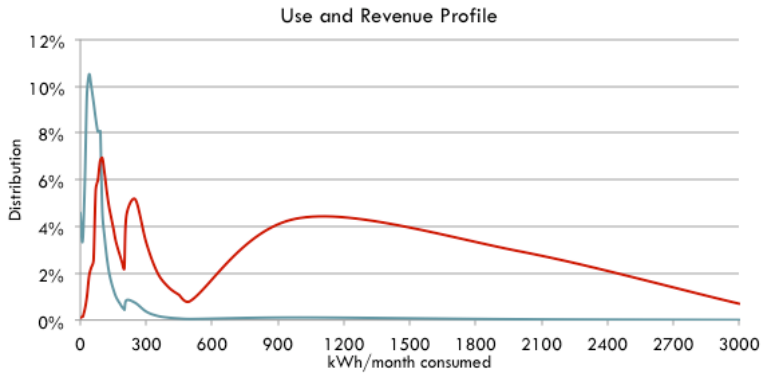
- As the above is the segment that generates the net revenue to CEB (substantially higher than the generating cost), if the net-metering is penetrated at a higher rate, CEB will gradually loose them and hence will continue to make huge financial losses.
- Low-end domestic consumers (below 60 kWh/month - More than 70% consumers of around 3.4 million) whose tariff (around LKR 5/kWh) is below the CEB generating cost will never be able to afford a net-metering system at the prevailing market rates despite zero rated import duties for renewable energy generating technologies and equipment including Solar Photo Voltaic panels and grid-tie inverters.
- The challenge is to make net-metering systems financially attractive to middle-level domestic consumers (using around 150-200 kWh/month) & industrial and commercial users.
- The net-metering concept needs to be looked at from two important but contrasting perspectives; what are the national benefits in terms of increasing the renewable content of the national energy mix so that energy dependency could be reduced while reducing the drain of foreign exchange for fossil fuel, which is nearly 50%. Meantime, the short-term negative consequences of CEB such as loss of revenue, system balancing and other technological issues, etc. need to be managed in order to reap the

long-term benefits of either delayed or avoided investment on fossil fuel based power generation to meet the increasing demand.

- In order to relive the CEB's biggest burden of curtailing the night peak demand, net-metering systems need to be supplemented with deep cycle battery storage[21].
- Imported deep cycle batteries are subjected to high import duties as they are also being treated as normal lead acid batteries used for vehicles.
- High cost of equipment (around LKR 1 to 2 million for a solar net-metering system of 3 kW).
- Suppliers (There are about 30 to 35 suppliers of net-metering equipment) keep high margins due to low demand.
- There is a need to reduce the cost of equipment by encouraging local manufacturing and to help them with increased demand through other interventions to achieve economies of scale.
- National Development Bank (NDB) has a special personal loan scheme (with personal guarantee) for solar net-metering in households with an annual fixed interest rate of 12.5% (prevailing normal lending rate is around 14.5%) and a repayment period of 5 years. Equity contribution requirement for this loan scheme is 25% and the maximum loan amount is LKR 4.5 million.
- However, only 10 loans have been disbursed (Highest loan granted was LKR 1.7 million) during the last quarter of this year due to very low demand.

Some criticisms of Net-metering: There are arguments against solar net-metering as follows that need to be properly understood and countered:

- Solar energy is an intermittent and unreliable form of energy with a very low plant factor at 17% for a typical meteorological year.
- Solar power generation is weather dependent and in Sri Lanka, the cloud cover is highly unpredictable.
- Present net metering system is a pro-rich mechanism, which is very harmful to the poor segment of the country.
- Net metering is a disruptive technology for centrally planned electricity systems.
- In solar systems, supply (generation) does not always coincide with usage (demand).
- Solar is a daytime generated energy option but what the country needs is peak time generation.
- Financial attractiveness of the roof top solar PV systems rests entirely on the net metering mechanism.
- Though individuals are benefited by net-metering, it would be a revenue loss to CEB and an economic disaster for the country.



- The formulators of the present electricity tariff of CEB have fixed a lower and an affordable price for poor consumers. This segment is cross-subsidized with the surplus revenue earned from the rich heavy users. This is an income re-distribution quasi taxation mechanism to collect additional revenue from those who can afford to pay for their extravagant life style. With the advent of net metering mechanism, these laudable

[21] May consists of Lithium-Iron-Phosphate batteries providing a guaranteed 5000 cycles or 7 years of performance.

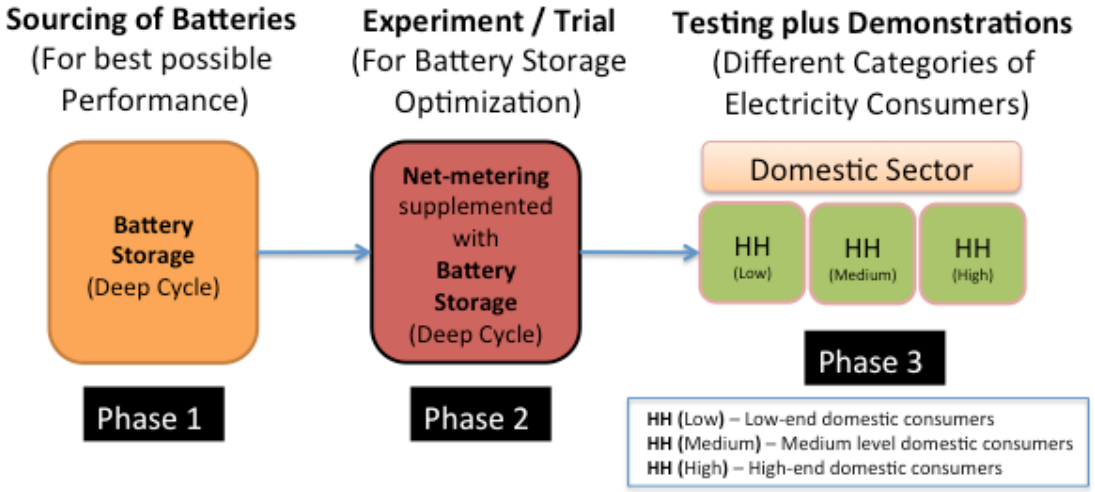
intentions are negated and instead the surplus is redistributed among foreign solar PV manufacturers, local solar system vendors and the rich consumers.

- Other countries do not assign the same value for daytime generated solar energy as done by CEB but offer only around 1/4th of the normal value.
- Solar power generation is more suited to countries where peak demand is in the daytime driven by industry demand. That demand is in perfect harmony with the solar generating capability of the households. Thus those utilities can prune down on their own generating plants.
- Standard Lead Acid Battery storage is undesirable owing to its high charging and discharging losses, which is around 25%.
- Deep cycle batteries are better but have lower lifetime and are very expensive.
- Other storage options such as water storage in reservoirs are desirable but the present daytime generated energy is not adequate at this stage to justify the heavy investment required for building new reservoirs and pumping facilities.
- As the Solar PV prices are rapidly coming down, we should not invest at this stage but should wait until the prices come down to an affordable level.
- Night peak is being slowly shifted to daytime with the fast development now taking place in the country

General criteria for the selection of mitigation actions/technologies: For the selection of mitigation actions / technologies, the fulfilment of following 4 criteria has been taken into consideration:

1. Energy saving and GHG emission reduction potential – It should result in a significant saving of energy and / or a reduction of GHG emission
2. Transformational effect – It should lead to a revolutionized change in the energy efficiency / renewable energy landscape of the country
3. Up scaling potential - There should be a possibility of propagating it to the national level across and encompassing many sectors
4. Novelty - It has to be something novel and innovative which has not been tried out before

Proposed pilot project: Three-phase approach is suggested:



Phase 1 – Carry out an international search to source most suitable deep cycle battery storage for solar systems for different user groups by considering technological and financial aspects[22] and also the possibility of local manufacturing with the increase of demand.

Phase 2 – Determine the optimum size of battery storage for different users by taking into consideration size of the installation, the requirement during the national night peak period, number of days of storage required to meet the demand during bad weather periods (days for

[22] The cost of a battery bank can be as much as a Solar PV panel for a well-designed system.

which the system can operate on battery power alone), system losses including battery charging and discharging, etc.

Phase 3 – Have testing plus demonstration installations in 205 domestic electricity consumers; 100 from low-end, 100 from medium and 5 from high-end users.

These units will not only be demonstrations but also will be testing grounds for SLSEA to understand the consuming patterns and related behavioral aspects of different user groups to formulate strategies for up scaling this effort to the national level.

Different consumers may require different system configurations as follows:

Table C.1a: Net metering system configuration for different target group consumers

Domestic Sector Category	Number of Units	Estimated Capacity of Net metering units (kW)	Installed capacity (kW)	Electricity Produced (kWh/y)	Unit Cost (USD)	Total Cost (USD)	% Rebate	GEF Rebate Cost (USD)
HH (Low)	100	0.25	25	31,800	958	95,769	80%	76,615
HH (Medium)	100	1.00	100	127,200	3,842	384,231	50%	192,115
HH (High)	5	3.00	15	19,080	11,538	57,692	20%	11,538
Total	**205**	**4.25**	**140.0**	**178,080**		**537,692**		**280,269**

This would cost around USD 538,690 including the battery storage[23] from which a contribution ranging from 20 to 80% from hosts is expected amounting to around USD 258,000 and hence the cost to the project would be around USD 280,278.

Recovery of Investment: As can be seen from the table below, only the high-end domestic consumers have an acceptable payback period of 5 years without battery storage.

Table C.1b: Net metering system financial details for different target group consumers

	Estimated Capacity of Net metering unit (kW)	Cost (mn LKR	Estimated Capacity of Battery Storage (Amph)	Cost (mn LKR)	Total Cost (mn LKR)	Typical Electricity Consumption (kWh/month)	Applicable Tariff (LKR/kWh)	Cost of Electricity (LKR/month)	Annual Electricity Cost (LKR)	Monetary Value of Energy Generation (LKR/year)	Simple Payback with Battery Storage (Years)	Simple Payback without Battery Storage (Years)
HH (Low)	0.25	0.083	85	0.04	0.123	50	6.12	306	3,672	1,946	63	43
HH (Medium)	1	0.333	340	0.17	0.503	120	22.50	2,700	32,400	28,620	18	12
HH (High)	3	1	1,020	0.5	1.5	350	43.50	15,225	182,700	165,996	9	6

As can be seen from the above table, only the high-end domestic consumers have an acceptable payback period of 6 years without battery storage.

Selection of testing/demonstration units: Consumers who could contribute 20% to 80% of the total cost of installation should be selected (to ensure the genuine interest and the ownership) through a competitive selection process for the demonstration if they fulfil other basic requirements such as the availability of proper electrical wiring system, willingness to allow other consumers in the locality to observe the facility when the system is in operation, etc. A fair geographical spread of testing / demonstrating units across the country also should be ensured.

[23] Cost of Lead Acid Batteries would be around USD 0.22/kWh. Cost of deep cycle batteries will have to be checked.

Priority also should be given to consumers who have already invested on solar PV installations. SLSEA should be allowed to use its discretion to integrate this effort with their on-going projects.

GHG Emission Mitigation from Solar PV Net Metering with Storage Battery

The calculation of the GHG savings due to the installation of 205 solar PV systems is made using the UNFCCC-approved AMS I.F methodology.

a. Lifetime Direct GHG Emissions Avoided

With an assumption of a 15% plant factor for a typical meteorological year and the system efficiency of 90%, on average, 1 kW system will produce around 106 kWh (units) during a 30-day period. Through this proposed intervention, 140 kW of Solar PV shall be installed at 205 testing and demonstrating units which will generate around 178,080 kWh of energy per year.

Lifetime direct emissions avoided attributable to the investments made during the projects supervised implementation period, totaled over the respective lifetime of the investments is presented in Table C.1c and C.2. The summary of the expected annual and cumulative waste avoided and GHG mitigation as a result of using the solar PV is shown in Table C.1c. Table C.2 shows the quantity of electricity generated and GHG mitigation from the first four years of operation of the solar system. The life of the solar PV system is expected to be about 20 years.

Table C.1c: SUMMARY - Total Lifetime direct GHG emissions reduction and energy savings through the use of solar PV system	
Description	**Solar PV (20 years)**
Quantity of electricity saved (MWh)	3,466
Quantity of energy saved (MJ)	38,126,494
GHG emissions mitigated (tCO_2)	2,493

Table C.2: First four year direct GHG Emissions avoided from solar PV system						
	Annual GHG savings per unit per year		0.62	tCO_2/unit/y		
	Annual Electricity saved per unit per year		0.87	MWh/unit/y		
	Solar PV installation		**GHG Reduction**		**Electricity savings**	
Year	End of year	Cumulative	End of year	Cumulative	End of year	Cumulative
	[# of plants]	[# of plants]	[tCO_2eq/y]	[tCO_2eq]	[MWh/y]	[MWh]
1	100	100	62.5	62.5	86.9	86.9
2	100	200	125.0	187.5	173.7	260.6
3	5	205	128.1	315.5	178.1	438.7
4	-	205	128.1	443.6	178.1	616.8

Lifetime direct post-project GHG emissions avoided from Solar PV:

The total co-financing expected for the implementation of solar PV, which was committed by Industrial Solutions Lanka Pvt. Ltd under the project is US$ 18,000,000 million over a period of 4 years for a capacity of 10 MW. About 140 kW will be implemented with a total cost of US$ 537,692, where US$ 257,423 is from co-financing and US$ 280,269 is from GEF grant in the form of rebate. From the remaining co-financing amount committed, 9.86 MW is expected to be implemented by Industrial Solutions Lanka Pvt. Ltd. Considering the same assumptions as mentioned above, i.e. 15% capacity factor, the annual electricity generation will be 12,956 MWh/y and over a technical lifetime of 20 years (on a conservative basis), 259,121 MWh will be generated. Then the overall possible direct post-project GHG emissions reduction will be 186,386 tCO_2.

b. Project indirect GHG emission mitigation

The indirect GHG emission reduction for bottom-up (by a replication factor of three) and top down (25% market growth rate, but GEF causality factor of 40% of 25% is 10%) calculations are shown above in Table B.12 and B.13 respectively. Assuming that, due to activities and support attributable to the Project, the solar PV technologies up-scaling are replicated so that the number of solar PV is increased at a modest rate of 10% per year, in 20 years after the end of the Project. Thus, the number of solar PV would have reached around 942 from a baseline number of 205. The GHG emissions reduced through this replication process (Project indirect GHG emission mitigation) is presented in Table C.3. The total indirect GHG emissions avoided are estimated to be 5,065 tonnes CO_2e and an electricity generation of 7,042 MWh (Table C.3).

Table C.3: Total indirect GHG emission mitigation of solar PV system at 10% growth rate attributable to GEF grant (top-down)

Year	Solar PV growth (10%)	Annual GHG reduction (tCO_2e/y)	Cumulative GHG reduction (tCO_2e)	Annual Electricity saved (MWh/y)	Cumulative electricity saved (MWh)
1					
2					
3					
4		-	-	-	-
5	226	140.9	140.9	195.9	195.9
6	248	155.0	295.9	215.5	411.4
7	273	170.5	466.4	237.0	648.4
8	300	187.5	653.9	260.7	909.1
9	330	206.3	860.2	286.8	1,195.9
10	363	226.9	1,087.1	315.5	1,511.4
11	399	249.6	1,336.8	347.0	1,858.4
12	439	274.6	1,611.3	381.7	2,240.2
13	483	302.0	1,913.4	419.9	2,660.1
14	532	332.2	2,245.6	461.9	3,122.0
15	585	365.5	2,611.1	508.1	3,630.0
16	643	402.0	3,013.1	558.9	4,188.9
17	708	442.2	3,455.3	614.8	4,803.7
18	778	486.4	3,941.7	676.3	5,480.0
19	856	535.1	4,476.8	743.9	6,223.8
20	942	588.6	5,065.4	818.3	7,042.1

Table C.4: Parameters used in the calculation of GHG emissions for Solar PV

Sub-sector		Unit	Estimated Capacity of Net metering unit (kW)	Installed capacity (kW)	Electricity Produced (kWh/y)	USD per unit	TOTAL Solar cost (USD)	% Rebate	GEF Rebate cost (USD)
Domestic	HH (Low)	100	0.25	25.00	31,800	958	95,769	80%	76,615
	HH (Medium)	100	1.00	100.00	127,200	3,842	384,231	50%	192,115
	HH (High)	5	3.00	15.00	19,080	11,538	57,692	20%	11,538
Total		205	4.25	140.0	178,080		537,692		280,269

Typical Useful Life (years)			20	y	
Assumed typical Capacity Factor, %			15.0	%	
Total installed capacity			140.0	kW	
Grid emission factor			0.72	tCO_2/MWh	
Total annual expected electricity generation			178	MWh	
Possible CO_2 emissions reduction			128	tCO_2/y	

Spillover effect: If this mitigation action is promoted island wide, with a very conservative estimate of reaching 0.02% CEB consumers (1,000 consumers) of around 5 million, it would generate around 11.1 GWh of energy per year (equivalent to over 0.1% electricity generation by CEB) resulting in a reduction of emission around 8,500 tons of CO_2 equivalent per annum.

Sustainability: It is expected that the cost of deep cycle battery will come down drastically in the near future as many worldwide manufactures are engaged in R&D to make their products cost effective to be able to patronize hosts of emerging new applications such as battery storage in hybrid and electric vehicles, solar, etc. This scenario is true with solar PVs as well.

Once the technical feasibility is properly established through the above demonstration, it is expected that many high-end domestic consumers and even some industrial and commercial establishments will embrace this technology without external support.

When the demand for Solar Net Metering increases, suppliers and installers may reduce their margins making the investment more attractive.

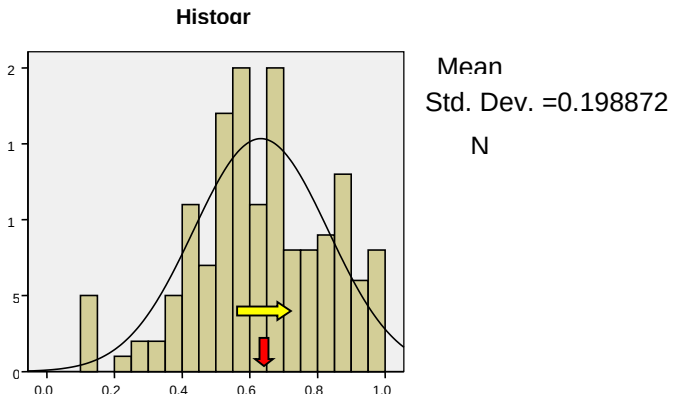
ANNEX D: ASSESSMENTS AND PROPOSED IMPLEMENTATION MODALITIES FOR THE HIGH EFFICIENT MOTORS IN TEA FACTORIES DEMONSTRATION PROJECTS

Introducing High Efficiency Motors (HEM) to the Tea Industry of Sri Lanka as a Nationally Appropriate Mitigation Action / Technology (NAMA) to reduce GHG Emission

Justification for the selection of the Tea Industry: For the selection of the tea industry out of many competing and eligible sectors, the following aspects have been taken into consideration:

- Tea industry is one of the most important and globally competitive economic sectors of Sri Lanka
- There are over 700 tea factories in the tea grown area of the country in Central, Uva, Sabaragamuwa and Southern Provinces
- In the industrial sector, tea industry is the highest consumer of fuel wood and there is a growing trend of switching over to biomass from fossil fuel due to significant saving of energy
- However, the fuel wood supply is rapidly diminishing creating supply constraints which will have other implications such as deforestation, reducing carbon sink, etc. in addition to the sustainability threat of the tea industry
- Tea industry ranks 8 in terms of electrical energy use & is responsible for over 5% of the electricity consumption of the entire industrial sector of the country
- Annual electrical energy consumption of the tea industry is about 175 million kWh
- Tea industry has the peak load demand power requirement of over 100 MW
- There have been many interventions in the past to improve the energy efficiency of the tea industry. However, energy efficiency (EE) potential is still high irrespective of such interventions especially in tea factories operating under 23 Regional Plantation Companies (RPCs)
- One of the positive attributes of the tea industry is that this sector is much more formalized and also regulated than many other industrial sectors of the country paving the way and offering a conducive environment for organized and systematic interventions

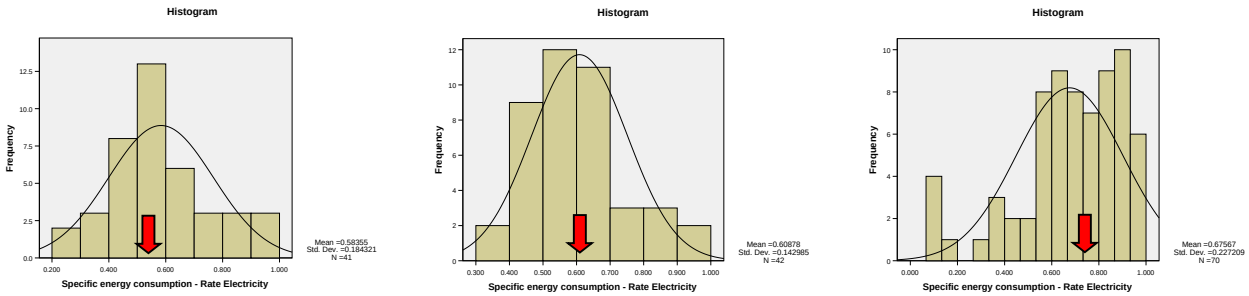
Electrical Energy Utilization Pattern of the Tea Industry: Presented below is the electrical energy utilization pattern in the tea manufacturing industry based on a study carried out by Sri Lanka Sustainable Energy Authority (SLSEA) in 2007 using a questionnaire survey conducted by National Engineering Research & Development Centre (NERDC) in 2001 covering 153 tea factories.



Mean: **0.63**, SD: **0.198,** N: **153**
Histogram of SEC for Electricity Consumption

According to the above histogram, mean value of specific electricity consumption is 0.63 kWh per kg of tea production for the entire tea industry with the standard deviation of 0.198.

Low Grown | **Mid Grown** | **High Grown**



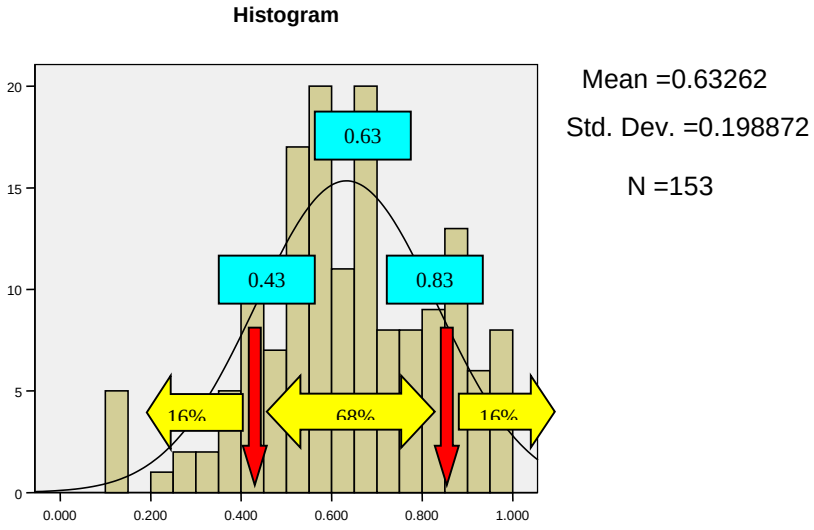
Mean: **0.58**, SD: **0.18,** N: **41** Mean: **0.61**, SD: **0.14,** N: **42** Mean: **0.68**, SD: **0.23,** N: **70**

Histogram of SEC for Electricity Consumption for 3 Elevations

Elevation	Mean	N	Std. Deviation
Low	0.58355	41	0.184321
Medium	0.60878	42	0.142985
High	0.67567	70	0.227209
Total	0.63262	153	0.198872

Histogram of SEC for Electricity Consumption for 3 Elevations

According to the above histogram, specific electricity consumption is higher in the 'high elevation' and lower in the 'low elevation'.



Mean: **0.63**, SD: **0.198,** N: **153**
Benchmarks for Specific Electrical Energy Consumption

The above histogram with a left (negative) skew represents the behavior of electricity utilization efficiency (SEC) of 153 tea factories consisting of 70 High grown (49%), 42 Medium grown (26%) and 41 Low grown (25%) factories. SEC has a mean of 0.63 kWh per kg of made tea (MT) and it varies from 0.1 (efficient) to 1.0 (inefficient). Left skewness indicates that the majority is electrically inefficient in electricity utilization.

Assuming that the distribution is more or less 'normal' as the skewness is insignificant, SEC of around 68% of the sample is in the range of 0.43 to 0.83 kWh/kg MT representing the majority, around 16% is above 0.83 kWh/kg MT representing the 'most inefficient' and around 16% is below 0.43 kWh/kg MT representing the 'most efficient'.

Taking the above as the basis, individual factories could set their own targets depending on their strategic, functional or operational needs. Targets could be set in various ways; freely set individual targets within the range, single target or multiple targets.

General Criteria for the Selecting of Mitigation Actions / Technologies: For the selection of mitigation actions / technologies, the fulfilment of following 4 criteria has been taken into consideration:

- Energy saving and GHG emission reduction potential – It should result in a significant saving of energy and a reduction of GHG emission
- Transformational effect – It should lead to a revolutionized change in the energy efficiency landscape of the country
- Up scaling potential - There should be a possibility of propagating it to the national level across and encompassing many sectors
- Novelty - It has to be something novel and innovative which has not been tried out before

Prospective Mitigation Technologies in Tea Industry: In the tea industry, electricity is used mainly for running the machineries and a small fraction for it is used for lighting. In the case of Orthodox tea production, the withering and rolling processes consume more energy while in CTC tea production, the CTC process consume much electrical energy. In the CTC process, the CTC machine consumes the most electrical energy followed by the grading operation. While in the Orthodox process, withering takes most of the electrical energy followed by rolling. The energy requirement for the withering process is mainly electrical energy to run the trough fans. Withering consumes about 15–55% of the total electrical energy consumption. In most number of factories, withering is done by air blowing at the highest speed throughout the withering cycle.

Withering airflow can be reduced after initial withering is done. When the airflow rate is reduced however, the motors are not designed to reduce the energy consumption proportionally to the airflow rate. In effect, only 10% of energy reduction is achieved, even if the flow is reduced by 50%. In most cases, factors such as oversized motors, minimal or no controls over speed of the motors or airflow, and the absence of monitoring process conditions have led to higher energy consumption. Only a few factories have Variable Speed Drives (VSDs) installed for speed control of withering fans.

The rolling/CTC process is also an electrically intensive operation. However, they are working with standard motors and influenced by the rolling pressure or cutting pressure. In the Orthodox process, rolling is equally energy consuming as in withering, while CTC is the highest energy consumer in CTC tea production. In the drying process, electrical energy is used for blowers and fans.

There are various EE technologies / measures that are being adopted by the tea industry in various degrees both in electrical and thermal energy utilization. Following table summarizes such technologies / measures along with their approximate investments and pay back periods.

From the above exhaustive list, most promising technologies are given below;

- Fuel switch over (from fossil fuel to biomass)
- Conversion from hot air generation to hot water / steam generation
- Introduction of efficient dryers
- Introducing of withering motor speed controllers
- Introducing of efficient blowers, etc.
- Introduction of high efficiency motors (HEM)

Except the High Efficiency Motors, other technologies are being adopted in varying degrees. According to the available information, though HEM have been in existence in other countries for quite sometimes, no attempt has been made to introduce them to Sri Lankan industry in a systematic and methodical way except an isolated attempt of one of the RPCs which was not successful.

Table D.1a: Payback period assessment for HEM intervention in comparison with other possible energy efficiency measures in tea industries.

Thermal	Energy Efficiency Measure	Approximate Investment (LKR)	Anticipated Payback Period (Years)
T1	Biomass fired hot water boiler to replace conventional fossil fuel fired air heaters	8.5 to 14 million	1.5
T2	Biomass fired steam boiler to replace conventional fossil fuel fired air heaters	8.5 to 14 million	1.5
T3	Biomass fired hot water boiler to replace conventional biomass fired air heaters	8.5 to 14 million	5 to 6
T4	Biomass fired steam boiler to replace conventional biomass fired air heaters	8.5 to 14 million	5 to 6
T5	Energy efficient dryers to replace conventional dryers	15 to 25 million	5
T6	Hot air ducting for withering troughs	1 to 1.5 million	6
T7	Common heat exchanger (Radiator) for each withering	1 to 1.5 million	6
T7	Individual heat exchangers (Radiator) for each withering trough	2.5 to 3.5 million	6
T8	Withering temperature monitoring and regulation (DB & WB)	500,000	
T9	Regular combustion efficiency monitoring	7,500 to 10,000 per test	5 days
T10	Chopping of firewood into smaller pieces for easy drying	450,000	2.5
T11	Proper storage of firewood to avoid getting wet		
T12	Firewood (Biomass) drying using flue gas waste heat	750,000 - 1,000,000	4
Electrical			
E1	Power factor correction	3,000 Per kVAr	2
E2	VSDs for withering motors	165,000 For 10 kW motor	2.5
E3	Step motors for withering motors	150,000 For 10 kW motor	2.5
E4	VSDs for roller motors	165,000 For 10 kW motor	2.5
E5	Step motors for roller motors	150,000 For 10 kW motor	2.5
E6	VSDs for heater blowers	165,000 For 10 kW motor	2.5
E7	High efficiency motors (HEM)	150,000 For 10 kW motor	3.5
E8	High efficiency withering fans		
E9	Energy efficient lighting		

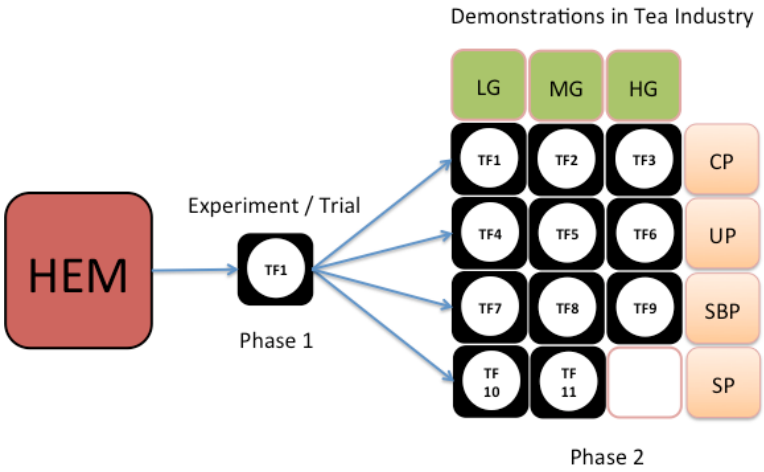
High Efficiency Motors (HEM): Studies and observations have shown that the motors used for withering trough fans, rollers, etc. in the tea industry are either mostly oversized or inefficient. Furthermore, electrical energy efficiency of motors are significantly reduced after rewinding as in many cases proper standards are not being followed. Therefore, there is a considerable potential to conserve electrical energy by replacing either oversized or inefficient motors with High Efficiency Motors (HEM).

High efficiency motors offer a number of potential benefits over standard models. These include lower utility bills and reduced operating expenses through lower failure rates and longer service life.

High efficiency motors do cost more, but many models can offer a return on investment within a few years. Current price of a HEM could be in the range of LKR 150,000 to 165,000 for a 10 kW motor. In many situations, investment could be recovered in less than 4 years.

High Efficiency Withering Fans: Electrical energy usage may be significantly reduced by making some improvements in the withering process. The withering process consumes about 20% of the total electricity consumption in a tea factory. The specific electrical energy consumption for tea processing ranges around 0.63 kWh/kg made tea. Studies and observations have shown that the trough fans are mostly oversized and there is no control over the speed of motors or airflow. There is inadequate monitoring of process conditions and these have often led to higher electrical energy consumption. In most of the tea factories, it has been noted that the trough fans generate about 5,000 CFM of air per kW of motor, whereas a modern motor-fan generates about 13,000 CFM of air per kW of motor. The high energy consumption is due to the improper design of the fan and inefficient motors and so there is a considerable potential to conserve electrical energy. Replacement of inefficient fans before the motor replacement would allow the employment of much smaller motors than existing ones due to synergetic efficiency gains. In the pilot project proposed below, this option could be offered to participating factories if they wish to realize enhanced savings.

Proposed Pilot Project: Two-phase approach is suggested:



Phase 1 – Carry out an experiment using two numbers of HEMs, one in a withering trough (around 5 to 7.5 kW motor) and another in a tea rolling machine (around 15 kW motor) in a tea factory to closely monitor the performance under different conditions (with different types of fans / blowers in the withering trough, varying load conditions of the roller, etc.). This experiment should be carried out by Sri Lanka Sustainable Energy Authority (SLSEA) in a tea factory preferably in the close proximity to Tea Research Institute (TRI) with easy access.

Withering Rolling

Phase 2 – Have demonstration installations in 130 tea factories selected from each elevation and from each tea-growing province as follows;

	Central Province (CP)	Uva Province (UP)	Sabaragamuwa Province (SBP)	Southern Province (SP)	Total
High grown	11	11	11	-	33
Mid grown	11	11	11	15	48

Low grown	13	13	13	10	49
Total	35	35	35	25	130

Ten numbers of HEMs to be installed in one factory; in 8 withering troughs and in 2 rollers. In total, 1,300 HEMs will be required for 130 factories that would require a GEF investment of USD 381,600 (@ LKR 130,000 per HEM) and a cost share of USD 918,400 from tea factories owners.

Selection of Demonstration Factories: Factories that could contribute between 50 to 80% of the total cost of installation as matching rebate (See Table 20, 21 and 22) should be selected (to ensure the genuine interest and the ownership) through a competitive selection process for the demonstration if they fulfil other basic requirements such as the availability of proper electrical wiring system, metering facilities, willingness to allow other tea factories in the region to observe the facility when the system is in operation, etc. A fair geographical spread of demonstrating factories across three elevations and across 4 provinces also should be ensured. Priority also should be given to factories that are willing to supplement this effort with fan replacement with their own investment.

GHG Emission Mitigation from High Efficient Motors in the Tea Factories

The calculation of GHG emissions from electricity savings due to the installation of high efficiency motors is made using the UNFCCC-approved consolidated methodology ***AMS-II D - Energy efficiency and fuel switching measures for industrial facilities. Version 13.0***[24]. This methodology comprises any energy efficiency improvement measures implemented at a single or several industrial facilities.

a. Lifetime Direct GHG Emissions Avoided

The 1,300 HEM will be disseminated in different phases and at different years. Lifetime direct emissions avoided attributable to the investments made during the projects supervised implementation period, totaled over the respective lifetime of the investments is presented in Table D.1b and D.2. The summary of the expected annual and cumulative electricity savings and GHG mitigation as a result of using the HEM is shown in Table D.1b. Table D.2 shows the electricity savings and GHG mitigation from the first four years of operation of the HEMs. The life of the HEMs supported in this Project is expected to be about 10 years. Thus, giving an average of 10 years from the end of Year 2, the HEMs that are supported by the Project by utilizing the institutional and matching rebate financing scheme set up within the Project, and disseminated through its roll-out mechanism, are expected to mitigate GHG emissions until the end of Year 10 as summarized in Table D.1b.

Table D.1b: SUMMARY - Total Lifetime direct GHG emissions reduction and energy savings through the use of HEM in tea factories	
Description	**HEM (10 years)**
Quantity of electricity saved (MWh)	24,882
Quantity of energy saved (MJ)	273,704,112
GHG emissions mitigated (tCO_2e)	17,898

Table D.2: Total lifetime direct GHG emission mitigation of HEM system		
Total electricity savings for: 10 motors/factory	MWh	
8 withering motors (MWh)	21	
2 rolling motors (MWh)	3.42	
Total electricity consumption per factory (MWh) (10 motors)/y	24	
Total electricity savings per motor (MWh/y)	2.41	
Grid emission factor (tCO_2e/MWh)	0.72	
Total Number of HEM (#)	1,300	units

[24] *https://cdm.unfccc.int/filestorage/2/X/3/2X3CULSE4TAM7INV8JKQFP6HZ5ORYD/EB%2075_repan23_AMS-II.D_ver%2013.0.pdf?t=QmN8bmE3MWc0fDC8rMaAsHk4P2BVffqEqwrJ*

Number of tea factories targeted	130	units
Reduced energy consumption with the influence of the project	3,136	MWh/y
	24	MWh/factory/y
Possible CO_2 emissions reduction	2,255	tCO_2/y
	17.35	tCO_2/factory/y
	1.73	tCO_2/motor/y

A. Annual direct project and End of Project Emissions reduction						
Year	End of year (# of motors)	Cumulative (# of motors)	End of year Annual ERs (tCO_2eq/y)	Cumulative ER(tCO_2e)	Annual Elect saved (MWh)	Cumulative Elect saved (MWh)
1	88	88	153	153	212	212
2	300	388	673	826	936	1,148
3	352	740	1,284	2,110	1785	2,933
4	560	1,300	2,255	4,365	3136	6,069
5	-	1,300	2,255	6,621	3136	9,204
6		1,300	2,255	8,876	3136	12,340
7		1,300	2,255	11,131	3136	15,475
8		1,300	2,255	13,387	3136	18,611
9		1,300	2,255	15,642	3136	21,747
10		1,300	2,255	17,898	3136	24,882

Lifetime direct post-project GHG emissions avoided from high efficient motors:

The total co-financing expected for the implementation of HEM under the project is US$ 4,000,000 million over a period of 4 years. About 1,300 HEM will be implemented with a total cost of US$ 1,300,000, where US$ 918,400 is from co-financing and US$ 381,600 is from GEF grant in the form of rebate. From the remaining co-financing amount committed, possible number of motors will be 3,082 numbers. Considering the same assumptions as above under Table D.2, the possible energy savings will be 74,328 MWh (total electricity savings per motor as 2.41 MWh/y over 10 years), and possible direct post-project GHG emissions reduction will be 53,464 tCO_2e (possible CO_2 emission reductions as 1.73 tCO_2/motor/y over 10 years) over the technical lifetime of intervention.

b. Project indirect GHG emission mitigation

Based on interviews with tea companies and experts, it is estimated conservatively that the technical potential HEMs that could be developed in Sri Lanka is about 10 HEMs/factory x 700 factories = 7,000 HEMs. The indirect GHG emission reduction for bottom-up (by a replication factor of three) and top down (25% market growth rate, but GEF causality factor of 40% of 25% is 10%) calculations are shown above in Table B.12 and B.13 respectively. Assuming that, due to activities and support attributable to the Project, the HEMs are replicated so that the number of HEMs is increased at a modest rate of 10% per year after considering a causality factor of 40% of market growth rate attributable to GEF grant. In 10 years after the end of the Project. Thus, the number of HEM would have reached around 2,303 from a base of 1,300 HEMs which represent over 33% of the country's potential. The amount of electricity saved would be 26,612 MWh through the introduction of the HEMs. The GHG emission reduced through this replication process (Project indirect GHG emission mitigation) is presented in Table D.3.

Table D.3: Total lifetime indirect GHG emission mitigation of HEM system (top-down approach)

Year	HEM growth (10%)	Annual GHG reduction (tCO_2e/yr)	Cumulative GHG reduction (tCO_2e/yr)	Annual Electricity saved (MWh)	Cumulative Electricity saved (MWh)
1					
2					
3					

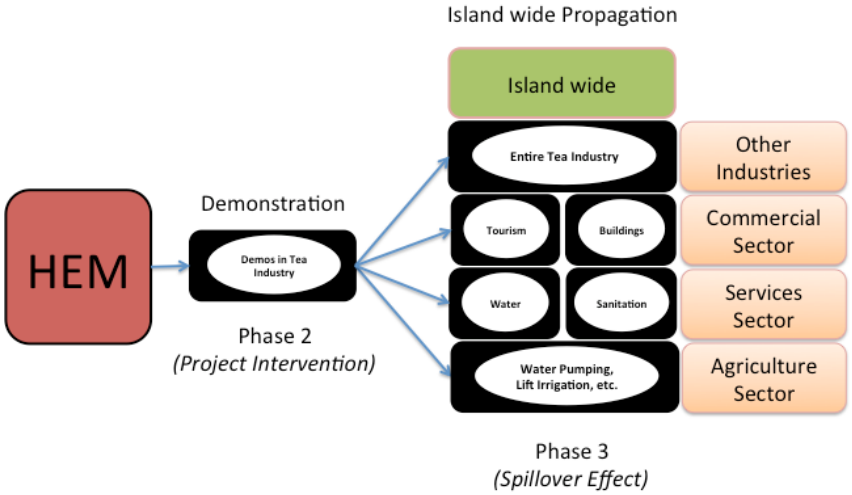
4					
5	1,430	2,481	2,481	3,449	3,449
6	1,573	2,729	5,210	3,794	7,243
7	1,730	3,002	8,212	4,173	11,417
8	1,903	3,302	11,514	4,591	16,008
9	2,094	3,632	15,147	5,050	21,057
10	2,303	3,996	19,142	5,555	26,612

Recovery of Investment: Based on the 10% improvement in the efficiency of the motors[25], the simple payback ranged from 1.8 to 3.6 years as shown in the table below:

Application	Motor Capacity (actual power)	No of Operating Hours per Day	Daily Power Usage	No of Operating Days per Year	Current Annual Power Usage	Applicable Tariff	Annual Cost of Power	Expected Saving	Annual Power Savings	Expected LKR Saving	Cost of the Motor	Simple Payback Period
	kW	h	kWh	Days	kWh	LKR/kWh	LKR	%	kWh	LKR	LKR	Year
Withering	5	15	75	300	22,500	17	382,500	10%	2,250	38,250	100,000	2.6
	6.5	15	97.5	300	29,250	17	497,250	10%	2,925	49,725	125,000	2.5
Rolling	9.5	6	57	300	17,100	17	290,700	10%	1,710	29,070	200,000	6.9

Financial Sustainability: Once the technical feasibility is properly established through the above demonstration, as the payback is less than 3 years, it is expected that many users of conventional electrical motors across all sectors will embrace this technology without external support. When the demand for HEMs increases, prices may come down making the investment even more attractive. The propagation would be further accelerated with the proposed introduction of energy labeling for electrical motors by SLSEA.

Spillover Effect: Buying a high efficiency motors could be considered for all new installations, when purchasing equipment packages, such as compressors, HVAC systems and pumps, when major modifications are made to facilities or processes, instead of rewinding older, standard efficiency units that have failed, when replacing oversized or under loaded motor systems, as part of a preventive maintenance or energy conservation program.



[25] Withering motor capacity of 5 kW, operating for 15 hour per day, over 300 days of operation will consume 22,500 kWh per year. Similarly, 6.5 kW capacity motor will consume 29,250 kWh per year. Assuming a 10% savings through improved efficient motors, annual electricity savings will be 2,250 kWh and 2,925 kWh respectively. Rolling motor of 9.5 kW operating 6 hours per day over 300 days of operation will consume 17,100 kWh per year. Assuming a 10% savings in electricity consumption will lead to a saving of 1,710 kWh of electricity.

ANNEX E: Terms of Reference of Key Project Personnel

1. Full time National Technical Advisor (NTA)

Under the direct supervision of the UNDP CO Head of Environment & Energy Unit, and in close cooperation with the Project Manager, the NTA is responsible for the day-to-day management and implementation of the GEF-UNDP project, including all project administrative matters. All work of the NTA will be carried out in line with the Country Program Action Plan and in full compliance with the UNDP Rules and Regulations. The management and coordination process will be pursued through undertaking appropriate actions in program formulation, implementation and evaluation. Strong emphasis will be made on ensuring cohesion with other UNDP programs.

Job content

i. Manage the project implementation in accordance with objectives, schedule and planned budget;
ii. Manage all project activity, staff, consultants and etc., for timely implementation of requirements on Monitoring and Evaluation;
iii. Coordinate awareness creation on all project activities;
iv. Coordinate the project activities with relevant activity and initiative of the Government;
v. Ensure cooperation between the participating institutions of the project;
vi. Ensure timely preparation of annual project reports, working plans and other relevant project documents.

Qualifications

At least 10 years work experience in project management. Previous work in international project management is an advantage

- University education in Engineering, Energy, Physics, Business Management or relevant field. A post-graduate degree (MSc, MPhil, PhD, etc.) is an advantage
- Strong interpersonal and communication skills
- Ability to take decisions
- Strong computer skills (Microsoft Office)

2. Part time Deputy Project Manager (Finance)

The Deputy Project Manager (Finance) will work under the guidance of the NTA and Project Manager and provide assistance to the project implementation in the mobilization of inputs and financial management and reporting.

Job content

(i) Prepare all payment requests, financial record-keeping and preparation of financial reports required in line with NEX financial rules and procedures
(ii) Assist in the recruitment and procurement processes, checking the conformity with UNDP and the Government rules and procedures
(iii) Assist in the organization of in-country training activities, ensuring logistical arrangements
(iv) Prepare internal and external travel arrangements for project personnel
(v) Maintain equipment ledgers and other data base for the project
(vi) Other duties which may be required

Qualifications

At least five years administrative and financial experience,

- University degree in Business Administration (Finance or Accounting)
- Good organizational skills
- Good computer skills, including spread-sheets and database

3. Full time Assistant Project Managers

Assistant Project Managers will assist respective NTA for the implementation 4 components of the UNDP-GEF project. All work of the Assistant Project Managers will be carried out in line with the Country Program Action Plan and in full compliance with the UNDP Rules and Regulations.

Job content

vii. Assist the NTA to:
   a. manage the implementation of project component in accordance with objectives, schedule and planned budget;
   b. manage respective project component activities, staff, consultants and etc., for timely implementation of requirements on Monitoring and Evaluation;
   c. coordinate awareness creation on project component activities;
   d. coordinate the project component activities with relevant activity and initiative of the Government; and
   e. ensure timely preparation of annual project reports, working plans and other relevant project documents for the project component:

Qualifications

At least 3 years work experience in respective project component.

- University education in Engineering, Energy, Physics, Business Management or relevant field. A post-graduate degree (MSc, MPhil etc.) is an advantage
- Strong interpersonal and communication skills
- Ability to take decisions
- Strong computer skills (Microsoft Office)

5. Project Officer

Project Officer will assist the Assistant Project Manager for the implementation component No 4 of the UNDP-GEF project. All work of the Project Officer will be carried out in line with the Country Program Action Plan and in full compliance with the UNDP Rules and Regulations.

Job content

viii. Assist the Assistant Project Manager to manage the implementation of project component No 4 in accordance with objectives, schedule and planned budget;
ix. Assist the Assistant Project Manager to manage project component No 4 activities for timely implementation of requirements on Monitoring and Evaluation;
x. Assist the Assistant Project Manager to coordinate awareness creation on project component No 4 activities;
xi. Assist the Assistance Project Manager to coordinate the project component No 4 activities with relevant activity and initiative of the Government;

xii. Assist the Assistant Project Manager to ensure timely preparation of annual project reports, working plans and other relevant project documents for the project component No 4:

Qualifications

At least 1 year work experience in project component No 4.

- University education in Engineering, Energy, Physics, Business Management or relevant field.
- Strong interpersonal and communication skills
- Ability to take decisions
- Strong computer skills (Microsoft Office)

6. International consultant – International Technical Advisor – Project Management

Job content

i. To serve as part-time ITA to provide overall technical guidance, advice and back-supporting to NTA and project team
ii. Assist the NTA and project team to prepare a detailed Annual Work Plan of all project activities in line with the programming and approved budget, and start and conclude them accordingly;
iii. Advise the NTA and project team on the project strategy and implementation methodology;
iv. Assist in the recruitment, supervision and management of local staff;
v. Participate in the recruitment of local consultants and international experts;
vi. Conduct mission to project sites on a quarterly basis.

Qualification

At least 5 years work experience in project management with expertise on NAMA and Climate Finance. Previous work in international project management is an advantage

- University education in engineering, energy, physics, business management or relevant field. A post-graduate degree (MSc, MPhil, PhD, etc.) is an advantage
- Strong interpersonal and communication skills
- Ability to take decisions
- Strong computer skills (Microsoft Office, Internet, e-mail)

7. International Consultant for Mid Term evaluation

The International Consultant will be recruited to conduct the Mid-term Evaluation of the Project. S/he will report to the NTA and act as the team leader for the following specific tasks:

- Provide guidance to the National Consultant in conducting the Mid-term Evaluation.
- Assess the progress towards achievement of the project objectives as outlined in the approved Project Document.
- Look into the linkages between this project and other relevant projects/agencies and assess their effectiveness.
- Assess the structure and performance of the project management team and support provided by GEF-UNDP.
- Identify lessons learned from the implementation of the project's activities.
- Provide guidance and specific recommendations on how the project team and UNDP can improve performance (both substantive and management) during the remaining duration of the current project.
- Provide guidance and specific recommendations for future support in the area of climate change mitigation and renewable energy for both the GoSL and UNDP to consider.
- Produce the Mid-term Evaluation Report.
- Present the findings to relevant stakeholders.

Qualifications:

- Familiarity with climate change challenges in developing countries; previous experiences related to renewable energy and particularly energy efficiency would be an advantage.
- 10 years of relevant field-based experience in monitoring and evaluation of projects.
- Familiarity with a participatory approach in project monitoring and evaluation.
- Familiarity with Sri Lanka or similar countries.
- Excellent writing and analytical skills.

8. National Consultant for Mid Term Review

The National Consultant will be recruited to conduct the Mid-term Evaluation of the Project. S/he will report to the NTA and support the International Consultant for the following specific tasks:

- Liaise with local stakeholders to ensure that cultural perspectives and local circumstances are taken into account and incorporated into recommendations.
- Assess the progress towards achievement of the project objectives as outlined in the approved Project Document.
- Look into the linkages between this project and other relevant projects/agencies and assess their effectiveness.
- Assess the structure and performance of the project management team and support provided by GEF-UNDP.
- Identify lessons learned from the implementation of the project's activities.
- Provide input on how the project team and UNDP can improve performance (both substantive and management) during the remaining duration of the current project.
- Provide inputs on specific recommendations for future support in the area of climate change mitigation and renewable energy for both the GoSL and UNDP to consider.
- Provide inputs to the International Consultant in preparing the Mid-term Evaluation Report.
- Present the findings to relevant stakeholders.

Qualifications:

- Understanding of climate change mitigation, renewable energy and energy efficiency in Sri Lanka.
- At least 5 years of work experience in the development sector in Sri Lanka.
- Excellent communication skills in English (oral and written).

9. International Consultant for Final Evaluation

The International Consultant will be recruited to conduct the Final Evaluation of the Project. S/he will report to the NTA and act as the team leader for the following specific tasks:

- Provide guidance to the National Consultant in conducting the Final Evaluation.
- Assess the progress towards achievement of the project objectives as outlined in the approved Project Document.
- Look into the linkages between this project and other relevant projects/agencies and assess their effectiveness.
- Assess the structure and performance of the project management team and support provided by GEF-UNDP and to what extent recommendations from the Mid-term Evaluation were implemented.
- Identify lessons learned from the implementation of the Project's activities in the following areas:

    - Relevance – the extent to which the activity is suited to local and national development priorities and organizational policies, including changes over time

  - Effectiveness – the extent to which the project objective has been achieved or how likely it is to be achieved
  - Efficiency – the extent to which results have been delivered with the least costly resources possible
  - Results – the positive and negative, and 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 replication effects and other, local effects
  - Sustainability – 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.

- Provide guidance and specific recommendations for future support in the area of climate change mitigation and renewable energy and energy efficiency for both the GoSL and UNDP to consider.
- Produce the Final Evaluation Report.
- Present the findings to relevant stakeholders.

Qualifications:

- Familiarity with climate change challenges in developing countries; previous experiences related to renewable energy and particularly energy efficiency would be an advantage.
- 10 years of relevant field-based experience in monitoring and evaluation of projects.
- Familiarity with a participatory approach in project monitoring and evaluation.
- Familiarity with Sri Lanka or similar countries.
- Excellent writing and analytical skills.

10. National Consultant for Final Review

The National Consultant will be recruited to conduct the Final Evaluation of the Project. S/he will report to the NTA and support the International Consultant for the following specific tasks:

- Liaise with local stakeholders to ensure that cultural perspectives and local circumstances are taken into account and incorporated into recommendations.
- Assess the progress towards achievement of the project objectives as outlined in the approved Project Document.
- Look into the linkages between this project and other relevant projects/agencies and assess their effectiveness.
- Assess the structure and performance of the project management team and support provided by GEF-UNDP and to what extent recommendations from the Mid-term Evaluation were implemented.
- Identify lessons learned from the implementation of the project's activities in the following areas:
  - Relevance – the extent to which the activity is suited to local and national development priorities and organizational policies, including changes over time
  - Effectiveness – the extent to which the project objective has been achieved or how likely it is to be achieved
  - Efficiency – the extent to which results have been delivered with the least costly resources possible
  - Results – the positive and negative, and 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 replication effects and other, local effects

  - Sustainability – 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.

- Provide inputs on specific recommendations for future support in the area of climate change mitigation and renewable energy for both the GoSL and UNDP to consider.
- Provide inputs to the International Consultant in preparing the Final Evaluation Report.
- Present the findings to relevant stakeholders.

Qualifications:

- Understanding of climate change mitigation, renewable energy and energy efficiency in Sri Lanka.
- At least 5 years of work experience in the development sector in Sri Lanka.
- Excellent communication skills in English (oral and written).

ANNEX F: List of Organizations Consulted During the Preparatory Phase

The following organizations were consulted during the project preparatory phase:

Public Sector
Ministry of Environment
Ministry of Power and Energy
Ministry of Finance and Economic Development
Ministry of Local Government and Rural Development
Environmental Protection Agency

Professional Trade Associations
Ceylon Chamber of Commerce
Planters Association of Ceylon

Private Sector
HELP-O
Industrial Solutions Lanka Pvt Ltd
Atkin Spence Plantation and Hotel
Sri Lanka Carbon Fund Ltd

Bilateral/Multilateral
UNDP
WB
ADB

NGOs
Lanka Biogas Association

ANNEX G: Co-financing letters

SLSEA co-financing letter

ශ්‍රී ලංකා සුනිත්‍ය බලශක්ති අධිකාරිය இலங்கை நிலைபெறுதகு வலு அதிகாரசபை
Sri Lanka Sustainable Energy Authority
පරිසර හා පුනර්ජනනීය බලශක්ති අමාත්‍යාංශය சுற்றாடல் மற்றும் புதுப்பிக்கத்தக்க சக்தி அமைச்சு Ministry of Environment and Renewable Energy

07.11.2014

Resident Representative
United Nations Development Programme
202, BaudhalokaMawatha
Colombo 07

Co-financing for GEF Supported NAMA Framework and Piloting for Energy in Sri Lanka

The Sri Lanka Sustainable Energy Authority is pleased to confirm parallel co-financing for the project ***Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors in Sri Lanka*** which will support the development of a national framework and monitoring systems to implement appropriate low-carbon actions in energy generation and end-use sectors.

We are pleased to confirm co-financing of USD 3.4 million for renewable energy and energy efficiency programmes which are being implemented by the SLSEA in selected provinces of Sri Lanka, and the programmes include establishment of energy use baselines, concessionary financing for establishment of biogas suits and technical support to the selection of appropriate technologies for energy efficiency and renewable energy promotion.

We thank you for all your cooperation and support in developing this proposal and look forward to working closely with the Ministry of Environment & Renewable Energy and UNDP in implementing this project.

Thank You.

Yours sincerely

Director General
Sri Lanka Sustainable Energy Authority

අංක. 05 ගොඩනැගිල්ල, පලමු මහල, BMICH, බෞද්ධාලෝක මාවත, කොළඹ 07. ශ්‍රී ලංකාව. 05 கட்டிடம் முதலாம் மாடி, BMICH, பௌத்தாலோக மாவத்தை, கொழும்பு 07. இலங்கை.
Block 05, 1st Floor, BMICH, Bauddhaloka Mawatha, Colombo 07. Sri Lanka.
කාර්යාලය அலுவலகம் Office +94 (0) 11-267-7445
දුරාලේඛනය தொலைநகல் Facsimile +94 (0) 11-268-2534
විද්‍යුත්පත්‍රය மின்னஞ்சல் E-mail info@energy.gov.lk
වෙබ් අඩවිය இணையம் Web Site www.energy.gov.lk

Co-financing letter from Ministry of Power and Energy

පරිසර හා පුනර්ජනනීය බලශක්ති අමාත්‍යාංශය
சுற்றாடல் மற்றும் புதுப்பிக்கத்தக்க சக்தி அமைச்சு
Ministry of Environment and Renewable Energy

"සම්පත්පාය" අංක 82, රජමල්වත්ත පාර, බත්තරමුල්ල, ශ්‍රී ලංකාව.
"சம்பத்பாய" இல. 82, ரஜமல்வத்த வீதி, பத்தரமுல்லை, இலங்கை.
"Sampathpaya" No. 82, Rajamalwatta Road, Battaramulla, Sri Lanka.
Gen. Tel: +94 - 11 - 2882112 - 3

ලේකම්
செயலாளர்
Secretary
+94-11-2877290

ෆැක්ස්
பெக்ஸ்
Fax
+94-11-2877292

මගේ අංකය / எனது இல. / My No. 04/04/05/369

ඔබේ අංකය / உது இல. / ur No.

දිනය / திகதி / Date 11.11.2014

Resident Representative
United Nations Development Programme
202, Baudhaloka Mawatha
Colombo 07

Dear Sir/ Madam,

Co-financing for GEF Supported project on
Nationally Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors

The Climate Change Secretariat of the Ministry of Environment and Renewable Energy is pleased to confirm parallel co-financing of USD 230,000 for the project ***Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors in Sri Lanka*** which will support the development of a national framework and monitoring systems to implement appropriate low-carbon actions in energy generation and end-use sectors.

This in kind co-financing comes from Ministry budgets for mitigation actions, and staff time of Ministry officials to provide coordination, technical support and monitoring of the above project at strategic level.

The Ministry of Environment and Renewable Energy has recognized this project as an important initiative to identify cost-effective mitigation options in energy generation and end-use sectors in Sri Lanka.

We thank you for all your cooperation and support in developing this proposal and look forward to working closely with Sri Lanka Sustainable Energy Authority and UNDP in implementing this project.

Yours sincerely

B.M.U.D. Basnayake
Secretary

"මේ මහපොළොව සහ ගස වැල් මිනිසාට මෙන් ම අනාගත පරම්පරාවන් සියලුදෙනාට ද, මිහිමත සරණ පිවුපාවුන්ට ද, සියලු සතුන්ට ද එකසේ අයිති ය."
"நாம் வாழும் இந்த பூமி மற்றும் மரம் செடி கொடிகள் மனிதனுக்கு மட்டுமன்றி வான் வெளியில் பறந்து திரியும் பறவைகள் மற்றும் பூமியிலுள்ள விலங்குகளுக்கும் ஏனைய அனைத்து விலங்குகளுக்கும் சொந்தமானது"

Co-financing letter from UNDP Sri Lanka Country Office.

United Nations Development Programme

Empowered lives.
Resilient nations.

7 November 2014

Dear Ms. Dinu,

Co-financing for GEF funded Environment Sensitive Areas (ESA) Project

The United Nations Development Programme is happy to commit co-financing of USD 250,000 to the project on ***Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors in Sri Lanka.***

This co-financing comes from a private sector partnership project called "Every Drop Matters" funded by Coca Cola and implemented globally through several UNDP country offices. In Sri Lanka, the project is implemented along one of Sri Lanka's largest river basins addressing land-based pollution. This project will invest in developing biogas systems with new and improved technology to intercept solid waste from municipalities along the river. The project is funded for the next two years, but UNDP expects the continuation of support for five years from 2014.

This model is complementary to the climate change mitigation pilot initiative on biogas planned through the GEF-supported project. UNDP would be happy to apply the NAMA framework developed through the project, especially the MRV (monitoring, reporting and verifying) system to this biogas initiative to determine the accumulated carbon saving of the biogas systems implemented in the river basin- through both energy replacement and waste management.

We thank you and your team for your generous support and cooperation.

Yours Sincerely,

Lovita Ramguttee
Country Director a.i.

Ms. Adriana Dinu
Executive Coordinator and Director a.i. UNDP GEF
Energy & Environment Group, BDP
304 East 45th Street, 9th Floor
New York, NY 10017
USA

UNDP Sri Lanka
202-204, Bauddhaloka Mawatha, Colombo 7, Sri Lanka ■ P.O. Box 1505
Tel: +94(11)2580691-8 ■ Fax: +94(11)2581116 ■ Email: registry.lk@undp.org

Co-financing letter from Private sector: Industrial Solutions Lanka (Pvt) Ltd. and The Planter's Association of Ceylon

Industrial Solutions Lanka (Pvt) Ltd.
ISL
Towards Greening the Globe

Industrial Solutions Lanka (Pvt) Ltd

13th October 2014

Country Director
United Nations Development Programme
UN Compound
202 - 204, Bauddhaloka Mawatha
Colombo 07
Sri Lanka

Dear Sir,

CO-FINANCING SUPPORT TO GEF FUNDED PROJECT "APPROPRIATE MITIGATION ACTIONS IN THE ENERGY GENERATION AND END-USE SECTORS IN SRI LANKA"

We wish to inform the GEF Secretariat that Industrial Solutions Lanka Limited (ISL) (A Company Registered in Sri Lanka) being a leading institution engaged in the development of renewable energy projects in Sri Lanka, would like to commit a co-funding of USD 18 million towards UNDP GEF initiated project titled "Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors in Sri Lanka" by way of investing in a grid connected Solar Energy Generation Project in Sri Lanka with the capacity of 10 MW within the next 4 years in collaboration with M/s Solon International of Germany.

This is to complement the resources approved by GEF for the successful implementation of the above project in partnership with the Ministry of Environment & Renewable Energy (MERE) of Sri Lanka and Sri Lanka Sustainable Energy Authority (SLSEA).

Thanking You.

Yours faithfully,
INDUSTRIAL SOLUTIONS LANKA (PVT) LTD

ENG. ANURA VIDANAGAMAGE
MANAGING DIRECTOR

123/8, Singhe Mawatha, Dambulla Road, Kurunegala, Sri Lanka.
Tel : 0094 37 7 395 300 Fax : 0094 37 2 223 368 E-Mail : info@isl.lk Web : www.isl.lk

THE PLANTERS' ASSOCIATION OF CEYLON

INCORPORATED

32, Vajira Road
P O Box 855
Colombo 5
Sri Lanka

Telephone: COLOMBO 2587013, 2592683
Facsimile: COLOMBO 2502265
E-mail: pack@eureka.lk

22nd October 2014

Country Director
United Nations Development Programme
UN Compound
202 - 204, Bauddhaloka Mawatha
Colombo 07
Sri Lanka

Dear Sir

Co-Financing Support for GEF Funded Project "Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors in Sri Lanka"

We write to inform the GEF Secretariat that the Regional Plantation Companies in the membership of the Planters' Association of Ceylon would be willing to consider co-funding USD 4 million towards the UNDP GEF initiated project titled "Appropriate Mitigation Actions in the Energy Generation and End-Use Sectors in Sri Lanka" by way of investing in High Efficiency Motors (HEM) in the tea industry in Sri Lanka over a 4 year period.

This is to complement the resources approved by GEF for the successful implementation of the above project in partnership with the Ministry of Environment & Renewable Energy (MERE) of Sri Lanka and Sri Lanka Sustainable Energy Authority (SLSEA).

Yours truly,

Malin Goonetileke
SECRETARY GENERAL
THE PLANTERS' ASSOCIATION OF CEYLON

ANNEX H: Letter of Agreement between UNDO and GoSL for the provision of support services

United Nations Development Programme

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Annex 2: STANDARD LETTER OF AGREEMENT BETWEEN UNDP AND THE GOVERNMENT FOR THE PROVISION OF SUPPORT SERVICES

Dear Mr. Kumarasiri,

1. Reference is made to consultations between officials of the Government of the Democratic Socialist Republic of Sri Lanka (hereinafter referred to as "the Government") and officials of UNDP with respect to the provision of support services by the UNDP country office for nationally managed programmes and projects. UNDP and the Government hereby agree that the UNDP country office may provide such support services at the request of the Government through its institution designated in the relevant programme support document or project document, as described below.

2. The UNDP country office may provide support services for assistance with reporting requirements and direct payment. In providing such support services, the UNDP country office shall ensure that the capacity of the Government-designated institution is strengthened to enable it to carry out such activities directly. The costs incurred by the UNDP country office in providing such support services shall be recovered from the administrative budget of the office.

3. The UNDP country office may provide, at the request of the designated institution, the following support services for the activities of the programme/project:

(a) Identification and/or recruitment of project and programme personnel;
(b) Identification and facilitation of training activities;
(c) Procurement of goods and services;

4. The procurement of goods and services and the recruitment of project and programme personnel by the UNDP country office shall be in accordance with the UNDP regulations, rules, policies and procedures. Support services described in paragraph 3 above shall be detailed in an annex to the programme support document or project document, in the form provided in the Attachment hereto. If the requirements for support services by the country office change during the life of a programme or project, the annex to the programme support document or project document is revised with the mutual agreement of the UNDP resident representative and the designated institution.

5. The relevant provisions of the UNDP Standard Basic Assistance Agreement, 20 May 1990 (the "SBAA"), including the provisions on liability and privileges and immunities, shall apply to the provision of such support services. The Government shall retain overall responsibility for the nationally managed programme or project through its designated institution. The responsibility of the UNDP country office for the provision of the support services described herein shall be limited to the provision of such support services detailed in the annex to the programme support document or project document.

UNDP Sri Lanka
202-204, Bauddhaloka Mawatha, Colombo 7, Sri Lanka ■ P.O. Box 1505
Tel: +94(11)2580691-8 ■ Fax: +94(11)2581116 ■ Email: registry.lk@undp.org

United Nations Development Programme

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6. Any claim or dispute arising under or in connection with the provision of support services by the UNDP country office in accordance with this letter shall be handled pursuant to the relevant provisions of the SBAA.

7. The manner and method of cost-recovery by the UNDP country office in providing the support services described in paragraph 3 above shall be specified in the annex to the programme support document or project document.

8. The UNDP country office shall submit progress reports on the support services provided and shall report on the costs reimbursed in providing such services, as may be required.

9. Any modification of the present arrangements shall be effected by mutual written agreement of the parties hereto.

10. If you are in agreement with the provisions set forth above, please sign and return to this office two signed copies of this letter. Upon your signature, this letter shall constitute an agreement between your Government and UNDP on the terms and conditions for the provision of support services by the UNDP country office for nationally managed programmes and projects.

Yours sincerely,

Signed on behalf of UNDP

Rozina Bilgrami
Country Director, a.i

UNITED NATIONS COLOMBO - SRI LANKA

For the Government

A. Kumarasiri
Director General
Department of External Resources
Ministry of Finance and Planning
The Secretariat
Colombo 01, Sri Lanka.

Mr. Ajantha Kumarasiri
Director General, Department of External Resources
On behalf of the Government of the Democratic Socialist Republic of Sri Lanka

23 May 2013

UNDP Sri Lanka
202-204, Bauddhaloka Mawatha, Colombo 7, Sri Lanka ■ P.O. Box 1505
Tel: +94(11)2580691-8 ■ Fax: +94(11)2581116 ■ Email: registry.lk@undp.org

46

STANDARD LETTER OF AGREEMENT BETWEEN UNDP AND THE GOVERNMENT FOR THE PROVISION OF SUPPORT SERVICES

DESCRIPTION OF UNDP COUNTRY OFFICE SUPPORT SERVICES

1. Reference is made to consultations between Ministry of Power and Energy and officials of UNDP with respect to the provision of support services by the UNDP country office for the nationally managed project "**Appropriate Mitigation Actions in Energy Generation and End Use Sectors in Sri Lanka**" (Project Number: 00089391).

2. In accordance with the provisions of the letter of agreement signed on (date) and the attached project document, the UNDP country office shall provide support services for the Project as described below

Support services (insert description)	Schedule for the provision of the support services	Cost to UNDP of providing such support services (where appropriate)	Amount and method of reimbursement of UNDP (where appropriate)
Services related to human resources (including but not limited to): 1. Identification, selection and recruitment of project personnel (including advertising, short-listing and recruiting): o Project Associate 2. HR & Benefits Administration & Management: o issuance of a contract; o closing the contract 3. Personnel management services: Payroll & Banking Administration & Management	April 2015 – June 2015 Ongoing throughout project implementation when applicable Ongoing throughout project implementation when applicable	As per the pro-forma costs: o 10 days over 60 months of GS5 HR Assistant: **1,000 USD** o 4 days over 60 months of NOB HR Manager: **1,000 USD**	UNDP will directly charge the project
Services related to procurement (including but not limited to): Procurement of goods Procurement of services o Consultant recruitment	Throughout project implementation when applicable	As per the pro-forma costs: o 35 days over 60 months of GS5 Procurement Associate:	UNDP will directly charge the project

○ Advertising ○ Short-listing & selection ○ Contract issuance		**3,000 USD** ○ 8 days over 60 months of NOB Procurement Manager: 1,7**00 USD**	
Services related to finance (including but not limited to): ○ Payments ○ Fund Transfers	Ongoing throughout implementation when applicable	As per the pro-forma costs: ○ 20 days over 60 months of GS6 Finance Associate: **2,300 USD** ○ 6 days over 60 months of NOB Finance Manager: **1,200 USD**	UNDP will directly charge the project
Services related administration (including but not limited to): ○ Travel authorization ○ Ticket requests (booking, purchasing, etc.) ○ F10 settlements ○ Asset management	Ongoing throughout implementation when applicable	As per the pro-forma costs: ○ 15 days over 60 months of GS5 Administration Assistant: **1,600 USD** ○ 2 days over 60 months of GS7 Administration Manager: **350 USD**	UNDP will directly charge the project
Services related to ICT (including but not limited to): ○ Email box maintenance ○ ICT and office equipment installation and maintenance ○ Internet channel use ○ Mobile telephony contracting and use	Ongoing throughout implementation when applicable	As per the pro-forma costs: ○ 4 days over 60 months of GS5 IT Assistant: **350 USD** ○ 1 day over 60 months of GS7 IT Manager: **185 USD**	UNDP will directly charge the project
Total		**12,685 USD**	