



# PROJECT IDENTIFICATION FORM (PIF)

PROJECT TYPE: Medium-sized Project

TYPE OF TRUST FUND: GEF Trust Fund

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## PART I: PROJECT INFORMATION

Project Title:	Reducing of Green House Gas Emissions in the Industrial Sector through Pelletization Technology in Lao PDR		
Country(ies):	Lao People's Democratic Republic (PDR)	GEF Project ID: <sup>1</sup>	
GEF Agency(ies):	UNIDO	GEF Agency Project ID:	140057
Other Executing Partner(s):	1. Department of Industry and Handicrafts (DoIH), Ministry of Industry and Commerce (MoIC) 2. Renewable Energy and New Materials Institute (REMI)	Submission Date: Resubmission Date:	03/07/2014 03/22/2014
GEF Focal Area (s):	Climate Change	Project Duration (Months)	36
Name of parent program (if applicable): • For SFM/REDD+ <input type="checkbox"/> • For SGP <input type="checkbox"/> • For PPP <input type="checkbox"/>	NA	Project Agency Fee (\$):	120,511

### A. INDICATIVE FOCAL AREA STRATEGY FRAMEWORK<sup>2</sup>:

Focal Area Objectives	Trust Fund	Indicative Grant Amount (\$)	Indicative Co-financing (\$)
CCM – 3 Promote investment in renewable energy technologies	GEFTF	1,268,539	6,690,000
Total Project Cost		1,268,539	6,690,000

### B. INDICATIVE PROJECT DESCRIPTION SUMMARY

<b>Project Objective:</b> To reduce GHG emission in Lao PDR's industries by promoting the production and usage of industrial grade solid bio-fuel for thermal energy generation						
Project Component	Grant Type <sup>3</sup>	Expected Outcomes	Expected Outputs	Trust Fund	Indicative Grant Amount (\$)	Indicative Cofinancing (\$)
1. Capacity development and knowledge management	TA	Improved capacity on solid bio-fuel production and usage	1.1. An information and learning unit established for solid bio-fuel production and usage 1.2. Trained key policy makers (50) and other target groups (50 in each group) available to continuously support the solid	GEFTF	170,000	850,000

<sup>1</sup> Project ID number will be assigned by GEFSEC.

<sup>2</sup> Refer to the reference attached on the [Focal Area Results Framework and LDCF/SCCF Framework](#) when completing Table A.

<sup>3</sup> TA includes capacity building, and research and development.

			bio-fuel production and usage			
2. Promoting investments in solid bio-fuel production and utilization	TA	Improved investment environment	2.1. Database developed on biomass availability and final energy consumption in the industrial sector 2.2. Biomass resource assessed and logistics planned for transporting wastes 2.3. Solid bio-fuel end user incentive scheme facilitated	GEFTF	82,000	200,000
3. Demonstration of solid bio-fuel production and utilization	INV	Increased use of solid bio-fuel in industries	3.1. Solid bio-fuel pelletizing systems installed for a cumulative 28.8 tpd <sup>4</sup> capacity	GEFTF	851,539	5,100,000
4. Monitoring and evaluation (M&E)	TA	Effectiveness of the outputs assessed, corrective actions taken and experience documented	4.1. Mid-term M & E report prepared 4.2. End of project M & E report prepared	GEFTF	50,000	200,000
Subtotal					1,153,539	6,350,000
Project Management Cost (PMC) <sup>5</sup>				GEFTF	115,000	340,000
Total Project Cost					1,268,539	6,690,000

**C. INDICATIVE CO-FINANCING FOR THE PROJECT BY SOURCE AND BY NAME IF AVAILABLE, (\$)**

Sources of Cofinancing	Name of Cofinancier	Type of Cofinancing	Amount (\$)
National Government	REMI	In-kind	750,000
National Government	DoIH	In-kind	780,000
Private Sector	Boten salt factory	Investment	1,170,000
Private Sector	Veunkham salt factory	Investment	1,920,000
Private Sector	Burapha agro forestry	Investment	420,000
Private Sector	Oudomxay salt factory	Investment	1,500,000
GEF Agency	UNIDO	Grant	60,000
GEF Agency	UNIDO	In-kind	90,000
<b>Total Cofinancing</b>			<b>6,690,000</b>

**D. INDICATIVE TRUST FUND RESOURCES (\$) REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY<sup>1</sup>**

GEF Agency	Type of Trust Fund	Focal Area	Country Name/Global	Grant Amount (\$) (a)	Agency Fee (\$) (b) <sup>2</sup>	Total (\$) c=a+b
(select)	(select)	(select)				0
<b>Total Grant Resources</b>				0	0	0

<sup>4</sup> Six units of 0.6 tph capacity operating for 8 hours (6x0.6x8 = 28.8 tpd). Depending upon the solid bio-fuel requirement individual units may operate for a lower or higher duration on a daily basis

<sup>5</sup> To be calculated as percent of subtotal.

<sup>1</sup> In case of a single focal area, single country, single GEF Agency project, and single trust fund project, no need to provide information for this table. PMC amount from Table B should be included proportionately to the focal area amount in this table.

<sup>2</sup> Indicate fees related to this project.

# **E. PROJECT PREPARATION GRANT (PPG)<sup>6</sup>**

Please check on the appropriate box for PPG as needed for the project according to the GEF Project Grant:

	<u>Amount Requested (\$)</u>	<u>Agency Fee for PPG (\$)<sup>7</sup></u>
• No PPG required.	-- 0--	--0--
• (upto) \$50k for projects up to & including \$1 million		
• (upto)\$100k for projects up to & including \$3 million	10,000	950
• (upto)\$150k for projects up to & including \$6 million		
• (upto)\$200k for projects up to & including \$10 million		
• (upto)\$300k for projects above \$10 million		

## **PPG AMOUNT REQUESTED BY AGENCY(IES), FOCAL AREA(S) AND COUNTRY(IES) FOR MFA AND/OR MTF PROJECT ONLY**

Trust Fund	GEF Agency	Focal Area	Country Name/ Global	(in \$)		
				PPG (a)	Agency Fee (b)	Total c = a + b
(select)	(select)	(select)				0
<b>Total PPG Amount</b>				<b>0</b>	<b>0</b>	<b>0</b>

MFA: Multi-focal area projects; MTF: Multi-Trust Fund projects.

<sup>6</sup> On an exceptional basis, PPG amount may differ upon detailed discussion and justification with the GEFSEC.

<sup>7</sup> PPG fee percentage follows the percentage of the GEF Project Grant amount requested.

## **PART II: PROJECT JUSTIFICATION**

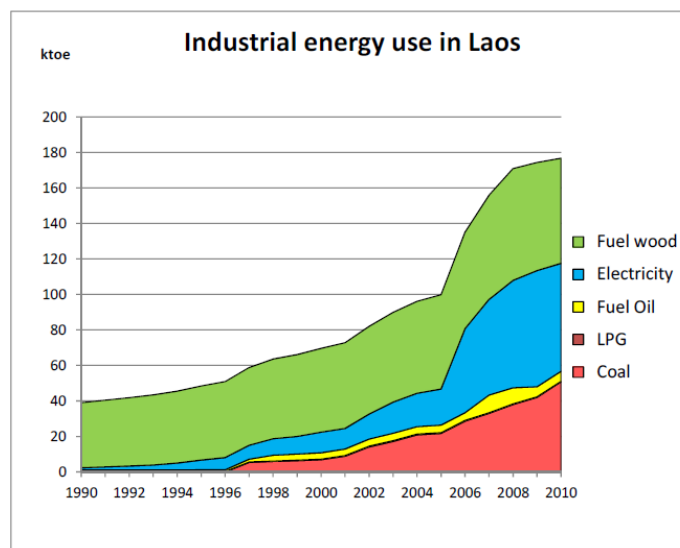
### **A. Project Overview**

#### **A.1. Project Description**

##### **1) Global Environmental Problems, Root Causes and Barriers**

In 2012, total energy consumption in Lao PDR was 2,336 ktoe. Residential sector accounted for 54% of total energy consumption, transport sector 22%, commercial sector 14% and industry & agriculture sectors together formed the remaining 10%. The high share by residential sector is mainly due to their reliance on biomass usage with very less efficiency. But at the same time, it also reflects the relatively low level of industrial and commercial activity<sup>8</sup>.

Figure 1 shows the industrial energy usage trend in Lao PDR from 1990-2010 and it clearly shows that the coal usage has increased rapidly<sup>9</sup>. One of the major objectives of the proposed project is therefore, to reduce the coal usage in industry as much as possible.



**Figure 1: Industrial energy use in Lao PDR**

In the year 2000, Lao PDR recorded a net emission of around 41.7 million t CO<sub>2</sub> (total emission of around 43.8 t CO<sub>2</sub> and a removal of around 2 million t CO<sub>2</sub>). This represents a substantial increase compared to the net sink of around 104.6 million t CO<sub>2</sub> in the year 1990. This increase can be attributed to the rapid socio-economic development in the country<sup>10</sup>.

As a least developed country (LDC) with limited adaptive or mitigating capacities, Lao PDR is highly vulnerable to the impacts of climate change. Moreover, without the development of technical capacity to manage the current climate change risks, the country will be exposed to even higher climate risks in the future. On the other hand, Lao PDR is bestowed with the abundant RE sources. Increased RE usage would reduce the dependence on fossil fuel and will lead to the overall reduction in GHG emissions.

Renewable Energy Development Strategy (REDS), 2011 identified the thermal energy potential from RE sources as 889 ktoe. It also had set the target of 400 ktoe of thermal energy generation from RE

<sup>8</sup> ADB Lao People's Democratic Republic: Energy Sector Assessment, Strategy, and Road Map, 2013 Update

<sup>9</sup> Future Energy Demand In Lao PDR: Scenario Alternatives for Development, Finland Futures Research Centre, 2012 accessible at [http://www.utu.fi/fi/yksikot/ffrc/julkaisut/e-tutu/Documents/eBook\\_2012-8.pdf](http://www.utu.fi/fi/yksikot/ffrc/julkaisut/e-tutu/Documents/eBook_2012-8.pdf)

<sup>10</sup> Second National Communication to UNFCCC, March 2013

sources by the year 2025 (biomass – 113 ktoe; biogas – 178 ktoe; solar – 109 ktoe)<sup>11</sup>. However, not many achievements have been made so far.

Lao PDR's annual agricultural production in the year 2010 was around 5,228,925 tons<sup>12</sup>. This resulted in a waste generation of 9,433,452 tons in the year 2010 (calculated based on residue product ratio from various studies<sup>13,14,15</sup>). Rice straw (5,395,114 tons/year), followed by maize stalk (2,041,750 tons/year), rice husk (614,128 tons/year) and maize cob (278,699 tons/year) accounted for the bulk of biomass generation.

In the year 2011, there were totally 1,175 wood industries in Lao PDR including saw mills and furniture factories<sup>16</sup>. The overall sawn wood and furniture production in Lao was estimated to be around 754,926 m<sup>3</sup> per year or 641,687 tons per year<sup>17</sup>. Various sources show that average wood waste generation in a typical saw mill is around 50% of the input (of which saw dust waste is around 18 to 20% saw dust)<sup>18</sup>. Sawn wood is taken to the furniture factory for processing after necessary drying. Typical furniture processing industries generate 50% wood waste (of which shaving dust waste is 30%)<sup>19</sup>.

Based on the above assumptions of 50% product recovery in saw mill and furniture factory, sawn wood (saw mill) and finished product (furniture factory) production is estimated as 427,791 and 213,896 tons per year respectively from the total production of 641,687 tons per year. Since the waste generation is also assumed to be 50% of input, waste generation<sup>20</sup> from saw mill and furniture factory also stands at 427,791 tons per year (around 86,000 tons of saw dust) and 213,896 tons per year (around 64,168 tons of shaving dust), respectively. It has to be noted that wood waste, from both saw mill and furniture factory will be dried to bring the moisture content below 20% before further usage for solid bio-fuel production.

Local use of the solid bio-fuel is not a common practice in Lao PDR. The main barriers include: a) cheaper cost of coal as compared to solid bio-fuel, b) absence of quality standards for the solid bio-fuel (production and end-usage), c) reduction in biomass quality during storing and transporting before to making solid fuels, d) insufficient information on demand and supply of solid bio-fuel, e) insufficient information on existing projects, f) lack of demonstrable and affordable local technology, g) insufficient knowledge on co-firing and combustion system modifications for using solid bio-fuel and operation and maintenance of these systems, h) inadequate policy, regulatory framework & incentive mechanisms for production and use of solid bio-fuels, i) lack of solid bio-fuel supply chain management.

The proposed project will address some of the above barriers to increase the usage of solid bio-fuels. Mitigation achieved through the proposed project for some of the barriers are listed under the “GEF alternative scenario and project”. It is also in alignment with Laos’ National Capacity Needs Self-Assessment for Global Environment Management report. Project component 1 addresses the capacity constraint identified at the national and institutional level through the establishment of an information and learning unit for solid bio fuel production and usage.

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<sup>11</sup> ADB Lao People's Democratic Republic: Energy Sector Assessment, Strategy, and Road Map, 2013 Update

<sup>12</sup> Lao Agriculture Census 2010-2011, Lao Statistic Bureau and Wikipedia

<sup>13</sup> Unused biomass extraction in agriculture, forestry and fishery, Daniela Jölli and Stefan Giljum, SERI

<sup>14</sup> Bhattacharya, S.C.; Pham, H.L.; Shrestha, R.M.; Vu, Q.V., CO2 Emissions due to Fossil and Traditional Fuels, Residues and Wastes in Asia. In Proceedings of AIT Workshop on Global Warming Issues in Asia, Bangkok, Thailand, 8–10 September 1992

<sup>15</sup> Theoretical Bioenergy Potential in Cambodia and Lao PDR, Orkide Akgün, Mika Korkeakoski, Suvisanna Mustonen, Jyrki Luukkanen, world renewable energy congress

<sup>16</sup> Department of Industry and Handicraft, internal report on reconstruction of wood industry No.617/DoIH/DOMPI, 07 September 2012

<sup>17</sup> Assuming an average density of 850 kg/m<sup>3</sup>

<sup>18</sup> <http://www.fao.org/docrep/003/x6966e/x6966e02.htm>

<sup>19</sup> Experience from Cleaner Production (CP)” in Luang Prabang Province by cooperating with the Souphanouvong University and the Department of Industry & Commerce of Luang Prabang Province in agro-processing industries, handicrafts and hotel sector

<sup>20</sup> As received basis (without any drying)

## **2) Baseline scenario and baseline project**

### **Baseline project**

*Green Industry Initiative:* Currently Lao PDR Government is processing the introduction of industrial policies aimed at efficient resource utilization, improving product quality, competitiveness and improving work environment.

### **Waste-to-energy projects**

Biomass projects can be categorized under the Waste-to-energy (WTE) projects. A brief summary on the WTE activities is given below.

Very few waste-to-energy (WTE) projects have been implemented in Lao PDR. However, in the recent years, some feasibility studies have been done in this area, including *Joint Crediting Mechanism/Bilateral offset crediting mechanism (JCM/BOCM)*<sup>21</sup> *Feasibility Study 2012, conducted by EX Research Institute Ltd.* The study identified the following projects:

- Landfill gas (LFG) capture, flaring and/or energy utilization from final disposal landfills of municipal solid waste (MSW)
- Aerobic treatment of organic matters in MSW with mechanical biological treatment (MBT) technology.

“*Cleaner Production (CP)*” project<sup>22</sup> was implemented in the year 2012 in agro-processing industries, handicrafts and hotel sector in Luang Prabang Province. A total of 19 demonstration projects have been established under this project. The project was successful in reducing energy, raw material and wastes which resulted in increased income. However, these did not focus on the available biomass utilization.

A 5 m<sup>3</sup> biogas plant in a pig farm/liquor processing plant for process heat applications at Vientiane province was implemented by REMI in collaboration with Science and Technology Research Institute (STRI), Chiang Mai University, Thailand. The installed system was able to reduce the firewood consumption by around 30%.

*Thai Biogas Energy Company (TBEC) Biogas Project* involved the construction of an anaerobic wastewater treatment facility at the Lao PDR-Indochina Group Company’s (LIG) tapioca starch factory in Vientiane, Lao PDR for utilization of the captured biogas for thermal energy utilization. This plant was expected to be in operation by end of November 2012. However, the operational details of the plant are not known<sup>23</sup>.

### **Other major donor initiatives**

Recently, Lao PDR has been a recipient of several donor projects in the energy sector from the World Bank, Japan International Cooperation Agency (JICA), Government of Finland and Asian Development Bank (ADB). Other development partners include the Australian Agency for International Development, KfW of Germany, the People’s Republic of China, the Republic of Korea and the Swedish International

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<sup>21</sup> A new carbon credit mechanism developed by Japan

<sup>22</sup> Lao PDR Government is implementing the project in cooperation with Souphanouvong University and the Department of Industry & Commerce. Supported by Swedish International Development Agency (SIDA), United Nations Development Programme (UNDP), United Nations Industrial Development Organization (UNIDO), International Labour Organization (ILO) and German Society for International Cooperation (GIZ).

<sup>23</sup> [http://cdm.unfccc.int/filestorage/l/d/OUF9SCK8147RD5VZQMI63GJNB02XTW.pdf/PDD%20TBEC%20LIG%20Biogas%20Project%20ACM0014%20Version%204.3%20public?t=REx8bXoxNm9IfDDZIWPVaxKs5\\_gxTryqCRa](http://cdm.unfccc.int/filestorage/l/d/OUF9SCK8147RD5VZQMI63GJNB02XTW.pdf/PDD%20TBEC%20LIG%20Biogas%20Project%20ACM0014%20Version%204.3%20public?t=REx8bXoxNm9IfDDZIWPVaxKs5_gxTryqCRa)

Development Cooperation Agency<sup>24</sup>. Some of the key areas of focus include tariff reform, energy efficiency and conservation, rural electrification, renewable energy development, hydropower development and power transmission and distribution.

*It is quite clear that very little activities have been going on in the field of RE utilization for thermal energy requirements in industries. Specifically considering biomass pelletization technology, no activity / initiative exists, which can be considered as a baseline project.*

The proposed project will therefore aim at creating a conducive environment for utilization of biomass in industries in the form of solid bio-fuels (pellets).

### Lao PDR Salt Industry

Owing to the traditional method of production by evaporating brine water into salt, Lao PDR's salt has increasingly become a niche product due to its authenticated and pure taste. As per the information from Lao PDR salt producer's association, there are eight salt factories in the country excluding small producers with one or two boiling pots.

Annual production in these factories is around 3,500 ton of industrial salt and around 32,200 tons of table salt. Starting from the year 2010, owing to increased price and scarcity of sawdust in market added with higher transportation cost, the industries started using anthracite cakes as additional fuel source. These cakes are made from low heating value grade anthracite purchased from cement factories and clay. There is a potential for replacing the anthracite and its products usage in salt industries through the pellets generated from wood wastes<sup>25</sup> and other biomass.

### **3) GEF alternative scenario and project**

The proposed project aims at promoting solid bio-fuel and reducing fossil fuel usage among industries, by removing barriers from both the producer and the user side for usage of industrial-grade solid bio-fuels.

The project will employ two prong strategy: On one hand, the project aspires to remove technological barriers of both the producers and the end users; On the other hand, it aims at removing policy and financial barriers to expedite the investment in production as well as the usage of the solid bio-fuels. Eventually, the project will be able to settle the entire supply chain of solid bio-fuels starting from a producer to end user including the equipment suppliers. By achieving this, the project will reduce GHG emissions as well as promote the use of available agricultural waste. Through the various outputs, the proposed project intends to mitigate the following barriers:

Barrier	Mitigation through
Insufficient information on demand and supply of solid bio-fuel.	<ul style="list-style-type: none"> <li>Establishment of I&amp;LU for effective information dissemination;</li> <li>Database maintenance.</li> </ul>
Insufficient information on the existing projects.	<ul style="list-style-type: none"> <li>Establishment of biomass database in I&amp;LU;</li> <li>Training to various target groups;</li> <li>Information dissemination through leaflets and</li> </ul>

<sup>24</sup> ADB Lao People's Democratic Republic: Energy Sector Assessment, Strategy, and Road Map, 2013 Update

<sup>25</sup> Due to avoided transportation cost for longer hauling distances, even saw dust would be procured and used for solid bio-fuel production if required.

	website.
Insufficient knowledge on co-firing and combustion system modifications for using solid bio-fuel and operation and maintenance of these systems.	<ul style="list-style-type: none"> <li>• Establishment of I&amp;LU;</li> <li>• Training to various target groups including local engineering and O&amp;M institutions;</li> <li>• Information dissemination through leaflets and website;</li> <li>• Customizing available guidebooks on solid bio-fuel production and usage for local condition adaptation.</li> </ul>
Reduction in biomass quality while storing and transporting prior to making solid bio-fuel production.	<ul style="list-style-type: none"> <li>• Comprehensive biomass resource assessment to address this issue;</li> <li>• Possible market linkages through solid bio-fuel depots.</li> </ul>
Cheaper cost of coal as compared to solid bio-fuel	Design of end-user incentive scheme of solid bio-fuel. Once approved by Government, will encourage solid bio-fuel end-users.
Absence of quality standards for the solid bio-fuel (production and end-usage).	Knowledge transfers to key policy makers, RE / technical institutions, etc., on solid bio-fuel production, standardization and usage.

Outputs and activities of each of the project components (PCs) are described below:

#### Component 1: Capacity development and knowledge management

Awareness will be created on production and usage of solid bio-fuel through trainings and information dissemination mechanisms.

a) An information and learning unit (I&LU), for continuous capacity building activities promoting solid bio-fuel production and usage, will be created at REMI. This arrangement will reduce the infrastructure development and operating costs of the I&LU. The sustainability of the I&LU would be ensured through following means: a) Well trained staff members of REMI would be managing the I&LU and hence, no additional man-power cost would accrue and b) a nominal fee would be charged for the training activities. This amount would be used to manage and maintain the activities of the centre.

The staff of the REMI will be given training in operation and management of I&LU before the start of the program. Necessary and appropriate training materials for different recipients will be prepared. Available guidebooks and strategies on solid bio-fuel production and usage will be customised for adapting to the local conditions. This will benefit the potential investors. Any information regarding solid bio-fuel including technology and regulatory issues can be obtained from this unit.

b) Capacity will be developed among the policy makers. Without appropriate supporting policy and regulatory environment, no technology development can take place. Therefore, it is essential to engage policy makers by providing tailored training to at least 50 personnel during the project period.

Specific trainings aimed at industries will also be conducted for at least 50 people. Only when the industries / power plant staff are educated on the potential of solid bio-fuel production and usage, they will be able to take initiatives for their own industries.



In addition to the training, various campaigns and workshops will be held to raise awareness regarding production and usage of solid bio-fuel. Awareness raising materials will be developed and they will be subsequently used for awareness raising purposes.

c) Around 50 individuals from banks and financial institutions will also be trained for assessing / conducting due diligence on the solid bio-fuel projects. Trainings to banks / financial institutions will be conducted at the earliest as a priority in order to enhance their knowledge and build up their confidence in financing the projects.

Trainings for various target groups such as local engineering and O&M institutions will be provided (at least 50 people) to facilitate sustainable operation for the demonstration and replication projects. The key decision makers from different RE / technical institutions, who are involved in the standardization of production and end-usage (at least 50 numbers) will be trained and equipped with the necessary technical capacity for supporting, developing and implementing such projects.

## Component 2: Promoting investments in solid bio-fuel production and utilization

a) A database on biomass availability and on final energy consumption in industrial sector. This database would be updated on a constant basis. This database is expected to be used for identification of replication projects in future. The database would contain details such as: a) sources of biomass waste, b) agro/wood processing details, c) waste generation quantity, d) existing waste usage, e) available waste for potential usage, f) distance from the nearby industry/industrial clusters who are the major coal products consumers and g) demand and supply of solid bio-fuel.

b) A detailed biomass resource assessment will be carried out to identify the biomass residue or waste generation points in target areas. Characteristics of biomass such as type, source of generation (by-product or process waste/residue), quantity generated, its fuel properties, need for pre-treatments, seasonal variation in generation, market price of fuel, etc., will be taken care of in the resource assessment.

The potential utilization regions, industries or end users for bio-fuel will also be studied in detail. The requirement of bio-fuel in such target regions with respect to type of bio-fuel needed, consumption rate and current/future market demands will be assessed.

For collecting and transporting the biomass from factories to solid bio-fuel production units, the available biomass resources need to be mapped and a very careful logistic planning has to be done. Due to the huge and bulky volume of biomass to be carried to the solid bio-fuel manufacturing locations, the cost of transportation will have an impact on the production cost and will also result in project emission. Such resource assessment will include the following:

- Comprehensive sustainable biomass resource availability;
- Collection and selling of agricultural wastes by communities;
- Pre-treatment techniques required to reduce the high moisture content of biomass residues;
- Logistic and transport of the biomass wastes.

The proposed project will also try to establish solid bio-fuel depots which would establish the market linkage between suppliers and end-users of the solid bio-fuels.

c) An exclusive end user incentive scheme to encourage the use of solid bio-fuels instead of fossil fuels will be facilitated through the project. This scheme will aim at converting the usage of solid biofuels as more cost effective than coal (on equivalent calorific value basis). This would create confidence among the solid bio-fuel users and mitigate the risk that they perceive. The exact scheme along with the budget and modalities & procedures, would be designed later during the GEF project implementation when the

funds are made available.

This scheme would be tested with the solid bio-fuel users participating in the proposed GEF project and modified as per the experience gained and lessons learnt to benefit the replication projects. Lao PDR government is expected to allocate funds for enhancing RE usage. In addition to this, various donors/banks and financing institutions are expected to support the Lao PDR's government in the coming years. A part of this money will be channeled for this solid bio-fuel end user incentive scheme.

### Component 3: Demonstration of solid bio-fuel production and utilization

Under this component, the project plans to establish 6 pelletizing units for a cumulative capacity of 28.8 tpd (6 x 0.6 tph x 8 hours per day)<sup>26</sup>. UNIDO has identified the following three factories who have evinced interest in the establishment of the solid bio-fuel production units (each factory would establish 2 pellet making units):

**Table 1: Tentative solid bio-fuel production units**

S. No.	Factory name	Location	Waste generation inside the factory	Annual waste availability near the factory
1.	Burapha agro forestry <sup>27</sup>	Vientiane Capital	Sawdust, bark and other waste: around 5 tons/day Shaving dust from planning operations: around 5 tons/day Waste wood: around 4 tons/day.	Thinning waste of around 3,400 ton in the next 3 years from 200 hectare area in the vicinity of the mill
2.	Veunkham salt factory	Vientiane Capital	NA	From Vientiane capital and neighboring Bolikhamxay province: <ul style="list-style-type: none"><li>- 118,150 tons of wood waste from saw mills</li><li>- 59,100 tons of wood waste from furniture factories</li></ul> Chip wood wastes from nearby plantation sites to the factory
3.	Boten salt factory	Luang Namtha	NA	4,320 tons and 27,600 tons of corn cobs from Luang Namtha and Oudomxay province respectively.

The proposed solid bio-fuel production projects will be screened using the “Biofuels Screening Toolkit”, prepared under UNEP, UNIDO, FAO / GEF global project “Establishing Sustainable Liquid Biofuels Production Worldwide (A Targeted Research Project)”, to identify potentially critical issues. The evaluations will be done for 3 sustainability indicators namely: a) environmental, b) economic and c)

<sup>26</sup> Depending upon the solid bio-fuel requirement individual units may operate for a lower or higher duration on a daily basis

<sup>27</sup> Estimated based on the data collected from the factory

social.

To prevent illegal logging, it is important to ensure that this project will not impact on illegal deforestation. Hence a research study will be initiated on various schemes to minimize deforestation to make sure that wood waste will only come from certified forestry sources.

These production units will make solid bio-fuel based on the fuel replacement requirement of the solid bio-fuel users as mentioned in table 2. If additional SME solid bio-fuel users are identified, solid bio-fuel production will be modified to suit this additional requirement.

The anthracite consumption in these factories is summarized in the table 2.

**Table 2: Anthracite consumption in selected salt factories**

S. No.	Factory name	Location	Industrial salt (tons/year)	Table salt (tons/year)	Consumption (tons/year)
1.	Boten Salt Factory	Luang Namtha	NA	1,600	1,600
2.	Oudomxay Salt Factory	Oudomxay	NA	10,000	3,000
3.	Veunkham Salt Factory	Vientiane Capital	1,000	4,000	3,000
				<b>Total</b>	<b>7,600</b>

From the above table it is clear that the total anthracite consumption in these salt industries is 7,600 tons per year, which would be completely replaced by solid bio-fuel through this project. Boten and Veunkham salt factories will be involved both in production and use of solid bio-fuel.

The project will provide technical assistance to adjust brine water-boiler pot so that the pot will be fired by biomass pellets effectively and efficiently. The pilot factories will also serve as a training venue to increase awareness about biomass pellets production and use, as one of RE technologies for industrial heating.

At present the salt industries are taking anthracite cakes from far off distance from Viengphoukha coal plant in Luang Namtha province. As a result of the proposed project, the fuel transportation distance of Boten and Veunkham salt factories will be drastically reduced as shown in table 3. On the other hand, the fuel transportation distance for Oudomxay salt factory will be increased. However, the additional emission due to increased transportation is overcome by the replacement of anthracite by solid bio-fuel. (for further details on this, please refer to “Global environmental benefits” below). Appropriate measures (such as identification of new users, identification of new producers, rearrangement of logistics, etc.) would be taken during PPG stage to avoid long distance in solid bio-fuel transportation.

The project will provide technical assistance to adjust brine water-boiler pot so that the pot will be fired by solid bio-fuel effectively and efficiently. These installations will be used for training purpose and to increase awareness about solid bio-fuel usage for industrial thermal energy needs.

Prior to the establishment of the production and usage plants, the following information would be established through detailed feasibility studies/design reports, both for the production and usage plants:

- Detailed baseline assessment;
- Actual installed capacity;

- Financial analysis and sensitivity analysis;
- Global environmental benefits;
- Potential for replication.

**Table 3: Reduction in transportation of fuel for salt factories**

S. No.	Factory name	Location	Distance from Viengphoukha coal plant (km)	Distance from solid bio-fuel plant (km) once implemented
1.	Boten Salt Factory	Luang Namtha	125	0
2.	Oudomxay Salt Factory	Oudomxay	150	680
3.	Veunkham Salt Factory	Vientiane Capital	150	0

Technical assistance will be provided for detailed technical plant design of the demonstration projects, tender document preparation, tendering, equipment supplier selection, etc. A portion of GEF grant (USD 200,000 for solid bio-fuel producers and users each) will be used to provide incentive towards equipment purchase within the limits set by the principles of incremental cost.

#### PC 4: Monitoring & Evaluation (M&E)

The project will be subjected to mid-term and final evaluations. The project will be monitored from the beginning and a mid-term evaluation will be conducted, and follow up corrective measures will be carried out. An independent final evaluation will be conducted three months prior to the terminal review meeting. The final evaluation will look at the impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefit goals. The final evaluation will also provide recommendations for follow-up activities.

After completion of the technical component, the project performance monitoring will be conducted to study the technical, financial, environmental and socio-economic aspects of the projects. Full scale project demonstration site visit and seminars will be organized and the project experiences will be disseminated to various interested stake holders in order to increase the replication potential of the project. Various dissemination tools such as leaflets, website, etc., will be used for effective dissemination.

Methodologies/tools will be developed to use the collated information for better planning and decision making. Case studies will be prepared and presented to increase more investments in solid bio-fuel projects, using the trained capacity that is created.

An annual report and periodical newsletter on best practices, information on country level projects and key indicators of progress made under the project will be prepared and distributed to the key stakeholders and agencies.

#### **4) Incremental/Additional cost reasoning:**

At present, the energy requirements in salt industries are met through anthracite cake. The project aims to replace this anthracite usage through solid bio-fuels. GEF funding will be used to meet the incremental cost of solid bio-fuel production and usage. GEF provides a grant of around USD 730,000 only, which is approximately 12.7% of total incremental cost of around USD 5.7 million.

## 5) Global environmental benefits<sup>28</sup>

The direct global environmental benefit is calculated from the use of 28.8 tpd of biomass pellets produced from the project (8,590 tons of solid bio-fuel per year<sup>29</sup>) to replace anthracite usage of 7,600 tons per year equivalent to 127.2 TJ/year<sup>30</sup>. As a result, the direct GHG emission avoided is around 12,509 t CO<sub>2</sub>e per year<sup>31</sup>. However, as a result of the increased fuel transportation distance for Oudomxay salt factory additional emission of 346 t CO<sub>2</sub>e is estimated<sup>32</sup>. (This is calculated only for Oudomxay salt factory. For Boten and Veunkham, even though there is net benefit due to decreased transportation distance, conservatively it is taken as zero). As a result, the net direct GHG emission avoided is around 12,163 t CO<sub>2</sub>e per year<sup>33</sup>. For a lifetime of around 15 years, the total direct emission reduction would be around 182,445 t CO<sub>2</sub>e.

Given the availability of biomass (over 8.4 million tons per year) and the necessity to reduce the GHG emission, as well as the expected market transformation, it is expected that many other industries such as cement<sup>34</sup>, salt and brick<sup>35</sup> would also initiate and develop similar projects.

It is expected that at least 144 tpd capacity plants will be implemented within a time span of a maximum of 10 years after the completion of the project. This will lead to indirect GHG reduction of 60,815 t CO<sub>2</sub>e per year and 912,225 t CO<sub>2</sub>e throughout its lifetime.

The total GEF resources of around 1.3 million will be used to mitigate CO<sub>2</sub> emissions at the rate of around USD 7/t CO<sub>2</sub>e directly and around USD 1.4/t CO<sub>2</sub>e indirectly.

## 6) Innovativeness, Sustainability and Potential for Scaling up

### Innovation

Currently, the private sector investments in South East Asia in solid bio-fuel technologies have been export market oriented. For example in Thailand, which has a greater economy than Lao PDR, local usage of solid bio-fuel has not seen much penetration. General observations from Thailand market are: a) produced solid bio-fuel is costlier for the local market, b) lack of motivation for the local market to shift toward solid bio-fuel usage and c) the existing fossil fuel users to shift to the solid biofuel need to invest in the utilization system.

The innovation is that the proposed GEF project has a holistic approach and targets both the production and local usage of solid bio-fuel in Thai industries. Without this approach, it is difficult to attain a balance between the production and usage of solid biofuel.

The proposed project will boost both the producer and end-user sides and will also enable investment environment and strengthen human and institutional capacities.

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<sup>28</sup> Calculated based on coal replacement only (primary targets of bio-fuel usage)

<sup>29</sup> Calculated based on a calorific value of 3,539 kCal/kg (Average heating value of wood pellet in Thailand, Ministry of Energy 2013)

<sup>30</sup> Calorific value of 4,000 kCal/kg (Information received during UNIDO site visit to the salt factories)

<sup>31</sup> Emission factor of imported coal is 98,300 ton of TJ of anthracite burnt (2006 IPCC Guidelines for National Greenhouse Gas Inventories)

<sup>32</sup> Conservatively assuming that both anthracite and solid bio-fuel have same density. Diesel emission factor for transportation (using diesel truck) is taken as 870 g of CO<sub>2</sub>/km from GHG protocol mobile guide <http://www.ghgprotocol.org/files/ghgp/tools/co2-mobile.pdf>

<sup>33</sup> Emission factor of anthracite is 98,300 kg of CO<sub>2</sub> per ton of TJ burnt

<sup>34</sup> In 2012, the Ministry of Energy and Mines (MEM) reported that the cement industry was the largest consumer of anthracite which was nearly 300,000 tons per year

<sup>35</sup> 209 brick industries in Lao PDR producing over 50 million bricks every year consuming around 69.9 ktce ([http://www.laocpc.org/index.php/publication-3/doc\\_download/1-annual-report-lcpc-2011](http://www.laocpc.org/index.php/publication-3/doc_download/1-annual-report-lcpc-2011))

## Sustainability

I&LU will sustain the promotional and development activities within the sector. Capacities of DoIH, REMI and others will be built throughout the duration of the project implementation. Thereafter, they will embrace the technical knowledge on solid biofuels, in both production and usage. They will continue to provide technical guidance to wider group manufacturers and enterprises, in particular, to those manufacturers who are clients of the Green Industry Initiative. By this way, the sustainability of the methodologies, introduced by the project, would be realized and the dissemination of the project's results to a wider range of users fulfilled.

Each demonstration project will be operated and maintained by the private investor through their own operation and maintenance (O&M) staff. Local engineering and O&M companies will be trained in O&M of solid bio-fuel plants through I&LP. Also, the O&M staff of the demonstration projects will be trained by the respective suppliers.

Through such arrangements, the demonstration projects will continue to operate sustainably after the project implementation is over.

## Scaling up

Solid bio-fuel usage will be scaled up, as a result of the following:

- Successful implementation and operation of the demonstration projects: *This will lead to gain in confidence among private investors (solid bio-fuel production) and industries (solid bio-fuel producers).*
- Facilitation of solid bio fuel end-user incentive scheme: *This would promote the use of solid bio-fuel usage substituting coal products.*
- Establishment of solid bio-fuel depots: *This will result in one stop centre for sale and purchase of solid bio-fuels. This convenient option will give thrust to the private investors for adopting solid bio-fuel (both production and usage).*

The project mitigates various barriers which currently prevents the scaling up of solid bio-fuel usage. Barriers and mitigation has been described above .

## **A.2. Stakeholders**

DoIH is the main executing agency and will take the leading role as the project steering committee chair. It will also be responsible for coordinating with the industries, supporting industrial application of solid bio-fuel, providing necessary technical support for solid bio-fuel end users in co-firing and conducting necessary awareness raising seminars.

REMI will work closely with international technical experts to be hired for the project. REMI team will receive knowledge transfers from the experts and will become trainers on solid bio-fuel production, standardization and usage. Along with UNIDO, DoIH, REMI will be responsible for establishment of pellet manufacturing units. It will also provide support to the project execution. It will also co-chair the project steering committee.

The private sector will work with the project to receive technical supports to produce and utilize the biomass pellets, which will replace fossil fuel. Other RE/technical institutions, financing institutions will be recipients of training on solid bio-fuel production and usage. This would encourage them to support development of solid bio-fuel projects.

Eligible women candidates will be involved as trainers and technical consultants. Terms of reference will be prepared to encourage qualified women applicants and experts, to mainstream the gender relation in the proposed project. Moreover, women will also be encouraged to participate as trainees in various capacity building sessions.

### A.3 Risk

Component	Risk	Proposed Mitigation Measure	Risk Level
Technical Risk	Solid bio-fuel production and utilization technology is not common in Lao PDR and may not yield the desired results.	Solid bio-fuel production and utilization is a well-known technology in many countries. Demonstration projects will be chosen only after a careful feasibility study to ensure technical and financial viability. Under the project, necessary trainings will be provided for various stakeholders (policy makers, potential investors, technical institutions, O&M companies). This capacity building will help mitigate the risk perceived.	Low
Political risk	Inadequate policy support for small scale biomass gasification projects	The project would engage 50 policy makers and would provide tailored training. This would create awareness on the policy supports required for the promotion of solid bio-fuel technology. This would enable the policy maker to support and create favourable policy and regulatory environment.  Also, the project would facilitate the establishment of solid bio-fuel incentive scheme.	Low
Financial Risk	Financial/credit constraints prevent investors from investing in the project.	UNIDO and other executing partners will mobilize investors and enterprises to invest in the demonstration projects.  The end-user incentive will encourage the investors in developing the solid bio-fuel utilizing units.	Moderate
Sustainability Risk	Failure to achieve the expected project outcome.	The installations will be done only after conducting a proper sustainable biomass resource assessment study in order to ensure supply of wastes from industries.  Local engineering and O&M companies will be trained in O&M of solid bio-fuel plants. Also, the O&M staff of the demonstration projects will be trained by the respective suppliers.  By making investors, suppliers and end users fully aware of the potential for solid bio-fuels and equipping them with the capacity and tools to realize and reap the benefits of such potential, the project will produce a supportive environment that will lead to achieving the expected project outcome.	Moderate
Implementation risk	Implementation failure	UNIDO has significant experience in developing and implementing biomass projects and it has a good knowledge of the key variables that determine the success and the failure of project implementation.	Low

Climate Change Risk	Flood at the project sites caused by climate change	The demonstration plant buildings and site offices will be located on an elevated area to prevent flooding. All buildings and structures will be designed and built appropriately to avoid destruction by floods.	Low
	Increased deforestation to generate raw material for solid bio-fuel generation	Wood waste for solid bio-fuel production will be procured from certified sources only.	Low
	Decreased availability of biomass availability due to climate change	<p>As mentioned in above section, biomass is available in excess.</p> <p>Through various programs, Lao PDR's is currently practicing climate change resilient agriculture. Climate change has been integrated in Lao PDR's agricultural policy. Also Agriculture Development Strategy for 2020, one of its long term development goals has been gradual introduced and has increased application of modernized lowland marketed- oriented agricultural production.</p> <p>As a result of these, it is expected that the impact of climate change on biomass availability is negligible.</p>	Low

#### A.4. Coordination

The proposed project will supplement the efforts of GEF and other national projects to achieve the global GHG emission reduction. The proposed project will facilitate the wide adoption of the clean energy in the industries to help in reducing GHG emissions in the country as part of a large country effort in mitigating the anticipated climate change impacts.

##### GEF initiatives

There are no on-going initiatives aimed at reducing the GHG emission in industrial sector. However, the proposed project will coordinate with the following projects (2 under implementation and 1 closed) and synergies will be sought with these.

- 1) *Off-grid Electrification Pilot Demonstration, A Component of the Lao PDR Southern Provinces Rural Electrification, SPRE I (IBRD, completed project)* whose objective was to increase electricity access in remote and rural areas of Lao PDR through RE technologies (micro-hydro and solar PV).
- 2) *Southern Provinces Rural Electrification II Program (IBRD, under implementation)*: Expansion of SPRE I project central and southern provinces of Lao PDR through solar, hydro, distributed engine-generator sets and other mini-grid technologies.
- 3) *Rural Electrification Phase II (IBRD, under implementation)*: This project aimed at: a) substantial adoption of RE energy in Government's rural electrification program and b) increased efficiency in electricity supply.

##### Other national initiatives

UNIDO is implementing another institutional project "Cleaner Production Center-Lao PDR" with funding from SWISS SECO and in co-operation with DoIH. Cleaner Production Centre-Lao PDR (CPC-L) has been initiating a large range of cleaner production and energy efficiency activities addressing sustainable development. CPC-L has been focusing on: a) increased production efficiency through optimization of the



productive use of natural resources, b) environmental management through minimization of the impact on environment and nature and c) minimization of risks to people and communities because of industries. The proposed project will be in synergy with “Cleaner Production Center-Lao PDR” project. In-depth consultation will be carried out during the PPG phase to identify possible collaborative activities with this centre.

The proposed project will seek close coordination with all above initiatives and other concerned stakeholders to ensure that relevant lessons and experiences are incorporated into the project. More in-depth consultation will be carried out during the PPG phase to identify possible collaborative activities.

## **B. Description of the consistency of the project with:**

### **B.1 National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. NAPAs, NAPs, NBSAPs, national communications, TNAs, NCSAs, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.:**

*Initial National Communication to UNFCCC, October 2000:* The major mitigation possibilities in the energy sector include: a) introduction of advanced technologies that are more efficient or based on RE sources, b) promotion of the use of RE, c) conservation of energy and energy efficiency through up gradation of currently employed technologies and d) expansion of public transportation service.

*Technology needs assessment, April 2004:* This identified the following mitigating measures: a) extend the utilization of the advanced technologies, b) enhance energy conservation and the utilization of higher efficient technology, c) utilize locally existing potentials, d) use small hydro power at places with abundant water resources and e) create the social awareness on efficient energy consumption.

*National Capacity Needs Self-Assessment (NCSA), April 2009:* Some of the key cross-cutting capacity strengthening needs to be identified through the NCSA process which are as follows: a) Technical assistance to develop national strategies for climate change and to combat land degradation and drought; b) Strengthen national information systems; c) Provide programme and technical support to provincial and district level line agencies; and d) A wide variety of domestic and international trainings and scholarships in technical fields related.

The proposed project is in alignment with NCSA. Project component 1 addresses the capacity constraint identified at the national and institutional level through the establishment of an information and learning unit for solid bio fuel production and usage.

*Renewable Energy Development Strategy, October 2011:* Through this strategy, Lao PDR aims to increase the share of RE to 30% of the total energy consumption in 2025.

*Second National Communication to UNFCCC, June 2013:* The major mitigation possibilities in the energy sector include: a) achieving electrification target of 90% by 2020, and accelerating the development of RE from solar, wind, biogas and hydro energy, b) using the coal-bed methane and coalmine methane, c) improving energy efficiency in industries and buildings and d) creating public awareness on energy saving.

*Proposed Green Industry Plan:* Lao PDR is one among the 21 Asian countries to agree on the Manila Declaration on Green Industry in Asia on 9<sup>th</sup> September 2009. Currently, MoIC is developing a new manufacturing law and the concept of green industry will be included in the law. The Green Industry focus area consists of: a) efficient use of materials, energy and water, b) prevention of emissions and wastes, c) safe and responsible management of chemicals, d) reduce, reuse and recycle (3R) industries, e) industrial pollution control and f) Corporate social responsibility (CSR).

The proposed project will support the above government policies and strategies targeted to increase the usage of RE in industrial sector.

## **B.2. GEF focal area and/or fund(s) strategies, eligibility criteria and priorities:**

The proposed project activities promote the use of solid biofuel for energy generation replacing coal usage. This area was selected due to its rapid scaling up and greenhouse gas (GHG) emission reduction potential. This is in line with *GEF-5 climate change focal area strategic programme CCM-3: Promoting the investment in RE technologies*.

## **B.3 The GEF Agency's comparative advantage for implementing this project:**

The project is a technical assistance/capacity development intervention that fits in the climate change focal area objective CCM-3. The GEF Council paper "Comparative Advantages of the GEF Agencies" (GEF/C.31/5rev.1)<sup>36</sup> recognizes the comparative advantage of UNIDO in these objectives.

Lao PDR is one of the countries implementing activities jointly with other UN agencies for the period between 2012 and 2015 for the programme known as United Nations Development Assistance Framework (UNDAF). Under UNDAF, the proposed project is reflected in outcome 8: *By 2015, the government and communities better adapt to and mitigate climate change and reduce natural disaster vulnerabilities in priority sectors*. UNDAF will better prepare the communities for disasters and climate change with regard to livestock, fisheries and agricultural production, and support the Government in their efforts with regard to agro-forestry. In doing so, the outcome will contribute directly to support the 7<sup>th</sup> National Socio-Economic Development Plan's (NSEDPP) targets on Environment.

More specifically, UNIDO has been providing technical assistance to Lao PDR for more than 20 years. The main objective of UNIDO's cooperation with Lao PDR is to promote sustainable industrial development as a way to alleviate poverty. UNIDO interventions in Lao PDR focus on four components: (i) industrial governance and enabling environment, (ii) private sector development and small medium enterprise development, (iii) manufacturing productivity and environmental soundness, and (iv) investment, promotion and trade capacity building.

During the last decade, UNIDO regional office in Thailand has implemented more than 30 projects in Lao PDR. UNIDO has also established its country presence through a desk office headed by the Head of UNIDO Operations in Vientiane, Lao PDR. This project will benefit from some of the administration structures established for the UNIDO projects. UNIDO will tap expertise and resources on Cleaner Production Centre- Lao PDR.

The above explanations clearly show that the project fits well within the GEF agency's programs. UNIDO has enough staff capacity to follow up the project implementation.

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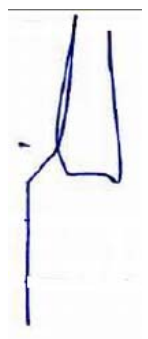
<sup>36</sup> <http://www.thegef.org/gef/sites/thegef.org/files/documents/C.31.5%20Comparative%20advantages.pdf>

**PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)**

- A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S):** (Please attach the [Operational Focal Point endorsement letter\(s\)](#) with this template. For SGP, use this [OFP endorsement letter](#)).

NAME	POSITION	MINISTRY	DATE (MM/dd/yyyy)
Mr. Khampadith Khammounheuang	Director General	Department of Environment Quality Promotion, Ministry of Natural resources and Environment, Lao PDR	12/03/2013

**B. GEF AGENCY(IES) CERTIFICATION**

<b>This request has been prepared in accordance with GEF/LDCF/SCCF/NPIF policies and procedures and meets the GEF/LDCF/SCCF/NPIF criteria for project identification and preparation.</b>					
Agency Coordinator, Agency name	Signature	DATE (MM/dd/yyyy)	Project Contact Person	Telephone	Email
Mr. Philippe Scholtès, Officer-in-Charge, PTC, UNIDO GEF Focal Point		03/22/2014	Mr. Jossy Thomas, Project Manager, PTC/ECC/RRE	+43 -1- 26026-3727	<a href="mailto:j.thomas@unido.org">j.thomas@unido.org</a> 