CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Adavikanda, Kuruwita Division Mini Hydro Power Project
Version : 3
Date : 30.03.2010

A.2. Description of the small-scale project activity:

Alternate Power Systems (Pvt.) Ltd. is constructing a run-of-river 6.5 MW mini hydro power plant in Sri Lanka. The project activity involves generation of electricity from a small-scale hydropower plant and supply of power generated to the Sri Lankan national utility grid which is Ceylon Electricity Board. The proposed project is expected to generate electricity of 19.93 GWh /year at a PLF of 35%[1]. As 50.6%[2] of the country's power requirement came from Thermal Energy in 2006, operation of this small hydropower plant will result in a displacement of electricity from thermal power stations.

The proposed project is run of the river type; hence minimal storage is required at the weir. The weir will be 25 meters long with a maximum height of 2.0 meters and will be designed as a concrete gravity structure with dowels provided for added safety against sliding. The Full Supply Level (FSL) of the pond will be at 370 m. MSL. The intake will be a closed reinforced concrete conduit with a flow area with a width of 3.6 meters and a height of 1.5 meters, and will slightly project in to the pond through the weir. There will be trash bars spaced at 75 mm to prevent twigs etc. entering the channel and provision for a stop-log gate. Intake will be designed for a maximum flow of 6.0 cubic meters per second.

Applying the simplified methodologies specified for small-scale projects, this small hydropower project will result in an average annual emissions reduction of 13,483 tCO2/ year.

Contribution to Sustainable Development

The Project activity will contribute to the sustainable development of Sri Lanka in the following ways:

Economic dimension

The project activity contributes to sustainable development by generating economic growth in the region; conserving natural resources by substituting fossil fuels used power generation facilities. This can help Sri Lanka to reduce its overall fossil fuel consumption, thus improving energy security.

For the construction, the Project employs only local residents for the semi-skilled and un-skilled jobs and maximum extent possible for the skilled jobs. This will boost the local economy and overall income of local people.

Environmental dimension

[1] Hydrology Study by M/s Ovara Consultants (Engineering consultant)

[2] Net Electricity Generation data received from Ceylon Electricity Board (CEB)

The renewable electricity generated by the project will displace electricity produced by fossil fuel power plants on the grid. By displacing the electricity generated with fossil fuel in the local grid, the Project activity will also reduce GHG emissions. The project activity will reduce greenhouse gas emissions in Sri Lanka compared to a business-as-usual scenario.

Further, the electricity produced by the project will displace electricity produced by fossil fuel power plants on the grid, leading to lower overall emissions of SO_x and NO_x from the grid as a whole.

Social dimension

The project activity will also have other social benefits, as it will boost employment opportunities and as also increase income of local people. The Company encourages local residents to upgrade their skills by attending vocational training courses and assist them to pursue such skill advancing initiatives.

At the request of the local stakeholders the Company constructed a bridge and a proper access road over the River Kuru Ganga connecting the two villages called Advikanda and Paladeniya. In the past, the residents were using a small foot bridge which connects the two villages. The proposed bridge and the connecting road system will be a huge benefit to residents of two villages. With the completion of the proposed bridge, the Lorries can travel to the Paladeniya village and the local farmers now need not waste their time carrying goods over their heads and shoulders.

In addition, the general public at large including the local residents and communities where the project is implemented will be indirectly benefited by greater availability of clean electricity in the national grid which would otherwise being met through grid connected fossil fuel based power plants.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Sri Lanka (host)	**Alternate Power Systems (Pvt.) Ltd. (Private Entity)**	**No**
Japan	**Mitsubishi UFJ Securities Co., Ltd (Private Entity)**	**No**

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

Project site is located along the river Kuru Ganga. This site can be accessed by proceeding approximately 15 km from Kuruwita along the trail road to Sri Pada through Kuruwita Division of District Ratnapura in Srilanka.

A.4.1.1. Host Party(ies):

Sri Lanka

A.4.1.2. Region/State/Province etc.:

Ratnapura District

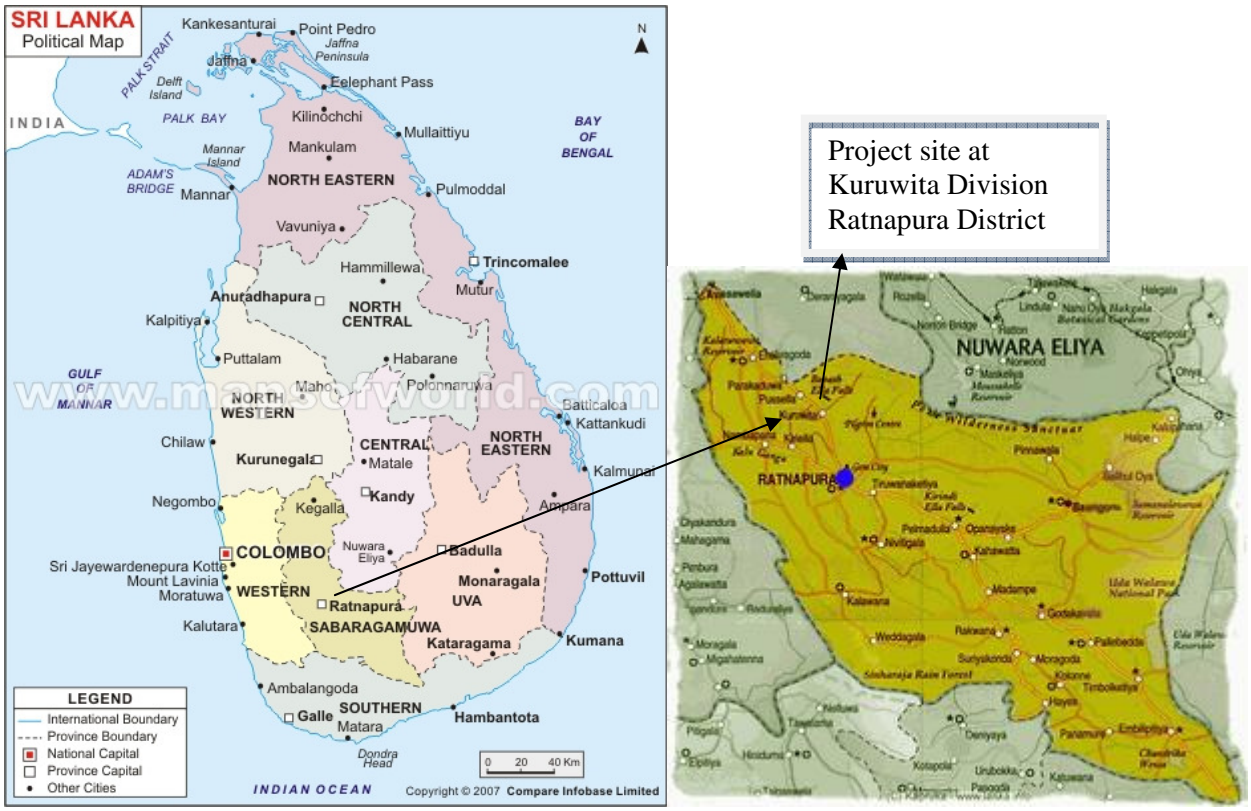
A.4.1.3. City/Town/Community etc:

Kuruwita Division

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The project area is located in the Kuruwita Division of the Ratnapura District, in Adavikanda and is in close proximity to the Adams Peak Pilgrims road through Erathna. The power house will be located about 300 meters upstream of the Erathna town. The weir site is situated close to the pilgrims trail from Erathna to Sri Pada in the village of Warnagala. The road access to the project area from Colombo is via Kuruwita (87 km. from Colombo on Route A4), to Erathna (12.2 km) and to Adavikanda (2.5 km). The Coordinates of the weir are: 6 49' 56" N, 80 25' 27" E[3]. A detailed survey map of the Ratnapura District is attached as Appendix 1 in the PDD.

[3] GPS Survey report of Geological Survey & Mines Bureau



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

Main Category:	Type I - Renewable Energy Projects
Sub Category:	D - Grid connected renewable electricity generation
Version:	13
Technology:	Run-of-river hydropower technology

The project is constructed along the River Kuru Ganga. Since the project is run of river type, minimal storage of water is required at the weir. A small weir of 25 meters length with a maximum height of 2 meter has been constructed across the river to divert water to an Intake. The weir is a concrete gravity structure with dowels for added safety against sliding. Water is taken through an Intake conduit of 10 meters x 3.6 m x 1.5 m. The Intake is a closed reinforced concrete conduit with a flow area of 3.6 meters wide and 1.5 meter high. The Intake leads to the Head race channel of 280 meters. The initial 10 meters of the channel from the Intake is a closed conduit. From the headrace channel, water is led to a Forebay. A silt settling tank is provided to settle any silt and sand. The water from the Forebay is taken through a Penstock for a distance of 2250 meters across very difficult terrain. Water flows at a total head of 153 meters through the penstock to three Francis type turbines in the Power house. Francis type is selected due to the flow available in the project. Each turbine is connected to a Synchronous Generator. The electricity is generated at 690 V, which is stepped up to 33 KV through 3 nos. 3 MVA Transformers. The stepped up electricity is connected to the grid of electric utility grid, Ceylon Electric Board (CEB). The exported energy is transmitted through a 33 KV line for a distance of 25 km to the Ratnapura Grid Sub-Station.

The electricity required for auxiliary consumption of the project activity will be consumed by the stepping down part of the generated electricity through a 100 KVA transformer. Regardless of the amount of the auxiliary consumption the electricity meter installed by the CEB records the net energy exported to the CEB grid. During the non operational time the auxiliary consumption is met by the supply from the CEB grid and such import is also recorded in the CEB meter installed at the meter hut. So, the auxiliary consumption of the plant is also met through CEB supply for which CEB used to raise a separate bill every month.

The net electricity generated by the project activity will be exported to the CEB grid. A standby diesel generator (DG) of 40 KVA is provided to supply electricity for lighting and other domestic uses of the project activity when both the sources of electricity supply namely, electricity from the project activity and the CEB grid are not available. The standby generator would be used very rarely because non availability of electricity from both the sources – from the project activity and the grid – would be a rare occurrence.

Application of environmentally sound and safe technology

The run of the river hydro power technology is the production of power through use of the gravitational force of falling or flowing water. Since the project is run of the river type, minimal storage of water is required at the weir. The water leaves the generating station and is returned to the river without altering the existing flow or water levels. The electricity is generated at 690 V, which is stepped up to 33 KV through 3 nos. 3 MVA Transformers to match the frequency with the local grid. The generated power is then transmitted through a 33 KV line to the Ratnapura Grid Sub-station.

In this mini hydro power project, flooding the upper part of the river is not required as it doesn't need a large reservoir. As a result, people living at or near the river don't need to be relocated and natural habitats are preserved. Once a hydro power plant is constructed, the project produces no direct waste. In the hydro power generation process there would be no greenhouse gas emissions and it does not involve burning of fossil fuels during the process. Thus, electricity would be generated through sustainable means without causing any negative impact on the environment. Hence, the technology adopted for the project activity is environmentally safe and sound technology.

Technical Specifications:

Hydrology

Catchments Area at Intake Site	:	19.5 km2
Catchments rainfall	:	4900 mm
Design Discharge	:	6m^3/sec (3x2.0 m^3/sec)
Design Flood Discharge	:	170 m^3/sec (once in 100 years)

Waterways

Total Length	:	300m
Structures	:	Channel – Boxed

Intake – (near outfall of Erathna Project)

Type of Intake	:	Side Intake
Size of Intake Opening	:	3.6 m wide and …1.5 m high with Open channel, supported on columns

Type	:	Rectangular – Box
Length	:	310 m
Size	:	3.1 m wide and 1.5 high, internally

Forebay / Sedimentation Tank

Capacity of Forebay	:	1000 m^3
Length excluding transition	:	18 m
Width	:	6 m
Depth	:	3.8 m

Penstock

Material	:	Steel Penstock
Length of Main Pipe	:	2100 m
Size of main pipe (dia/thickness):		1.65m @ 10 mm 1.55m @ 12 mm 1.45m @ 12 mm 1.35m @ 14 mm 1.25m @ 14mm 0.9m @ 14 mm
Length of Branched triple Pipes :		149 m
Size of triple pipes (dia. thickness):		0.9 @ 14 mm
Design Discharge	:	6 m^3/sec
Design Net Head	:	141m

Turbine:

Manufacturer	: Gilbert Gilkes & Gordon Ltd.
Country of Origin	: United Kingdom
Model	: 550G150
No. of Units	: 3(Three)
Mean Diameter of Runner	: 550 mm
Rated Speed	: 1000 RPM
Over speed	: 1960 rpm
Inlet Pipe Nominal Diameter	: 800 mm
Shaft Attitude	: Horizontal
Altitude	: 302 m.a.s.l.
Turbine Power Output	: 2418 KW

Generator:

Item	: 1
No. of Units	: 3
Input Power	: 2418 KW
Type	: NIR6375A-6
Apparent Output	: 2920 KVA

Maximum Power Output	: 2336 KW
Power Factor	: 0.8
Tension	: 660 V
Frequency	: 50 Hz
Speed	: 1000 rpm
Runaway speed	: 1960 rpm
Runaway Speed Period	: 60 min every 24 hours
Protection	: IP-23
Service	: S1

As per the feasibility study the proposed maximum power output of each generator of the three generator configuration should be 2166 KW. However when the project proponent (PP) approached the equipment supplier, the supplier offered a slightly higher power output of 2336 KW generator which could be made available within the shortest possible time. Due to the expected delay in the implementation and cost escalation (if PP will ask for a set of generators with a maximum output of 2166 KW each to be designed especially for the Project) the PP agreed to purchase the slightly higher capacity generators for the Project. However, from the standpoint of the design of the civil structure, the hydrological data, and the power purchase agreement, the project will remain to all practical purposes a hydro power project of maximum installed capacity of 6.5 MW. Most importantly the Project is capable producing maximum of 6.5 MW regardless of the generator capacity due to the civil design that could accept maximum of 6.0 cubic meters of water flow per second. The Ceylon Electricity Board will also not accept the Project if it can produce energy at more than 6.5 MW of capacity. It shall be the responsibility of the equipment supplier to prove the maximum capacity of the Plant is 6.5 MW at the time of handing over the plant after commissioning.

Technology Transfer

In the course of building and operation of this power plant, Host Country personnel will become knowledgeable about both the design and operation of such plant, which is in effect a technology transfer to the Host Country because the equipment supplier for the proposed plant is not from the Host Country.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Renewable crediting period is chosen for the project activity. The crediting period will start from 1st May 2010 or the date of registration whichever is later (for the successive 365 days), for the Year 1.

Year	Annual estimation of emission reduction in tonnes of CO_2 e
Year 1	13,483
Year 2	13,483
Year 3	13,483
Year 4	13,483
Year 5	13,483
Year 6	13,483

Year 7	13,483
Total estimated reductions expected in 7 years (tonnes of CO2 e)	**94,381**
Total number of crediting years	7
Annual average over the first crediting period of estimated reductions (tonnes of CO2 e)	13,483

A.4.4. Public funding of the small-scale project activity:

The Project has not received any public funding.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to "Compendium of guidance on the debundling for SSC project activities (Annex 27, EB36)", a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

(a) With the same project participants;
(b) In the same project category and technology/measure; and
(c) Registered within the previous 2 years; and
(d) Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

There is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity by the same project participants. The project participants are not engaged in any way in any other small scale CDM project activities in small hydro power or by using other technologies within the project boundary. Therefore, the Project activity is not a debundled component of a large scale project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

Type I, Category D, "Grid Connected Renewable Energy Generation" (AMS I. D.), Version 13

To calculate the combined margin emission factor "Tool to calculate the emission factor for an electricity system (Version 01.1)" is referred.

B.2 Justification of the choice of the project category:

The applicability criteria of AMS I.D and the justification of the choice of this project category for the Project activity are as follows:

1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an

electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.

- This category comprises of renewable energy generation units including hydro, that supply electricity to an electricity distribution system that would have been supplied by at least one fossil fuel fired generating unit.

2. If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.
   - This project has a total installed capacity of 6.5 MW, which is significantly less than the maximum eligibility limit of 15MW for a small-scale CDM project activity

3. Combined heat and power (co-generation) systems are not eligible under this category.
   - The Project activity is only renewable electricity generation and does not include co-generation.

4. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.
   - The Project activity does not involve the addition of renewable energy generation units at an existing renewable power generation facility.

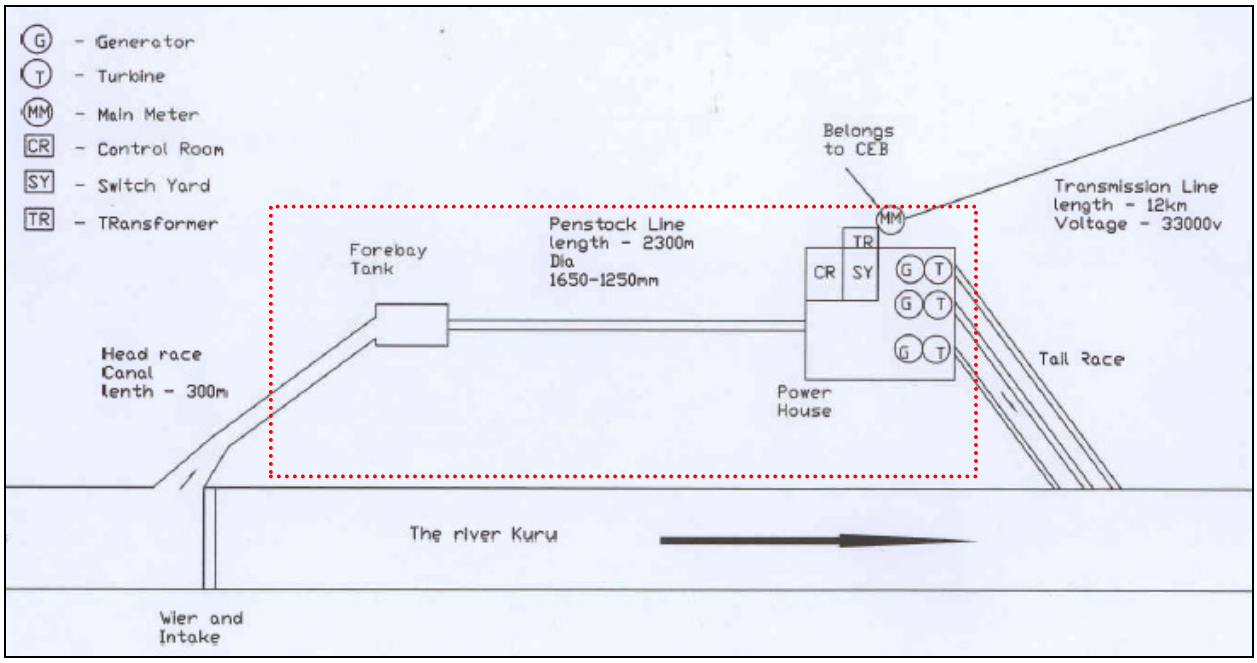
5. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.
   - The Project activity does not seek to retrofit or modify an existing facility for renewable energy generation.

Therefore it is evident that the project activity meets all the applicability condition of the approved small scale methodology AMS I.D/ Version 13.

B.3. Description of the project boundary:

In accordance with Appendix B, Category I.D paragraph 6, the project boundary "encompasses the physical, geographical site of the renewable generation source."

The project boundary of the project activity will consist of diversion structure, penstock, powerhouse**,** DG Set, tail race channel and the transmission system till switch yard. The project activity is connected to the Ceylon electricity grid. The figure below shows the project boundary with location of major installations of the project activity -



---- **Project Boundary**

B.4. Description of baseline and its development:

The proposed project activity qualifies to use the simplified methodology for small scale projects total capacity of the project is 6.5 MW which is less than the 15 MW (upper limit) as per the CDM guideline for a small scale project and this position will remain unchanged during the crediting period.

As per the guidance provided in AMS I.D. Version 13 (point 9) for this project "the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2e/kWh) calculated in a transparent and conservative manner" as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system(Version 01.1)'.

OR

(b) The weighted average emissions (in kg CO2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Here we used the method (a) for baseline determination. Since the project will sell entire energy generated to the Ceylon Electricity Board (CEB) grid, the relevant electric power system for the purpose of calculating the CM is the CEB grid.

Calculation of OM emissions factor

As per Annex 12, EB 35 Report **"Tool to calculate the emission factor for an electricity system (Version 01.1)" (now referred as "Grid Tool")** the OM emissions factor can be calculated in one of four ways:

a) Simple OM
b) Simple adjusted OM
c) Dispatch data analysis OM
d) Average OM

The table B.4 below shows data on the generation by the CEB for the latest five years for which data are available (2003 to 2007) by low cost/must run resources (hydro and wind) and total grid generation (the additional plants all being thermal plants).

Table B.4 **(In GWh)**

Generation	2003	2004	2005	2006	2007
Total Power Generation	7,218	7,534	8,769	9,389	9,814
Total Thermal Power Generation	3,904	4,571	5,314	4,750	5,864
Total Low Cost Power Generation	3,314	2,963	3,455	4,638	3,950
Thermal % of Total grid generation	54.09	60.67	60.60	50.60	59.75
Low Cost % of Total grid generation	**45.91**	**39.33**	**39.40**	**49.40**	**40.25**
Average of the five most recent years of % of Low Cost generation out of Total grid generation					**42.86**

Source: Letter issued by Ceylon Electricity Board dated 08.04.2009 and the Long Term Generation Expansion Plan of Ceylon Electricity Board 2006 - 2020

Since the total percentage of low cost/must run generation is less than 50% it is possible to use the Simple OM method to calculated the operating margin, as specified in Grid Tool. Option B is used to calculate the Simple OM. The relevant formula as given in the Grid Tool is

$$EF_{grid,OMsimple,y} = \frac{\sum_{m} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

m = All power units serving the grid in year y except low-cost / must-run power units

y = the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

We used the ex ante approach to calculate the Simple OM, namely, "A 3 year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation" The latest generation statistics available from the CEB at this time was for the calendar year 2007. We have therefore used data for the three years 2005, 2006 and 2007 to calculate the OM.

Calculation of BM emissions factor

As per the Grid Tool all plants (including hydro), other than plants which have been registered as CDM activities, must be considered for calculating the build margin (BM). Equation 12 of the Grid tool for calculating the BM is taken for this project.

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

m = All power units included in Build Margin calculation

y = Most recent historical year for which power generation data is available (2007)

As for the OM the most recent generation information available is for the year 2007. We therefore use this information to calculate the BM. The data sources used in the calculation are also the same as for calculation of the OM.

Calculation of the CM emissions factor

As per equation 13 of the Grid Tool the combined margin (CM) emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

Where:
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

w_{OM} = Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

As per the Grid Tool, a default value of 0.5 for the weighting factors is used to average the OM and the BM emissions factors for the first crediting period.

Calculation of the Baseline

As per the Grid Tool, the baseline (in tCO_2) is the MWh produced by the project multiplied by the Combined Margin expressed in tCO_2/MWh.

Leakage

As specified in paragraph 12 of AMS I.D./Version 13, leakage is to be considered when generating equipment is transferred from another activity or when existing equipment is transferred to another activity. In the Project, neither of these situations applies, and therefore no leakage source needs to be considered for this project. The generating equipment is new, and there is no existing equipment that could be transferred to another activity.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

For grid connected mini hydro project in Sri Lanka, realistic and credible baseline scenarios may include:

1. Supply of the electricity form Grid Connected Fossil fuel based Power plants (current practice)
2. The proposed project not undertaken as a CDM project activity.

Alternative 1: "Supply of the electricity form Grid Connected Fossil fuel based Power plants" does not face any barriers and can be a credible baseline scenario. In the absence of the project activity electricity will be generated in CEB Grid Connected Fossil Fuel based Power Plants.

Alternative 2: "The proposed project activity not undertaken as a CDM project activity" cannot be a baseline scenario as it faces associated barriers as explained further in section B.5

Early consideration of CDM

The current development is the second attempt to implement the project. The first attempt begun in April 2005 by preparation of original feasibility study, but faced delay due to various regulatory clearances in acquisition of land for the project which concluded in October 2007. By this time the original feasibility study was out dated because of various cost escalations. The second attempt begun in November 2007 and a new feasibility study were prepared. The Project cost identified in the new feasibility study was

significantly higher than the original feasibility study. The project developer approached two banks for enhanced debt financing on account of cost escalation of the Project, which was approved at a very high interest rate(Prime Lending Rate plus 3.5%) than the earlier agreed rate of AWDR plus 5%. The banks also advised project developer for seeking CDM status in order to make the project financially feasible[4].

The project developer had conducted a feasibility study to undertake this project in April 2005 which concluded that the project was a viable proposition. Based on this study the project developer started preparation work for the project including seeking project finance from banks and seeking the requisite land from the concerned authorities. This was based on a total project cost of LKR 540 Mn. The project developer could raise two loans from DFCC Bank and Commercial Bank of Ceylon Ltd totaling to LKR 301 Mn at an interest of AWDR plus 5% approved in May/June 2005.

However, due to various regulatory reasons, the project developer had to wait for a long time for acquiring the requisite land for implementing the project which could finally be obtained in October 2007. By the time the project developer was in possession of the land in October 2007 the cost of the project had dramatically escalated due to high rate of inflation and depreciation in the of the local Sri Lankan Rupee (LKR) against hard currencies.

In order to assess the viability of the project, a revised feasibility study was conducted by a third party who estimated the total project cost at LKR 895 Mn which was 65.74 % higher than the original project cost estimations. However, with the escalated project costs, the project became financially un-attractive to the project developer due to much lower project IRR.

Faced with the escalated project cost, the project developer approached two banks for enhanced debt financing on account of cost escalation of the Project. Both the banks agreed in principle to offer additional debt financing amounting to LKR 150 Mn contributed by the two banks equally. However, both DFCC Bank and Commercial Bank agreed to offer the additional debt of LKR 150 Mn at the rate of PLR plus 3.5%. In addition, both the banks demanded that the project sponsor increase its equity contribution and meet any further cost escalation by additional equity contribution. The two banks also stipulated the project developer that the Project should obtain the benefits under the Clean Development Mechanism (CDM) project in order to achieve its financial viability[5].

The project proponent sees the revenue from sale of Certified Emission Reductions (CER) generated by the project as a vital means of overcoming the barriers described above. The project proponents adopted a resolution during the Board of Directors Meeting held on 22.11.2007 confirming that the project would have to avail of CDM in order to be implemented. The project activity took more than 4 years for completion due to the envisaged problems in raising the debt financing. As soon as the funds problem was solved and banks sanctioned additional loan in November 2007, the PP immediately started negotiations to hire a consultant for CDM. As soon as the PDD was ready the PP started negotiations for hiring of the DOE from January 2009.

The project activity is expected to be commissioned by July 2009. The following tables show the timeline of the actions taken for the project implementation as well as the CDM registration.

[4] Copy of Loan Approval letters from the two banks dated 20th November 2007.

[5] Copy of Loan Approval letters from the two banks dated 20th November 2007

Timeline for Project Implementation

S.No.	Event	Date	Supporting document
1.	First Feasibility Study for the project	April 2005	Copy of Feasibility Report prepared by OVARA consultant
2.	Bank approval for financing the project	30/5/2005 and 17/6/2005	Copy of Letter from DFCC bank Copy of Letter from Commercial bank of Ceylon Limited
3.	1st Board Resolution to undertake the project without CDM	22/6/2005	Copy of Certified extracts from the minutes of the Board meeting
4.	Land deed execution	28/5/2007	Copies of Land Deeds
5.	Land deed execution (second part)	03/10/2007	Copies of Land Deeds
6.	Bank application for additional financing	04/10/2007	Copy of Company letter to two banks
7.	Second Feasibility Report	November 2007	Copy of Feasibility Report prepared by external consultant
8.	Bank approval for additional finance	20/11/2007	Copy of Loan Approval letters from the two banks
9.	2nd Board Resolution to undertake the project with CDM	22/11/2007	Copy of Certified extracts of the Board resolution
10.	Signing of the first contract for Penstock	21/01/2008	Copy of the contract for Penstock clearing, transportation & painting with M/s APS & Liyanage (Pvt.) Ltd
11.	Letter of confirmation for supply of Turbines, Generators to Gilbert Gilkes & Gordon Ltd.	28/02/2008	Letter of acceptance of offer for Turbines, Generators and Associated Equipment issued by APSL

Timeline for CDM registration

S.No.	Event	Date	Supporting document
1.	2nd Board Resolution to undertake the project with CDM	22/11/2007	Copy of Certified extracts of the Board resolution
2.	Offer from Mitsubishi UFJ Securities for providing Consulting services	12/12/2007	Copy of the offer letter
3.	Signing of CDM consulting agreement with Mitsubishi UFJ Securities for CDM Consulting services	20/3/2008	Copy of the consulting agreement
4.	Submission of PIN to the Sri Lankan DNA	11/09/2008	Copy of the application
5.	In-principle approval from the Sri Lankan DNA	20/09/2008	Copy of the letter received from the Ministry of Environment
6.	Stakeholder consultation meeting	16/12/2008	Copy of minutes of meeting

7.	Offer from DoE for providing Validation Services	13/02/2009	Copy of the proposal from TUV Nord

The project is a small scale project activity. As such, the provisions of Attachment A to Appendix B of the *simplified modalities and procedures for small-scale CDM project activities* will apply to this project. The '*indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories*' require the project proponents to show that the project activity would not have occurred anyway due to *at least one* of the following barriers:

a) **Investment barrier**: A financially more viable alternative to the project activity would have led to higher emissions.
b) **Technological barrier**: A less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.
c) **Barrier due to prevailing practice:** Prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions.
d) **Other barriers**: Without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The project proponent has considered proving the additionality using investment barrier. The same is shown in the following sections:

Investment Barrier:

Low return on investment

According to the latest guidelines given by CDM – Executive Board on "Guidelines on the Assessment of Investment Analysis (Version 03)", Benchmark Analysis has been chosen to demonstrate additionality. The PP has considered weighted average Prime Lending Rate (PLR) in October 2007 the as benchmark for the purpose of comparison with post tax project IRR. The benchmark is available publically on the Central Bank of Sri Lanka website[6]. The Weighted Average PLR in the month of October 2007 was 18.31%.The Benchmark considered is in conformity with the Clause 12 of the "Guidelines on the Assessment of Investment Analysis (Version 03)" which allows Local Commercial Lending Rates as suitable benchmark for Project IRR. The project is a case of refinancing where a portion of the loan was sanctioned at a concessional rate lower then Bank PLR and the balance loan at a higher interest rate then the Bank PLR. The 16.82% is the weighted average interest rate on total loan sanctioned. The explanation is included in the PDD for more clarity.

We have considered the Bank PLR as the benchmark for the project activity, which is in con-formity with the Guidance EB 51, Annex 58 (Para 12-13)

[6] http://www.cbsl.gov.lk/htm/english/_cei/ir/i_4.asp?date=&Mode=2&Page=5

The project costs and PLF directly influence the project Internal Rate of Return. An IRR analysis has been prepared for the project activity to determine the project IRR, its attractiveness and the effect of GHG income using the feasibility report prepared by one external consultant.

S. No.	Particulars	Value	Source
1.	Installed Capacity(MW)	6.5	Feasibility Study/Equipment Supplier Certificate
2.	Annual Electricity generation (GWh/ annum)	19.93	Estimated at 35% PLF as per Hydrology Study
3.	Electricity generated in year 2009-10 (GWh)	15.17	For 9 months generation in 2009-10 (7 month wet and 2 month dry)
4.	Plant Load Factor	35%	As per Hydrology study
5.	Selling price LKR per kWh for 2009-10[7]	7.92	Computed based on Tariff rates announced by CEB from 2003 to 2007 and SPPA
6.	Yearly escalation in selling price	5.33%	Computed based on Tariff rates announced by CEB from 2003 to 2007
7.	Operations & Maintenance costs for 2009-10 (LKR Mn)	19.90	Computed as shown in the IRR calculation sheet
8.	Yearly escalation in O&M cost	6.63%	Computed based on the Tariff Explanatory Note of 2009 (Point 6.7)[8]
9.	Total Project Cost (LKR Mn)	895.0	Estimated as per BOQ estimates and Offers from various vendors
10.	Total Loan Amount (LKR Mn)	451.0	Bank Loan approval Letters
11.	Total Equity Amount (LKR Mn)	444.0	Computed (Total Capital Cost less Total Debt amount)
12.	Average rate of Interest on Loan	16.82%	Computed (Interest calculation sheet)
13.	Loan Repayment Period (years)	6	Bank Loan approval

[7] The tariff considered from the 16th year till 21st year is based on the third tier of the tariff in force on the date of the signing of the new SPPA. This is described in the Point 12 of the explanatory note available on Sri Lankan Government website (http://www.energy.gov.lk/pdf/explanatory_note_april_2009.pdf)

[8] http://www.energy.gov.lk/pdf/explanatory_note_april_2009.pdf . A separate excel sheet is provided to the DoE for computation of the O&M escalation rate as per the recommended procedure by the local government.

			Letters
14.	Annual land Lease (LKR Mn)	0.11	Lease payment receipts
15.	Water levy (LKR per Horse Power per annum)	25	Letter from Land Commissioner General's Department
16.	Economic Service Charges (% of Revenue)	0.25%	Economic Service Charge Act, No. 13 of 2006 (Sri Lanka)
17.	Depreciation per year (LKR Mn)	82.06	Calculated as per The Inland Revenue Act of 2006
18.	Residual value of assets at the end of 2029-30(LKR Mn)	87.30	10% of the Asset value assumed for calculation
19.	Taxation for the first 5 years	nil	Agreement with Board of Investment of Sri Lanka
20.	Taxation for 6th & 7th year	10%	Agreement with Board of Investment of Sri Lanka
21.	Taxation for rest of the period	20%	Agreement with Board of Investment of Sri Lanka
22.	Social Responsibility Levy (% of Income Tax)	1.50%	Finance Act, No.5 of 2005 (Sri Lanka)

The IRR works out to 16.13% in the baseline case which is significantly less than the benchmark of 18.31%.

Sensitivity analysis

The robustness of the conclusion drawn above has been tested with reasonable variations in the critical assumptions. Annex 58 "Guidelines on the Assessment of Investment Analysis" issued by the EB in its 51st Meeting covers two aspects on sensitivity analysis, viz., subjecting only those variables which constitute more than 20% of either total project cost or total project revenue to sensitivity analysis and considering a ± 10% variations in the selected variables. Accordingly, two sets of scenarios have been identified, viz., variation in project cost and variation in revenue by 10% on either side. In addition, a sensitivity analysis has also been conducted for a variation in O&M Expenses by 10% on either side. The sensitivity analysis for the project activity in consideration of these three scenarios is furnished below:

DETAILS	+10%	BASE CASE	-10%
Project Cost	14.57%	16.13%	17.96%
Plant Load Factor (PLF)	18.00%	16.13%	14.16%
O & M Expenses	15.85%	16.13%	16.40%

The sensitivity analysis proves beyond doubt that the project is unlikely to be financially attractive even under the most optimistic conditions of project cost going down by 10% or PLF going up by 10%. In

either case, the project IRR remains at 17.96% and 18.00% respectively in comparison to the benchmark return of 18.31%.

In addition, the project proponent is contractually obligated to accept any rate announced by the CEB. The CEB has guaranteed only 90% of the stated tariff in the Standard Power Purchase Agreement to the project proponent. This means, that the tariff will not go below the guaranteed tariff in the next year, which is 90% of the stated tariff in the SPPA. Still the Project proponent has no option other then selling the power to CEB due to the lack of opportunity to sell power outside the CEB controlled grid. This barrier combined with the uncertainty in tariffs results in a significant investment risk barrier to the project, particularly in Sri Lanka where inflation has run at an average of 10.63% per annum over the past 5 years(from 2003 to 2007).

The CDM benefits will improve the financial attractiveness of the project activity, as evident from the fact that with CDM benefits, the project IRR in the baseline scenario improves to 18.59%. Hence, the project definitely requires CDM benefits to make it financially attractive for the project proponent.

Conclusion

From the foregoing, it could be seen that the project faces significant investment barrier as well as other barriers. The difficulty in quantification of such risks renders them a serious barrier for the project. Small hydro power projects have been a learning-by-doing exercise for both the project developers and financiers. With limited information, both project developers and financiers have to take a decision on setting up and financing the project, which is a major constraint in this project. Thus, the project is not a business -as –usual scenario. The project is, therefore additional and requires CDM benefits to overcome the barriers.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The methodological choices made to estimate the baseline are directly in keeping with the guidance provided in AMS I.D. Version 13 (paragraph 9). The project activity is generation of electricity using hydro power and exporting the same to the local grid system, which is mainly fed by fossil fuel based power plants. Emission reductions due to the project activity are considered to be equivalent to the emissions avoided in the baseline scenario by displacing the electricity generated to the Grid.

Baseline Emission

As per the guidance provided in AMS I.D. Version 13 (point 9) for this project “the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2e/kWh) calculated in a transparent and conservative manner” as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the **"Tool to calculate the emission factor for an electricity system (Version 01.1)" (now referred as "Grid Tool")**.

OR

(b) The weighted average emissions (in kg CO2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Here we have used the method (a) for baseline determination. The baseline emissions are calculated based on the net energy supplied to the grid (in kWh/year), and an emission factor for the displaced grid electricity (in kg CO2 e/kWh).

$BE_y = EG_y * EF_y$

Where,

EG_y = the net electricity exported to the grid system during the year *y*

EF_y = the emission factor of the grid to which the project exports electricity

In accordance with the "Tool to calculate the emission factor for an electricity system," the grid emission factor is calculated using Combined Margin (CM), comprised of an Operating Margin (OM) emission factor and a Build Margin (BM) emission factor. The following procedure was adopted for estimating the grid electricity emission factor:

Step 1. Identify the relevant electric power system.
Step 2. Select on operating margin (OM) method.
Step 3. Calculate the operating margin emission factor according to the selected method.
Step 4. Identify the cohort of power units to be included in the build margin (BM).
Step 5. Calculate the build margin emission factor.
Step 6 Calculate the combined margin (CM) emission factor.

Step 1 – Identify the relevant electric power system

Since the project will sell entire energy generated to the Ceylon Electricity Board (CEB) grid, the relevant electric power system for the purpose of calculating the CM is the CEB grid.

Step 2 – Select an operating margin (OM) method

The approved methodological tool recommends the use of one of the following for the calculation of the operating margin emission factor ($EF_{grid,OM,y}$):

a) Simple OM, or
b) Simple adjusted OM; or
c) Dispatch data analysis OM; or
d) Average OM.

The methodological tool recommends the use of dispatch data analysis as the first methodological choice. However, in Sri Lanka availability of accurate data on grid system dispatch order for each power plant in the system and the amount of power dispatched from all plants in the system during each hour is practically not possible. Also, still the merit order dispatch system has not become applicable and is unlikely to be so during the crediting period.

In view of this it is proposed to apply other choices as suggested in the Grid Tool. The table B.4

(mentioned in Section B.4 of the PDD) shows data on the generation by the CEB for the latest five years (2003 to 2007) by low cost/must run resources (hydro and wind) and total grid generation (the additional plants all being thermal plants). As shown in the Table B.4 , since the power supplied by low cost must run power plants to the CEB grid during 2003-2007 is clearly below 50%, the Simple OM method is used.

The data vintage option selected is the *ex-ante* approach, where a 3 year average OM is calculated. The most recent three year generation data provided from the CEB authority is used for the calculation.

Step 3 – Calculate the operating margin emission factor according to the selected method.

In the Simple OM method, the emission factor is calculated as generation weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. Simple OM can be calculated using any of the three available methods in the Grid Tool. Option B is used to calculate the Simple OM in absence of the data availability for Option A. The relevant formula as given in the Grid Tool is

$$EF_{grid,OMsimple,y} = \frac{\sum_{m} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:
$EF_{grid, OMsimple, y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m, y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL, m, y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m = All power units serving the grid in year y except low-cost / must-run power units
y = the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

The ex ante Simple Operating Margin calculated using the data for the CEB Grid for the years 2005, 2006 and 2007 is **0.7073 tCO2/ MWh**.

Step 4 – Identify the cohort of power units to be included in the build margin

The tool to calculate the emission factor for an electricity system offers two options for determination of build margin emission factor: *ex ante* and *ex post* determination of the Build Margin (BM). The build margin emission factor is calculated *ex- ante* based on most recent information available on plants already built for sample group *m* in CEB grid. This simplifies the monitoring procedures, but also offers a conservative approach of BM calculation.

The sample group *m* shall be the one having higher power generation between (a) five power plants that have been built most recently and (b) the capacity additions in the electricity system that comprises 20% of the system generation built most recently. It is found that the option (a) has more than 20% of the total generation in the year 2007. Hence Option (a) is chosen.

Step 5 – Calculate the build margin emission factor

The build margin emissions factor is the generation of weighted average emission factor (tCO2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available. Equation 12 of the Grid tool for calculating the BM is taken for this project.

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m = All power units included in Build Margin calculation
y = Most recent historical year for which power generation data is available (2007)

As for the OM the most recent generation information available is for the year 2007. We therefore use this information to calculate the BM. The data sources used in the calculation are also the same as for calculation of the OM. Using this method the ex ante Build Margin emission factor is determined as **0.6459 tCO2/ MWh**.

Step 6 – Calculation of the baseline emission factor (Combined Margin)

As per equation 13 of the Grid Tool the combined margin (CM) emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

Where:
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (%)
w_{BM} = Weighting of build margin emissions factor (%)

As per the Grid Tool, a default value of 0.5 for the weighting factors is used to average the OM and the BM. The ex ante Combined Margin calculated based on the above method is **0.6766 tCO2/MWh**

Project emissions

As part of the project activity a backup diesel generator to meet the emergency requirements of power house will be installed. Emissions resulting from usage of diesel backup generator will be accounted as project emissions based on the following equation as provided in the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 02)".

$PE_{Diesel,y} = FC_{Diesel,y} * COEF_{Diesel,y}$
Where,
$PE_{Diesel,y}$ = Project emissions due to combustion of Diesel for the project activity (tCO_2)
$FC_{Diesel,y}$ = Is the quantity of Diesel combusted in process during the year (Liters)
$COEF_{Diesel,y}$ = Is the CO_2 emission coefficient of Diesel (tCO2/ Liters)

The CO_2 emission coefficient $COEF_{Diesel,y}$ is calculated based on net calorific value and CO_2 emission factor of the Diesel , as follows:

$COEF_{Diesel,y} = Density * NCV_{Diesel,y} * EF_{CO2,Diesel,y}$
Where,
Density = Density of Diesel in Kg/Liter (http://www.energy.gov.lk/spec/fual.php)
$NCV_{Diesel,y}$ = Is the weighted average net calorific value of the fuel type i in year y (GJ/Kg)
$EF_{CO2,Diesel,y}$ = Is the weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ)

Leakage:

No leakage emissions are considered for the proposed project activity since no energy generating equipment will be transferred from another activity and no existing equipment will be transferred to another activity.

Emission Reductions:

Because no leakage is anticipated, the emission reductions are equal to the baseline emissions less any project emissions that occur. Baseline emissions are calculated based on the monitored net amount of electricity supplied to the grid, and the baseline emission factor.

$ER_y = BE_y - PE_y$

Key baseline information is furnished in Annex 3. Also, a detailed emission factor calculation based on the data available from the CEB is presented in an Excel sheet to the DoE.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**Density**
Data unit:	*Kg/Liter*
Description:	Density of Diesel used at project activity
Source of data used:	Sri Lanka Sustainable Energy Authority
Value applied:	0.8460
Justification of the choice of data or description of measurement methods and procedures actually applied :	National default value for the Auto Diesel is used. The values are publically available on the Sri Lanka Sustainable Energy Authority's website at http://www.energy.gov.lk/spec/fual.php
Any comment:	

Data / Parameter:	$NCV_{Diesel,y}$
Data unit:	*GJ/Kg*
Description:	Weighted Average Net Calorific Value of Diesel
Source of data used:	IPCC 2006 default values
Value applied:	$43.3 * 10^{-3}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Any comment:	

Data / Parameter:	$EF_{CO2,Diesel,y}$
Data unit:	*tCO2/GJ*
Description:	Weighted Average CO2 emission factor of Diesel
Source of data used:	IPCC 2006 default values
Value applied:	$74.8 * 10^{-3}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Any comment:	

Data / Parameter:	$EF_{elec,i,j,y}$
Data unit:	tCO2/MWh
Description:	CO2 emission factor for the electricity source i (i=grid), displaced due to the project activity, during year y
Source of data used:	Calculated
Value applied:	0.6766
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated as per "Tool to calculate the emission factor for an electricity system(Version 01.1)"
Any comment:	This parameter will be calculated once for each crediting period

Data / Parameter:	$EF_{OM\ y}$
Data unit:	tCO_2/MWh
Description:	Simple Operating Margin for the CEB Grid
Source of data used:	Calculated based on the Official data provided by Ceylon Electricity Board
Value applied:	0.7073
Justification of the	Calculated according to procedure prescribed in the "Tool to calculate the

choice of data or description of measurement methods and procedures actually applied :	emission factor for an electricity system (Version 01.1)".
Any comment:	This parameter will be calculated once for each crediting period

Data / Parameter:	**$EF_{BM,y}$**
Data unit:	tCO_2/MWh
Description:	Build Margin for the WESTERN Grid
Source of data used:	Calculated based on the Official data provided by Ceylon Electricity Board
Value applied:	0.6459
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according to procedure prescribed in the "Tool to calculate the emission factor for an electricity system (Version 01.1)".
Any comment:	This parameter will be calculated once for each crediting period

Data / Parameter:	**$EF_{CO2,m,i,y}$**
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type i in year y
Source of data used:	IPCC 2006 Default Values
Value applied:	Naphtha: 69.3 Diesel oil: 72.6 Furnace oil: 75.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	This parameter is monitored once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation. (ex-ante option)
Any comment:	-

Data / Parameter:	$\eta_{m,y}$
Data unit:	-
Description:	Average net energy conversion efficiency of power unit m in year y
Source of data used:	The default values provided in the Annex I of "Tool to calculate the emission factor for an electricity system(Version 01.1)"
Value applied:	Please refer to Annex 3
Justification of the choice of data or description of measurement methods and procedures	The default values provided in the Annex I of "Tool to calculate the emission factor for an electricity system (Version 01.1)" is used for the calculation.

actually applied :	
Any comment:	This parameter is monitored once for each crediting period

B.6.3 Ex-ante calculation of emission reductions:

Baseline emissions

As per AMS I.D, the baseline emissions are calculated as the net electricity generated by the project activity, multiplied with the baseline emission factor for the project grid.

Baseline emissions calculated as explained in section B.6.1 above are summarized as below.

$BE_y = EG_y * EF_y$

Where,
EG_y = the net electricity exported to the grid system during the year *y (19929 MWh/annum)*
EF_y = the emission factor of the grid to which the project exports electricity (0.6766 tCO2/MWh)

Hence,

BE_y = 19,929 MWh/annum * 0.6766 tCO2/MWh

BE_y = 13,483 tCO2 per annum

Project emissions

The quantity of diesel consumed for operating the DG set during emergency situations is expected to be negligible. The project emissions due to the combustion of diesel are considered as zero for estimating ex-ante emission reductions. However, the quantity of diesel consumed in the project activity will be monitored during each year of crediting period and respective project emissions will be deducted from baseline emissions.
$PE_{Diesel,y} = FC_{Diesel,y} * Density * NCV_{Diesel,y} * EF_{CO2,Diesel,y}$

Hence,
$PE_{Diesel,y} = 0 * 0.8460 * 74.8 * 43.3 * 10^{-6} = 0$ tCO2e

Leakage

No leakage emissions are applicable.

Emission reductions

ERy = BEy - PEy

ERy = 13,483 – 0

ERy = 13,483 tCO2 (ERy = BEy)

B.6.4 Summary of the ex-ante estimation of emission reductions:

The estimated Ex-ante emission reductions expected of the project activity for the first crediting period is given below:

Year	Baseline Emissions	Project Emissions	Leakage	Emission Reductions
	tCO_2	tCO_2	tCO_2	tCO_2
Year 1	13,483	0	0	13,483
Year 2	13,483	0	0	13,483
Year 3	13,483	0	0	13,483
Year 4	13,483	0	0	13,483
Year 5	13,483	0	0	13,483
Year 6	13,483	0	0	13,483
Year 7	13,483	0	0	13,483
				94,381

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG_Y**
Data unit:	MWh
Description:	Net Electricity exported to the grid
Source of data to be used:	Monthly Invoice
Value of data	Value of the data will be used to calculate the baseline emissions
Description of measurement methods and procedures to be applied:	Measured by the export meter installed at the project boundary. The net electricity exported will be jointly recorded and certified by CEB and the project developer. The data will be archived electronically for the entire crediting period.
QA/QC procedures to be applied:	Meter will be calibrated as per CEB standards. A check meter is also installed near to the export meter to cross check the electricity exported to the CEB grid. The check meter reading would also be used in case of failure of export meter
Any comment:	The accuracy class of the energy meter is 1.0

Data / Parameter:	**EI_Y**
Data unit:	MWh
Description:	Electricity imported from the grid
Source of data to be used:	Monthly bill from CEB
Value of data	Value of data would be used to calculate the project emissions
Description of measurement methods and procedures to be applied:	Measured by the import meter installed by the CEB at the project site for billing the project activity. This CEB bill will be used to calculate the project emission which includes the auxiliary consumption for the plant equipments.

	The data will be archived electronically for the entire crediting period.
QA/QC procedures to be applied:	The meter will be calibrated as per CEB standards. A check meter is also installed near to the import meter to cross check the electricity imported from the CEB grid. The check meter reading would also be used in case of failure of import meter.
Any comment:	The accuracy class of the energy meter is 1.0

Data / Parameter:	**$FC_{Diesel,y}$**
Data unit:	*Liter*
Description:	Quantity of Diesel used in DG sets during the year
Source of data to be used:	Stores Record/ On site measurements
Value of data	0 (Projected)
Description of measurement methods and procedures to be applied:	The total number of operating hours of DG set and the corresponding quantity of diesel consumed for the purpose will be recorded in the log book maintained at the DG set room. The operating hours and the quantity of diesel consumption will be recorded shift wise by shift superintendent.
QA/QC procedures to be applied:	The weigh bridge meter will undergo calibration/maintenance subject to appropriate manufacturer standards. The calibration will be done once in every 3 years. The data recorded can be cross checked against the fuel purchase receipts.
Any comment:	The data on quantity of diesel procured would be collected separately. Data archived: Crediting period + two years. Instruments : Level gauge The project activity may combust only one type of fossil fuel i.e., diesel during the project operation. .DG set is used only for lighting for emergency purposes and hence consumption of diesel will be negligible.

B.7.2 Description of the monitoring plan:

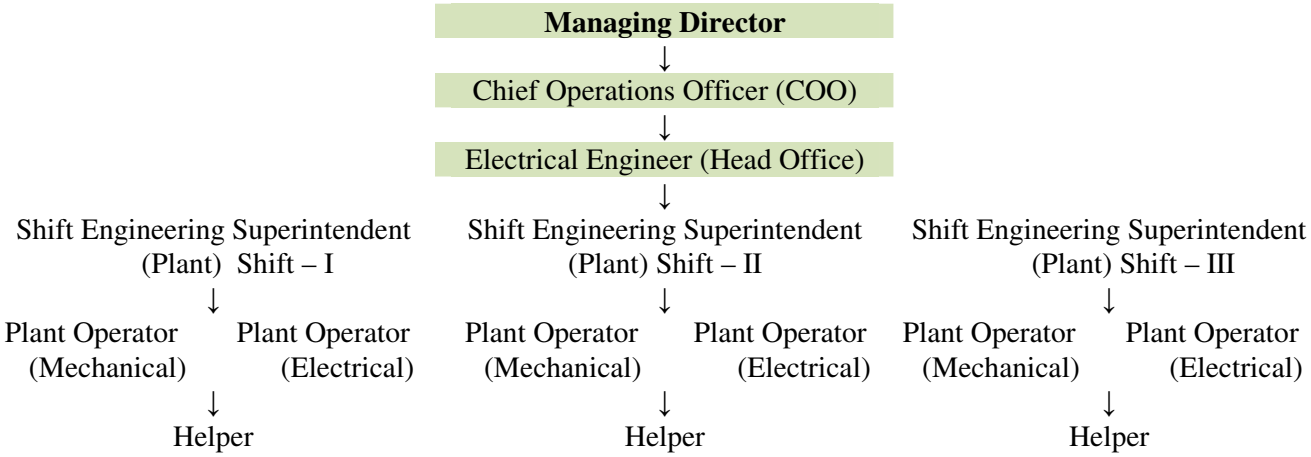
Monitoring Organisation

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data would rest with the COO of the Company. A team of experienced personnel in various disciplines will assist the Shift Engineering Superintendents in plant operation, measurements and management. The primary responsibility of the team is to measure, monitor, record and report the information on various data items to the Engineer-in-Charge, in accordance with the applicable standards.

The responsibility of review, storage and archiving of information in good condition would lie with the COO. The COO would undertake periodic verifications and onsite inspections to ensure the quality of the data collected by the team and initiate steps in case of any abnormal conditions. An internal verification report would be prepared for review by the COO, which would be later submitted for verification by an independent entity (DOE).

The team including the Engineer-in-Charge would be appointed by the COO in advance before the start of project operations. The Engineer-in-Charge would report to the COO and seeks guidance in case of conflicts or difficulties in order to maintain the monitoring organisation in good spirit.

Organization Chart



Parameters Requiring Monitoring

This monitoring plan would require monitoring of all parameters indicated in section B7 of the PDD. Necessary documents required for verification of the data would be maintained for later archiving. Using the power exported to the grid, emission reductions would be calculated as illustrated in Section B 6.3. Emission reductions generated by the project would be monitored at regular intervals and would be reported to the Managing Director.

Procedures for training of monitoring personnel

The project would employ qualified and experienced persons for plant operation. Basic personnel to deal with monitoring of parameters are Shift Engineering Superintendents. The project would maintain standard log sheets and formats to record the monitoring parameters. The persons would be given proper training to maintain the plant records. The Engineer-in-charge of the Plant would be the designated person to verify, compile and archive all the monitored data. The parameters to be monitored during the crediting period would be provided in a tabular format to the designated person. The Shift Engineering Superintendents and the Engineer-in-charge of the Plant would be provided necessary training with respect to maintenance of the relevant monitoring records to enable him/her to deal the monitoring independently. The training would be provided to the monitoring personnel for monitoring of the following parameters:

- Electricity Export
- Electricity Import
- Gross electricity generated
- Periodical calibration of monitoring equipment
- Diesel consumption

Procedures for documentation and storage:

Operations of the hydro power project will be overseen by the Shift Engineering Superintendent (ES) of the company. The company will have three Shift Engineering Superintendent (ES) for each of the three shifts. The Shift Engineering Superintendent (ES)'s position will be occupied by qualified electrical engineers who have obtained necessary training in plant operations, data monitoring, report generation etc. For the smooth operations of the plant, the company will have Two Plant Operators (Mechanical and Electrical) and one helper for each of three shifts to help the shift Engineering Superintendent.

The Shift Engineering Superintendents would record the parameters every day during the operation of the plant. Since the project is a hydro power project, only the following energy related data are to be monitored: Gross Electricity generation, Energy Export and import and diesel consumption for the DG set:

The Energy meter readings would be taken at the end of each shift at a designated time every day to ensure constant recording frequency of parameter. The recorded parameters would be documented every day in the standard log books maintained at the plant. The day to day records would be verified by Engineer In charge, compiled and documented for preparation of internal verification reports.

The net electricity exported to the grid will be recorded from the export meter installed within the premises, jointly with the representatives of Ceylon Electricity Board in the last week of each month. This reading will be taken as the basis for raising invoice on the CEB for the payment against net electricity exported to the grid.

The energy imported from the CEB grid is recorded in the import meter installed by the CEB for billing the project activity for the electricity imported from the CEB grid.

This record will be maintained by the project proponent at the project site as well as at the head office.

Internal audits

The company will introduce an internal verification system for documentation and safe storage of data. Internal verification would be carried out as per the monitoring plan and whenever necessary. An internal verification report would be prepared for review by the Chief Operating Officer (COO). The COO would verify the records independently with reference to the power exported and imported. Internal verification reports are the basic documents for the monitoring and storage of plant operational data.

The Managing Director of the company will visit the plant once in a month and conduct an internal audit of various monitoring parameters of the project. The Managing Director will review all safety installations, operating procedures, monitoring records, etc. and will discuss any corrective action to be taken for the smooth functioning of the plant.

Procedures for Corrective actions

The parameters to be monitored during a crediting period would be compiled as internal verification report for every quarter of each crediting year and submitted to the Managing Director for review. The parameters include the Gross generation, Auxiliary consumption, Energy export, Import and diesel

consumption for the DG set. Based on the verification report submitted by Shift Engineering Superintendents

The Engineer-in-Charge would assess the performance of plant. The COO would discuss and recommend necessary mechanism to improve the operational efficiency of the plant and directs the respective person to rectify the problem.

QA & QC Procedures

The projects would employ such equipment or instruments that would measure, record, report, monitor and control of various key parameters of the plant. These monitoring and controls would be the part of the Control Systems of hydroelectric plant.

For measuring the energy exported / imported main meter and a check meter as required would be in service. The check meter reading will be used to measure electricity export/import in case of failure of the main meter. The CEB officials will replace the main meter immediately on PP request. Both the meters would be calibrated and sealed at least once in 3 years as per the CEB standard. Records of these test certificates would be maintained for verification. Hence, high quality is ensured with the above parameters. Delivery records would be used and kept for checking the consistency of the recorded data.

Data Storage & Archiving

All the data items monitored under the monitoring plan would be kept for 2 years after the end of crediting period or the last issuance of CERs, for this project activity, whichever occurs later. Methodology proposed to be adopted for determining base line emission factor is the combined margin of the generating mix in the CEB grid system, which represents the intensity of carbon emissions of the grid system. The baseline emission factor would be adopted from the CEB published generation data for the latest available year for the CEB grid and the same would be used for the future projection and would be reviewed each year based on data published by the CEB. The monitored data would be presented to an independent verification agency or DOE to whom verification of emission reductions is assigned.

Maintenance of Equipments

All the equipments used in the project activity will undergo scheduled maintenance as specified in the operational manual of the equipment supplier. The Chief Operations Officer is responsible to oversee the maintenance activity on periodic basis.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

The baseline study was completed in 18/05/2009 by the Clean Energy Finance Committee. The contact detail of Mitsubishi UFJ Securities Co., Ltd. appears in Annex I:

Clean Energy Finance Committee
Mitsubishi UFJ Securities Co., Ltd.
Tokyo, Japan

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>> 21/01/2008 (Signing of contract for Penstock clearing, transportation & painting with M/s APS & Liyanage (Pvt.) Ltd)

C.1.2. Expected operational lifetime of the project activity:

>> 25 years

C.2 Choice of the crediting period and related information:

Renewable Crediting Period

C.2.1. Renewable crediting period

Renewable Crediting Period of 21 years chosen by the project proponent.

C.2.1.1. Starting date of the first crediting period:

01st June 2010 or Date of Registration whichever is later.

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

Not Chosen

C.2.2.1. Starting date:

Not Applicable

C.2.2.2. Length:

Not Applicable

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

In Sri Lanka, it is mandatory for all new projects to take approval from the Central Environmental Authority (CEA) which investigates the environmental and social impacts from the project. Due to the small size of the investment, CEA guidelines allow the project developers to prepare an Environmental Examination Report rather than a very comprehensive Environmental Impact Assessment.

This Environmental Examination Report (EER) is according to a format provided by the CEA. The Environmental Examination Report includes the following sections:-

- Project description (location, weir & intake, headrace channel, spill-way, forebay, penstock, power house, tailrace, access roads, and transmission line). This is mentioned in the geological report prepared by Project Developer.
- Description of site topography, geology, hydrology, fauna and flora, upstream and downstream users, and social/cultural sensitive areas. This is mentioned in the geological report prepared by Project Developer.
- Discussion of possible impacts such as erosion, land scarring, migration, construction hazards, changes in land use patterns, relocation, etc. This is mentioned in the Soil Conservation Management plan prepared by Project Developer.
- Description of detailed monitoring plan to continuously measure and protect the flora & fauna in the project area. The monitoring plan includes parameters to be monitored, monitoring locations and timing of sampling as well as effective monitoring responsibilities.
- List of clearances and authorizations obtained, including:
  - Approval from CEB for sale of electricity.
  - No Objection Certificate (NOC) from Chief Minister Office of Sabaragamuwa Province.
  - NOC from Department of Agrarian Services, Ratnapura
  - Water Right from Divisional Secretary for diversion of water.
  - NOC from Irrigation Department
  - Approval from National Water Supply & Drainage Board
  - Renewable Energy Permit from Sri Lanka Sustainable Energy Authority

After submission of Environmental Examination Report to CEA, the CEA official visit the site with a team of experts and obtain clarifications if required, prior to granting approval for a project.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impact of the proposed project was considered negligible and the Central Environment Authority granted environmental approval for the project on 17th February 2005. The Central Environment Authority studied the response to the environmental questionnaire submitted by the project developer and a report for flora & fauna in the region.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

Alternate Power Systems (Pvt) Ltd. invited the local stakeholders for a joint Stakeholder Meeting by way of a Press Advertisements in two national news papers (both In English and Sinhala) and by way of direct invitation to some of the key stakeholders. A local stakeholders meeting was conducted by Alternate Power Systems (Pvt) Ltd. on 16th December, 2008. The meeting took place at the Paladeniya School, which is situated near the site where the proposed project will be carried out. The meeting was attended by around 50 local residents including local Member Parliament, various community leaders, local priest,

school principal, Govt officials, employees, workers and local residents. The composition of the participants who attended was:

Category / Occupation	Number of attendees
Local villagers	18
Technology Supplier	1
Local NGO's members	4
Government Officials	3
Intellectuals working in the Local Area	11
Company Employees of APSL	13
Total	**50**

The Managing Director of Alternate Power Systems (Pvt) Ltd. welcomed all those present and briefed them about the proposed CDM project activity and various activities undertaken by the project developer for the socio-economic advantage of the local community / residents of the Adavikanda Village where the project is located. He highlighted the importance of the project to the national power scenario and the economy. At the end of the presentation, the Managing Director invited the participants to ask any question or raise any issues arising from the construction of the project that may be of concern to them.

E.2. Summary of the comments received:

The participant's whole heartedly spelt out the advantages being availed / to be availed by the local community from the project activity. The community leaders highlighted the contributions made by the project developer in terms of constructing a bridge between two neighbouring villages (Adavikanda and Paladeniya), enhancing facilities at the local school building, preaching hall at the local temple, community centre (Praja Shalawa) as well as providing direct and indirect employment for local residents.

E.3. Report on how due account was taken of any comments received:

Representatives of the local community requested the project developer for additional contributions for arranging a bus stop to facilitate pilgrims, improving the road network of the village and facilities at the local hospital. The local residents also suggested plantation of tree to maintain natural look of the area. Although the questions raised by the participants were not directly relevant to the Project activity, the project developer agreed to consider the requests made by the local community leaders / residents favourably.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Alternate Power Systems (Pvt.) Ltd.
Street/P.O.Box:	27-2 East Tower, Echelon Square,
Building:	World Trade Centre,
City:	Colombo
State/Region:	
Postfix/ZIP:	1
Country:	Srilanka
Telephone:	+94-11-2381111
FAX:	+94-11-2381115
E-Mail:	leel_wickrema@yahoo.com
URL:	
Represented by:	Leel Wickremarachchi
Title:	Managing Director
Salutation:	Mr.
Last Name:	Wickremarachchi
Middle Name:	
First Name:	Leel
Department:	
Mobile:	
Direct FAX:	+94-11-2381115
Direct tel:	+94-11-2381111
Personal E-Mail:	leel_wickrema@yahoo.com

Organization:	Mitsubishi UFJ Securities Co., Ltd.
Street/P.O.Box:	2nd Floor, 5-4-9 Toyosu
Building:	KR Toyosu Building
City:	Koto-ku
State/Region:	Tokyo
Postfix/ZIP:	135-0061
Country:	Japan
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FAX:	+81-3-6213-6175
E-Mail:	watanabe-hajime@sc.mufg.jp
URL:	http://www.sc.mufg.jp/english/e_cefc/index.html
Represented by:	
Title:	Chairman of Clean Energy Finance Committee
Salutation:	Mr.
Last Name:	Watanabe
Middle Name:	
First Name:	Hajime
Department:	Clean Energy Finance Committee
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding received for this project activity.

Annex 3

BASELINE INFORMATION

Operating Margin 2005

Plant Name	Unit No.	Generation Type (Most Efficient)	Fuel Type Used	Installation Year	Net Electricity Generation (GWh)	Net Energy Conversion Efficiency (%)	Average CO2 Emission factor of Fuel Type (tCO2/GJ)	CO2 emission factor of Power Plant/Unit (tCO2/MWh)	CO2 emission from Power Plant/Unit (tCO2)
CEB Owned Thermal Power Plants									
Kelanitissa Gas Power station									
	4 Units	Gas turbine (old)	Diesel	December, 1981 March, 1982, April, 1982	22.231	30%	0.0726	0.8712	19367.65
	1 Unit	Gas turbine(New)	Diesel	August, 1997	276.909	30%	0.0726	0.8712	241243.12
	1 unit	Combined Cycle	Naptha	August, 2002	672.998	46%	0.0693	0.5423	364999.00
		Combined Cycle	Diesel		333.717	46%	0.0726	0.5682	189609.29
Sapugaskanda Power station									
	4 Units	Diesel Generator	Diesel	1984	327.948	30%	0.0726	0.8712	285708.30
	8 Units	Diesel Generator	Diesel	Sept 1997, Oct 1999	527.482	30%	0.0726	0.8712	459542.32
Small Thermal Plants (Chunnakam)									
	1 Unit	Diesel Generator	Diesel	Mar-99	0.590	30%	0.0726	0.8712	514.01
IPP's Thermal Power Plants									

Kool Air (KKS)		Diesel Generator	Diesel	2005	55.556	39.5%	0.0726	0.6617	36759.79
Aggreko(Chunnakam)		Diesel Generator	Diesel	2005	55.554	39.5%	0.0726	0.6617	36758.46
Lakdhanavi		Diesel Generator	Furnace Oil	November, 1997	151.082	30%	0.0755	0.9060	136880.29
Asia Power Ltd		Diesel Generator	Heavy Fuel	June, 1998	353.692	30%	0.0755	0.9060	320444.95
Colombo Power (Pvt) Ltd		Diesel Generator	Furnace Oil	Mid 2000	475.780	39.50%	0.0755	0.6881	327384.82
ACE Power Matara		Diesel Generator	Furnace Oil	March, 2002	163.308	39.50%	0.0755	0.6881	112372.44
ACE Power, Horana		Diesel Generator	Furnace Oil	December, 2002	174.017	39.50%	0.0755	0.6881	119741.32
AES Kelanitissa (Pvt) Ltd		Combined Cycle	Diesel	GT- March 2003 ST- October, 2003	475.780	46%	0.0726	0.5682	270325.78
Heladanavi (Pvt) Ltd		Diesel Generator	Furnace Oil	October, 2004	758.887	39.50%	0.0755	0.6881	522191.11
Ace Power Embilipitiya Ltd		Diesel Generator	Furnace Oil	March, 2005	488.219	39.50%	0.0755	0.6881	335944.11
TOTAL					**5313.75**				**3779786.77**

Operating Margin 2006

Plant Name	Unit No.	Generation Type (Most Efficient)	Fuel Type Used	Installation Year	Net Electricity Generation (GWh)	Net Energy Conversion Efficiency (%)	Average CO2 Emission factor of Fuel Type (tCO2/GJ)	CO2 emission factor of Power Plant/Unit (tCO2/MWh)	CO2 emission from Power Plant/Unit (tCO2)
CEB Owned Thermal Power Plants									
Kelanitissa Gas Power station									
	4 Units	Gas turbine (old)	Diesel	December, 1981 March, 1982, April, 1982	5.806	30%	0.0726	0.8712	5058.1872
	1 Unit	Gas turbine(New)	Diesel	August, 1997	66.578	30%	0.0726	0.8712	58002.7536
	1 unit	Combined Cycle	Naptha	August, 2002	340.622	46%	0.0693	0.5423	184735.6012
			Diesel		392.625	46%	0.0726	0.5682	223079.2826
Sapugaskanda Power station									
	4 Units	Diesel Generator	Diesel	1984	347.660	30%	0.0726	0.8712	302881.392
	8 Units	Diesel Generator	Diesel	Sept 1997, Oct 1999	514.347	30%	0.0726	0.8712	448099.1064
Small Thermal Plants (Chunnakam)									
	1 Unit	Diesel Generator	Diesel	Mar-99	1.280	30%	0.0726	0.8712	1115.136
IPP's Thermal Power Plants									
Kool Air		Diesel Generator	Diesel	2005	42.258	39.5%	0.0726	0.6617	27960.8883

Aggreko		Diesel Generator	Diesel	2005	55.345	39.5%	0.0726	0.6617	36620.17519
Lakdhanavi		Diesel Generator	Furnace Oil	November, 1997	103.688	30%	0.0755	0.9060	93941.328
Asia Power Ltd		Diesel Generator	Heavy Fuel	June, 1998	334.203	30%	0.0755	0.9060	302787.918
Colombo Power (Pvt) Ltd		Diesel Generator	Furnace Oil	Mid 2000	452.048	39.50%	0.0755	0.6881	311054.801
ACE Power Matara		Diesel Generator	Furnace Oil	March, 2002	129.824	39.50%	0.0755	0.6881	89332.05873
ACE Power, Horana		Diesel Generator	Furnace Oil	December, 2002	131.778	39.50%	0.0755	0.6881	90676.60861
AES Kelanitissa (Pvt) Ltd		Combined Cycle	Diesel	GT- March 2003 ST- October, 2003	619.684	46%	0.0726	0.5682	352088.2831
Heladanavi (Pvt) Ltd		Diesel Generator	Furnace Oil	October, 2004	619.330	39.50%	0.0755	0.6881	426161.757
Ace Power Embilipitiya Ltd		Diesel Generator	Furnace Oil	March, 2005	593.380	39.50%	0.0755	0.6881	408305.5291
TOTAL					**4750.456**				**3361900.806**

Operating Margin 2007

Plant Name	Unit No.	Generation Type (Most Efficient)	Fuel Type Used	Installation Year	Net Electricity Generation (GWh)	Net Energy Conversion Efficiency (%)	Average CO2 Emission factor of Fuel Type (tCO2/GJ)	CO2 emission factor of Power Plant/Unit (tCO2/MWh)	CO2 emission from Power Plant/Unit (tCO2)
CEB Owned Thermal Power Plants									
Kelanitissa Gas Power station									
	4 x 20 MW	Gas turbine (old)	Diesel	December, 1981 March, 1982, April, 1982	47.705	30%	0.0726	0.8712	41560.596
	1 x 115 MW	Gas turbine(New)	Diesel	August, 1997	220.237	30%	0.0726	0.8712	191870.4744

	1 x 165 MW	Combined Cycle	Naptha	August, 2002	517.641	46%	0.0693	0.5423	280741.471
			Diesel		578.050	46%	0.0726	0.5682	328432.9304
Sapugaskanda Power station									
	4 x 20 MW	Diesel Generator	Diesel	1984	417.815	30%	0.0726	0.8712	364000.428
	8 x 10 MW	Diesel Generator	Diesel	Sept 1997, Oct 1999	550.126	30%	0.0726	0.8712	479269.7712
Small Thermal Plants (Chunnakam)									
	1 x 8 MW	Diesel Generator	Diesel	Mar-99	3.965	30%	0.0726	0.8712	3454.308
IPP's Thermal Power Plants									
Kool Air		Diesel Generator	Diesel	2005	18.707	39.5%	0.0726	0.6617	12377.87727
Aggreko-Chunnakam		Diesel Generator	Diesel	2005	85.56	39.5%	0.0726	0.6617	56612.56101
Lakdhanavi	22.5 MW	Diesel Generator	Furnace Oil	November, 1997	118.422	30%	0.0755	0.9060	107290.332
Asia Power Ltd	51 MW	Diesel Generator	Heavy Fuel	June, 1998	361.725	30%	0.0755	0.9060	327722.85
Colombo Power (Pvt) Ltd	64 MW	Diesel Generator	Furnace Oil	Mid 2000	456.343	39.50%	0.0755	0.6881	314010.1959
ACE Power Matara	24.8 MW	Diesel Generator	Furnace Oil	March, 2002	147.708	39.50%	0.0755	0.6881	101638.0618
ACE Power, Horana	24.8 MW	Diesel Generator	Furnace Oil	December, 2002	142.412	39.50%	0.0755	0.6881	97993.87747
AES Kelanitissa (Pvt) Ltd	163 MW	Combined Cycle	Diesel	GT- March 2003 ST- October, 2003	786.885	46%	0.0726	0.5682	447087.5296
Heladanavi (Pvt) Ltd	100 MW	Diesel Generator	Furnace Oil	October, 2004	747.740	39.50%	0.0755	0.6881	514520.8405
Ace Power Embilipitiya Ltd	100 MW	Diesel Generator	Furnace Oil	March, 2005	663.027	39.50%	0.0755	0.6881	456229.718
TOTAL					**5864.068**				**4124813.823**

Build Margin 2007

Total Power Generation by CEB Grid in Year 2007	**9813.97**	**GWh**
20% of total Generation	**1962.79**	**GWh**

S. No	Plant Name	Generation Type (Most Efficient)	Fuel Type Used	Installation Year	Net Electricity Generation (GWh)	Net Energy Conversion Efficiency (%)	Average CO2 Emission factor of Fuel Type (tCO2/GJ)	CO2 emission factor of Power Plant/Unit (tCO2/MWh)	CO2 emission from Power Plant/Unit (tCO2)
1	Ace Power Embilipitiya Ltd	Diesel Generator	Furnace oil	March, 2005	663.027	39.50%	0.0755	0.6881	456229.72
2	Kool Air	Diesel Generator	Diesel	2005	18.707	39.50%	0.0726	0.6617	12377.88
3	Aggreko-Chunnakam	Diesel Generator	Diesel	2005	85.56	39.50%	0.0726	0.6617	56612.56
4	Heladanavi (Pvt) Ltd	Diesel Generator	Furnace oil	October, 2004	747.74	39.50%	0.0755	0.6881	514520.84
5	AES Kelanitissa (Pvt) Ltd	Combined Cycle	Diesel	GT- March 2003 ST- October, 2003	786.885	46%	0.0726	0.5682	447087.53
				TOTAL	**2301.919**				**1486828.53**

BM for the year 2007	**0.6459**

SUMMARY- OPERATING MARGIN			
Year	**GWh**	**tCO2**	**tCO2/MWh**
2005	5,314	3,779,787	0.7113
2006	4,750	3,361,901	0.7077
2007	5,864	4,124,814	0.7034
Grand Total	**15,928**	**11,266,501**	**0.7073**

COMBINED MARGIN Basis 2007			
OPERATING MARGIN	0.7073	0.50	0.35366
BUILD MARGIN	0.6459	0.50	0.32295
COMBINED MARGIN			**0.6766**
Generation		MWh	19,929
CERs		tCO2e	**13,483**

Annex 4

MONITORING INFORMATION

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Appendix 1