CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

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>.

SECTION A. General description of the small-scale project activity

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

Sanquhar and Delta Small Hydro Power Projects. PDD version 10, 20/10/2006

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

This PDD presents and details two small-scale, run of river hydropower plants in Sri Lanka, owned by Hydro Power Free Lanka, a joint venture between Pussellawa Plantation Ltd and Eco-F Limited. Each plant has an installed capacity of 1.6 MW. Sanquhar was commissioned in December 2003 and Delta was commissioned in April 2006. HPFL signed the agreement with the Authorities in September 2000 to implement these sites and construction at Sanquhar was commenced in April 2001. The construction for Delta commenced in November 2004. The sites are located in Sanquhar and Delta tea estate respectively, in the Central Province, in the Kandy District. Both estates are operated by Pussellawa Plantations Ltd under a long term lease from the Sri Lankan Government.

The electricity from the hydropower plant is being sold to the monopoly government-owned electricity utility in Sri Lanka, the Ceylon Electricity Board (CEB) under a standard power purchase agreement for renewable energy generators under 10 MW, including small hydro power. Due to CEB policies and procedures, operation of the hydropower plant results in a displacement of electricity from the highest marginal cost thermal power stations.

Payment by the CEB is for actual electricity generated by the small hydropower facility at a rate reflecting avoided energy costs of operating their highest cost thermal power stations to produce the same amount of power.

The existing marginal thermal power plants in Sri Lanka operate on fuel oil or diesel and the share of fossil fuel based thermal power is expected to increase dramatically over the next ten years, primarily through an expansion of coal-fired plants. Small hydropower projects are not factored into the main annual base case electricity supply-demand forecasts of the CEB expansion plan.

Applying the simplified methodologies specified for small-scale CDM projects supplying renewable energy to a grid, the project will result in an annual emissions avoidance of 0.6816 kg of CO_2 equivalent per kWh generated (kg CO_2/kWh). Annual emissions reductions for the project are 5489 tCO_2e per year in average, achieved by displacing fossil fuel based generation from the national grid.

Table 1: Summary of Baseline and Project scenarios

Baseline Scenario	Project Scenario
Generation of 9.58GWh/year of electricity from fuel oil and diesel based generating sources	Generation of 9.58GWh/year of electricity from a zero emissions small-scale project

The project is helping Sri Lanka to fulfill its goals of promoting sustainable development. Specifically, the project:

• Increases employment and skills development opportunities for local people during construction and operation phases of the project. This will occur in an area where reliable sources of employment are scarce
• Contribute to roads maintenance and repairs as the project obtains economical stability
• Diversifies sources of electricity generation
• Helps the Sri Lanka Government to achieve its commitment to environmentally and economically sustainable development by providing private sector support for renewable energy technologies

Other project benefits include reductions in NOx and SOx pollution from burning fossil fuels..

A.3. Project participants:

Table 2 : 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)	Private entity - Hydro Power Free Lanka (Pvt) Ltd	No

See Annex 1 for contact information of all project participants.

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

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

A.4.1.1. Host Party(ies):

Sri Lanka

Sri Lanka ratified the UNFCCC on 23 November 1993 and acceded to the Kyoto Protocol on September 3, 2002. The Government has established its Designated National Authority which is registered with the CDM Executive Board. The DNA contact point is the Director, Environment Economics and Global Affairs Division, Ministry of Environment and Natural Resources (Tel:94-1-887452; e-mail: envocon@sltnet.lk; airmac@sltnet.lk).

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

Projects are in Kandy District, Central Province.

A.4.1.3. City/Town/Community etc:

Sanquhar Hydro Power Plant - Sanquhar Tea Estate, Atabage, Gampola in Kandy district
Delta Hydro Power plant - Delta Tea Estate, Pupuressa, Gampola in Kandy district

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

Sanquhar Hydro Power Plant

The site is located in Sanqhuar estate in the district of Kandy. The project is using the flow from Galatha Oya on its lower section. The project can be accessed through Gampola – Nuwara Eliya Road, turning into Sanquhar estate after passing Atabage village and driving down to the river.

Delta Hydro Power Plant

The site is located in Delta estate in the district of Kandy. The project is using the flow from Attabage Oya on its upper section. The project can be accessed through Gampola – Nuwara Eliya Road, turning into Delta estate at Delpitiya junction and driving down to the river.

Table 3. Location of intake and power house of the project

Project	Intake location			Power house location		
	East	North	Elevation	East	North	Elevation
Sanqhuar	80°35.906”	7°06.950”	620 m	80°35.906”	7°06.950”	526 m
Delta	80°39’63’’	07°07’54’’	1080m	80°40’40’’	07°06’93’’	866m

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

Small – scale project activity
Type (i): Renewable Energy Projects
Category (i). D: Renewable energy generation for a grid
Technology: The project uses run-of-river hydropower technology.

Plant: Sanquhar Hydro Power Plant
The plant will harness the flow of Galatha Oya between the 620 m elevation (intake) and 526 m elevation (power house).

The civil structures at the site consist of a gated weir designed to store 3000 m3 of water, a penstock, a power house and a tailrace. The powerhouse is located 1000 m from the weir. The penstock consists of one Mild Steel pipe of 1.1 m diameter.

Length of transmission line is 800 m.

Daily containment run-of-river hydro generation facility
Turbine supplier is Hydro Power S.A., France

Installed capacity	-	1.6 MW
Head	-	98 m
Number of units	-	1 horizontal Francis at 750rpm
Generator voltage	-	660 V
Power line	-	33 kV

Plant: Delta Hydro Power Plant
The plant will harness the flow of Atabage Oya between the 1080m elevation (intake) and 863m elevation (power house).

The civil structures at the site consist of a gated weir, a canal, a penstock, a power house and a tailrace. The powerhouse is located 2280 m from the weir. The penstock consists of Glass Reinforced Polymer (GRP) pipe of 0.8 m and 0.6m diameter. Length of the penstock is 1080m. Length of the channel is 1200m.
Length of transmission line is 4500 m.

Powerhouse
Daily containment run-of-river hydro generation facility

Turbine supplier is		HPP, France
Installed capacity	-	1.6 MW
Head	-	220 m
Number of units	-	1 Vertical Pelton 3 jet running at 750rpm
Generator voltage	-	660 V
Power line	-	33 kV

Most of the equipment used in the projects are developed and manufactured outside the host country and some are innovations for Sri Lanka like the use of GRP pipe for small hydro power project. The transfer of Know-How has been realized with training abroad and visit from the manufacturer representative.
This technology used in small hydro project is safe for the environment and a well proven technology.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

Apart from minor emissions during the construction phase and those associated with maintenance and monitoring, the Sanquhar and Delta plants will supply greenhouse emission free electricity to the Sri Lankan grid, at a time when the grid is otherwise becoming increasingly reliant on fossil fuels.

The Sri Lankan grid is currently supplied to a significant extent by hydro power from plants constructed during the period 1950 -1992. However there have been no new large hydro plants constructed since 1992, due to the exhaustion of suitable sites and increasing awareness of the environmental and social impacts of large dams. The eleven power plants commissioned since 1992 have all been thermal plants burning fossil fuels.

Moreover, planned expansion of generating capacity by the CEB is based almost entirely on new fossil fueled thermal plants (See Table 5 in Section B.2).

The CEB sources supply from power plants based on calculations of lowest generation cost per kilowatt hour. Small scale renewable energy facilities such as the Sanquhar and Delta are not included in energy supply forecasts, but are rather substituted for the highest cost (thermal) power output.

Therefore the HPFL project will result in a reduction of anthropogenic of greenhouse gas by displacing an equivalent volume of electricity that would otherwise be generated by the most expensive (fossil-fuelled) thermal power plants in the national grid. The expansion plans and small power purchase policies of the CEB are discussed in greater details in Section B of this PDD.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Table 4. Estimated annual emission reductions

Years	**Annual estimation of emission reductions (Tonnes CO_2e)**
2004	3,408
2005	3,408
2006	5,489
2007	6,529
2008	6,529
2009	6,529
2010	6,529
Total estimated reductions (tonnes CO2e)	38,421
Total number of crediting years	7
Annual average over the crediting period	5,489

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

Funding for this project has come from Pussellawa Plantations Limited (PPL), Hydro Power Free Lanka (Pvt) Ltd (HPFL), Eco-F Limited (Eco-F) and local development or commercial banks: No ODA funds are or were used for the project.

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

According to Appendix C of the Simplified Modalities & Procedures for Small Scale CDM project activities, “Debundling” is defined as the fragmentation of a large project activity into smaller parts.

With reference to the criteria mentionned, this small hydro power plants are not a debundled components of a large project activity as there is no registered small scale CDM project activity (previous 2 yrs) or an application to register another small scale CDM project activity by the same (Hydro Power Free Lanka

(Pvt) Ltd) project proponent, in the same category and technology/measure with project boundary within 1 km radius of this project activity.

SECTION B. Application of a baseline methodology:

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

Project Category Title: Category I.D. Renewable Electricity Generation for a Grid
Reference: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM Project activities, category I.D. taken from the document version 09 dated 28/07/2006.

B.2 Project category applicable to the small-scale project activity:

The project sells emissions-free electricity to the national monopoly grid manager, the Ceylon Electricity Board. This corresponds precisely with the SSC CDM project category 1.D.
The Sri Lankan national grid is currently supplied by a mix of generators including large scale hydro, combined cycle gas, diesel and fuel oil, and future plans of the Ceylon Electricity Board are for a major investment in coal fired thermal power.
The baseline approved for electricity supply to a grid served by a mix of generating capacity (not solely fuel oil and diesel) is either:

a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to procedures prescribed in the approved methodology ACM0002. Or,
b) The weighted average emissions of the current generation mix.

The first of these alternatives capture the recent and accelerating trend towards fossil fuel based energy production in Sri Lanka. The second would poorly represent the likely baseline because of the increasing reliance on fossil fuels indicated by the following table of planned expansion of generating capacity by the CEB.

Table 5. Planned expansion of generating capacity by CEB

Plant	**Capacity (MW)**
Kerawalapitiya combined cycle (2008)	300
Gas turbine (2008)	105
Gas turbine (2009)	140
Upper Kotmale Hydro (2010)	150
Coal Steam West Coast 1 (2010)	300
Coal Steam West Coast 2 (2011)	300
Coal Steam West Coast 3 (2012)	300
Coal Steam Trincomalee 1 (2013)	300
Coal Steam Trincomalee 2 (2014)	300
Gas turbine (2015)	285
Total	**2480**

source: CEB, ‘Long Term Generation Expansion Plan 2005 – 2019’, November 2004

Given the increasing reliance on fossil fuels planned by the CEB it would not be possible to justify a baseline of the weighted average emissions of the current generation mix, as this will change towards an increasing reliance on fuels with significantly greater emission intensity.

Using the combination of the operating margin and the build margin represents better the current and likely future developments, as it balances the emissions intensity of all plants constructed since 1992 (and a few older fossil fuelled facilities) with that of the last plants added to the grid although the reality over the next years, with the commissioning of the Coal Power Plants, will be presumably much worse in terms of CO2 emission.

Table 6 : Key Information and data used to determine the Baseline scenario

Variable	**Data Source**
Annual Generation of a power plant (MWh/yr), Genj,y	ENERGY CONSERVATION FUND, data for “Energy Balance 2004” DGM(EPT BRANCH), CEB, Fax dated 02/05/2006
Plant Efficiency, ηj,y (%)	ENERGY CONSERVATION FUND, data for“Balance 2004” DGM(EPT BRANCH), CEB, Fax dated 02/05/2006
Fuel type per plant	DGM(EPT BRANCH), CEB, Fax dated 02/05/2006
Parameter	
Carbon Content of fuel (kgC/TJ) and oxidation factor	IPCC Guidelines 1996

B.3. 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:

Energy demand in Sri Lanka has grown at around 7-8% [a] per year over the last 20 years, and this trend is likely to accelerate as the nation develops. In the absence of clean energy projects (such as this one) made economically feasible by revenue from CERs, there is little doubt that the baseline case for expansion of capacity would be as reflected in the CEB’s supply forecast to 2016 above.

[a] CEB, “Long Term Generation Expansion Plan 2005 – 2019”, November 2004

CEB,
The CEB is a state-owned monopoly with responsibility for managing, as well as owning and operating most power plants connected to the Sri Lankan grid. It purchases all power connected to the grid, under terms which tend to favour thermal energy over hydro and other small renewables.

In terms of barriers as described in Attachment A to Appendix B of the simplified modalities and procedures for small scale CDM project activities, small scale hydro faces the following:

Investment Risk Barrier:
The purchasing arrangement for hydro power outlined above poses considerable risk to investors in small scale hydro in Sri Lanka. Specifically, investors face risks because the CEB does not pay any upfront capacity charge, which in the case of thermal power producers covers capital costs plus an agreed rate of return on investment. Additional payment is made for the actual energy supplied. Therefore, in contrast to investors in small scale renewable projects, investors in thermal power have no risk of return on investment provided that the facility is technically sound.

Small hydro power on the other hand has no guarantee of price stability for its electricity, as the avoided costs can, and have in the past varied considerably. Hydro operators can suffer losses in some years.

Also, thermal operators can claim payment for drought induced energy shortfalls. This is not the case for small hydro operators. Increased climatic variability predicted for the future may lead to more frequent or prolonged drought conditions, with consequent risk to hydro plants associated with inability to supply contracted power.

Finally, small-scale hydropower investors like HPFL face risks related to power purchase terms of the CEB. The CEB does not transparently demonstrate to small power producers the method for calculating power purchase prices. As mentioned earlier, the tariff is based on the avoided cost of the most expensive thermal unit displaced. The tariff should therefore follow the rate of increase of the crude oil price. As showed in the table below, the Crude Oil has been increasing between 2001 and 2004 by 25% in average. During the same period, the tariff has increased of only 10% in average.

		2001	2002	2003	2004	Average
Crude Oil	Rs/BBL	2,208	2,405	2,835	4,164	
Tariff	Rs/kwh	4.05	5.71	5.90	5.14	
Oil Increase	%		9%	18%	47%	25%
Tariff Increase	%		41%	3%	-13%	10%

The tariff is calculated as the weighted average between the tariff for wet and dry season

Source: CEB, Energy and Purchase and Transmission, Branch, supporting document (5)
ECF, data for "Energy Balance 2004", supporting document (4)

In the last few years, CEB has also increased the projects implementation cost for small hydro project, by getting developers to upgrade existing CEB lines at their own expenses. In this respect, for Delta project, in addition to a new line of 1 km, HPFL had to upgrade more than 3.5 km of existing line.

CEB is now facing limitation for the existing substation where the small hydro power projects are located. For this reason, Delta is so far allowed to dispatch only 1.3 MW of its installed capacity of 1.6 MW until the substation capacity is increased.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:

The project boundary for the Sanquhar project encompasses the physical, geographical site of the power plants and associated physical structure.
The system boundary for the project is the national electricity grid in Sri Lanka.

Conforming to the guidance provided for small scale CDM project activities, the emissions related to production, transport and distribution of the fuel used for the power plants in the baseline are not included in the project boundary as these do not occur at the physical and geographical site of the project. For the same reason the emissions related to the transport are excluded from the project boundary.

B.5. Details of the baseline and its development:

Pursuant to guidance provided in Appendix B of the simplified modalities and procedures for small-scale CDM project activities the baseline emissions for the project are calculated in a transparent and conservative manner as follows:
The combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to procedures prescribed in the approved methodology ACM0002 where:

(i) The Operating Margin emission factor (EFom,y) is based on one of the four following methods: 1) Simple OM, or 2) Simple Adjusted OM, or 3) the Dispatch Data Analysis OM, or 4) the average OM;
(ii) The build margin emission factor (EFbm,y) is the generation weighted average emissions (in TCO_2/MWh) of a sample of power plants m. The sample group *m* consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group comprises the larger annual generation. Power plant capacity additions registered as CDM project activities should be excluded from the sample group m. If 20% falls on part capacity of a plant, that plant is included in the calculation.
(iii) The baseline emission factor (EFy) is the weighted average of the Operating Margin emission factor (EFom,y) and the Build Margin emission factor (EFbm,y), where the weights are by default 50% each.

To calculate the Operating Margin emission factor, the Dispatch data analysis should be the first methodological choice. However, this method couldn’t be used in this case as the hourly dispatch data were not available. The Operating Margin emission factor can the calculated as the Simple OM method only where low-cost/must run resources constitute less than 50% of total grid generation in 1) average of the five most recent years, or 2) based on long term normals for hydroelectricity production.
As showed in the calculation tables, the low-cost/must run resources constitute less than 50% of total grid generation in average of the five most recent years. Therefore, this method was selected for the calculation of the Operating Margin emission factor.

The Simple OM has been calculated EX-ANTE, using the data vintages for years y, as the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission.

The build margin BM has been calculated EX-ANTE based on option 1: Most recent information available on plants already built at the time of PDD submission.

The CEB base case supply forecast is as follows.

Table 7: Ceylon Electricity Board base case supply forecast

Plant Name	Capacity (MW)	Annual Average Energy (GWh)
EXISTING		
Laxapana	335	1563
Mahaweli Complex	660	2258
Samanala Wewa	120	344
Inginiyagala	11	
Uda Walawe	6	
Nilambe	3	
Private Hydro Power	74	206
Kukule	70	300
COMMITTED		
Upper Kotmale (2010)	150	530
TOTAL HYDRO POWER	**1429**	**5201**

Source: CEB, “Long Term Generation Expansion Plan 2005 – 2019”, November 2004
CEB, “Long Term Generation Expansion Plan 1999 – 2013”, January 1999
CEB, “Statistical Digest 2004”

Existing, Committed and Additional Thermal Power Plants		
EXISTING	**Capacity (MW)**	**Annual Average Energy (GWh)**
Kelanitissa station		
Old gas turbines	120	656
New gas turbines	115	707
Combined cycle plant (August 2002)	165	1290
Sapugaskanda Station		
Diesel	72	472
Diesel extension	72	504
Independent Power producers		
Lakdhanavi	22.5	156
Asia Power Ltd	49	330
Colombo Power (Pvt) Ltd	60	420
Diesel Plant Matara (2002)	20	167
Kelanitissa AES CCY (2003)	163	1314
Diesel Plant Horana (2003)	20	167
Heladanavi (Pvt.) Ltd	100	698
TOTAL THERMAL POWER	**978.5**	**6881**
EXPANSION PLAN ADDITIONS (in sequence)		
Kerawalapitiya combined cycle (2008)	300	
Gas turbine (2008)	105	
Gas Turbine (2009)	140	
Upper Kotma;e Hydro (2010)	150	
Coal Steam West Coast I (2010)	300	
Coal Steam West Coast II (2011)	300	
Coal Steam West Coast III (2012)	300	
Coal Steam Trincomalee I (2013)	300	
Coal Steam Trincomalee II (2014)	300	
Gas Turbine (2016)	285	

Source: CEB, "Long Term Generation Expansion Plan 2005 – 2019", November 2004
CEB, "Statistical Digest 2004"

As per the instructions for small-scale projects, the power plants considered for the baseline include only those grid-connected power facilities in operation as of the date of preparation of the PDD. Table 8 lists the twelve (12) power plants included for purposes of estimating the approximate operating margin.

Table 8: Power plants included in the approximate operating margin

	CEB-operated facilities	Capacity (MW)	Date(s) commissioned
1	Kelanitiss gas turbine (old)	120	1980-82
2	Kelanitiss gas turbine (new)	115	1997
3	Sapugaskanda diesel plant	72	1984
4	Sapugaskanda diesel extension	72	1997-99
5	Combined cycle plant 1(JBIC-financed)	165	2002-2003
	Independent Power Producers (BOOT contracts)		
6	Lakdhanavi diesel engine	22.5	1997
7	Asia Power Ltd diesel engine	51	1998
8	Colombo Power Ltd diesel engine	64	2000
9	Matara diesel plant	24.8	2002
10	AES Kelanitissa (Pvt.) Ltd	163	2003
11	Horana diesel plant	24.8	2003
12	Heladanavi (Pvt.) Ltd	100	2004

Source: CEB, "Long Term Generation Expansion Plan 2005 – 2019", November 2004
CEB, "Statistical Digest 2004"

The baseline build margin is calculated from the sample group m, consisting of the power plant which capacity additions in the electricity system comprises 20% of the system generation (in Mwh) that have been built most recently. In this sample group, power plants which have been registered as CDM project activities have been excluded. This sample has been selected instead of the five power plants that have been built most recently because this sample group comprises a larger annual generation.

Table 9: Power plants for calculation of the build margin

Power plants	Date commissioned
46. Combined Cycle Power Plant 1 L.A.D.*	Aug-02
47. Combined Cycle Power Plant 1 Naphta	Aug-02
48. Deiyanwala MHP	Oct-02
49. Ace Power - Horana	Dec-02

50. Kukule Hydro Power Project	Jul-03
51. AES Kelanitissa	Oct-03
52. Ritigaha Oya Phase II, Dedugala	Dec-03
53. Sanquhar Estate (Lower Atabage Oya)	Dec-03
54. Kandureliya (Karawila Ganga) MHP, Uda Maliboda	Jan-04
55. Brunswick MHP, Moray Estates, Maskeliya	Mar-04
56. Sitagala, Balangoda	Apr-04
57. Way Ganga	May-04
58. Rath Ganga MHP. Enhancement not allowed due to grid limitations	Jul-04
59. Erathna (Waranagala) MHP, Erathna	Jul-04
60. Nakkawita MHP, Deraniyagala	Aug-04
61. Gampola Walakada MHP, Hapugoda, Kalawana	Sep-04
62. Miyanawita Oya, Deraniyagala	Sep-04
63. Battalgala MHP, Battalgala Estate, Dickoya	Nov-04
64. Atabage Oya MHP, Atabage, Gampola	Nov-04
65. Walapane Dendro Power Plant	Nov-04
66. Heladanavi Diesel Power Plant	Dec-04

Source: CEB, “Long Term Generation Expansion Plan 2005 – 2019”, November 2004
CEB, “Statistical Digest 2004”
CEB, EPT Branch, supporting document (6)

The final draft of the baseline was completed on 30/09/2006.

The baseline was developed by Hydro Power Services (Pvt) Ltd who is not a project participant listed in Annex 1, and act as a consultant.

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SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

The starting date of the project is taken as the construction starting date of the first plant of Sanquhar. The starting date is therefore the 05/04/2001.

C.1.2. Expected operational lifetime of the small-scale project activity:

Both plants have an expected operational lifetime of 25 years. Therefore the operational lifetime of the project is to be considered adding 25 years to the commissioning date of the second plant Delta, i.e. upto 2031.

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

The baseline emission factor will be based on an EX-ANTE estimate.

C.2.1. Renewable crediting period:

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

The starting date of the first crediting period is the 01/01/2004

C.2.1.2. Length of the first crediting period:

7 years 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Application of a monitoring methodology and plan:

D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:

Project category title: Category I.D. Renewable Electricity Generation for a Grid

Reference: Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities, Category I D taken from the document AMS 1D, Version 9, Scope 1, 28 July 2006.

Consistent with Appendix B of the simplified modalities and procedures for small-scale CDM projects for renewable electricity supplied to a grid (category 1.D) the monitoring shall consist of metering the electricity generated by the renewable technology.

D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:

Projects are small, run of river hydro power plant, with 3.2 MW of installed capacity (below the 15MW threshold of small – scale CDM projects), that displaced diesel fired electricity generation from thermal plant in the Sri Lanka National Grid. This fulfills the requirement of type 1 , Category 1.D. CDM small scale projects.

D.3 Data to be monitored:

Table 10: Data to be collected in order to monitor emissions from the small-scale project activity, and how this data will be archived:

ID number	Data Type	Data variable	Data unit	Measured (M), Calculated (C) or Estimated (E)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long archived data to be kept	Comment
1	Amount of electricity generated for Sanquhar	Metered electricity supplied to the grid	kWh	M	Monthly	100%	Electronically and paper records	Ten years after CER	Record at the head office
2	Amount of electricity consumed from the grid while the plant is stopped for Sanquhar	Metered electricity imported from the grid	kwh	M	Monthly	100%	Electronically and paper records	Ten years after CER	Record at the head office
3	Amount of	Metered	kWh	M	Mont	100%	Electroni	Ten	Record

	electricity generated for Delta	electricity supplied to the grid			hly		cally and paper records	years after CER	at the head office
4	Amount of electricity consumed from the grid while the plant is stopped for Delta	Metered electricity imported from the grid	kwh	M	Mont hly	100%	Electroni cally and paper records	Ten years after CER	Record at the head office

The meter used for the metering of the electricity supplied to the grid as well as the electricity imported from the grid is the meter installed, calibrated and maintained by CEB. This meter will be the one used to monitor the CER. This meter is a bi-directional meter connected on the medium voltage side through CTs and PTs supplied by CEB and connected to the CEB line at the point of supply. The meter was calibrated by CEB at the time of installation. CEB is checking it every month and HPFL is planning to get it calibrated every year.
The values are cross checked using a meter installed by HPFL inside the control panels on the low voltage side using CTs and PTs installed by HPFL. Steps are being taken to calibrate the meter every three years.

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

Pursuant to the simplified monitoring methodology used for the project the only variable that requires monitoring is the actual generation of electricity supplied from the project to the grid. This is done as follows.
Upon completion of construction, the CEB required independent testing of the facility and inspection of its equipment. The CEB witnessed the testing procedure.
The CEB installed and maintains a primary meter measure electricity passing to the grid to enable correct payment to HPFL. The metering equipment is located adjacent to the plant and is sealed.
The CEB read the meter at the end of each month for determination of the electrical energy delivered to and accepted by CEB under the terms of the SPPA.
The power plant is automatic and operators take down periodic readings. In case of any problem with operations or monitoring, the operator contacts a senior engineer over the phone.
The HPFL CEO will have direct responsibility for ensuring adherence to and compliance with HPFL's roles in the above procedures.

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

HPFL power plant operators monitor plant operation including energy supplied to the grid by taking at least daily readings of generation levels and recording them on site. These data are also archived at the HPFL main office.

For the purpose of project verification, records of electricity supplied to the grid and meter calibration will be available at HPFL's office in Colombo. The verifier will also be welcome to visit the project site to confirm the status of operations.

No leakage effects are applicable to the plant's operation as the equipment at the plant has not been moved from any other operational location.

D.6. Name of person/entity determining the monitoring methodology:

Hydro Power Services (Pvt) Ltd
Prince Alfred Tower Level 3,
10 Alfred House garden
Colombo 03
Sri Lanka
Tel : 0094 (0) 112514006
Fax : 0094 (0) 112514006
This entity is not a project participant listed in Annex 1.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

Appendix B does not provide a formula for calculating the baseline for a type AMS 1.D. project.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

This is not applicable as no significant emissions occur within the project boundary. Therefore, as per the Simplified Procedures for SSC Project Activities no leakage calculation is required.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

This is not applicable as the renewable energy technology used is not equipment transferred from another activity. Therefore, as per the Simplified Procedures for SSC Project Activities no leakage calculation is required.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

Sanquhar's and Delta's project emissions are zero.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

Pursuant to guidance provided in Appendix B of the simplified modalities and procedures for small-scale CDM project activities the baseline emissions for the project are calculated in a transparent and conservative manner as follows:

The combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to procedures prescribed in the approved methodology ACM0002 where:

(iv) The Operating Margin emission factor (EFom,y) is based on the Simple OM,

(v) The Build Margin emission factor (EFbm,y) is the generation weighted average emissions (in TCO_2/MWh) of a sample of power plants m. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Power plant capacity additions registered as CDM project activities are excluded from the sample group m. As 20% falls on part capacity of a plant, that plant is included in the calculation.

(vi) The baseline emission factor (EFy) is the weighted average of the Operating Margin emission factor (EFom,y) and the Build Margin emission factor (EFbm,y), where the weights are by default 50% each.

The Operating Margin emission factor is calculated based on the Simple OM method as low-cost/must run resources constitute less than 50% of total grid generation in average of the five most recent years and because the hourly dispatch data were not available to use the Dispatch Data Analysis.

The Simple OM has been calculated EX-ANTE, using the data vintages for years y, as the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission.

The build margin BM has been calculated EX-ANTE based on the most recent information available on plants already built at the time of PDD submission.

Step 1: Calculate the Operating Margin emission factor (EFom,y)

a. Selection of the method to calculate the Operating Margin emission factor (EFom,y)

The simple OM method can only be used where low-cost/must run resources constitute less than 50% of the total grid generation in: (1) average of the five most recent years, or (2) based on the long term normals for hydroelectricity production.

To demonstrate this, the following equation was used:

G = Σ Genlc,j,y/Σ Geny Where

Genlc,j,y= Generation of the low-cost/must run plant for the five most recent years (Gwh)
Geny = Total generation for the five most recent years ((Gwh)

The Dispatch Data Analysis could not be used as the hourly dispatch data were not available.

b. Calculation of the operating margin of thermal power plant connected to the grid in 2002

As per ACM0002 for the simple OM, the following equations were used:

EFom,y= (∑Fi,j,y(kg)*COEFi,j,y(tCO2/kg))/(∑GENj,y(mwh)) (1)

COEFi,j= NCVi(Tj/kg)*EFco2,i(tCO2/TJ)*OXIDi (2)

Where,

EFom,y	is the Operating Margin emission factor for year y (tCO_2/mwh)
Fi,j,y(kg)	is the amount of fuel i (in kg) consumed by relevant power sources j in year y
COEFi,j,y	is the CO_2 emission coefficient of fuel i (tCO_2/kg), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel
NCVi	is the net calorific value (energy content) per kg of a fuel i
EFco2,i	is the Emission Factor of CO_2 for the fuel i used by the plant (tCO_2/TJ)
OXIDi	is the percent oxidation of the fuel
Genj,y(Mwh)	is the Generation of the plant j for year y in Mwh (Mwh)
j	refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants

To calculate EFom,y, based on the data available, the following equation were also used :

$$F_{i,j,y}(kg) = F_{i,j,y}(TJ)/NCV_i(Tj/kg) \quad (3)$$

$$F_{i,j,y}(TJ) = GEN_{j,y}(TJ)/\eta_{j,y} \quad (4)$$

$$GEN_{j,y}(TJ) = 3.6 * 10^{-3} * GEN_{j,y}(Mwh) \quad (5)$$

Where,

Fi,j,y(TJ)	is the amount of energy consumed by the relevant plant j in TJ (TJ)
Genj,y(TJ)	is the Generation of the plant j for year y in TJ (TJ)
$\eta_{j,y}$	is the average efficiency of the plant j for year y
GENj,y(Mwh)	as defined above
NCVi	as defined above

In equation (1), the relevant variable were replaced based on the equation (2) to (5), so that equation (1) above could be written as :

$$EF_{om,y} = (\sum(GEN_{j,y}(TJ)/\eta_{j,y}) * EF_{co2,i}(tCO_2/TJ) * OXID_i) / (\sum GEN_{j,y}(Mwh))$$

In this step, the calculation was made for the year 2002 with the thermal plant connected to the grid in this particular year.

c. Calculation of the operating margin of thermal power plant connected to the grid in 2003.

The same equations, as in the b., were used to calculate the operating margin in 2003 with the thermal plant connected to the grid in this particular year.

d. Calculation of the operating margin of thermal power plant connected to the grid in 2004.

The same equations, as in the b., were used to calculate the operating margin in 2004 with the thermal plant connected to the grid in this particular year.

e. Calculation of the 3 year average of the Operating Margin Emission Factor

The Operating margin emission factor is calculated as the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission.

$$EF_{om} = (\sum Gen_{j,2002} * EF_{om,2002} + \sum Gen_{j,2003} * EF_{om,2003} + \sum Gen_{j,2004} * EF_{om,2004}) / (\sum Gen_{j,2002} + \sum Gen_{j,2003} + \sum Gen_{j,2004})$$

Where, EF_{om} is the Operating Margin
$EF_{om,2002}$ is the Operating Margin emission factor for 2002
$EF_{om,2003}$ is the Operating Margin emission factor for 2003
$EF_{om,2004}$ is the Operating Margin emission factor for 2004
$\sum Gen_{j,2002}$ is the total generation of the plant j in 2002
$\sum Gen_{j,2003}$ is the total generation of the plant j in 2003
$\sum Gen_{j,2004}$ is the total generation of the plant j in 2004

Step 2: Calculate the Build Margin emission factor ($EF_{bm,y}$)

The build margin is the weighted average emissions of recent capacity additions to the system. It is based on a sample group comprises of either the five power plants that have been built most recently or the power plant capacity additions to the electricity system that comprise 20% of the system generation and that have been build most recently. The selection of the sample group should be based on the group that comprises the larger annual generation. Power plant capacity additions registered as CDM project activities should be excluded from the sample group:

The annual total generation for 2004 has been obtained from the ECF, data for “Energy Balance 2004”.
The capacity addition of the most recent five plants as defined in table 9 above as been calculated and compared to 20% of the annual total generation for 2004.

As, the capacity addition of the most recent five plants is lower than 20% of the annual total generation for 2004, the sample group was selected as the most recent power plants contributing to the annual total generation upto 20% of the annual total generation.

From the sample group, the build margin weighted average was calculated based on the equation detailed in Step 1 above.

Step 3: Calculate the baseline emission factor EF_y

The baseline emission factor EF is the weighted average of the Operating Margin emission factor (EF_{om}) and the Build Margin emission factor (EF_{bm}):

EF= Wom*EFom+Wbm*EFbm

Where the weights Wom and Wbm, by default, are 50% and EFom and EFbm are calculated as descrived in step 1 to 6 above and are expressed in tCO2/MWh.

Baseline anthropogenic emissions

The baseline emissions of the project were calculated using the Baseline Emission Factor described above. Based on this annual emission reductions of the project were calculated as follows.

Annual power generation * Weighted average emission reduction = baseline emissions

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Based on the above equations, when the two plants are producing, the emissions reductions will be as follow:

Table 11: Emission reduction due to the project activity

Project	MWh/year	Weighted average Emissions reduction (TCO_2 /MWh)	Emission reduction for a 12-month period tons CO_2 / kWh)
Sanquhar	5,000	0.6816	3,408
Delta	4,579	0.6816	3,121
Total			6,529

E.2 Table providing values obtained when applying formulae above:

Step1: Calculate the Operating Margin emissio factor (EFom,y)

a. Selection of the method to calculate the Operating Margin emission factor (EFom,y)
The Simple OM method can only be used where low-cost/must run resources constitute less than 50% of the total grid generation in: (1) average of the five most recent years, or (2) based on the long term normals for hydroelectricity production.
The Dispatch Data analysis could not be used as the hourly dispatch data were not available.

Table 12: Generation over the five most recent years for which data are available

(Gwh)	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
CEB Hydro	3,153.84	3,044.87	2,588.62	3,190.04	2,754.70	14,732.07
CEB Non Conventional	3.36	3.46	3.64	3.39	2.82	16.67
SPP Hydro	43.14	64.71	103.46	120.29	205.58	537.18
Total Low-cust/must Run	3,200.34	3,113.04	2,695.72	3,313.72	2,963.10	15,285.92
CEB Thermal	2,205.34	1,895.50	1,952.62	2,247.92	2,506.86	10,808.24
IPP Thermal	822.44	1,057.78	1,243.32	1,745.68	2,086.96	6,956.18
SPP Thermal	0.15	0.05	0.39	1.16	1.42	3.17
Hired Thermal	484.61	471.09	939.25	394.40	509.24	2,798.59
Total Thermal	3,512.54	3,424.42	4,135.58	4,389.16	5,104.48	20,566.18
Total Generation	6,712.88	6,537.46	6,831.30	7,702.88	8,067.58	35,852.10
% of low-cost/must run	48%	48%	39%	43%	37%	43%

Source: Energy Conservation Fund, Data for the "Energy Balance 2004", supporting document (2)

The average of the five most recent years for which data are available of low-cost/must run resources constitute less than 50% of the total grid generation (43%). Therefore the simple OM method has been selected.

b. Table 13: Calculation of the operating margin of thermal power plant connected to the grid in 2002

Power plants	Date commissioned	Fuel Type	Generation	Generation	Efficiency	Carbon Emission Factor	Emission Factor	Oxidation	Emission	Emission Factor	
	yc	Ft	Gen $_{j,y}$ (MWh)	Gen $_{j,y}$ (TJ)	$\eta_{j,y}$	$EFc_{,i}$	$EFco2_{,i}$		$F_{i,j,y}$*$COEF_{i,j}$	$EFom_{,y}$	symbol
	Year	-	MWh	TJ		TC/TJ	TCO2/TJ		TCO2	TCO2/MWh	Unit
Facilities as of December2002	-	-	(a)	(b)=(a)*3.6*10^{-3}	(c)	(d)	(e) = 44/12* (d)	(f)	(g)=((b)/(c)) *(e)*(f)	(i)=(g)/(h)	Formula
	(1)	(1)	(1)	Calc	(1)	(2)	Calc	(2)	Calc	Calc	source
CEB-operated Kelanitissa Power station											
1. Gas turbine (old)	1981-82	L.A.D.	179,020	644	20.90%	20.2	74.07	0.99	226,108	0.073	
2. Gas turbine (new)	1997	L.A.D.	226,745	816	26.80%	20.2	74.07	0.99	223,338	0.072	
3. Combined Cycle Power Plant 1	2002	L.A.D.	251,370	905	29.00%	20.2	74.07	0.99	228,810	0.073	
		Naptha	219,035	789	30.70%	20.0	73.33	0.99	186,472	0.060	
CEB-operated sapugaskanda power station											
4. Diesel plant	1984	H.F.O.	524,278	1,887	40.90%	21.1	77.37	0.99	353,452	0.113	
5. Diesel extension	1997-99	H.F.O.	473,139	1,703	43.50%	21.1	77.37	0.99	299,910	0.096	
Independent Power Producers (BOOT contracts)											
6. Lakdhanavi diesel engine	Nov-97	F.O.	200,940	723	32.60%	20.2	74.07	0.99	162,708	0.052	
7. Asia Power Ltd diesel engine	Jun-98	H.F.O.	377,040	1,357	39.40%	21.1	77.37	0.99	263,866	0.085	
8. Barge Mounted	Jul-00	F.O.	501,950	1,807	32.60%	20.2	74.07	0.99	406,446	0.130	
9. Ace Power – Matara	Mar-02	F.O.	154,390	556	32.60%	20.2	74.07	0.99	125,015	0.040	
10. Ace Powe - Horana	Dec-02	F.O.	9,000	32	32.60%	20.2	74.07	0.99	7,288	0.002	
		Total (h)	3,116,907						Total	**0.7968**	

Source: (1) DGM (EPT BRANCH), CEB, Fax dated 02/05/2006, supporting document (1)

(2) IPCC Guidelines 1996 and (3) EC, Data for « Energy Balance 2004 », supporting document (3)

C. Table 14: Calculation of the approximate operating margin of thermal power plant connected to the grid in 2003

Power plants	Date commissioned	Fuel Type	Generation	Generation	Efficiency	Carbon Emission Factor	Emission Factor	Oxidation	Emission	Emission Factor	
	yc	Ft	$Gen_{j,y}$ (mwh)	$Gen_{j,y}$ (TJ)	$\eta_{j,y}$	$EFc_{,i}$	$EFco2_{,i}$		$F_{i,j,y}$*$COEF_{i,j}$	$EFom,_{y}$	Symbol
	Year	-	Mwh	TJ		TC/TJ	TCO2/TJ		TCO2	TCO2/MWh	Unit
Facilities as of December2003	-	-	(a)	(b)=(a)*3.6*10^{-3}	(c)	(d)	(e) = 44/12* (d)	(f)	(g)=((b)/(c))*(e)*(f)	(i)=(g)/(h)	Formula
	(1)	(1)	(1)	Calc	(1)	(2)	Calc	(2)	Calc	Calc	source
CEB-operated Kelanitissa Power station											
1. Gas turbine (old)	1981-82	L.A.D.	37,936	137	18.20%	20.2	74.07	0.99	55,023	0.014	
2. Gas turbine (new)	1997	L.A.D.	292,791	1,054	27.50%	20.2	74.07	0.99	281,051	0.073	
3. Combined Cycle Power Plant 1	2002	L.A.D.	315,427	1,136	37.60%	20.2	74.07	0.99	221,448	0.057	
		Naptha	539,622	1,943	41.30%	20.0	73.33	0.99	341,491	0.088	
CEB-operated sapugaskanda power station											
4. Diesel plant	1984	H.F.O.	494,690	1,781	40.60%	21.1	77.37	0.99	335,969	0.087	
5. Diesel extension	1997-99	H.F.O.	512,779	1,846	43.60%	21.1	77.37	0.99	324,291	0.084	
Independent Power Producers (BOOT contracts)											
6. Lakdhanavi diesel engine	Nov-97	F.O.	152,620	549	28.45%	20.2	74.07	0.99	141,609	0.037	
7. Asia Power Ltd diesel engine	Jun-98	H.F.O.	344,870	1,242	38.75%	21.1	77.37	0.99	245,400	0.063	
8. Barge Mounted	Jul-00	F.O.	415,700	1,497	28.45%	20.2	74.07	0.99	385,708	0.100	
9. Ace Power - Matara	Mar-02	F.O.	151,080	544	28.45%	20.2	74.07	0.99	140,180	0.036	
10. Ace Powe - Horana	Dec-02	F.O.	109,620	395	28.45%	20.2	74.07	0.99	101,711	0.026	
11. AES Kelanitissa	Oct-03	L.A.D.	497,730	1,792	36.38%	20.2	74.07	0.99	361,153	0.093	
		Total (h)	3,864,865						Total	**0.7594**	

Source: (1) DGM (EPT BRANCH), CEB, Fax dated 02/05/2006, supporting document (1)

(2) IPCC Guidelines 1996 and (3) EC, Data for « Energy Balance 2004 », supporting document (3)

D. Table 15: Calculation of the approximate operating margin of thermal power plant connected to the grid in 2004

Power plants	**Date commissioned**	**Fuel Type**	**Generation**	**Generation**	**Efficiency**	**Carbon Emission Factor**	**Emission Factor**	**Oxidation**	**Emission**	**Emission Factor**	
	yc	Ft	$Gen_{j,y}$ (MWh)	$Gen_{j,y}$ (TJ)	$\eta_{j,y}$	$EFc_{,i}$	$EFco2_{,i}$		$F_{i,j,y}$*$COEF_{i,j}$	$EFom_{,y}$	Symbol
	Year	-	MWh	TJ		TC/TJ	TCO2/TJ		TCO2	TCO2/MWh	Unit
Facilities as of December2004	-	-	(a)	(b)=(a)*3.6*10^{-3}	(c)	(d)	(e) = 44/12*(d)	(f)	(g)=((b)/(c))*(e)*(f)	(i)=(g)/(h)	Formula
	(1)	(1)	(1)	Calc	(1)	(2)	Calc	(2)	Calc	Calc	source
CEB-operated Kelanitissa Power station											
1. Gas turbine (old)	1981-82	L.A.D.	141,418	509	19.05%	20.2	74.07	0.99	195,961	0.043	
2. Gas turbine (new)	1997	L.A.D.	438,532	1,579	28.50%	20.2	74.07	0.99	406,178	0.090	
3. Combined Cycle Power Plant 1	2002	L.A.D.	582,089	2,096	42.50%	20.2	74.07	0.99	361,544	0.080	
		Naptha	525,352	1,891	46.70%	20.0	73.33	0.99	294,017	0.065	
CEB-operated sapugaskanda power station											
4. Diesel plant	1984	H.F.O.	303,196	1,092	40.50%	21.1	77.37	0.99	206,424	0.046	
5. Diesel extension	1997-99	H.F.O.	512,558	1,845	43.60%	21.1	77.37	0.99	324,152	0.072	
Independent Power Producers (BOOT contracts)											
6. Lakdhanavi diesel engine	Nov-97	F.O.	176,070	634	26.73%	20.2	74.07	0.99	173,879	0.038	
7. Asia Power Ltd diesel engine	Jun-98	H.F.O.	368,260	1,326	39.36%	21.1	77.37	0.99	257,983	0.057	
8. Barge Mounted	Jul-00	F.O.	507,000	1,825	26.73%	20.2	74.07	0.99	500,691	0.111	
9. Ace Power – Matara	Mar-02	F.O.	198,380	714	26.73%	20.2	74.07	0.99	195,911	0.043	
10. Ace Powe - Horana	Dec-02	F.O.	167,780	604	26.73%	20.2	74.07	0.99	165,692	0.037	
11. AES Kelanitissa	Oct-03	L.A.D.	407,060	1,465	36.38%	20.2	74.07	0.99	295,363	0.065	
12. Heladhanavi	Dec-04	F.O.	202,730	730	26.73%	20.2	74.07	0.99	200,207	0.044	
		Total (h)	4,530,425						Total	**0.7898**	

Source: (1) DGM (EPT BRANCH), CEB, Fax dated 02/05/2006, supporting document (1)

(2) IPCC Guidelines 1996 and (3) EC, Data for « Energy Balance 2004 », supporting document (3)

E. Table 16: Calculation of the full generation weighted average for the most recent 3 years

	2002	2003	2004	Avg.
Operating Margin emission factor	0.7968	0.7594	0.7898	**0.7815**
Total Generation	**3,116,907**	**3,864,865**	**4,530,425**	

Step 3 : Calculate the Build Margin
Table 17: Selection of Sample group

	Energy (GWh)
Total Generation to CEB grid in 2004	8067.58
20% of the system generation in 2004	1613.51
Generation of the five most recent plants	203.74

Selection of sample	**20% of the system generation is more than the generation addition from the five power plants that have been built most recently. Therefore, the sample group m will be considered as the power plant capacity additions in the electricity system that comprise 20% of the system generation and that have been most recently, excluding the plant regisitered as CDM project activities.**

Table 18: Calculation of the Build Margin emission factor based on the most recent plants contributing to 20% of the system generation

Power plants	Date commissioned	Generation	Generation	Efficiency	Carbon Emission Factor	Emission Factor	Oxidation	Emission	Emission Factor
		Gen $_{j,y}$ (MWh)	Gen $_{j,y}$ (TJ)	$\eta_{j,y}$	$EFc_{,i}$	$EFco2_{,i}$		$F_{i,j,y}$*$COEF_{i,j}$	$EFom_{,y}$
		MWh	TJ		TC/TJ	TCO2/TJ		TCO2	TCO2/MWh
		(a)	(b)=(a)*3.6*10-3	(c)	(d)	(e) = 44/12* (d)	(f)	(g)=((b)/(c))*(e)* (f)	(i)=(g)/(h)
		(1)	Calc	(1)	(2)	Calc	(2)	Calc	Calc
1.Old Laxapana	1950								
2. Kelanitissa Steam Power Units	1962								
3. Inginiyagala	1963								
4. Wimalasurendra Hydro	1965								
5. Polpitiya	1969								
6. Uda Walawe	1969								
7. New Laxapana	1974								
8. Ukuwela	1976								
9. Kelanitissa Old Gas Turbine	1980								
10. Bowatenna	1981								
11. Canyon Hydro	1983								
12. Sapugaskanda Old Diesel	1984								
13. Victoria	1985								
14. Kotmale	1985								
15. Randenigala	1986								
16. Nilambe	1988								
17. Rantambe	1990								
18. Samanalawewa	1992								
19. Seetha Eliya MHP	Mar-96								
20. Dickoya MHP	Apr-96								
21. Kelanitissa New Gas Turbine	1997								
22. Sapugaskanda New Diesel ext. (4	1997								

units)										
23. Lakdhanavi diesel engine	Nov-97									
24. Rakwana MHP	Feb-98									
25. Asia Power Ltd diesel engine	Jun-98									
26. Thalawakelle MHP	Aug-98									
27. Madampe WHP	Dec-98									
28. Kolonna MHP	Feb-99									
29. Delgoda MHP	Mar-99									
30. Weddemulla MHP	Jun-99									
31. Ellapita Ella MHP	Jun-99									
32. Carolina 1 MHP	Jun-99									
33. Sapugaskanda New diesel ext. (4 units)	Oct-99									
34. Glassaugh MHP	Mar-00									
35. Barge Mounted Diesel Power Plant	Jul-00									
36. Mandagal Oya MHP	Jan-01									
37. Minuwanella MHP	Apr-01									
38. Kabaragala MHP	May-01									
39. Bambarabotuwa Oya MHP	Jun-01									
40. Galatha Oya MHP	Jun-01									
42. Solar PV System	Jan-02									
43. Ace Power - Matara	Mar-02									
44. Lower Bellihul Oya MHP	May-02									
45. Watawala MHP (Carolina-II)	Jun-02									
46. Combined Cycle Power Plant 1 L.A.D.*	Aug-02	582,089	2,096	42.50%	20.2	74.07	0.99	361,544	0.160
47. Combined Cycle Power Plant 1 Naphta	Aug-02	525,352	1,891	46.70%	20	73.33	0.99	294,017	0.130
48. Deiyanwala MHP	Oct-02	3,597	13	88.00%	0	0.00	0	0	0.000
49. Ace Power - Horana	Dec-02	167,780	604	26.73%	20.2	74.07	0.99	165,692	0.073
50. Kukule Hydro Power Project	Jul-03	320,340	1,153	88.00%	0	0.00	0	0	0.000
51. AES Kelanitissa	Oct-03	407,060	1,465	36.38%	20.2	74.07	0.99	295,363	0.130
52. Ritigaha Oya Phase II, Dedugala	Dec-03	2,074	7	88.00%	0	0.00	0	0	0.000

53. Sanquhar Estate (Lower Atabage Oya)	Dec-03	3,948	14	88.00%	0	0.00	0	0	0.000
54. Kandureliya (Karawila Ganga) MHP, Uda Maliboda	Jan-04	2,358	8	88.00%	0	0.00	0	0	0.000
55. Brunswick MHP, Moray Estates, Maskeliya	Mar-04	458	2	88.00%	0	0.00	0	0	0.000
56. Sitagala, Balangoda	Apr-04	2,341	8	88.00%	0	0.00	0	0	0.000
57. Way Ganga	May-04	13,603	49	88.00%	0	0.00	0	0	0.000
58. Rath Ganga MHP. Enhancement not allowed due to grid limitations	Jul-04	5,593	20	88.00%	0	0.00	0	0	0.000
59. Erathna (Waranagala) MHP, Erathna	Jul-04	17,592	63	88.00%	0	0.00	0	0	0.000
60. Nakkawita MHP, Deraniyagala	Aug-04	737	3	88.00%	0	0.00	0	0	0.000
61. Gampola Walakada MHP, Hapugoda, Kalawana	Sep-04	5,123	18	88.00%	0	0.00	0	0	0.000
62. Miyanawita Oya, Deraniyagala	Sep-04	182	1	88.00%	0	0.00	0	0	0.000
63. Battalgala MHP, Battalgala Estate, Dickoya	Nov-04	0	0	88.00%	0	0.00	0	0	0.000
64. Atabage Oya MHP, Atabage, Gampola	Nov-04	773	3	88.00%	0	0.00	0	0	0.000
65. Walapane Dendro Power Plant	Nov-04	59	0	30.00%	29.9	109.63	0.99	77	0.000
66. Heladanavi Diesel Power Plant	Dec-04	202,730	730	26.73%	20.2	74.07	0.99	200,207	0.088
Capacity sub-total end 2004		2,263,790	100%						
								Build margin	**0.5817**

*As 20% falls on part capacity of the combine cycle power plant, it has also been included in the calculation

Source: (1) DGM (EPT BRANCH), CEB, supporting document (1)
(2) IPCC Guidelines 1996 and (3) EC, Data for « Energy Balance 2004 », supporting document (3)

Step 3

Calculation of the Emission f actor as the weighted average of the Operating Margin emission factor and the Build Margin emission factor

Operating Margin Emission Factor	EFom	0.7815	TCO2/MWh
Build Margin Emission Factor	EFbm	0.5817	TCO2/MWh
Baseline Emission Factor	**EF**	**0.6816**	**TgCO2/MWh**

Baseline Anthropogenic Emission

Table 18: Emission reduction due to the project activity

	Annual Production	Emission Coefficient	Emission Reduction
	MWh/year	TCO2/MWh	TCO2/Year
Sanquhar	5,000	0.6816	3,408
Delta	4,579	0.6816	3,121
			6,529

SECTION F.: Environmental impacts:

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

The Central Environment Authority of Sri Lanka requires a detailed Environmental Report for projects such as the Sanquhar Hydropower Project. This report was compiled as part of obtaining necessary approvals for the project.

The Report identified no significant negative environmental impacts from implementation of the project. The full report is available from Pussellawa Plantations on request.

SECTION G. Stakeholders' comments:

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

The two sites are located within Tea Estates where the only local stake holder is the trade unions. Local stakeholders are primarily represented by the Trade Unions who represent the workers. The Trade Unions are very active in liaising with the Project Participants through Pussellawa Plantations Ltd who employ the Estate workforce.

In the Delta Small Hydro power projects, there is also a small village near the power house. That village has previously attached to the estate. Several meetings and discussions were held with the villagers since the inception of the project. Some of the meetings have been recorded in meeting.
Minutes of these meetings are available in full from the company.

All statutory and local authority approvals necessary were obtained prior to project commencement.

G.2. Summary of the comments received:

No significant concerns were raised for the implementation of the two hydro power plants on either environmental or social grounds.
At Delta project, the estate workers union requested for some benefit from the project either in supply of electricity or in monetary terms. Three villagers living in the immediate neighborhood of Delta Plant expressed also their interest in getting help to improve their houses by providing material and workmanship.

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

Comments obtained from the Central Environment Authorities and other authorities like the Archeological department are given in the approval letter issued by them. The original letters are kept in the head office, while copies of these letters are kept at the site office so that the comments are taken into account by the people working at site.
Comments obtained from the workers and the villagers at Delta have been taken note of by HPFL. Action has been taken to provide material and workmanship to the villagers living in the neighborhood of Delta plant. Discussions are in progress with the estate workers union to finalize the mode and quantum of benefit that will be given to them by HPFL, as CEB doesn't allow for direct supply of electricity.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization	Hydro Power Free Lanka (Pvt) Ltd.
Street /P.O.Box:	228, Havelock Road
Building	
City:	Colombo 05
State/Region:	Western Province
Postcode/ZIP:	
Country:	Sri Lanka
Telephone:	+94 (0) 11 4516903, 4516904
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E-Mail:	HPFL@sltnet.lk
URL:	
Represented by:	
Title:	Project Director
Salutation:	Mr.
Last Name:	Goybet
Middle Name:	
First Name:	Alexis
Department:	
Mobile:	+94 (0) 77 7686172
Direct FAX:	As earlier
Direct tel:	As earlier
Personal E-Mail:	As earlier

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding was available for the project
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Annex 3

PROJECT MANAGEMENT PLAN

Task	Sanquhar			Delta		
	Name of the person	**Designation**	**Others**	**Name of the person**	**Designation**	**Others**
Measuring the hourly production data	Mr.Heenkenda	Plant Incharge	These will be recorded for the use of company records.	Mr.Praneeth	Plant Incharge	These will be recorded for the use of company records.
	Mr.Piyasiri	Plant Incharge		Mr.Ravi	Plant Incharge	
Monitoring the hourly production data	Mr.Heenkenda	Plant Incharge		Mr.Praneeth	Plant Incharge	
	Mr.Piyasiri	Plant Incharge		Mr.Ravi	Plant Incharge	
Calculating the daily production data	Mr.Heenkenda	Plant Incharge		Mr.Praneeth	Plant Incharge	
	Mr.Piyasiri	Plant Incharge		Mr.Ravi	Plant Incharge	
Monitoring the daily production data	Mr.Heenkenda	Plant Incharge		Mr.Praneeth	Plant Incharge	
	Mr.Piyasiri	Plant Incharge		Mr.Ravi	Plant Incharge	
Calculating the monthly production data	Mr.Heenkenda	Plant Incharge		Mr.Praneeth	Plant Incharge	
	Mr.Piyasiri	Plant Incharge		Mr.Ravi	Plant Incharge	
Calculating the annual production data	Mr.Heenkenda	Plant Incharge		Mr.Praneeth	Plant Incharge	
	Mr.Piyasiri	Plant Incharge		Mr.Ravi	Plant Incharge	
Who will do the training of monitoring personnel	Mr. Alexis Goybet	Project Director		Mr. Alexis Goybet	Project Director	
Who will look after the unintended emissions due to emergency preparedness	Mr. Alexis Goybet	Project Director		Mr. Alexis Goybet	Project Director	
Who will do the calibration of monitoring equipment	CEB - For medium voltage meter		Use for invoicing, carbon credit and project emission	CEB - For medium voltage meter		use for invoicing, carbon credit and project emission

Annex 4

Environmental Monitoring Action Plan

Sanquhar Mini Hydro Power Project

The mitigation measures proposed in the environmental management plan will be carried at by the responsible agencies.

Activity	Monitoring Objectives	Parameters to be monitored	Monitoring Location	Responsible during Construction	Responsible during operation	Frequency
Surface water	Mitigate the environmental Impacts due to project	Nutrient levels in terms of Phosphate	Diversion weir	HPS	HPS	Every three months, during the Construction and Operation (Dry/Wet season basis)
Surface water		Total Inorganic Nitrogen (TIN)	Diversion weir, flowing stream	HPS	HPS	
Surface water		BOD	Upstream of the weir, water release to river	HPS	HPS	
Surface water		COD	Upstream of the weir, water release to the river	HPS	HPS	
Ecology		Fauna and Flora	Below the diversion point	HPS	HPS	
River Bank Erosion		Erosion level	Anywhere project induced erosion	HPS	HPS	
Sediments		Sediments deposits	Upstream of Weir	HPS	HPS	

Environmental Monitoring Action Plan

Delta Mini Hydro Power Project

The mitigation measures proposed in the environmental management plan will be carried at by the responsible agencies.

Activity	Monitoring Objectives	Parameters to be monitored	Monitoring Location	Responsible during Construction	Responsible during operation	Frequency
Surface water	Mitigate the environmental Impacts due to project	Nutrient levels in terms of Phosphate	Diversion weir	HPS	HPS	Every three months, during the Construction and Operation (Dry/Wet season basis)
Surface water		Total Inorganic Nitrogen (TIN)	Diversion weir, flowing stream	HPS	HPS	
Surface water		BOD	Upstream of the weir, water release to river	HPS	HPS	
Surface water		COD	Upstream of the weir, water release to the river	HPS	HPS	
Ecology		Fauna and Flora	Below the diversion point	HPS	HPS	
River Bank Erosion		Erosion level	Anywhere project induced erosion	HPS	HPS	
Sediments		Sediments deposits	Upstream of Weir	HPS	HPS	