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:

Hebbakavadi Canal Based Mini Hydro Project in Karnataka, India
Version I
Dated December 25, 2005

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

The Hebbakwadi mini hydel project is a canal based hydel project of capacity 2.95 MW. Four mini hydel units are proposed to be commissioned along the Hebbakvadi canal. Unit I will be of 400 kW located at 2500 m from Hebbakwadi head regulator, whereas Unit II, Unit III and Unit IV are each of 850kW each and will be located at chainage 5550 m, 6920 m and 7850 m respectively from Hebbakwadi head regulator. Unit II & III have been commissioned and are under operation whereas unit I and IV are under implementation.

Visweswariah Canal takes off from the left Bank of Krishnarajasagara dam situated in Mysore District. Visweswariah canal branches in to cauvery branch canal. Cauvery branch canal further bifurcates into hebbakavadi branch canal & thuruganur branch canal, near Village hebbakavadi. The four mini canals are located along the Hebbakavadi branch.

The candidate CDM project described in this Project Design Document will generate 18 million kWh of hydro power annually (i.e., Unit I will generate 2.822 MU, Unit II 5.335, Unit III 4.655 & Unit IV 4.417). The Units II and III of the Project were commissioned in July 2002. The Power Generation carried out by the commissioned units is 2036348 (2005), 2501536 (2004), 2157754 (2003), 1046774 (2002).

Purpose of Project

The small scale grid connected hydro project is an additional source of supply for the Southern Grid. Given the large difference in the demand and supply statistics of power supply in the southern region , the project, which utilizes renewable source to generate electricity, will play a vital role in strengthening the local grid (frequency improvement) and would be providing electricity from a clean source of energy. Apart from the generation of a utility the project also has socio economic implications, which add value to the project.

Although Karnataka State achieved good progress in the power sector both in hydro and thermal power generation besides other sources of energy generation, it is still not able to cope with the eternal demand for power. The contribution form these hydel projects although would be small, it would go a long way in meeting the power demand to a certain extent and help in avoiding frequent load shedding due to overloading. The power project is partly for captive consumption and partly for sale to electricity utility. Its contribution would be helpful for economic development local region because of better availability of the electricity.

Being a canal based mini hydel project it does not lead to any displacement of human population and thus rehabilitation is required. Further water for the project is drawn from an approach canal from the Habbakavadi Canal and is let back into the canal after passing through the generating equipment. There is no consumption of water and no disturbance to the irrigation regime. No forest clearance is also involved as the proposed area is in irrigated land.

View of the project participants on the contribution of the project activity to sustainable development

Ministry of Environment and Forests, Govt. of India has stipulated the following indicators for sustainable development in the interim approval guidelines for CDM projects:

A > Social well being – *The CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contribution to provision of basic amenities to people leading to improvement in quality of life of people.*

The proposed project activity leads to alleviation of poverty by establishing direct and indirect benefits through employment generation and improved economic activities by strengthening of local grid of the state electricity utility. The infrastructure in and around the project area has also improved due to project activity. This includes improvement of electricity quality, frequency and availability as the electricity is fed into a deficit grid.

B>Economic well-being - *The CDM project activity should bring in additional investment consistent with the needs of the people.*

The project activity leads to an investment of about INR 186.873 million to a developing region which otherwise would not have happened in the absence of project activity. The generated electricity is fed into the southern regional grid through available grid interconnection point, thereby improving the grid frequency and availability of electricity to the local consumers (villagers & sub-urban habitants) which will provide new opportunities for industries and economic activities to be setup in the area thereby resulting in greater local employment, ultimately leading to overall development. The project activity also leads to diversification of the national energy supply, which is dominated by conventional fuel based generating units.

C > Environmental well being - *This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general.*

The project utilizes hydro energy for generating electricity which otherwise would have been generated through alternate fuels based power plants, contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions. Being a renewable resource, using hydel energy to generate electricity contributes to resource conservation. Thus the project causes no negative impact on the surrounding environment contributing to environmental well-being.

D >Technological well being - *The CDM project activity should lead to transfer of environmentally safe and sound technologies with a priority to the renewables sector or energy efficiency projects that are comparable to best practices in order to assist in upgradation of technological base.*

The project activity leads to the promotion of Kaplan Turbines for Canal Based power generation units, the Power units produced are fed into the nearest sub-station (part of the southern regional grid), thus increasing energy availability and improving quality of power under the service area of the substation. Hence the project leads to technological well being.

The project is an attempt to provide a renewable source of electricity and at the same time help bridge the gap between the ever-increasing power deficit in the southern Grid, which has the highest deficit among the five grinds in the country.

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)
Government of India (Host Country)	Vijaylakshmi Hydro Power Pvt Ltd.,	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the party (ies) involved is required.		
Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party (ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

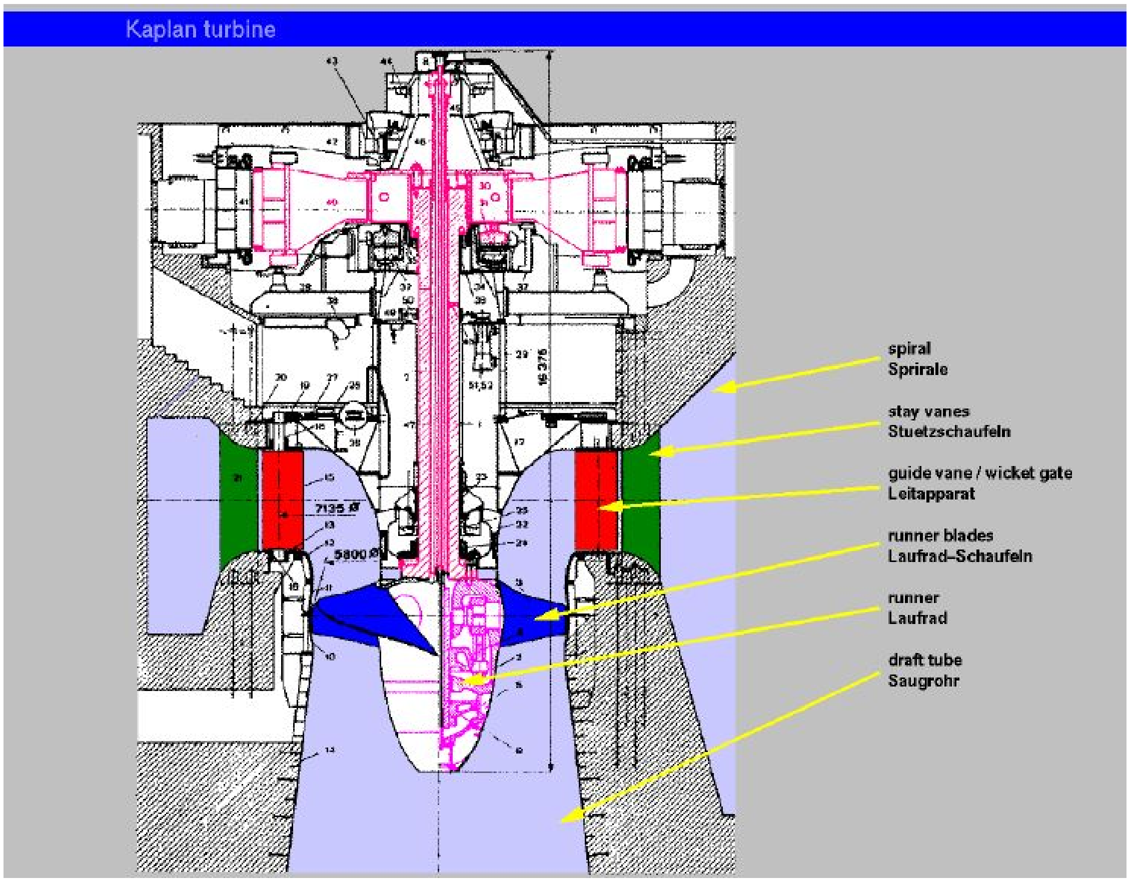
A.4. Technical description of the small-scale project activity:

Unit I will utilize a vertical open flume, semi Kaplan turbine of capacity 400kW and Runner Diameter 1860mm.The Unit uses a 400 kW, 415V, 3 phase 50 Hz, Induction Generator. The generator will comply with the requirements of the latest Indian Standards. The speed of the Generator will be 1000 rpm and will be capable of working with a voltage variation of ±10% and frequency variation of ± 3%.

Unit II and Unit III use Horizontal S type full Kaplan turbines of capacity 850kW each and Runner Diameter 1500mm.The generators are 850kW, 11kV, 3 phase, 50 Hz, 0.8 p.f Horizontal Synchronous generators.

This turbine is most suitable for canal drops.

Kaplan turbines are used where head and discharge variations are high. Propeller turbines are used where head and discharge variations are low and Semi Kaplan turbines are used where head and discharge variations are high in comparison to propeller turbines.



Unit IV will utilize a Full Kaplan Turbine of 850 kW capacity and a synchronous Generator.

The power generated from each unit is received at Unit III and transmitted through an 11KV single circuit line to Karnataka Electricity Board substation at KM Doddi, which is about 12 km from Unit III generating station, for wheeling and banking.

The total power evacuated through 11kV line would be received at KM Doddi substation through an 11kV feeder. The Feeder would consist of Vacuum Circuit Breaker of suitable current rating having a fault level of 26.3kA.The feeder will also provide the necessary CTs,PTs, protection relays etc.The bus bars of the 11kV panel would be directly connected to the 11kV bus of existing 11kV panels of KEB.

Further, as the water is drawn from Krishnaraja Sagar reservoir, no serious sedimentation problem is anticipated. Further in view of the steep bed gradient of the Hebbakavadi canal, the possibility of silt getting deposited at the mouth of the canal is not there.

The hydraulic data for the power project indicates that the water discharge in the Hebbakavadi is continuous for six months from July to December and on rotational bases of two weeks "ON" and one week "OFF" between January and May.

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

A.4.1.1. Host Party (ies):

Country: India

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

State: Karnataka
District: Mandya

A.4.1.3. City/Town/Community etc:

City Mandya

Village:	Unit I-	Chikkamalagudu	Chainage of Branch Canal 2400 M to 2564M
	Unit II-	Sabbanahalli	Chainage of Branch Canal 5260M to 6294M
	Unit III-	Bheemanahalli	Chainage of Branch Canal 6526M to 7580M
	Unit IV-	Kadukothanhalli	Chainage of Branch Canal 7580M to 8710M

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

The above Map shows the location of the Project in the vicinity of the Krishnarajasagar.

Visweswariah Canal takes off from the left Bank of Krishnarajasagara dam situated in Mysore District. Visweswariah canal branches in to cauvery branch canal. Cauvery branch canal further bifurcates into hebbakavadi branch canal & thuruganur branch canal, near Village hebbakavadi. The four mini canals are located along the Hebbakavadi branch.

The nearest village is Timmana Hosur. The site is about 2 km away from Hebbakvadi Head Work site and is 14 km away from Mandya town which is the district headquarters. A water bound macadam road runs parallel along the canal and the proposed site is located at a distance of about 8 Km from the Mandya - Malavalli road.

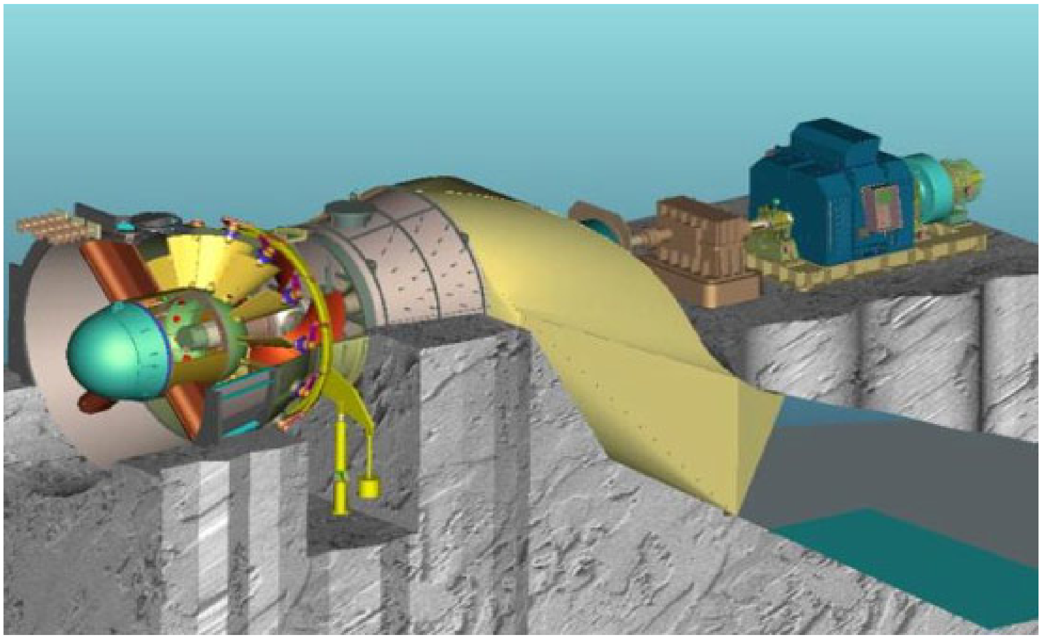
A.4.2. Type and category(ies) and technology of the small-scale project activity:

The project activity falls under category 1D of the appendix B of the simplified modalities and procedures for the small-scale CDM project activities.

Project category: Renewable Energy Project
Sub- category: renewable electricity generation for the regional grid.

Small Scale canal based hydro electricity generation is an important and vital mechanism to add to the generation capacity and thereby reduce the large demand and supply equation of power need in India. This project consisting of four cascading Mini hydel schemes is located on the Hebbakavadi Branch canal.

The project will involve conversion of potential energy available in the water flow into mechanical energy using hydro turbines and then into electric energy using alternators.



The above diagram is a representation of the Full Kaplan Turbines, which are being operated at Units II and III under the project.

Unit I of the project would utilize a Vertical Open Flume, Semi Kaplan Turbine.

The proposed CDM project activity does not involve any GHG emission within the project boundaries, as neither the project installation/operation involves any emissions nor the project involves any upstream inundation of land/storage of water, which may lead to generation of any other GHG gas.

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:

Government of India considers Climate Change as one of the most serious threats to the World's environment, with overall adverse impacts on human health, food security, economic activity, water and other natural resources.

Since the independance of India, the installed generation capacity of the nation has increased from 1362 MW to over 100,000 MW. However there are widespread shortages of power in almost all parts of the country. India has abundant coal reserves enough to last for at least 200 years. The high ash content in the Indian Coal is a cause of concern for GHG emissions as well as other forms of pollution. Still the hydro – thermal energy mix of the country has deterioerated from 35 % (Ist 5 year plan – 1956) to 17 % (Current). Thermal power stations which are good for base load applications have been used for meeting the peak load requirements whereas a vast hydro potential of approximatly 150,000 MW has been identified in the country, which is much suited for peak load demands and also signeficantly environmentally benign as compared to conventional generating stations, is still to be implemented.

The Planning Commission / Government is pro-conventional fuel based generating stations because of following reasons:

1. Availability of coal as a firm fuel for the nation.
2. Small gestration peirod of the plant.
3. Less debatable as compared to storage type multipurpose hydropower projects.
4. Ease of expansion of generating capacity.
5. Comparitively more cost effective as compared to hydropower for a considerable peirod of time.
6. Most of the identified large hydropower schemes were near the border of the country and thus existance of possibility of their becoming a potential war time target for mass distruction could not be overlooked.
7. Development of ditribution networks for carrying the power to the grid from remote small hydropower projects was out of question for developing country like India.

All these reasons in one way or the other stopped or limit the development of Hydropower Projects in the Country.

The project generates clean electricity which is feed to the regional grid, replacing an equivelent amount of electricity generated by the thermal power stations.

Additionally Hebbakavadi Mini Hydel Power Scheme is a small scale project as its installed capacity is below 15 MW (installed capacity 2.95 MW) and has been contemplated as a canal based scheme without creating any upstream storage of water.

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

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S. No.	**Year**	**Annual Emission Reduction tCO_2e**
1	2002-03	4839
2	2003-04	8306
3	2004-05	8306
4	2005-06	8306
5	2006-07	8306
6	2007-08	12317
7	2008-09	14324
Total estimated reductions (tonnes of CO_2e)		66714
Total number of crediting years		7
Annual average over the crediting period of estimated reductions (tones of CO2 e)		9530

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

No recourse to public funding had been taken. The project is financed through loans from financial institutions/banks and balance through in house equity participation. The Debt equity ratio is 75:25 with financial assistance coming from Indian Renewable Energy Development Agency Limited has been taken for the implementation of Unit II & III, whereas the company has applied for a term loan for Unit I & IV to the State Bank of Hyderabad. The loan application is under process.

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

According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/Add.3), a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

- With the same project participants
- In the same project category and technology
- Registered within the previous two years; and
- Whose project boundary is within 1km of the project boundary of the proposed small scale activity

This project is not a part of any large scale project / this is not a debundled / unbundled activity. The project is unique and is the only project owned by the investor on this canal.

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 Type: I	Renewable energy project
Project Category: I D	Renewable electricity generation for a grid
Reference:	Appendix B of the simplified M&P for small scale CDM project activities (UNFCCC, 2003b)

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

The project is a grid-connected hydro power plant and thus belongs to the category "Renewable electricity generation for a grid".

According to Article 23 of Appendix B of the simplified M&P for small scale CDM project activities (UNFCCC, 2003b) category I.D. "comprises renewables, such as photovoltaic, hydro, tidal/wave, wind, geothermal and biomass, that supply electricity to an electricity distribution system that is or would have been supplied by at least one fossil fuel or non-renewable biomass fired generating unit".

The proposed small-scale CDM project comprises run-of-river small hydro plant that will supply electricity to the grid that is now fed primarily by thermal power plants with future plans overwhelmingly in favor of fossil fuel based generating facilities and is thus applicable for project category 1D.

Appendix B to the simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/ADD.3) gives two options for calculating the baseline for a Type I D project:

(a) The average of the "approximate operating margin" and the "built margin"
OR
(b) The weighted average emissions (in kgCO_2 equ/kWh) of the current generation mix.

According to Article 23 of Appendix B of the simplified M&P for small scale CDM project activities (UNFCCC, 2003b) category I.D. "comprises renewables, such as photovoltaics, hydro, tidal/wave, wind, geothermal and biomass, that supply electricity to an electricity distribution system that is or would have been supplied by at least one fossil fuel or non-renewable biomass fired generating unit".

The proposed small-scale CDM project comprises run-of-river small hydro plant that will supply electricity to the grid that is now fed primarily by thermal power plants with future plans overwhelmingly in favor of fossil fuel based generating facilities and is thus applicable for project category 1D.

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:

Justification for application of simplified methodologies to the project activity
The installed capacity of the project is 2.95 MW, which is less than the limiting capacity of 15 MW and is thus eligible to use small-scale simplified methodologies. Further, the project activity is generation of electricity for a grid system using hydro potential. Hence, the type and category of the project activity matches with I.D. as specified in Appendix B of the indicative simplified baseline and monitoring methodologies for small-scale CDM project activities.

Justification for additionality of the project
The proposed CDM activity was neither planned by state or central sector utilities of the country nor was it identified as project for private sector development. Thus practically the project is a clear additional project, as the investor decided to exploit the possibility of low head canal based electricity generation. The description and explanation on why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances is given below.

The total installed generating capacity in India, as on January 2005 was about 115,545 MW. This includes 69.4% thermal (80201 MW), 26.08% hydro (30135 MW), 2.35% nuclear (2720 MW) and 2.15% wind based generation (2488 MW) [1]. Coal based thermal power generation has been the mainstay of electricity generation (http://cea.nic.in/exe_summ/jan/6.pdf).

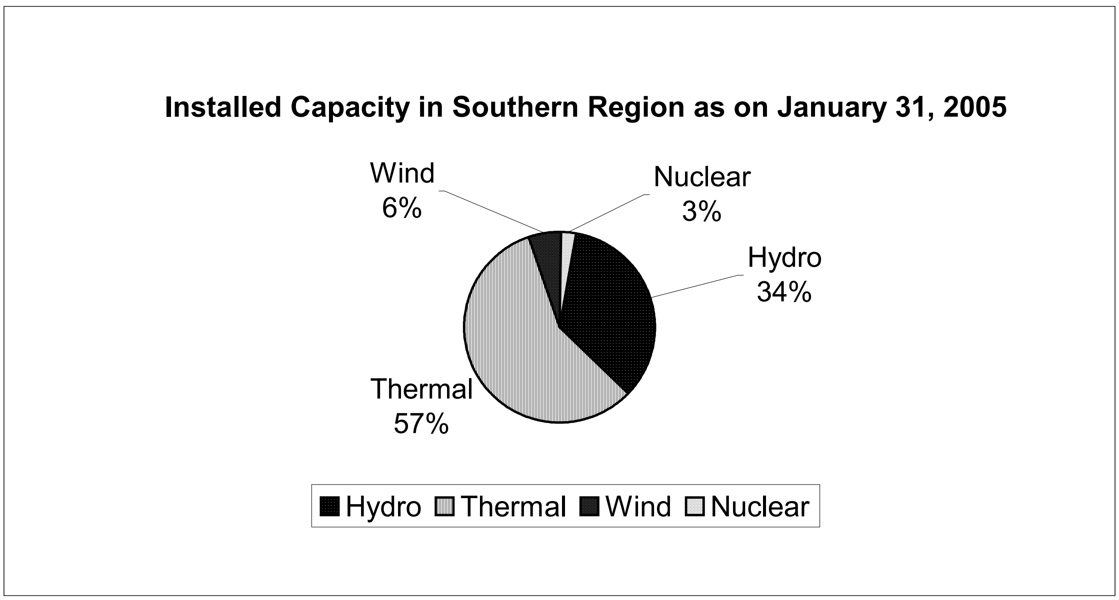
The total electricity generated in the country during the year 2003-04 was 633275 GWh (utilities + non utilities) recording an increase of 6.16% from the previous year with nearly 83% coming from thermal power plants. It is evident that the power generation is heavily dependent on the thermal generation. There are about 143 thermal power stations in India, out of which 90 are coal based and remaining use other fuels like gas, diesel, naphtha, etc.

In India, electricity is a concurrent subject between the state and the central governments. The perspective planning, monitoring of implementation of power projects is the responsibility of Ministry of Power, Government of India. At the state level the state utilities or state electricity boards (SEBs) are responsible for supply, transmission, and distribution of power. With power sector reforms there have been

[1] <http://cea.nic.in/exe_summ/jan/6.pdf>

unbundling and privatisation of this sector in many states. Many of the state utilities are engaged in power generation also. In addition, there are different central / public sector organizations involved in generation like National Thermal Power Corporation (NTPC), National Hydro Power Corporation (NHPC), etc. in transmission e.g. Power Grid Corporation of India Ltd. (PGCIL) and in financing e.g. Power Finance Corporation Ltd. (PFC).

There are five regional grids: Northern, Western, Southern, Eastern and North-Eastern. Different states are connected to one of the five regional grids. The CDM project is located in the southern Grid. The Southern Region of India comprises of four states and one Union Territory (UT) namely Tamil Nadu, Kerala, **Karnataka**, Andhra Pradesh and Pondicherry (UT). Pondicherry has only one combined cycle gas power generating station (32.50 MW) and hence receives power from the states in the Southern Region, through allocations and also imports power from Western, Eastern and Northern Regions. (Source: Southern Regional Electricity Board Annual Report 2002-2003).



The total installed capacity in the southern regional grid, to which the proposed project would be feeding electricity, is 30316.72MW as on December 31, 2004 (http://www.cea.nic.in/exe_summ/dec/6.pdf). The major source of power generation in the grid is thermal which constitutes approximately 57.6% of the total installed capacity. The installed capacity in MW of thermal, hydro, nuclear and wind in the southern grid as on December 31, 2004 was 17482, 10438, 780 and 1672 respectively. The total energy generated during the year 2003-2004 was 140744 MW (as calculated in the baseline calculations). The interregional assistance received in terms of energy is to the tune of 3810 Million units from eastern region. The growth in installed capacity in the southern region from 2002-2003 to 2003-2004 is of the order of 4.02% (CEA General Review 2005).

The Indian power system requirement had been assessed to need a hydropower and thermal / nuclear power mix in the ratio of 40.60 for flexibility in system operation depending on typical load pattern. The present ratio is 25:75 which needs to be corrected immediately to meet peak load requirements as well as system and frequency stability.

The estimated hydro potential in the country is 1,50,000 MW (corresponding to 84,044 MW at 60% load factor) out of which only 26,910 MW amounting to 18% of the total potential has been harnessed. While 14,393 MW hydro capacity is planned to be added in 10th Plan, action has been taken to ensure that more than 20,000 MW of hydro capacity is added during the 11th Plan period.

Additionality:

According to Attachment A to Annex B of the simplified modalities and procedures for CDM small-scale project activities evidence to why the proposed project is additional is offered under the following categories of barriers:

Investment Barrier:

The company is working towards implementation of 2.95 MW canal based grid connected renewable energy project. The complete project activity is divided into four units of 400 kW (one unit) & 850 kW (three units). The following table depicts the investment required and expected generation fro it.

Unit Number	Implementation Cost as per DPR (INR – million)	Annual Generation Potential (million kWh)	Actual / Expected Year of Installation
Unit I	30.832	2.822	July 2007
Unit II	49.841	5.335	July 2002
Unit III	51.700	4.655	July 2002
Unit IV	54.500	4.417	July 2007

Unit II & Unit III (Actual Performance Financials)

Description	**Year (All Figures in Indian National Rupee)**		
	2002-03	**2003-04**	**2004-05**
Sales	4418256	6376928	11945116
Interest Recd	1030669.58	1847992.42	1787790.54
Other Income	-	191719	1750
Power House Maintenance	150954.15	150540.3	345104.27
Other Maintenance	6080	20395	205492
Overheads	132989.26	262943.5	204401
Administrative Expenditures	941788.88	1487180.76	1777892.96
Prel Expenditures	66086	66086	66086
Profit before Depreciation & Interest	4151027.31	6429493.08	11135680.33
Depreciation	1881261.6	3650954	2009170
Profit before Interest	2269765.71	2778539.88	7488510.33
Interest	4325561.96	7843008.84	8529642
Total Profit / Loss	- 2055796.25	- 5064468.97	- 1041131.68
DSCR Unit II	**1.25**	**0.85**	**1.48**
DSCR Unit III	**0.67**	**0.79**	**1.14**

From the above it is clear that the already implemented two units of the project are running under losses and the Debt Service Coverage Ratio is less than prevailing business operation standards in India. The company is still continuing with its motive to install the balance two units (Unit I & Unit IV) for which they have applied for term loan and the bank is processing the loan application.

The company is facing significant difficulties in getting the financial assistance for the balance two units because of the following two reasons:

1) The previous two units with possibilities of higher plant load factors are underperforming and thus the expected DSCR has not been achieved through the actual cash flows.

2) The implementation cost of the balance two units is higher than the existing units whereas the expected plant load factor is lower, thus there is likelihood that the project may not be able to repay the loans At present the company is meeting the loan repayment demand through return on equity, which might not be possible after implementation of the balance two units.

The additional revenue through CDM can provide significant support to the project and bring in financial viability for the overall establishment.

Additionally since the generation of electricity is dependent upon the availability of water in the canal which is controlled by the irrigation department of the state of Karnataka, the project proponent will be dependent upon the irrigation department for the generation of electricity throughout the life of the project.

Thus for this particular project, neither availability of water, nor availability of grid is within the control of the project proponent and thus the dependency on state government would be there through the project life.

Given the above snapshot it is evident that the installation of the Hydel project on the canal will help bridge the deficit to some extent. The additionality of the project should be read in this background of High Power deficit and the initiative undertaken by the Project. By undertaking the project on the canal there has been additional power generation, which would otherwise have not been there. Furthermore, given the over dependence on thermal energy this project helps in bringing about diversification in the source of energy generation which is essential both from environmental and economical view point.

Harnessed energy has become a symbol of growth and instrument for development. Electric power particularly the hydro is among the cleanest and renewable energy input for economic activity, domestic and civic conveniences, climate control, communication and technology. The Ministry of Power has set on objective of providing "Power for all by 2012". This will entail electrification of all villages by 2007 and of all households by 2012. The infrastructure would need the availability of assured and quality power at affordable price through reliable and adequate generation, transmission and distribution facilities.

Further, given the audited reports of the company it is evident that the project requires additional revenue generation facility from CDM to sustain its operations. The profits and loss accounts of the Company from the two Units, which are operational, are in red and need additional revenue stream, which can be provided from CDM. This basic financial barriers needs to be addressed. Given the fact that the project has two more units which have to be commissioned it is essential that the project earns additional cash flows from CERs so that its commercial viability can be justified.

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 is defined as the notional margin around a project within which the project's impact (in terms of GHG reduction) will be assessed. As defined in the Annex B for small-scale project activities, the project boundary for a small-scale hydropower project that provides electricity to a grid encompasses the physical, geographical site of the renewable energy generation source.

The physical project boundary essentially covers the zone between diversion weir and tailrace of the project units along with the evacuation facility till grid interconnection point. No emissions have been envisaged within the project boundary.

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

The baseline calculations are carried out as under:

The baseline is calculated using the combined margin approach. The baseline emission factor is calculated in the following steps:

Step 1: Calculation of Operating Margin Emission Factor

The operating margin emission factor has been calculated using a 3 year data vintage excluding low operating cost and must run plants where low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

The $EF_{OM,Y}$ is estimated to be:
For the year 2002-2003 the $EF_{OM,Y}$ is 0.9542 tCO_2/MWh
For the year 2003-2004 the $EF_{OM,Y}$ is 0.9629 tCO_2/MWh
For the year 2004-2005 the $EF_{OM,Y}$ is 0.9705 tCO_2/MWh

Thus the final $EF_{OM,Y}$ based on three years average is estimated to be **0.9525 tCO_2/MWh**.

Step 2: Calculation of the Build Margin Emission Factor $EF_{BM,Y}$

The build margin has to be calculated by constituting a sample group m from either the 5 most recently built power plants or the power plant capacity additions in the electricity system that comprise 20% of the system generation (that have been built most recently). The sample group that comprises larger annual generation from either of these has to be chosen. It is observed that the generation from the sample group that comprises 20% of the system generation has larger generation than the 5 most recently built plants. So the Build Margin is calculated from the sample group comprising the most recently additions to the grid that comprise 20% of the system generation.

The $EF_{BM,y}$ is estimated as **0.7005 tCO_2/MWh** (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation).

Thus the baseline emission factor i.e. the Combined Margin emission factor will be calculated as the average of Step 1 and Step 2.

Baseline Emission factor: Average EF_{OM} & EF_{BM} = **0.8315 tCO_2/MWh**

Details of Baseline data:

Operating margin emission factor calculations:
The data for installed capacity and generation details of all the power plants in the Southern grid for the year 2004-05 has been compiled from SREB Annual Report 2002-2003, 2003-2004 and 2004-2005. CEA reports including Performance Review of Thermal Power Plants 2002-2003, 2003-2004, 2004-2005 and General Review 1999-2000 to 2004-2005 and websites of state electricity boards, NTPC, NHPC, NPCIL and other organisations. Installed capacity though not used directly in calculations, gives idea about the size of individual power plant, which is useful in future projections about the size of individual power plants, which would be added.

Station wise operating heat rates of coal/lignite based major thermal power stations were available in CEA Performance Review of Thermal Power Plants 2002-2003, 2003-2004 and 2004-2005, Section 13. For the remaining coal/lignite based thermal power stations, the Finalised Operation Norms published by CEA in its report Technical Standards on Operation Norms for Coal/Lignite Fired Thermal Power Stations were used. The operating heat rates of gas (combined cycle and open cycle units) and diesel based thermal power plants were obtained from the report entitled "Baseline for Renewable Energy Projects under CDM" which is available under public domain on the official website of the MNES (http://www.mnes.nic.in). Tariff orders issued by State electricity regulatory commissions have also been used to determine the operating heat rates of certain power plants.

The Net Calorific values (NCV) and emission factors ($EFCO_{2,}$ i) of various fuel types (grades of coal from D to F, Lignite, Gas, Diesel) utilised in power stations were also obtained from the report "Baseline for Renewable Energy Projects under CDM" who have used the values used by CEA in planning studies.

The fuel consumption data was obtained by back calculating fuel consumption from generation data, operating heat rates and net calorific values of the fuel used.

The oxidation factors of the fuel used have been taken from 1996 Revised IPCC Guidelines for Green House Gas Inventories: Reference Manual.

Calculation of Build Margin emission factor:

It requires the data for recent capacity additions to the grid. This data was obtained from CEA General Review 1999-2000, 2000-2001, 2001-2002, 2002-2003 and 2003-2004. The generation details of these capacity additions for the year 2003-2004 were obtained from Performance Review of Thermal Power Station 2003-04 and SREB Annual Report 2004-05.

Date of completing the final draft of this baseline section: 24/08/2005

Name of Person/entity determining the baseline:
Senergy Global Private Limited
D-33 Defence Colony
New Delhi – 110024
India
Tel: +91 11 2465 5141
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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:

30/11/2000

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

35 Years

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

>>

C.2.1. Renewable crediting period:

>>

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

20/07/2002

C.2.1.2. Length of the first crediting period:

7 Years (with two revisions)

C.2.2. Fixed crediting period:

N/A

C.2.2.1. Starting date:

N/A

C.2.2.2. Length:

N/A

SECTION D. Application of a monitoring methodology and plan:

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

The name of the methodology applied for the project activity is *"Metering the Electricity Generated"*. This is in accordance with the Appendix B of simplified modalities and procedures for small-scale CDM project activities. The reference to the proposed monitoring methodology is Clause 31 of Appendix B of simplified modalities and procedures for small-scale CDM project activities.

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

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The methodology was selected as suggested by the simplified monitoring methodologies for small scale CDM projects. Measuring and recording the amount of electricity supplied to the buyer is the most accurate method of monitoring the GHG reductions from the project.

D.3 Data to be monitored:

>>

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 is archived data to be kept?	Comment
1	Electricity supplied to the regional electricity grid	electricity	kWh	M	Monthly	100%	Electronic & Paper	Two years beyond Crediting period	

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

For a small scale CDM project activity the only set of data to be monitored is the net electricity output from the project. This data is already monitored by a third party. The state electricity utility is purchasing the generated electricity and the electricity is metered at grid interconnection point, against which the payment is made / will be made on monthly basis.

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:

1. The project activity does not involve any leakage within the project boundary because no alternate fuel (fossil fuel or any other GHG emitting fuel) can be used to run the turbines and generate electricity.
2. The generated electricity from the project is wheeled through the state electricity utility (KEB) for the complete project lifespan, for which the promoter has entered into a long term power purchase agreement (PPA) and wheeling agreement with the state electricity utility. Thus throughout the project cycle (crediting period) and beyond the electricity generated from the project will be monitored by both the project proponent and a third party i.e. KEB.
3. The generated electricity, before entering into the grid, at the grid interconnection point will be measured by digital, sealed kilowatt hour (kWh) meter of class 0.2, on monthly basis and will be documented both on paper as well as in electronic form. The generation records will be signed by the officials from project proponent and third party (KEB). This generation record will form the basis of payment by KEB to the project proponent. Such records will be maintained and would be made available on demand throughout the crediting period of the project.
4. The project proponent has appointed a full time project incharge to manage the overall project activities after commissioning. The project incharge will be stationed at the project site and will be responsible for monitoring the generation of electricity.

The responsibility of project registration has been directly taken up by the Executive Director of the company.

Mr. Rajgopal Gilada
Executive Director
Vijayalakshmi Hydro Power Pvt. Limited

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

Senergy Global Private Limited
D-33 Defence Colony, New Delhi –110024,India
Tel: +91 11 2645 5141/ 42/ 43 Fax: +91 11 2645 5144
Email: is@senergyglobal.com
Contact Person: Dr. Inderjeet Singh (Manager- CDM)

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

The applicable project category from Appendix B i.e. Category I D does not indicate a specific formula to calculate the GHG emission reductions by sources

E.1.1 Selected formulae as provided in appendix B:

No formula is provided for the baseline for project category 1D, paragraph 7

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

No formula is used. Emissions by sources are zero since hydroelectric power is a zero GHG emission source of energy.

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 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.1.2.2 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:

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:

The project uses the Combined Margin methodology as suggested in the Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

The total baseline emissions BE_y (tCO_2/yr) = $EG_y * EF_y$

Where
BE_y = Baseline emissions in year *y* (tCO2).
EG_y (MWh/yr) = Electricity generated by the project in year y;
EF_y (tCO_2/MWh) = CO_2 emission factor of the Southern Region Grid

The emission factor EF_y of the Southern Region Grid is a fixed value over the projects crediting period and is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM, y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$\mathbf{EF_y = w_{OM}\, EF_{OM,y} + w_{BM} \,.EF_{BM,y}}$$

Where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,\ y}$ and $EF_{BM,\ y}$ are the Operating Margin and Build Margin emission factors respectively calculated in the following paragraph. The emission factor EF_y is estimated to be 0.8315 kg CO_2/kWh.

The Operating Margin is the weighted average emissions of all generating sources serving the Southern Grid excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. It is derived from the following equation:

$$\mathbf{EF_{OM,\ simple,\ y} = \frac{\Sigma F_{i,\ j,\ y}\ COEF_{i,\ j}}{\Sigma GEN_{j,\ y}}}$$

Where
$F_{i,\ j,\ y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y,
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid.

$COEF_{i,j\ y}$ is the CO2 emission coefficient of fuel i (tCO2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and

$GEN_{\ j,\ y}$ is the electricity (MWh) delivered to the grid by source j.

The CO2 emission coefficient $COEF_i$ is obtained as

$$\mathbf{COEF_i = NCV_i * EF_{CO2,\ i} * OXID_i}$$

Where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i,
$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
$EF_{CO2,i}$ is the CO2 emission factor per unit of energy of the fuel i.

The $EF_{OM,Y}$ is estimated to be 0.9525 kg CO_2/kWh.

The Build Margin emission factor ($EF_{BM,y}$) is calculated as the generation weighted average emission factor (tCO_2/MWh) of a sample of power plants m, as follows:

$$\mathbf{EF_{BM,y} = \frac{\Sigma\ F_{i,\ m,\ y} . COEF_{i,\ m}}{\Sigma GEN_{m,y}}}$$

Where
$F_{i,\ m,y}$ = quantity of fuel i used in plant m (kt/yr) in year y

$COEF_{i,\ m}$ = carbon emissions factor for fuel i in plant m (tCO_2/kt), taking into account the carbon content of the fuels by power sources and the percent oxidation of the fuel

$GEN_{m,\ y}$ = annual generation from plant j (MWh/yr) in year y

The $EF_{BM,y}$ is estimated as 0.7005 kg CO_2/kWh (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation).

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:

The emission reductions ER_y by the project activity during a given year y is the difference between Baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y).
$ER_y = BE_y - PE_y - L_y$

Since the project emissions and the leakage are zero, the emissions reductions are equal to the baseline emissions.

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

Year	Net Baseline emission factor (kg CO_2/kWh)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of Leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2002-03	0.8315	4839	0	0	4839
2003-04	0.8315	8306	0	0	8306
2004-05	0.8315	8306	0	0	8306
2005-06	0.8315	8306	0	0	8306
2006-07	0.8315	8306	0	0	8306
2007-08	0.8315	12317	0	0	12317
2008-09	0.8315	14324	0	0	14324
Total (tonnes of CO_2e)		66714	0	0	66714

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 project is environmental friendly as none of the environmental concerns associated with hydro projects are involved in the project such as displacement and rehabilitation of people, deforestration, disturbance to the wild life habitat, disruption of fish culture, soil degradation and destruction of flora and fauna, depletion of ground water table etc. No unacceptable modifications consequential to the project construction to the landscape are required.

No environmental concerns, both visible and invisible, are applicable to the project. It may be emphasized that the construction of the mini hydel project on the Hebbakavadi Branch Canal has had no impact on the environment. Further all clearances have been obtained from the state pollution control.

The project is compatible with all pollution control norms for Water pollution, Air pollution and Solid waste disposal.

SECTION G. Stakeholders' comments:

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

There have been several meetings and discussions held with the villagers and the gram Panchayat, which is the representative body for Local Self Government in the Village at the time of implementation of the project. As the project has no impact over the availability of water in the canal thus villagers have no objections with the implementation of the project.

G.2. Summary of the comments received:

There were no objections to the project from the villagers, as it does not involve any consumption of water and there was no disturbance to the irrigation regime. There was no displacement and rehabilitation of the villagers involved in the project. Further, the project has resulted in the employment of the local people.

A road bridge has been constructed over the power canal to retain the existing access to the villages. Further, since the land utilized was irrigated land there has been no cutting down of tress and other related environmental implications.

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

Since no comments were received from the local habitants, only necessary operation licences were obtained for implementation of the candidate CDM project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Vijayalakshmi Hydro Power Pvt Limited
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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