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:

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Title: 11.3 MW renewable energy project for a grid system by K.M.Power (P) Limited, India
Version : 02, 12th October, 2006

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

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The CDM project activity is a bundle of three Small Hydro Electric Projects on Nippulavagu located in Kurnool District of Andhra Pradesh. The name "Nippula vagu" refers to the name of a natural stream. Nippulavagu is a tributary to Galeru river flowing in the same district.

The purpose of the project activity is to produce clean electrical energy in a sustainable manner, optimising the utilization of renewable resource (water) in order to meet the local power demand. The proposed project with an installed capacity of 11.3 MW contributes to meeting the demand for electricity in the State of Andhra Pradesh. The project will displace an equivalent amount of carbon-intensive grid electricity.

The project activity envisages construction of three hydroelectric projects utilizing the drop in the bed levels in the Nippulavagu which is being used as a carrier canal for Kurnool – Cuddapah Canal and the discharges for the ayacut(irrigation) requirements under K.C canal. The bundle comprises three projects- 4 MW hydroelectric project at Guntakandala Village, 3.3 MW hydroelectric project at Velpanur Village and 4 MW hydroelectric project at Madhavaram Village, all located in the district of Kurnool.

The project activity has several positive impacts for sustainable development. Some of the socio economic benefits that are expected due to implementation of the proposed small hydro project are:

Generation of employment opportunities

- Alleviation of poverty by generating direct and indirect employment. The three projects employed about 225 workmen during construction of the project activity. Further the project activity contributed for direct employment for about 45 persons during operation of the project.

Agricultural Development

- The power generated from the project activity will stabilise the local grid and helps in providing uninterrupted power for farmers.

Promoting Infrastructure Development

- The project activity contributed to development of infrastructure like roads, buildings and communication systems in the rural area, which helps in the development of the region.

Checks rural migration

- Since project generates indirect and direct job opportunities to the local populace, it will check rural migration to urban areas.

Preserving Biological Diversity

- The project helps preserve Biological diversity of the surrounding area, as it does not involve in disturbing the ecological pattern of the existing site.

Reduced impact of Global warming

- As the project helps in bringing down greenhouse gases concentration in the atmosphere, thus reducing impact of global warming and mitigating climate change to some extent.

  Thus the project activity contributes to the sustainable development of the region.

A.3. Project participants:

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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)
India (host)	Private Entity: KM Power (P) Ltd.	No

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

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

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A.4.1.1. Host Party(ies):

>> India

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

>> Andhra Pradesh

A.4.1.3. City/Town/Community etc:

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Name of the project	Guntakandala Mini Hydel Scheme (4 MW)	Velpanur Mini Hydel Scheme (3.3 W)	Madhavaram Mini Hydel Scheme (4 MW)
District	Kurnool	Kurnool	Kurnool
Mandal	Velugodu	Velugodu	Velugodu
Village	Guntakandala	Velpanur	Madhavaram

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

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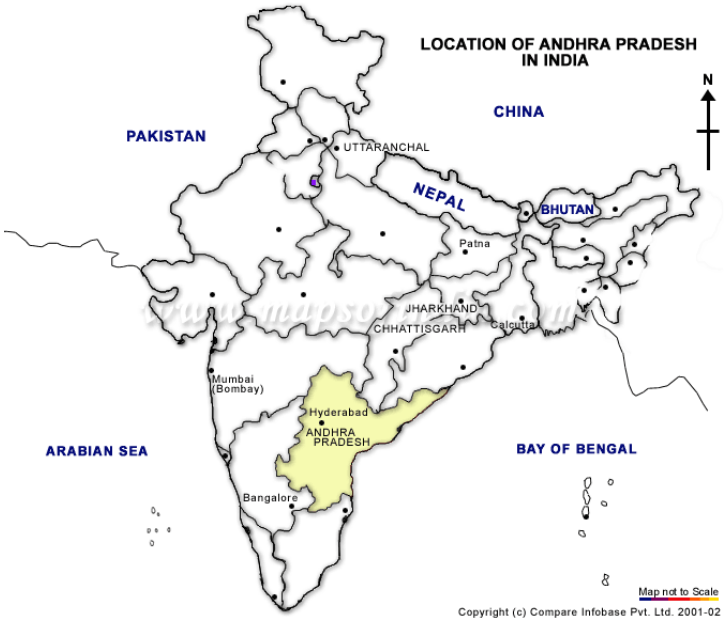
The three small hydro projects are situated at a distance of about 17 km from Velugodu Mandal which is the Mandal headquarters and is about 70 km away from the nearest rail head, Kurnool on Secunderabad – Guntakal Railway line. Kurnool is located at a distance of 200 km from Hyderabad the state capital of Andhra Pradesh. The generated power will be exported to the grid through a 33/11 kV substation located at Velugodu village at a distance of 5 Km in respect of Guntakandala SHP and Velpanur SHP and Gadivamula village in respect of Madhavaram SHP located at a distance of 11 Km from the plant location.



Map 1: Location of Andhra Pradesh state (Yellow Marked) in India

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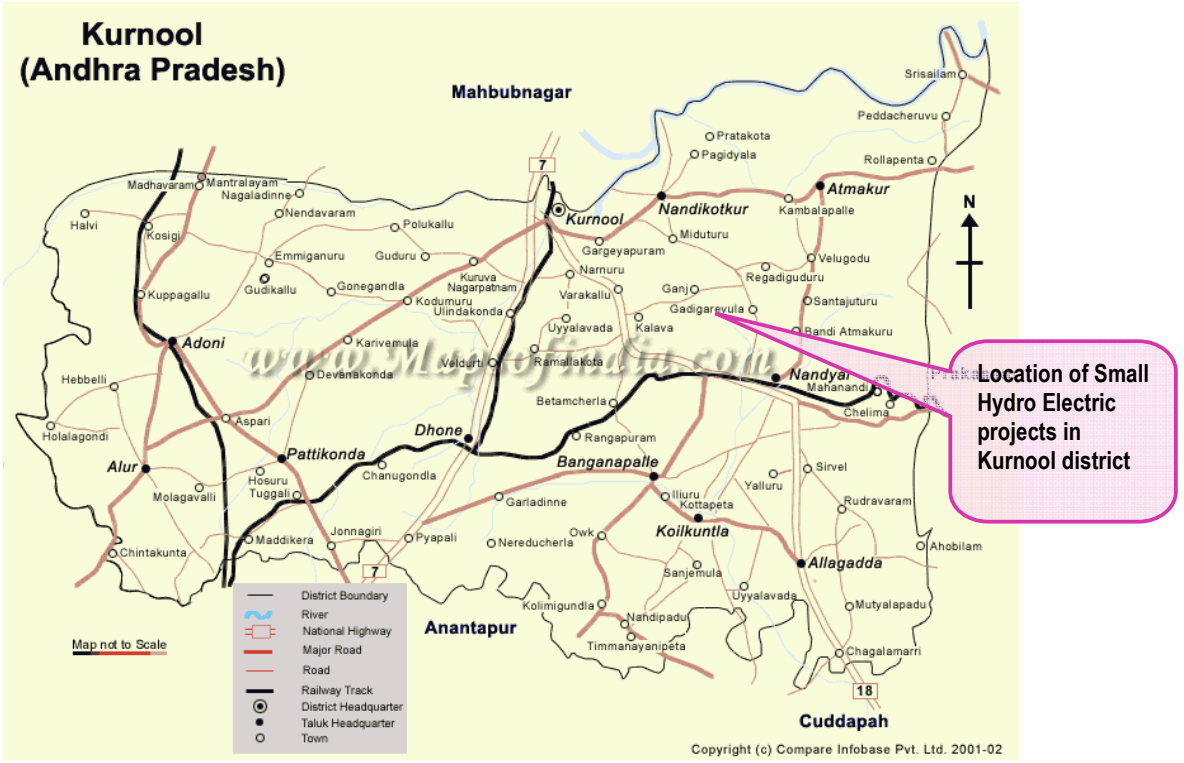
Map 2: Location of Kurnool District in Andhra Pradesh



Map3: Location of Small Hydro Electric Projects in Kurnool District.

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

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According to Appendix B to the simplified modalities and procedures for small-scale CDM project activities the proposed project activity falls under Type I, Renewable energy projects since the project activity utilises hydro resource as the main energy source for electricity generation. Since, the generated electricity is intended for export to the regional grid system, the applicable category is I.D., Renewable electricity generation for a grid.

The project activity utilizes renewable hydro potential for power generation and exports the generated power to the grid. Since, the capacity of the CDM project is 11.3 MW, which is less than the qualifying capacity of 15 MW, the project activity is a small-scale CDM project activity and UNFCCC indicative simplified modalities and procedures are applied.

Technology

The technology of power generation process using hydro resources is converting the potential energy available in the water flow into mechanical energy using hydro turbines and then to electrical energy using alternators. The generated power will be transformed to match the nearest grid sub-station for proper interconnection and smooth evacuation of power.

Proposed projects are natural stream hydroelectric schemes and each scheme involves construction of diversion structure, intake chamber, desilting chamber, power channel, fore bay, power station and tailrace.

Power station in each scheme comprises two identical power-generation units of capacity 2000 kW in respect of Guntakandala and Madhavaram hydro projects and 1650kW each in respect of Velpanur hydro project. Power will be generated at a voltage of 6.6 kV which will be stepped up to 33 kV within the project boundary to facilitate export of power to the Transmission Corporation of Andhra Pradesh Ltd. (APTRANSCO). Brief technical parameters of the three projects under the CDM project activity are furnished below:

Parameter	**Guntakandala**	**Velpanur**	**Madhavaram**
Hydrology			
Design flow	34.72 cumecs	34.72 cumecs	34.72 cumecs
Gross head	6.0m	6.0m	6.0m
Net rated head	5.7m	5.7m	5.7m
Energy			
Gross energy generation (GWh)	12.6	10.39	12.60
Net export to the grid (GWh)	12.22	10.08	12.22
Plant Equipment			
Type of hydro turbine	Vertical Full Kaplan type	Vertical Full Kaplan type	Vertical Full Kaplan type
Type of generator	Synchronous	Synchronous	Synchronous
No. of generating units	2	2	2
Capacity of each generating units	2.0 MW	1.65 MW	2.0 MW
Generation voltage	6.6 KV	6.6 KV	6.6 KV
Grid interfacing voltage	33 KV	33 KV	33 KV
Frequency	50 Hz	50 Hz	50 Hz

Technology transfer

No technology transfer from other countries is involved in the project.

Demonstration for being with in the limits of SSC through out the crediting period

The water and power studies carried out for this project demonstrate that the project activity will remain under the limits of SSC through out the crediting period. Based on the head available and water flow the optimum capacity of each power plant has been envisaged at 4.0 MW, 3.3 MW, and 4.0 MW respectively. Since, the maximum electricity generating capacity is limited by its design and construction based on which license was issued by the state nodal agency, there is no possibility of exceeding the limits of small scale CDM project activity during the crediting period and will remain as a small scale project activity.

By keeping the above considerations, the project proponent declares that the project will be within the limits of small scale through out the crediting period.

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:

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The proposed project activity generates electricity-using hydro potential and exports the generated power to the regional grid system. Hence, the generation by the proposed project activity is non-GHG source and it is expected that the proportion of fossil fuel based generation in the grid will be displaced by the project activity leading to lesser carbon intensity in the grid.

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

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Emission reductions due to the project activity depend on the energy fed to the regional grid and the content of fossil fuel based generation in the grid system. Hence, power fed to the regional grid and the generation mix in the baseline becomes the basis for estimating emissions reductions.

The installed capacity of the CDM project is 11.3 MW, which is expected to export 34.51 GWh every year based on the best estimate plant load factor of 80%. Since the commissioning of the project in 2002-03, the actual plant load factor and generation were substantially lower than these best estimates due to unusually low monsoon rains.

The emission reductions from the project are projected using the weighted average emission factor for the Southern Region of 739.14 t CO_2 /GWh. This baseline emission factor is derived from the most recent data available at the time of PDD submission. The actual baseline emission factors for the Southern Grid in each year will be determined ex post during the crediting period.

Year wise generation of emission reductions during the crediting period is shown below.

Years	**Annual estimation of emission reductions in tonnes of CO2 e**
2002-03	4,370
2003-04	10,583
2004-05	23,303
2005-06	20,662
2006-07	25,511
2007-08	25,511
2008-09	25,511
2009-10	25,511
2010-11	25,511
2011-12	25,511
Total estimated reductions (tonnes of CO2 e)	**211,984**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	21,198

In the above table the year 2002-03 corresponds to 01.02.02 to 31.01.03. Similar interpretation shall apply for remaining years.

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

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No Public Funding is involved in this project.

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

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The project proponents hereby confirm that the proposed project activity is not a debundled component of a larger project activity.

The project proponents further confirm that they have not registered any small scale CDM activity or applied to register another small scale CDM project activity within 1 km of the proposed project boundary, in the same project category and technology/measure in the previous 2 years.

SECTION B. Application of a baseline methodology:

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

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Title : Type I, Renewable Energy Project.
Reference : I.D. Renewable Electricity Generation for Grid. Version 9 (28th July 2006)

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

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The project category is renewable energy generation for a grid system which is fed by both fossil fuel fired generating plants and non-fossil fuel based generation plants. Hence the applicable baseline as per para 9 of AMS I.D of Appendix B, indicative simplified baseline and monitoring methodologies is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in $kgCO_2/kWh$) calculated in a transparent and conservative manner.

With a capacity of 11.3 MW the project activity qualifies as small scale and therefore is eligible to use approved methodology AMS I.D. The application of the methodology is described below:

a) Selection and justification of calculation approach.

There are two methods for estimating the baseline emission factor under Para 9 of the selected methodology AMS I.D. They are as follows.

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM).

OR

(b) The weighted average emissions (in $tCO_2eq./kWh$) of the current generation mix. The data of the year in which project generation occurs must be used.
The methodology suggests a conservative approach by selecting the lower of the above two options. The project participants have opted for approach (b).

The project activity is displacing grid electricity, which is fed by both fossil, and non-fossil fuel based generation sources. Keeping in view of the electricity scenario, the entire Southern region electricity grid system with its expansion plans, generation and investment trends is considered for identifying the

baseline.

The projection of the emission reductions in this PDD is based on the most recent data on generation in the Southern Region available at the time of PDD submission. The data vintages are Fiscal Years 2005-06, 2004-05, 2003-04 and 2002-03 for generation respectively. Actual emission reductions will be calculated ex post based on actual baseline emission factors for each year.

b) Calculation of the baseline emission factor

As explained earlier, the baseline for the project activity is kWh produced by the proposed project multiplied by an emission co-efficient calculated in a transparent and conservative manner as the weighted average emissions (in $kgCO_2/kWh$) of the current generation mix of the Southern Region. For this purpose, the generation data published by Central Electricity Authority for the Southern Region was used. Baseline emissions were estimated as explained below.

i : Estimation of emissions from each power generating unit in the baseline

Emissions from each fossil fuel source are estimated using the following formula.

Station Emissions tCO_2	=	**Actual Generation GWh**	x	**CEFx for fuel tC/TJ**	**Net Heat Rate TJ/ GWh**	x	**Conversion Factor 44/12**	X	**Oxidation Factor**

For the estimation of emissions from each power generating unit in the grid, actual generation data monitored and published by Central Electricity Authority is used. IPCC default emission factors for fuels are used for CEF of each fuel type.

Using the above formula, emissions from each power generating source are estimated. For non-fossil fuel sources such as hydro and nuclear, GHG emissions are not applicable.

ii : Total grid emissions

Total emissions from all stations in the grid are estimated by summation of emissions from all baseline power generating units.

iii : Estimation of baseline emission coefficient

The baseline emission coefficient for the grid is estimated as the weighted average of all existing generation sources using the following formula.

Baseline Emissions Coefficient tCO_2/GWh	=	Total grid emissions/ $t\ CO_2$	Total net energy in the system / GWh

Using the above formula and data for the year 2002-03 to 2005-06, the baseline / emission coefficient is estimated as follows.

2002-03	819.04 t CO_2/GWh
2003-04	841.16 t CO_2/GWh
2004-05	795.04 t CO_2/GWh
2005-06	739.14 t CO_2/GWh

The detailed data underlying this calculation is furnished in the Attachment.

The key information and data used to determine baseline emission coefficient (variables, parameters, data sources etc) are listed in the following table.

Key Parameter	Value	Data Source	Website
Power generation	Power generated by all sources including hydro, nuclear.	All related authentic sources like CEA, AP Transco and AP Genco	www.cea.nic.in www.apgenco.org www.aptranscorp.com
CEF for fuel	Carbon Emission factor for each fuel type	IPCC	www.ipcc.ch/
Fuel Type	Type of Fuel used for individual plant	MNES	www.mnes.nic.in
Oxidation factor	Oxidation factor for each fuel type	IPCC provides default Oxidation factors for fuels.	www.ipcc.ch/
Net heat rate	Net heat rate of individual power plants	CEA and MNES	www.cea.nic.in www.mnes.nic.in
Efy	Baseline emission factor for the project grid	Calculated for power plants in the southern regional grid	------
Egy	Power export to the grid per annum	Projection as per DPR; actual values monitored from Plant and AP Transco Records	------

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:

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UNFCCC simplified modalities require to establish additionality of the project activity as per Attachment A to Appendix B, which listed various barriers, out of which, at least one barrier shall be identified due to which the project would not have occurred any way. Project participants identified the following barriers for the proposed project activity.

Early Consideration of CDM

The project activity obtained the license from the State nodal agency in August 2000. However financial closure was achieved during the period February 2001 to November 2002 (there are three small hydro schemes in the bundle and each project achieved separate financial closure).The first hydro project commenced civil construction in May 2001 where as the third project commenced civil construction in January 2003. The three hydro projects were commissioned at different dates. The 4MW Guntakandala SHP is commissioned on 6th February 2002, the 3.3MW Velpanur SHP is commissioned on 7th November 2002 and the 4MW Madhavaram SHP is commissioned on 29th October 2003.

The project proponents have considered CDM revenues during the project planning stage. They have sponsored the project for CERUPT 2001 Tender for sale of emission reductions so that additional stream of income can be generated to mitigate some of the hardships that could be faced by the company. The company has also received host country endorsement for the project which is one of the conditions of tender in order to participate in the CERUPT during 2001. The company has appointed a consultant for the purpose of providing services for the CERUPT Tender. Further the Board of Directors of the Company by virtue of resolution passed in March, 2001 have decided to explore the possibility of developing the project as a CDM project and take necessary steps required for the purpose. Necessary evidences and documents will be furnished to the DOE.

Investment Barriers

The project participants required investing around Rs.500 millions for implementing the three hydroelectric projects of 11.3 MW which works out to Rs.44.25 millions/MW, which is high compared to investment required for conventional power plants, which is around Rs.30 to Rs.35 million per MW. The financial return on this investment is subject to large uncertainties, such as:

- Uncertainty with respect to the availability of water in natural stream on which the proposed project activity is established is a major concern. The three small-scale hydroelectric schemes are located on Nippulavagu, a natural stream in Kurnool District. The proposed project activity depends for its water discharges from its own catchment area of Nallmala Forest as well as the surplus discharges of K.C.Canal which are drained into Nippulavagu. K.C.Canal gets its water from reservoirs of Tungabadra and Srisailam. It has been witnessed during the last few years that releases have been considerably reduced into this canal due to lack of sufficient water flows into the reservoirs which is the effect of irregular monsoons. Though these projects are expected to export 34.51 GWh of power every year, the actual generation was only at 5.35 GWh in 2002-03 and 12.59 GWh in 2003-04 and 29.32 in the year 2004-05. This shows considerable variance in the power generation, which is directly related to irregular monsoons. The past experience confirms that power generation is highly variable and cannot be predicted with certainty. This was and is a major barrier for investment in hydro plants, unlike investment in a fossil fuel based power plants where the availability of resources is assured.

- The river Krishna as well as Tungabadra are inter-state rivers. Therefore, water resources are to be shared in a predetermined proportion due to which diversion of water into irrigation canals including K.C.Canal whose excess waters are drained out into Nippulavagu would be restricted depending on the yields and hence the water availability in Nippulavagu for power generation is not guaranteed and power generation is highly influenced by interstate politics and regulations.

- The impact of failure of monsoon has been recognized by the lending institution IREDA. IREDA has extended the loan period from original 7 years to 12 years as the cash flows were not permitting payment of installments of term loan as well as interest. IREDA vide its letter dt.20th February, 2003 has while extending repayment period to the 4 MW Guntakandala SHP has stated that "Looking to the drought conditions in the State of Andhra Pradesh, we have considered the matter. As requested by you, we have decided to fund the interest for the quarters 31st December, 2002 upto 30th September, 2003 and also to extend the revised repayment schedule upto 30.06.2016. Accordingly, the revised schedule of installments of principal for the sum of Rs.13,44,75,000/- and schedule of funded interest for the sum of Rs.199,82,095/- shall be as are contained in Annexure-II". Similar letter was issued for the 3.3 MW Velpanur SHP. Necessary evidence will be produced for verification of the validator.

Lack of Infrastructure

The area where the project is proposed is an under-developed area. No infrastructure such as roads, electricity, communication, transportation and proper civic amenities etc., are available. The project proponents had to develop these facilities before implementation of the project.

Institutional barriers

The project faced important institutional barriers before and during project implementation, mainly with respect to the determination of the tariff for electricity exported. The following evidence underlines the relevance of this barrier:

- The project was first envisaged at a time when the state utility was offering tariff based on the guidelines of Ministry of Non-conventional Energy Sources (MNES). MNES has fixed a rate of Rs.2.25 per kWh with a yearly escalation of 5% considering the base year as 1994-1995. The project proponent entered into a power purchase agreement with APTRANSCO for supply of entire power generated by the hydroelectric projects at the rate recommended by MNES. However, Electricity Regulatory Commission of Andhra Pradesh later reduced the tariff with effect from 01-04-2004. As per the revised tariff the hydro power project is eligible for only Rs.2.69 per unit against the envisaged tariff of Rs.3.69 per kWh (for the year 2004-05). This decision has seriously affected the project viability.

- The regulatory commission has made further changes on power export to the utility. At the time of executing the PPA, there was no ceiling on plant load factor but as per the revised policy, a hydro project cannot have more than 35% plant load factor (PLF) which means that project will not have an advantage to generate more electricity when water is available in the stream.

The risk of such adverse change in tariff policy was known to the promoters at the time of PPA conclusion as the agreement was subject to clearance of APERC and there was market information that tariff may be lowered in the State. These risks were one of the drivers that prompted the project proponent to participate in the CERUPT tender in 2001.

Prevailing practice

In the Indian power sector, the common practice is investing in medium or large scale fossil fuel fired power projects, which is evident from a host of planned projects that comprises mostly large-scale fossil fuel based power generation projects. This is mainly due to the assured return on investment, economies of scale and easy availability of finances. This is also true in the Southern Region.

There are three main indicators proving that investment in small hydro power (defined as plants with a capacity not exceeding 25 MW) is currently not a common practice in India in general, nor in Andhra Pradesh:

- The total contribution of small hydro to the overall power supply is very small; and
- The available potential for small hydro has only been tapped to a small degree; and
- The few small-scale hydro plants existing in the project region (State of Andhra Pradesh) are different from the proposed project in material respects.

Each of these three indicators is analyzed in more detail below.
a) Contribution of small hydro to total power supply

The total installed capacity of power projects in India was 126,089 MW as on 30.06.2006[1]. In comparison, the installed capacity of small hydro plants in operation in India was 1748 MW[2] as on the same date, representing a share of only 1.4%. This percentage is only related to the installed capacities. On a generation basis, the share of small hydro will be even lower, because the load factor of hydro plants is typically much lower (sometimes as low as below 30%), as compared to approx. 70 – 90% for thermal plants in India.

b) Tapping of Potential for Small Hydro

[1] www.cea.nic.in/Planning/Power Scenario at a glance

[2] MNES Annual Report 2005-06, www.mnes.nic.in

The potential for small hydro power projects in Andhra Pradesh is approximately 500 MW, according to an estimate by the Non-Conventional Energy Development Corporation of Andhra Pradesh (NEDCAP). In comparison, approximately 56.23 MW of small hydro projects have been commissioned before commencement of the project activity by the project proponent.[3] Even out of this installed capacity, projects of a capacity of 34.04 MW were commissioned before 2000. The projects commissioned after 2000 and before taking up of the project activity are only to the extent of 22.19 MW. This means that only about 11% of the available potential in the state have been tapped before commissioning of the project activity. Given that hydro power is per se quite a mature technology, this low penetration level underlines that small hydro projects are not yet a common practice.

c) Analysis of Existing Plants in the State

In order to establish that the project activity is not a common practice the following information is furnished with details of small hydro projects commissioned in Andhra Pradesh.

Name of the Project	Capacity (MW)	Date of Commissioning	Remarks
Deccan Cements Limited	3.75	28-02-1996	Canal based
Dhanalakshmi Cotton & Rice Mills Ltd.,	2.0 1.58 2.61	24-11-1997 23-12-1997 23-07-1997	Canal Based
Sagar Power Limited	4.3 4.0	27-11-1997 07-09-1998	Canal based
Rayalaseema Power Projects Limited	3.0	21-11-1998	Canal based
SKJ Power Limited	1.5	27-01-1999	Canal based
Trident Power Corporation	2.0 2.0 3.0	13-10-1999 26-08-1999 28-02-2001	Canal based
KCP Limited	2.25 1.50 1.50 1.50	06-09-1999 20-11-1998 18-09-1998 02-04-1999	Canal based
Bhavani Hydro Power (P) Limited	0.55	28-08-1999	Canal based
Active Power Corporation Limited	1. 4	28.04.2000	Cooling tower waters of Vijayawada Thermal Power Plant and assured water through out the year.
Tirumala Hydro Power P Ltd	0.8	02.02.2000	Irrigation canal
Tirumala Hydro Power P Ltd	0.8	01.07.2000	Irrigation canal
Tirumala Hydro Power P Ltd	0.8	06.11.2000	Irrigation canal
Espar Pack Limited	1.3	8.04.2000	Irrigation canal
Shivani Power Spinners Ltd	0.75	11.03.2000	Irrigation canal
Jaya Laxmi Power Corporation Limited	2.0	27.02.2000	Irrigation canal

[3] Source: http://www.aponline.gov.in/apportal/departments/departments.asp?dep=05&org=58

Jaya Laxmi Power P Ltd.	2.0	19.01.2000	Irrigation canal
NCL Industries Limited NCL Industries Limited	2.5 2.5	28.09.2000 17.11.2000	Irrigation canal
Ncl Industries Limited	2.5	09.02.2000	Irrigation canal
Manihamsa Power projects P Ltd	3.0	17.01.2000	Reservoir based project
Akshay Profiles P Ltd	0.5	13.07.2000	Irrigation canal
Akshay Profiles P Ltd	0.5	11.09.2000	Irrigation canal
Total	**56.23**		

Source: Statistics from NEDCAP

The above analysis further shows that all the projects are established on existing irrigation canals except one reservoir based project.

In contrast., the proposed project activity is located at a natural stream, Nippulavagu. This stream depends for its water on discharges from its catchment area of Nallamala Forest, as well as the on the surplus discharges of K.C.Canal which are drained into Nippulavagu.

To date, there are no dams constructed or reservoirs formed on this stream for any other purpose. The proposed project is therefore a run off river scheme in the proper sense, and represents the first such run of the river based project activity in the State of Andhra Pradesh. As such, the proposed project faces important barriers which are not applicable to the same extent to canal or reservoir-based projects:

- The investment requirement is higher, due to the need for additional structures (e.g., diversion weir);

- In an irrigation canal there will be uniformity of flow of water under controlled conditions. In the case of a stream, there will not be any control on the stream. Water will be available during monsoons or when ever there is an excess discharges in K.C.Canal. Losses will be more in a stream as levels can not be maintained.

Impact of CDM Revenue

Approval and registration of the project as a CDM activity enable the project proponents to access additional revenues by selling emission reductions. It is estimated that the project could generate about 25,511 CERs per year based on the estimated power generation. Assuming a sale price of Euro 10 per CER, additional revenue from sale of CERs account for Rs.14.63 million.

This additional revenue, along with the fact that CER revenues are in hard currency, help the promoter to achieve an acceptable overall return on investment and absorb the financial risks associated with these barriers.

In view of the above, the proposed project activity is additional and not the same as the baseline scenario.

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:

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Project boundary specified in the Appendix B of simplified modalities and procedures is that encompasses the physical, geographical site of the renewable generation source.

For the project activity under consideration, the project boundary encompasses the diversion structure, power channel, powerhouse, and power evacuation system and tailrace channel.

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

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The baseline for the project activity is constructed according to para 9.(b) of AMS I.D. Version 09 i.e. weighted average emissions of the current generation mix (in $kgCO_2e/kWh$), applicable for Type I.D CDM project activities, as contained in Appendix B of simplified modalities and procedures for small scale CDM project activities.

Date of completion of the baseline: 04/09/06

Name of the person / entity determining the baseline: Zenith Energy Services (P) Limited with inputs from Factor Consulting + Management AG

Contact Information of the above entity is furnished below:

Organization:	Zenith Energy Services (P) Limited
Street/P.O. Box, Building:	10-5-6/B, My Home Plaza, Masabtank,
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500028
Country:	India
Telephone:	+91- 40- 2337 6630, 2337 6631
FAX:	+91- 40- 2332 2517
E-Mail:	zenith@zenithenergy.com
URL:	www.zenithenergy.com
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Reddy
Middle Name:	Mohan
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Mobile	+91- 9849408485
Direct Fax	+91- 40- 2332 2517
Direct Telephone	+91- 40- 2337 6630, 2337 6631
Personal E.mail	attipallimohan@gmail.com

The above entity is not a project participant.

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:

>>

07/05/2001 (start of construction)

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

>>

30 years

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

>>

C.2.1. Renewable crediting period:

>>

Not Chosen

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

>>

Not applicable

C.2.1.2. Length of the first crediting period:

>>

Not applicable

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>

06/02/02

C.2.2.2. Length:

>>10y-0m

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:

>>

AMS I.D. Renewable Electricity Generation for Grid, Version 9 (28th July, 2006)

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

>>

The project activity is generation of electricity using hydro potential and exporting the same to the grid system, which is also fed by other fuel sources such as fossil and non-fossil types. Since, the capacity of the CDM project is 11.3 MW, which is less than the qualifying capacity of 15 MW, the project activity is a small-scale CDM project activity and UNFCCC indicative simplified modalities and procedures are applied. The project qualifies for AMS I.D and the monitoring provisions contained therein.

Emission reductions are related to the electricity exported by the project and the carbon intensity of the displaced grid electricity (baseline emission factor). Both parameters will be monitored. Net electricity exports to the grid can be reliably monitored through meters and verified sales records. The baseline emission factors for each year will be determined based on official publications from CEA.

D.3 Data to be monitored:

>>

ID number *(Please use numbers to ease cross-referencing to D.3)*	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
D.3.1	Gross Generation **	kWh	m	Continuous	100%	Electronic and Paper	Crediting period plus 2 years	Meter is Calibrated and Regularly inspected by APTRANSCO
D.3.2	Auxiliary Consumption**	kWh	m	Continuous	100%	Electronic and Paper	Crediting period plus 2 years	Meter is Calibrated and Regularly inspected by APTRANSCO
D.3.3	Power Import**	kWh	m	Continuous	100%	Electronic and Paper	Crediting period plus 2 years	Meter is Calibrated and Regularly inspected by APTRANSCO
D.3.4	Power Export**	kWh	m	Continuous	100%	Electronic and Paper	Crediting period plus 2 years	Meter is Calibrated and Regularly inspected by APTRANSCO
D.3.5	Grid Emission Factor (EF)	tCO2/GWh	c	Yearly	100%	Electronic and Paper	Crediting period plus 2 years	This data item is required for estimating the baseline emissions and emission reductions.

** The monitoring of data variable will be carried out separately for the three bundled project activities viz., Guntakandala SHP, Velpanur SHP and Madhavaram SHP

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

>>

Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary
D.3.1 & D.3.2	Low	This data item will be recorded at the project site which is under the control of project proponent. The energy generated and consumed is measured using calibrated meters and recorded by project proponent. Records of measurements will be used for calculating net export to grid.
D.3.3	Low	This data will be recorded at the project site and the energy imported is measured using APTRANSCO calibrated meter. Records of measurements will be used for calculating net export to grid. Sales bills/receipts may be compared as an alternative proof of the power imported from APTRANSCO grid.
D.3.4	Low	This data item will be recorded at the grid substation, which is under the control of APTRANSCO. The energy measured using calibrated meters and recorded at APTRANSCO substation will be monitored. Records of measurements will be used for verification of emissions reductions. Sales bills / receipts may be compared as an alternative proof of the power exported to the grid
D.3.5	Low	Based on official data from CEA. A project participant has no influence on quality control 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:

>>

The project activity is managed by the Board of Directors. The board has appointed a Managing Director who is assisted by a Executive Director, incharge of all technical aspects. The Executive Director who is responsible for operation of the project is supported by other staff such as Managers, Shift Incharges, Operators, maintenance personnel etc.

The authority and responsibility for implementation, development and registration of the CDM Project activity rests with the Board of Directors. The Board may delegate the same to a competent person/committee identified for the purpose. The identified person will be the in charge of GHG monitoring activities and prepare necessary audit reports for review by the management i.e. Board of Directors or its Committee for review.

The identified person in charge will be assisted by a team of experienced personnel in disciplines such as mechanical and electrical with experience in plant operation, measurements and management. The primary responsibility of the team is to collect, measure, monitor, record and report the information on various data items to the person in charge, in accordance with the applicable standards. Periodic calibration of various instruments used in the monitoring of the data and record keeping of the same also will be the responsibility of the team.

The responsibility of storage and archiving of information in good condition also lies with the designated person in charge. The person in charge will undertake periodic verifications and onsite inspections to ensure the quality of the data collected by the team and initiate steps in case of any abnormal conditions.

The company may if required introduce an internal audit system for the GHG compliance. Internal auditing will be carried out as per the monitoring plan and whenever necessary. An internal audit report will be prepared for review by the Board of Directors which will be later submitted for verification by an independent entity (DOE). Board of directors will examine the internal audit reports prepared by the internal auditor or the designated person and will in particular take note of any deviations in data over the norms and monitor that the corrective actions have resulted in adherence to the standards.

As detailed in Section D, Electricity supplied to the grid by the project activity will be monitored using calibrated meters. The project design employed latest microprocessor-based high-accuracy monitoring and control equipment that will measure, record, report, monitor and control of various key parameters like generation by the project and net energy exported to the grid. Necessary standby meters or check meters are installed to operate in standby mode when the main meters are not working. All meters will be calibrated and sealed as per the industry practices at regular intervals. Hence, high quality is ensured for all the above parameters. Sales records will be used and kept for checking consistency of the recorded data.

The Power Purchase Agreement signed by the Project Participant and the APTRANSCO provides procedures for monitoring the energy fed to the grid, emergency preparedness, calibration of monitoring equipment, company's operation and maintenance responsibilities etc. The same will be adopted for GHG audits and will form part of the monitoring plan. Hence, no separate procedures for QA/QC are provided in this monitoring plan.

The project has necessary provisions for emergency preparedness so that any unforeseen events such as fire etc. could be averted. The provisions include fire fighting systems, standby features for critical items etc.

All the data monitored under the monitoring plan will be kept in electronic form and hard copy format for 2 years after the end of crediting period or the last issuance of CERs for this project activity whichever occurs later. The monitoring reports will be kept at the project site with a copy at head office in Hyderabad.

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

>>

Name of the person / entity determining the monitoring methodology: Zenith Energy Services (P) Limited with inputs from Factor Consulting + Management AG

Contact Information of the above entity is furnished below:

Organization:	Zenith Energy Services (P) Limited
Street/P.O. Box, Building:	10-5-6/B, My Home Plaza, Masabtank,
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500028
Country:	India

Telephone:	+91- 40- 2337 6630, 2337 6631
FAX:	+91- 40- 2332 2517
E-Mail:	zenith@zenithenergy.com
URL:	www.zenithenergy.com
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Reddy
Middle Name:	Mohan
First Name:	Attipalli
Mobile	+91- 9849408485
Direct Fax	+91- 40- 2332 2517
Direct Telephone	+91- 40- 2337 6630, 2337 6631
Personal E.mail	attipallimohan@gmail.com

The above entity is not a project participant.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

>>

E.1.1 Selected formulae as provided in appendix B:

>>

Appendix B of the simplified modalities and procedures for small-scale CDM project activities does not provide specific formulae for the baseline for project Category I.D.

Calculation of the project GHG emissions reductions applies a weighted average emissions factor for all thermal plants that are operational on the Southern grid of India as of March 2006.

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:

>>

The proposed hydroelectric project is zero CO_2 emission project; no specific formulae are specified for the applicable project category.

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

>>

No leakage is anticipated due to the project activity.

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

>>

Zero emissions.

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:

>>

As explained in Section B.2, the baseline for the project activity is kWh produced by the hydroelectric project multiplied by an emission co-efficient calculated in a transparent and conservative manner as the weighted average emissions (in $kgCO_2/kWh$) of the current generation mix.

The emission reductions for a given year are calculated as baseline emissions minus the project emissions and leakage:

$$\mathbf{ER_y = BE_y – PE_y - L_y}$$

Since the project emissions (PE_y) as well as the leakage (L_y) are zero, the emission reductions are equal the baseline emissions. These are calculated based on the monitored net amount of electricity supplied to the grid, and the baseline emission factor. The latter is monitored and hence determined ex post.

$$\mathbf{ER_y = BE_y = EF_y \times EG_y}$$

Emission reductions resulting from the project activity throughout the crediting period is furnished in the table below :

S.No	year	Power export to Grid (GWh)	Energy Import (GWh)	Net energy Export (GWh)	Emission Factor (t CO2/Gwh)	Baseline Emissions (t CO2)
Retrospective Emission Reducitons (Export values are actual data Recoreded)						
1	2002-03	5.35	0.014	5.34	819.04	4370
2	2003-04	12.59	0.008	12.58	841.16	10583
3	2004-05	29.32	0.010	29.31	795.04	23303
4	2005-06	27.96	0.006	27.95	739.14	20662
Prospective Emission Reductions (Export is assumed)						
5	2006-07	34.51	0.0	34.51	739.14	25511
6	2007-08	34.51	0.0	34.51	739.14	25511
7	2008-09	34.51	0.0	34.51	739.14	25511
8	2009-10	34.51	0.0	34.51	739.14	25511
9	2010-11	34.51	0.0	34.51	739.14	25511
10	2011-12	34.51	0.0	34.51	739.14	25511
Baseline Emissions (tCO2)						**211984**

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:

>>

Using the above formula, baseline emissions or emissions avoided by the project activity are estimated as 21,198 tCO_2 (Average) per annum. This is based on an anticipated net generation of 34.51 GWh from the project. The resulting baseline emissions during the crediting period are tabulated below.

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Baseline Emissions E.1.2.4 tCO_2	4370	10583	23303	20662	25511	25511	25511	25511	25511	25511
Project Emissions E.1.2.3 tCO_2	0	0	0	0	0	0	0	0	0	0
Emission Reductions E.1.2.4 – E.1.2.3, tCO_2	4370	10583	23303	20662	25511	25511	25511	25511	25511	25511

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

>>

Years	**Annual estimation of emission reductions in tonnes of CO2 e**
2002-03	4,370
2003-04	10,583
2004-05	23,303
2005-06	20,662
2006-07	25,511
2007-08	25,511
2008-09	25,511
2009-10	25,511
2010-11	25,511
2011-12	25,511
Total estimated reductions (tonnes of CO2 e)	**211,984**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	21,198

In the above table the year 2002-03 corresponds to 01.02.02 to 31.01.03. Similar interpretation shall apply for remaining years.

SECTION F.: Environmental impacts:

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

>>

As per the prevailing regulations of the Host Party (represented by the Ministry of Environment and Forests, Govt. of India and also the line ministry for environmental issues in India), the project activity need not conduct environmental impact assessment.

The project activity does not result in any negative impacts on the socio economic environment of the

region. Displacement of local population, disturbance in the local eco systems, deforestation etc., are not involved.

Hence the project does not cause any impacts on the environment or socio economic situation in the region.

SECTION G. Stakeholders' comments:

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

>>

No specific public consultation / participation requirements are specified in Indian statutes for setting up of small hydro projects. However, there are certain procedural requirements which every project investor needs to follow before implementing any project.

Before implementing any project, project investors / developers need to identify the stakeholders, prepare necessary documents, approach the identified stakeholders directly and obtain required clearances / approvals. The stakeholders after review of documents and investment profile, will accord approvals / licences or send comments in writing to project investors for further clarifications / corrections. In case they are not satisfied with the project design or they feel that the project impacts any of the local environment / social / economical environments, they will not issue clearances / approvals and stop the implementation of the project.

The project participants, as required for setting up the project, have identified the following stakeholders.

a) The Non-conventional Energy Development Corporation of Andhra Pradesh Ltd. (NEDCAP)
b) Transmission Corporation of Andhra Pradesh Ltd. (APTRANSCO)
c) Andhra Pradesh Electricity Regulatory Commission (APERC)
d) Andhra Pradesh State Pollution Control Board (APPCB)
e) Ministry of Non-conventional Energy Sources, Govt. of India (MNES)
f) Irrigation department of Government of Andhra Pradesh

The project participants prepared necessary documentation before implementation of the project activity and approached the above stakeholders individually. No negative comments have been received by the project participants, which is evident from the following clearances and approvals.

a) NEDCAP has issued license for establishing the hydro projects
b) APTRANSCO agreed to purchase the power generated by the project activity and signed Power Purchase Agreement (PPA) with project participants.
c) APERC has framed tariff policy, which is applicable to the project activity also
d) Clearance from irrigation department of Government of Andhra Pradesh.

Other stakeholders also issued their approvals / clearances, which is evident from the fact the power plant is in operation.

G.2. Summary of the comments received:

>>

No comments are received on the project.

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

>>

No comments are received; hence, no action taken report is applicable.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	KM Power Private Limited
Street/P.O.Box:	6-3-883/3, First Floor, Punjagutta
Building:	R.K.Plaza
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500 082
Country:	India
Telephone:	+ 91 (040) 2341 4635
FAX:	+ 91 (040) 2341 4711
E-Mail:	kmpowerltd@yahoo.co.in
URL:	-
Represented by:	
Title:	MD
Salutation:	Mr
Last Name:	Reddy
Middle Name:	Ramnarayan
First Name:	G
Department:	Management
Mobile:	9440716319
Direct FAX:	+ 91 (040) 2341 4711
Direct tel:	+ 91 (040) 2341 4711
Personal E-Mail:	-

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from the parties included in Annex -I is involved in the project activity

Annex 3

Data for baseline calculation

Station Heat Rates and Emission Factors

Fuel i	SHR_i *	EF_{Ci} **	Oxid ***	(SHR_i x EF_{Ci} x 44/12 x $Oxid_i$)
	Kcal/kWh	tC/TJ		tCO2/GWh
Coal & Lignite	2,717	25.8	98.0%	1,053
Diesel - open cycle	2,929	20.2	99.0%	898
Naphtha	2,061	20.0	99.5%	629
Natural gas CCGT	2,061	15.3	99.5%	481

baseline Emission Factor 2002-03

Power station	Owner	Installed capacity	Fuel Type	Actual Generation 2002-03	Net Heat Rate	IPCC EF for Fuel	Oxidation factor	Emission Factor	CO_2 Emissions
		MW		GWh	kcal/kWh	tC/TJ		tCO_2/GWh	tCO_2
Reference	1	1	2	1	2	3	3		
Karnataka									
Raichur	KPCL	1470	Coal	**10290**	2717	25.8	0.98	1052.9	**10834241**
Torangallu IMP	Jindal	260	Coal	**872**	2717	25.8	0.98	1052.9	**918120**
Yelahanka	VVNL	127.8	Diesel	**715**	2929	20.2	0.99	897.7	**641889**
Bellary	Pvt	25.2	Diesel	**64**	2929	20.2	0.99	897.7	**57456**
Belgaum	Tata	81.3	Diesel	**365**	2929	20.2	0.99	897.7	**327677**
Tanir Bavi	GMR	220	Naphtha	**1280**	2062	20.2	0.995	635.2	**813057**
Jog	KEB	139.2	Hydro	**146**				0.0	
Sivasamundrum	KEB	42	Hydro	**14**				0.0	
Shimsapura	KEB	17.2	Hydro	**57**				0.0	
Munirabad	KEB	27	Hydro	**47**				0.0	
Sharavathy	KPCL	1006.2	Hydro	**2950**				0.0	
Kadra	KPCL	150	Hydro	**238**				0.0	
Kodasali	KPCL	120	Hydro	**218**				0.0	
Kalinadi	KPCL	855	Hydro	**1812**				0.0	
Supa	KPCL	100	Hydro	**257**				0.0	
Linganamakki	KPCL	55	Hydro	**111**				0.0	
Varahi	KPCL	230	Hydro	**844**				0.0	
Bhadra	KPCL	39.2	Hydro	**18**				0.0	
Ghat Prabha	KPCL	32	Hydro	**59**				0.0	
Mani DPH	KPCL	9	Hydro	**18**				0.0	
Mallarpur	KPCL	9	Hydro	**1**				0.0	
Gerusuppa	KPCL	240	Hydro	**297**				0.0	
Almatti DPH	KPCL	290	Hydro	**0**				0.0	
Shivpura	BPCL	18	Hydro	**67**				0.0	
Shahpur	BPCL	6.6	Hydro	**22**				0.0	
Harangi	BPCL	9	Hydro	**0**				0.0	
Madhavmantri	BPCL	4.5	Hydro	**0**				0.0	
Mandagiri	Pvt	3.5	Hydro	**0**				0.0	
Narayanpur	My PC	11.6	Hydro	**36**				0.0	
Kaiga	NPC	440	Nuclear	**3317**				0.0	
Andhra Pradesh									
K_Gudam	APGENCO	1180	Coal	**8729**	2717	25.8	0.98	1052.9	**9190680**
Vijayaw ada	APGENCO	1260	Coal	**10288**	2717	25.8	0.98	1052.9	**10832136**
Ramagundam	APGENCO	62.5	Coal	**390**	2717	25.8	0.98	1052.9	**410627**
Nellore	APGENCO	30	Coal	**147**	2717	25.8	0.98	1052.9	**154775**
Rayal Seema	APGENCO	420	Coal	**3488**	2717	25.8	0.98	1052.9	**3672481**
vijesw aram	APGPC	272	Gas	**2031**	2062	15.3	0.995	481.1	**977149**
Machkund	APGENCO	114.9	Hydro	**579**				0.0	**0**
Upper Sileru	APGENCO	240	Hydro	**245**				0.0	**0**
Low er Sileru	APGENCO	460	Hydro	**615**				0.0	**0**
T. B. Dam	APGENCO	36	Hydro	**119**				0.0	**0**
Hampi	APGENCO	36	Hydro	**0**				0.0	**0**
Nagarjuna Sagar	APGENCO	810	Hydro	**868**				0.0	
Nag Sagar RBC	APGENCO	90	Hydro	**0**				0.0	
Nag Sagar LBC	APGENCO	60	Hydro	**0**				0.0	
Donkarayi	APGENCO	25	Hydro	**41**				0.0	
Srisailam	APGENCO	770	Hydro	**537**				0.0	
Srisailam LB	APGENCO	900	Hydro	**558**				0.0	
Pochampad	APGENCO	27	Hydro	**81**				0.0	
Nizam Sagar	APGENCO	10	Hydro	**0**				0.0	
Penna Ahobelam	APGENCO	20	Hydro	**0**				0.0	
Singur	APGENCO	15	Hydro	**7**				0.0	
Small Hydro	APGENCO	15	Hydro	**15**				0.0	
Peddapuram CCGT	REL	220	Gas	**850**	2062	15.3	0.995	481.1	**408950**
Jegurupadu GT	GVK	455.4	Naphtha	**1583**	2062	20.2	0.99	632.0	**1000469**
Kondapalli	Kondapalli Th	350	Naphtha	**2477**	2062	20.2	0.99	632.0	**1565485**
Vemagiri CCPP	Pvt	233	Gas		2062	15.3	0.995	481.1	**0**
LVS Pow er	LVS Pow er	36.8	Diesel	**2**	2929	20.2	0.99	897.7	**1795**
Godavari GT	Spectrum	208	Gas	**1250**	2062	15.3	0.995	481.1	**601397**
R'gundam STPS	NTPC	2600	Coal	**16839**	2717	25.8	0.98	1052.9	**17729620**
Simhadri	NTPC	1000	Coal	**4974**	2717	25.8	0.98	1052.9	**5237076**

Kerala									
Brahamapuram DG	KSEB	106.6	Diesel	**128**	2929	20.2	0.99	897.7	**114912**
Kozikode DG	KSEB	128	Diesel	**296**	2929	20.2	0.99	897.7	**265733**
Kuttiadi	KSEB	125	Hydro	**304**				0.0	**0**
Idukki	KSEB	780	Hydro	**1905**				0.0	**0**
Sabarigiri	KSEB	300	Hydro	**804**				0.0	
Idamalayar	KSEB	75	Hydro	**259**				0.0	
Kakkad	KSEB	50	Hydro	**150**				0.0	
Sholayar	KSEB	54	Hydro	**138**				0.0	
Sengulam	KSEB	48	Hydro	**130**				0.0	
Narimangalam	KSEB	45	Hydro	**230**				0.0	
Pallivasal	KSEB	37.5	Hydro	**157**				0.0	
Poringalkuttu	KSEB	32	Hydro	**123**				0.0	
Poringalkuttu L	KSEB	16	Hydro	**78**				0.0	
Panniar	KSEB	30	Hydro	**78**				0.0	
Kallada	KSEB	15	Hydro	**35**				0.0	
Low er Periyar	KSEB	180	Hydro	**414**				0.0	
Malankara	KSEB	10.5	Hydro	**0**				0.0	
Chembukadavu	KSEB	6.5	Hydro					0.0	
Urumi	KSEB	6.2	Hydro					0.0	
Peppara	KSEB	3	Hydro	**6**				0.0	
Madhupatty	KSEB	2	Hydro	**2**				0.0	
Cochin CCGT	REL	174	NG	**305**	2062	15.3	0.995	481.1	**146741**
Kasargode	RPG	21.8	Diesel	**148**	2929	20.2	0.99	897.7	**132866**
Maniyar	KLPVT	10	Hydro	**23**				0.0	
Kuthungal	KLPVT	21	Hydro	**23**				0.0	
Kayamkulam	NTPC	350	NG	**2127**	2062	15.3	0.995	481.1	**1023336**
TamilNadu									
Ennore	TNEB	450	Coal	**1747**	2717	25.8	0.98	1052.9	**1839399**
Tutikorin	TNEB	1050	Coal	**8187**	2717	25.8	0.98	1052.9	**8620013**
Mettur	TNEB	840	Coal	**6739**	2717	25.8	0.98	1052.9	**7095428**
North Chennai	TNEB	630	Coal	**4405**	2717	25.8	0.98	1052.9	**4637982**
Basin Bridge	TNEB	120	NG	**276**	2062	15.3	0.995	481.1	**132788**
Nariman GT	TNEB	10	NG	**0**	2062	15.3	0.995	481.1	**0**
Valuthur GT	TNEB	94	NG	**104**	2062	15.3	0.995	481.1	**50036**
Kuttlam GT	TNEB	100	NG	**0**	2062	15.3	0.995	481.1	**0**
Kovilakalappal	TNEB	107	NG	**726**	2062	15.3	0.995	481.1	**349291**
Pyakara	TNEB	70.1	Hydro	**254**				0.0	**0**
Pyakara Dam	TNEB	2	Hydro	**0**				0.0	**0**
Moyar	TNEB	36	Hydro	**105**				0.0	
Kundah	TNEB	555	Hydro	**764**				0.0	
Mettur Dam &Tunnel	TNEB	240	Hydro	**130**				0.0	
Periyar	TNEB	140	Hydro	**227**				0.0	
Kodayar	TNEB	100	Hydro	**150**				0.0	
Sholayar	TNEB	95	Hydro	**320**				0.0	
Aliyar	TNEB	60	Hydro	**108**				0.0	
Sarkarpathy	TNEB	30	Hydro	**97**				0.0	
Papanasam	TNEB	28	Hydro	**65**				0.0	
Suruliyar	TNEB	35	Hydro	**75**				0.0	
Servalar	TNEB	20	Hydro	**19**				0.0	
Low er Mettur	TNEB	120	Hydro	**168**				0.0	
Kadampari	TNEB	400	Hydro	**203**				0.0	
Vaigai	TNEB	6	Hydro	**4**				0.0	
Low er Bhavani	TNEB	8	Hydro	**21**				0.0	
Sathur Dam	TNEB	7.5	Hydro	**2**				0.0	
Parsen_S Valle	TNEB	30	Hydro	**16**				0.0	
Pykara ULT	TNEB	150	Hydro					0.0	
Karuppur GT	KEPS	119.8	NG		2062	15.3	0.995	481.1	**0**
Samayanallur	Madurai P	106	Diesel	**589**	2929	20.2	0.99	897.7	**528773**
Neyveli	Pvt	250	Lignite	**406**	2897	27.6	0.98	1201.0	**487593**
P Nallur CCGT	PPNPG	330.5	NG	**2169**	2062	15.3	0.995	481.1	**1043543**
Samalpatti DG	Samalpatti	105.7	Diesel	**623**	2929	20.2	0.99	897.7	**559296**
Valantharvi GT	Valanth Th	38	NG		2062	15.3	0.995	481.1	**0**
Basin Bridge DG	Vasavi	200	Diesel	**1209**	2929	20.2	0.99	897.7	**1085375**
Neyveli STI	NLC Th	600	Lignite	**4421**	2717	27.6	0.98	1126.3	**4979584**
Neyveli STII	NLC Th	1470	Lignite	**10495**	2717	27.6	0.98	1126.3	**11821020**
Neyveli FST Ext	NLC Th	420	Lignite	**89**	2897.86	27.6	0.98	1201.3	**106918**
MAPP	NPC	390	Nuclear	**1073**				0.0	**0**
Pondichery									
Karaikal GT	PPCL	32.5	Gas	**265**	2062	15.3	0.995	481.1	**127496**
Total				**134942**					**110523204**
Weighted Average Emission Factor for the year 2002-03					**819.04**	tCO_2/GWh			

Baseline Emission Factor 2003-04

Power station	Owner	Installed capacity	Fuel Type	Actual Generation 2003-04	Net Heat Rate	IPCC EF for Fuel	Oxidation factor	Emission Factor	CO_2 Emissions
		MW		GWh	kcal/kWh	tC/TJ		tCO_2/GWh	tCO_2
Reference	1	1	2	1	2	3	3		
Karnataka									
Raichur	KPCL	1470	Coal	**11400**	2717	25.8	0.98	1052.9	**12002950**
Torangallu IMP	Jindal	260	Coal	**766**	2717	25.8	0.98	1052.9	**806514**
Yelahanka	VVNL	127.8	Diesel	**384**	2929	20.2	0.99	897.7	**344735**
Bellary	Pvt	25.2	Diesel	**42**	2929	20.2	0.99	897.7	**37705**
Belgaum	Tata	81.3	Diesel	**235**	2929	20.2	0.99	897.7	**210970**
Tanir Bavi	GMR	220	Naphtha	**1631**	2062	20.2	0.995	635.2	**1036012**
Jog	KEB	139.2	Hydro	**160**				0.0	
Sivasamundrum	KEB	42	Hydro	**79**				0.0	
Shimsapura	KEB	17.2	Hydro	**57**				0.0	
Munirabad	KEB	27	Hydro	**41**				0.0	
Sharavathy	KPCL	1006.2	Hydro	**3316**				0.0	
Kadra	KPCL	150	Hydro	**223**				0.0	
Kodasali	KPCL	120	Hydro	**214**				0.0	
Kalinadi	KPCL	855	Hydro	**1718**				0.0	
Supa	KPCL	100	Hydro	**241**				0.0	
Linganamakki	KPCL	55	Hydro	**120**				0.0	
Varahi	KPCL	230	Hydro	**721**				0.0	
Bhadra	KPCL	39.2	Hydro	**11**				0.0	
Ghat Prabha	KPCL	32	Hydro	**62**				0.0	
Mani DPH	KPCL	9	Hydro	**11**				0.0	
Mallarpur	KPCL	9	Hydro	**0**				0.0	
Gerusuppa	KPCL	240	Hydro	**358**				0.0	
Almatti DPH	KPCL	290	Hydro	**0**				0.0	
Shivpura	BPCL	18	Hydro	**54**				0.0	
Shahpur	BPCL	6.6	Hydro	**22**				0.0	
Harangi	BPCL	9	Hydro	**0**				0.0	
Madhavmantri	BPCL	4.5	Hydro	**13**				0.0	
Mandagiri	Pvt	3.5	Hydro	**0**				0.0	
Narayanpur	My PC	11.6	Hydro	**38**				0.0	
Kaiga	NPC	440	Nuclear	**3123**				0.0	
Andhra Pradesh									
K_Gudam	APGENCO	1180	Coal	**8177**	2733	25.8	0.98	1059.1	**8660184**
Vijayawada	APGENCO	1260	Coal	**10104**	2495	25.8	0.98	966.9	**9769164**
Ramagundam	APGENCO	62.5	Coal	**471**	2856	25.8	0.98	1106.8	**521282**
Nellore	APGENCO	30	Coal	**146**	2717	25.8	0.98	1052.9	**153722**
Rayal Seema	APGENCO	420	Coal	**3331**	2304	25.8	0.98	892.8	**2974066**
vijesw aram	APGPC	272	Gas	**2147**	2062	15.3	0.995	481.1	**1032959**
Machkund	APGENCO	114.9	Hydro	**529**				0.0	
Upper Sileru	APGENCO	240	Hydro	**401**				0.0	
Low er Sileru	APGENCO	460	Hydro	**977**				0.0	
T. B. Dam	APGENCO	36	Hydro	**102**				0.0	
Hampi	APGENCO	36	Hydro	**0**				0.0	
Nagarjuna Sagar	APGENCO	810	Hydro	**369**				0.0	
Nag Sagar RBC	APGENCO	90	Hydro	**0**				0.0	
Nag Sagar LBC	APGENCO	60	Hydro	**0**				0.0	
Donkarayi	APGENCO	25	Hydro	**111**				0.0	
Srisailam	APGENCO	770	Hydro	**309**				0.0	
Srisailam LB	APGENCO	900	Hydro	**328**				0.0	
Pochampad	APGENCO	27	Hydro	**64**				0.0	
Nizam Sagar	APGENCO	10	Hydro	**6**				0.0	
Penna Ahobelam	APGENCO	20	Hydro	**0**				0.0	
Singur	APGENCO	15	Hydro	**6**				0.0	
Small Hydro	APGENCO	15	Hydro	**8**				0.0	
Peddapuram CCGT	REL	220	Gas	**1249**	2062	15.3	0.995	481.1	**600915**
Jegurupadu GT	GVK	455.4	Naphtha	**1505**	2062	20.2	0.99	632.0	**951173**
Kondapalli	Kondapalli Th	350	Naphtha	**2238**	2062	20.2	0.99	632.0	**1414435**
Vemagiri CCPP	Pvt	233	Gas	**0**	2062	15.3	0.995	481.1	**0**
LVS Pow er	LVS Pow er	36.8	Diesel	**0**	2929	20.2	0.99	897.7	**0**
Godavari GT	Spectrum	208	Gas	**1100**	2062	15.3	0.995	481.1	**529229**
R'gundam STPS	NTPC	2600	Coal	**16332**	2717	25.8	0.98	1052.9	**17195805**
Simhadri	NTPC	1000	Coal	**7722**	2717	25.8	0.98	1052.9	**8130419**

Kerala									
Brahamapuram DG	KSEB	106.6	Diesel	**266**	2929	20.2	0.99	897.7	**238801**
Kozikode DG	KSEB	128	Diesel	**313**	2929	20.2	0.99	897.7	**280995**
Kuttiadi	KSEB	125	Hydro	**259**				0.0	
Idukki	KSEB	780	Hydro	**1246**				0.0	
Sabarigiri	KSEB	300	Hydro	**698**				0.0	
Idamalayar	KSEB	75	Hydro	**155**				0.0	
Kakkad	KSEB	50	Hydro	**126**				0.0	
Sholayar	KSEB	54	Hydro	**202**				0.0	
Sengulam	KSEB	48	Hydro	**128**				0.0	
Narimangalam	KSEB	45	Hydro	**196**				0.0	
Pallivasal	KSEB	37.5	Hydro	**193**				0.0	
Poringalkuttu	KSEB	32	Hydro	**142**				0.0	
Poringalkuttu L	KSEB	16	Hydro	**88**				0.0	
Panniar	KSEB	30	Hydro	**76**				0.0	
Kallada	KSEB	15	Hydro	**36**				0.0	
Low er Periyar	KSEB	180	Hydro	**363**				0.0	
Malankara	KSEB	10.5	Hydro	**0**				0.0	
Chembukadavu	KSEB	6.5	Hydro	**0**				0.0	
Urumi	KSEB	6.2	Hydro	**0**				0.0	
Peppara	KSEB	3	Hydro	**1**				0.0	
Madhupatty	KSEB	2	Hydro	**8**				0.0	
Cochin CCGT	REL	174	NG	**991**	2062	15.3	0.995	481.1	**476787**
Kasargode	RPG	21.8	Diesel	**78**	2929	20.2	0.99	897.7	**70024**
Maniyar	KLPVT	10	Hydro	**21**				0.0	
Kuthungal	KLPVT	21	Hydro	**19**				0.0	
Kayamkulam	NTPC	350	NG	**2118**	2062	15.3	0.995	481.1	**1019006**
TamilNadu									
Ennore	TNEB	450	Coal	**1258**	3318	25.8	0.98	1285.8	**1617523**
Tutikorin	TNEB	1050	Coal	**8084**	2474	25.8	0.98	958.7	**7750317**
Mettur	TNEB	840	Coal	**6735**	2656	25.8	0.98	1029.3	**6932010**
North Chennai	TNEB	630	Coal	**4347**	2495	25.8	0.98	966.9	**4202945**
Basin Bridge	TNEB	120	NG	**89**	2062	15.3	0.995	481.1	**42819**
Nariman GT	TNEB	10	NG	**0**	2062	15.3	0.995	481.1	
Valuthur GT	TNEB	94	NG	**671**	2062	15.3	0.995	481.1	**322830**
Kuttlam GT	TNEB	100	NG	**108**	2062	15.3	0.995	481.1	**51961**
Kovilakalappal	TNEB	107	NG	**745**	2062	15.3	0.995	481.1	**358432**
Pyakara	TNEB	70.1	Hydro	**141**				0.0	
Pyakara Dam	TNEB	2	Hydro	**0**				0.0	
Moyar	TNEB	36	Hydro	**53**				0.0	
Kundah	TNEB	555	Hydro	**429**				0.0	
Mettur Dam &Tunnel	TNEB	240	Hydro	**85**				0.0	
Periyar	TNEB	140	Hydro	**213**				0.0	
Kodayar	TNEB	100	Hydro	**141**				0.0	
Sholayar	TNEB	95	Hydro	**199**				0.0	
Aliyar	TNEB	60	Hydro	**86**				0.0	
Sarkarpathy	TNEB	30	Hydro	**51**				0.0	
Papanasam	TNEB	28	Hydro	**47**				0.0	
Suruliyar	TNEB	35	Hydro	**41**				0.0	
Servalar	TNEB	20	Hydro	**19**				0.0	
Low er Mettur	TNEB	120	Hydro	**97**				0.0	
Kadampari	TNEB	400	Hydro	**408**				0.0	
Vaigai	TNEB	6	Hydro	**5**				0.0	
Low er Bhavani	TNEB	8	Hydro	**9**				0.0	
Sathur Dam	TNEB	7.5	Hydro	**2**				0.0	
Parsen_S Valle	TNEB	30	Hydro	**18**				0.0	
Pykara ULT	TNEB	150	Hydro	**0**				0.0	
Karuppur GT	KEPS	119.8	NG	**0**	2062	15.3	0.995	481.1	**0**
Samayanallur	Madurai P	106	Diesel	**457**	2929	20.2	0.99	897.7	**410270**
Neyveli	Pvt	250	Lignite	**1395**	2897	27.6	0.98	1201.0	**1675350**
P Nallur CCGT	PPNPG	330.5	NG	**1314**	2062	15.3	0.995	481.1	**632188**
Samalpatti DG	Samalpatti	105.7	Diesel	**458**	2929	20.2	0.99	897.7	**411168**
Valantharvi GT	Valanth Th	38	NG	**0**	2062	15.3	0.995	481.1	**0**
Basin Bridge DG	Vasavi	200	Diesel	**992**	2929	20.2	0.99	897.7	**890564**
Neyveli STI	NLC Th	600	Lignite	**4400**	3923	27.6	0.98	1626.3	**7155729**
Neyveli STII	NLC Th	1470	Lignite	**10003**	2935	27.6	0.98	1216.7	**12170859**
Neyveli FST Ext	NLC Th	420	Lignite	**1993**	2897.86	27.6	0.98	1201.3	**2394239**
MAPP	NPC	390	Nuclear	**1577**				0.0	
Pondichery									
Karaikal GT	PPCL	32.5	Gas	**277**	2062	15.3	0.995	481.1	**133269**
Total				**137442**					**115610325**
Weighted Average Emission Factor for the year 2003-04					**841.16**	tCO_2/GWh			

Baseline Emission Factor 2004-05

Power station	Owner	Installed capacity	Fuel Type	Actual Generation 2004-05	Net Heat Rate	IPCC EF for Fuel	Oxidation factor	Emission Factor	CO_2 Emissions
		MW		GWh	kcal/kWh	tC/TJ		tCO_2/GWh	tCO_2
Reference	1	1	2	1	2	3	3		
Karnataka									
Raichur	KPCL	1470	Coal	**10717.93**	2717	25.8	0.98	1052.9	**11284805**
Torangallu IMP	Jindal	260	Coal	**516.33**	2717	25.8	0.98	1052.9	**543639**
Yelahanka	VVNL	127.8	Diesel	**271.14**	2929	20.2	0.99	897.7	**243415**
Bellary	Pvt	25.2	Diesel	**40.32**	2929	20.2	0.99	897.7	**36197**
Belgaum	Tata	81.3	Diesel	**238.46**	2929	20.2	0.99	897.7	**214077**
Tanir Bavi	GMR	220	Naphtha	**629.55**	2062	20.2	0.995	635.2	**399890**
Jog	KEB	139.2	Hydro	**174.18**				0.0	
Sivasamundrum	KEB	42	Hydro	**191.59**				0.0	
Shimsapura	KEB	17.2	Hydro	**93.85**				0.0	
Munirabad	KEB	27	Hydro	**68.71**				0.0	
Sharavathy	KPCL	1006.2	Hydro	**3853.74**				0.0	
Kadra	KPCL	150	Hydro	**230.98**				0.0	
Kodasali	KPCL	120	Hydro	**214.76**				0.0	
Kalinadi	KPCL	855	Hydro	**1719.69**				0.0	
Supa	KPCL	100	Hydro	**294.64**				0.0	
Linganamakki	KPCL	55	Hydro	**194.32**				0.0	
Varahi	KPCL	230	Hydro	**973.27**				0.0	
Bhadra	KPCL	39.2	Hydro	**41.4**				0.0	
Ghat Prabha	KPCL	32	Hydro	**96.61**				0.0	
Mani DPH	KPCL	9	Hydro	**23.46**				0.0	
Mallarpur	KPCL	9	Hydro	**0**				0.0	
Gerusuppa	KPCL	240	Hydro	**437.59**				0.0	
Almatti DPH	KPCL	290	Hydro	**138.68**				0.0	
Shivpura	BPCL	18	Hydro	**72.34**				0.0	
Shahpur	BPCL	6.6	Hydro	**25.15**				0.0	
Harangi	BPCL	9	Hydro	**0**				0.0	
Madhavmantri	BPCL	4.5	Hydro	**22.86**				0.0	
Mandagiri	Pvt	3.5	Hydro	**0**				0.0	
Narayanpur	My PC	11.6	Hydro	**42.26**				0.0	
Kaiga	NPC	440	Nuclear	**2926.25**				0.0	
Andhra Pradesh									
K_Gudam	APGENCO	1180	Coal	**9504.3**	2594	25.8	0.98	1005.2	**9553964**
Vijayawada	APGENCO	1260	Coal	**9848.8**	2435	25.8	0.98	943.6	**9293425**
Ramagundam	APGENCO	62.5	Coal	**496**	2723	25.8	0.98	1055.2	**523387**
Nellore	APGENCO	30	Coal	**153.9**	2717	25.8	0.98	1052.9	**162040**
Rayal Seema	APGENCO	420	Coal	**3353.6**	2288	25.8	0.98	886.6	**2973451**
vijeswaram	APGPC	272	Gas	**1993.4**	2062	15.3	0.995	481.1	**959059**
Machkund	APGENCO	114.9	Hydro	**900.4**				0.0	
Upper Sileru	APGENCO	240	Hydro	**544.2**				0.0	
Lower Sileru	APGENCO	460	Hydro	**1171.1**				0.0	
T. B. Dam	APGENCO	36	Hydro	**148.2**				0.0	
Hampi	APGENCO	36	Hydro	**0**				0.0	
Nagarjuna Sagar	APGENCO	810	Hydro	**501.5**				0.0	
Nag Sagar RBC	APGENCO	90	Hydro	**47.7**				0.0	
Nag Sagar LBC	APGENCO	60	Hydro	**5.1**				0.0	
Donkarayi	APGENCO	25	Hydro	**132.3**				0.0	
Srisailam	APGENCO	770	Hydro	**941**				0.0	
Srisailam LB	APGENCO	900	Hydro	**1411.7**				0.0	
Pochampad	APGENCO	27	Hydro	**1.6**				0.0	
Nizam Sagar	APGENCO	10	Hydro	**0**				0.0	
Penna Ahobelam	APGENCO	20	Hydro	**0**				0.0	
Singur	APGENCO	15	Hydro	**1.47**				0.0	
Small Hydro	APGENCO	15	Hydro	**6.3**				0.0	
Peddapuram CCGT	REL	220	Gas	**1141.34**	2062	15.3	0.995	481.1	**549118**
Jegurupadu GT	GVK	455.4	Naphtha	**1419.62**	2062	20.2	0.99	632.0	**897212**
Kondapalli	Kondapalli Th	350	Naphtha	**2246.34**	2062	20.2	0.99	632.0	**1419706**
Vemagiri CCPP	Pvt	233	Gas	**0**	2062	15.3	0.995	481.1	**0**
LVS Power	LVS Power	36.8	Diesel	**0**	2929	20.2	0.99	897.7	**0**
Godavari GT	Spectrum	208	Gas	**1372.96**	2062	15.3	0.995	481.1	**660555**
R'gundam STPS	NTPC	2600	Coal	**17169.83**	2717	25.8	0.98	1052.9	**18077948**
Simhadri	NTPC	1000	Coal	**8122.1**	2717	25.8	0.98	1052.9	**8551680**
Kerala									
Brahamapuram DG	KSEB	106.6	Diesel	**136.4**	2929	20.2	0.99	897.7	**122453**
Kozikode DG	KSEB	128	Diesel	**160.5**	2929	20.2	0.99	897.7	**144088**

Kuttiadi	KSEB	125	Hydro	**370.54**				0.0	
Idukki	KSEB	780	Hydro	**2003.4**				0.0	
Sabarigiri	KSEB	300	Hydro	**1224.54**				0.0	
Idamalayar	KSEB	75	Hydro	**338.31**				0.0	
Kakkad	KSEB	50	Hydro	**210.38**				0.0	
Sholayar	KSEB	54	Hydro	**263.01**				0.0	
Sengulam	KSEB	48	Hydro	**166.96**				0.0	
Narimangalam	KSEB	45	Hydro	**231.95**				0.0	
Pallivasal	KSEB	37.5	Hydro	**222.55**				0.0	
Poringalkuttu	KSEB	32	Hydro	**181.6**				0.0	
Poringalkuttu L	KSEB	16	Hydro	**107.89**				0.0	
Panniar	KSEB	30	Hydro	**142.43**				0.0	
Kallada	KSEB	15	Hydro	**76.93**				0.0	
Lower Periyar	KSEB	180	Hydro	**512.39**				0.0	
Malankara	KSEB	10.5	Hydro	**2.95**				0.0	
Chembukadavu	KSEB	6.5	Hydro	**6.19**				0.0	
Urumi	KSEB	6.2	Hydro	**0.91**				0.0	
Peppara	KSEB	3	Hydro	**6.37**				0.0	
Madhupatty	KSEB	2	Hydro	**4.07**				0.0	
Cochin CCGT	REL	174	NG	**111.83**	2062	15.3	0.995	481.1	**53803**
Kasargode	RPG	21.8	Diesel	**15.74**	2929	20.2	0.99	897.7	**14131**
Maniyar	KLPVT	10	Hydro	**34.47**				0.0	
Kuthungal	KLPVT	21	Hydro	**36.18**				0.0	
Kayamkulam	NTPC	350	NG	**620.5**	2062	15.3	0.995	481.1	**298533**
TamilNadu									
Ennore	TNEB	450	Coal	**1222.96**	3244	25.8	0.98	1257.1	**1537399**
Tutikorin	TNEB	1050	Coal	**8180.01**	2493	25.8	0.98	966.1	**7902593**
Mettur	TNEB	840	Coal	**6683.96**	2622	25.8	0.98	1016.1	**6791411**
North Chennai	TNEB	630	Coal	**3915.96**	2456	25.8	0.98	951.7	**3727006**
Basin Bridge	TNEB	120	NG	**40.47**	2062	15.3	0.995	481.1	**19471**
Nariman GT	TNEB	10	NG	**0**	2062	15.3	0.995	481.1	
Valuthur GT	TNEB	94	NG	**557.5**	2062	15.3	0.995	481.1	**268223**
Kuttlam GT	TNEB	100	NG	**640.88**	2062	15.3	0.995	481.1	**308338**
Kovilakalappal	TNEB	107	NG	**763.32**	2062	15.3	0.995	481.1	**367246**
Pyakara	TNEB	70.1	Hydro	**213.43**				0.0	
Pyakara Dam	TNEB	2	Hydro	**5.04**				0.0	
Moyar	TNEB	36	Hydro	**90.17**				0.0	
Kundah	TNEB	555	Hydro	**1567.42**				0.0	
Mettur Dam &Tunnel	TNEB	240	Hydro	**334.58**				0.0	
Periyar	TNEB	140	Hydro	**492.72**				0.0	
Kodayar	TNEB	100	Hydro	**207.06**				0.0	
Sholayar	TNEB	95	Hydro	**350.38**				0.0	
Aliyar	TNEB	60	Hydro	**162.08**				0.0	
Sarkarpathy	TNEB	30	Hydro	**114.67**				0.0	
Papanasam	TNEB	28	Hydro	**88.5**				0.0	
Suruliyar	TNEB	35	Hydro	**101.41**				0.0	
Servalar	TNEB	20	Hydro	**34.62**				0.0	
Lower Mettur	TNEB	120	Hydro	**254.66**				0.0	
Kadampari	TNEB	400	Hydro	**256.79**				0.0	
Vaigai	TNEB	6	Hydro	**12.25**				0.0	
Lower Bhavani	TNEB	8	Hydro	**61.52**				0.0	
Sathur Dam	TNEB	7.5	Hydro	**10.21**				0.0	
Parsen_S Valle	TNEB	30	Hydro	**55.6**				0.0	
Pykara ULT	TNEB	150	Hydro	**0**				0.0	
Karuppur GT	KEPS	119.8	NG	**0**	2062	15.3	0.995	481.1	**0**
Samayanallur	Madurai P	106	Diesel	**382.02**	2929	20.2	0.99	897.7	**342957**
Neyveli	Pvt	250	Lignite	**1335.82**	2897	27.6	0.98	1201.0	**1604277**
P Nallur CCGT	PPNPG	330.5	NG	**464.3**	2062	15.3	0.995	481.1	**223383**
Samalpatti DG	Samalpatti	105.7	Diesel	**357.33**	2929	20.2	0.99	897.7	**320792**
Valantharvi GT	Valanth Th	38	NG	**0**	2062	15.3	0.995	481.1	**0**
Basin Bridge DG	Vasavi	200	Diesel	**762.22**	2929	20.2	0.99	897.7	**684280**
Neyveli STI	NLC Th	600	Lignite	**4257.78**	3981	27.6	0.98	1650.3	**7026811**
Neyveli STII	NLC Th	1470	Lignite	**9247.38**	2871	27.6	0.98	1190.2	**11006133**
Neyveli FST Ext	NLC Th	420	Lignite	**3237.68**	2897.86	27.6	0.98	1201.3	**3889504**
MAPP	NPC	390	Nuclear	**1480.48**				0.0	
Pondichery									
Karaikal GT	PPCL	32.5	Gas	**275.69**	2062	15.3	0.995	481.1	**132639**
Total				**142292.68**					**113129038**
Weighted Average Emission Factor for the year 2004-05					**795.04468**	tCO_2/GWh			

Baseline Emission Factor 2005-06

Power station	Owner	Installed capacity	Fuel Type	Actual Generation 2005-06	Net Heat Rate	IPCC EF for Fuel	Oxidation factor	Emission Factor	CO_2 Emissions
		MW		GWh	kcal/kWh	tC/TJ		tCO_2/GWh	tCO_2
Reference	1	1	2	1	2	3	3		
Karnataka									
Raichur	KPCL	1470	Coal	**9173.48**	2717	25.8	0.98	1052.9	**9658668**
Torangallu IMP	Jindal	260	Coal	**1382.95**	2717	25.8	0.98	1052.9	**1456095**
Yelahanka	VVNL	127.8	Diesel	**96.7**	2929	20.2	0.99	897.7	**86812**
Bellary	Pvt	25.2	Diesel	**17.25**	2929	20.2	0.99	897.7	**15486**
Belgaum	Tata	81.3	Diesel	**133.12**	2929	20.2	0.99	897.7	**119508**
Tanir Bavi	GMR	220	Naphtha	**241.49**	2061	20.0	0.995	628.6	**151802**
Jog	KEB	139.2	Hydro	**237.75**				0.0	
Sivasamundrum	KEB	42	Hydro	**260.75**				0.0	
Shimsapura	KEB	17.2	Hydro	**93.27**				0.0	
Munirabad	KEB	27	Hydro	**83.28**				0.0	
Sharavathy	KPCL	1006.2	Hydro	**4865.65**				0.0	
Kadra	KPCL	150	Hydro	**345.96**				0.0	
Kodasali	KPCL	120	Hydro	**314.03**				0.0	
Kalinadi	KPCL	855	Hydro	**2161.91**				0.0	
Supa	KPCL	100	Hydro	**357.63**				0.0	
Linganamakki	KPCL	55	Hydro	**275.69**				0.0	
Varahi	KPCL	230	Hydro	**971.84**				0.0	
Bhadra	KPCL	39.2	Hydro	**76.03**				0.0	
Ghat Prabha	KPCL	32	Hydro	**122.5**				0.0	
Mani DPH	KPCL	9	Hydro	**20.64**				0.0	
Mallarpur	KPCL	9	Hydro	**0**				0.0	
Gerusuppa	KPCL	240	Hydro	**557.01**				0.0	
Almatti DPH	KPCL	290	Hydro	**598.62**				0.0	
Shivpura	BPCL	18	Hydro	**85.79**				0.0	
Shahpur	BPCL	6.6	Hydro	**21.73**				0.0	
Harangi	BPCL	9	Hydro	**0**				0.0	
Madhavmantri	BPCL	4.5	Hydro	**22.89**				0.0	
Mandagiri	Pvt	3.5	Hydro	**6.1**				0.0	
Narayanpur	My PC	11.6	Hydro	**55.9**				0.0	
Kaiga	NPC	440	Nuclear	**2859.58**				0.0	
Andhra Pradesh									
K_Gudam	APGENCO	1180	Coal	**8212.97**	2594	25.8	0.98	1005.2	**8255886**
Vijayaw ada	APGENCO	1260	Coal	**9755.14**	2435	25.8	0.98	943.6	**9205046**
Ramagundam	APGENCO	62.5	Coal	**397.23**	2723	25.8	0.98	1055.2	**419163**
Nellore	APGENCO	30	Coal	**7.4**	2717	25.8	0.98	1052.9	**7791**
Rayal Seema	APGENCO	420	Coal	**2369.09**	2288	25.8	0.98	886.6	**2100541**
vijesw aram	APGPC	272	Gas	**1836.92**	2061	15.3	0.995	480.9	**883345**
Machkund	APGENCO	114.9	Hydro	**628.14**				0.0	
Upper Sileru	APGENCO	240	Hydro	**472.96**				0.0	
Low er Sileru	APGENCO	460	Hydro	**1037.06**				0.0	
T. B. Dam	APGENCO	36	Hydro	**167.64**				0.0	
Hampi	APGENCO	36	Hydro	**57.6**				0.0	
Nagarjuna Sagar	APGENCO	810	Hydro	**1560.16**				0.0	
Nag Sagar RBC	APGENCO	90	Hydro	**273.94**				0.0	
Nag Sagar LBC	APGENCO	60	Hydro	**120.97**				0.0	
Donkarayi	APGENCO	25	Hydro	**114.71**				0.0	
Srisailam	APGENCO	770	Hydro	**1490.26**				0.0	
Srisailam LB	APGENCO	900	Hydro	**2232.9**				0.0	
Pochampad	APGENCO	27	Hydro	**111.82**				0.0	
Nizam Sagar	APGENCO	10	Hydro	**9.64**				0.0	
Penna Ahobelam	APGENCO	20	Hydro	**9.88**				0.0	
Singur	APGENCO	15	Hydro	**8.93**				0.0	
Small Hydro	APGENCO	15	Hydro	**24.96**				0.0	
Peddapuram CCGT	REL	220	Gas	**842.31**	2061	15.3	0.995	480.9	**405053**
Jegurupadu GT	GVK	455.4	Gas	**1293.7**	2061	15.3	0.995	480.9	**622119**
Kondapalli	Kondapalli Th	350	Gas	**2116.12**	2061	15.3	0.995	480.9	**1017608**
Vemagiri CCPP	Pvt	233	Gas	**1.96**	2061	15.3	0.995	480.9	**943**
LVS Pow er	LVS Pow er	36.8	Diesel	**0**	2929	20.2	0.99	897.7	**0**
Godavari GT	Spectrum	208	Gas	**1331.16**	2061	15.3	0.995	480.9	**640133**
Rgundam STPS	NTPC	2600	Coal	**19691.1**	2717	25.8	0.98	1052.9	**20732569**
Simhadri	NTPC	1000	Coal	**7741.4**	2717	25.8	0.98	1052.9	**8150845**
Kerala									
Brahamapuram DG	KSEB	106.6	Diesel	**55.71**	2929	20.2	0.99	897.7	**50013**
Kozikode DG	KSEB	128	Diesel	**93.34**	2929	20.2	0.99	897.7	**83796**

Kuttiadi	KSEB	125	Hydro	**515.52**				0.0	
Idukki	KSEB	780	Hydro	**2698.85**				0.0	
Sabarigiri	KSEB	300	Hydro	**1468.53**				0.0	
Idamalayar	KSEB	75	Hydro	**375.46**				0.0	
Kakkad	KSEB	50	Hydro	**248.56**				0.0	
Sholayar	KSEB	54	Hydro	**290.21**				0.0	
Sengulam	KSEB	48	Hydro	**188.93**				0.0	
Narimangalam	KSEB	45	Hydro	**244.9**				0.0	
Pallivasal	KSEB	37.5	Hydro	**238.42**				0.0	
Poringalkuttu	KSEB	32	Hydro	**164.85**				0.0	
Poringalkuttu L	KSEB	16	Hydro	**105.19**				0.0	
Panniar	KSEB	30	Hydro	**159.82**				0.0	
Kallada	KSEB	15	Hydro	**64.16**				0.0	
Lower Periyar	KSEB	180	Hydro	**631.39**				0.0	
Malankara	KSEB	10.5	Hydro	**20.42**				0.0	
Chembukadavu	KSEB	6.5	Hydro	**10.59**				0.0	
Urumi	KSEB	6.2	Hydro	**12.81**				0.0	
Peppara	KSEB	3	Hydro	**6.17**				0.0	
Madhupatty	KSEB	2	Hydro	**4.53**				0.0	
Cochin CCGT	REL	174	NG	**37.15**	2061	15.3	0.995	480.9	**17865**
Kasargode	RPG	21.8	Diesel	**7.91**	2929	20.2	0.99	897.7	**7101**
Maniyar	KLPVT	10	Hydro	**40.84**				0.0	
Kuthungal	KLPVT	21	Hydro	**48.4**				0.0	
Kayamkulam	NTPC	350	NG	**358.5**	2061	15.3	0.995	480.9	**172397**
TamilNadu									
Ennore	TNEB	450	Coal	**600.53**	3244	25.8	0.98	1257.1	**754934**
Tutikorin	TNEB	1050	Coal	**7674.14**	2493	25.8	0.98	966.1	**7413879**
Mettur	TNEB	840	Coal	**6518.91**	2622	25.8	0.98	1016.1	**6623708**
North Chennai	TNEB	630	Coal	**4001.21**	2456	25.8	0.98	951.7	**3808143**
Basin Bridge	TNEB	120	NG	**39.89**	2061	15.3	0.995	480.9	**19182**
Nariman GT	TNEB	10	NG	**0**	2061	15.3	0.995	480.9	
Valuthur GT	TNEB	94	NG	**697.42**	2061	15.3	0.995	480.9	**335378**
Kuttlam GT	TNEB	100	NG	**674.23**	2061	15.3	0.995	480.9	**324226**
Kovilakalappal	TNEB	107	NG	**572.86**	2061	15.3	0.995	480.9	**275479**
Pyakara	TNEB	70.1	Hydro	**257.37**				0.0	
Pyakara Dam	TNEB	2	Hydro	**10.52**				0.0	
Moyar	TNEB	36	Hydro	**175.44**				0.0	
Kundah	TNEB	555	Hydro	**1972.31**				0.0	
Mettur Dam &Tunnel	TNEB	240	Hydro	**729.87**				0.0	
Periyar	TNEB	140	Hydro	**441.16**				0.0	
Kodayar	TNEB	100	Hydro	**244.71**				0.0	
Sholayar	TNEB	95	Hydro	**379.05**				0.0	
Aliyar	TNEB	60	Hydro	**205.53**				0.0	
Sarkarpathy	TNEB	30	Hydro	**115.1**				0.0	
Papanasam	TNEB	28	Hydro	**129.76**				0.0	
Suruliyar	TNEB	35	Hydro	**125.74**				0.0	
Servalar	TNEB	20	Hydro	**53.95**				0.0	
Lower Mettur	TNEB	120	Hydro	**341.22**				0.0	
Kadampari	TNEB	400	Hydro	**581.48**				0.0	
Vaigai	TNEB	6	Hydro	**18.13**				0.0	
Lower Bhavani	TNEB	8	Hydro	**63.02**				0.0	
Sathur Dam	TNEB	7.5	Hydro	**23.36**				0.0	
Parsen_S Valle	TNEB	30	Hydro	**53.39**				0.0	
Pykara ULT	TNEB	150	Hydro	**189.36**				0.0	
Karuppur GT	KEPS	119.8	NG	**357.33**	2061	15.3	0.995	480.9	**171834**
Samayanallur	Madurai P	106	Diesel	**328.59**	2929	20.2	0.99	897.7	**294990**
Neyveli	Pvt	250	Lignite	**1450.45**	2717	27.6	0.98	1126.3	**1633711**
P Nallur CCGT	PPNPG	330.5	NG	**428.82**	2061	15.3	0.995	480.9	**206213**
Samalpatti DG	Samalpatti	105.7	Diesel	**332.5**	2929	20.2	0.99	897.7	**298501**
Valantharvi GT	Valanth Th	38	NG	**98.06**	2061	15.3	0.995	480.9	**47155**
Basin Bridge DG	Vasavi	200	Diesel	**745.47**	2929	20.2	0.99	897.7	**669243**
Neyveli STI	NLC Th	600	Lignite	**3990.28**	3981	27.6	0.98	1650.3	**6585343**
Neyveli STII	NLC Th	1470	Lignite	**9173.54**	2871	27.6	0.98	1190.2	**10918250**
Neyveli FST Ext	NLC Th	420	Lignite	**3082.33**	2717	27.6	0.98	1126.3	**3471776**
MAPP	NPC	390	Nuclear	**1853.41**				0.0	
Pondichery									
Karaikal GT	PPCL	32.5	Gas	**256.71**	2061	15.3	0.995	480.9	**123448**
Total				**146435.92**					**108235980**
Weighted Average Emission Factor for the year 2005-06					**739.13545**	tCO_2/GWh			

Source:

1. Generation Data for the respective periods:
   - Central Electricity Authority http://www.cea.nic.in/god/opm/Monthly_Generation_Report
   - Tamilnadu Electricity Board – Vision Statement – Statistics at a Glance 2004-05
   - Andhra Pradesh Power Generation Corporation – Annual Reports
   - Karnataka Power Corporation Limited - http://www.karnatakapower.com
   - Kerala State Electricity Board - http://www.kseboard.com

2. Type of Fuel and Net heat rate: Table 2.4 & Annexure II C, Baselines for Small Scale CDM Project activities published by Ministry of Non-conventional Energy Sources, Govt. of India http://mnes.nic.in/baselinerpt.htm and Section 13, Performance review of Thermal Power Stations 2004-05, by Central Electricity Authority http://www.cea.nic.in/god/opm/Thermal_Performance_Review/0405/start.pdf

3. Revised IPCC Guidelines for National Greenhouse Gas Inventories, Work Book Volume (2) - Module1 Energy - Pages 1-20 Table 1-2 http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1wb1.pdf