CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Jorethang Loop Hydroelectric Project, India
28 December 2007

A.2. Description of the project activity:

The Jorethang Loop Hydroelectric project (JLHEP) is proposed for development by DANS Energy Private Ltd (DANS Energy) on the Rangit River in the state of Sikkim, India. The Rangit River is a tributary of the Teesta River, which is the main river traversing the state of Sikkim. The project will have an installed capacity of 96 MW, and will generate approximately 444.03 GWh (gross) per annum. The project will involve the construction of a diversion barrage, 108 m in length and 13m in height, which will create a small reservoir of approximately 10.1 ha.

The main purpose of the project is to use the hydro potential of the Rangit River to generate zero emission electricity. The electricity generated will be exported to the Eastern Regional grid through the Eastern Regional Load Dispatch Centre (ERLDC).

Contribution to Sustainable Development

The JLHEP will contribute strongly to the sustainable development of the region and surrounding areas in the following ways:

- The generation of electricity by the project will not result in the emission of greenhouse gases to the atmosphere.
- The electricity to be generated displaces grid-sourced electricity that is dominated by non-renewable fossil fuel resources, thereby reducing the carbon intensity of the Eastern Regional grid.
- The project will result in a reduction in air borne pollutants, such as oxides of nitrogen, oxides of sulphur, carbon monoxide and particulates, through a reduction in the combustion of fossil fuels.
- The project will generate local employment, on a temporary basis during the construction phase, with more permanent on-going employment during the operational phase.
- The project will encourage the demand for materials, spare parts, equipment and on-going consumables.
- The project will not compromise access to the river resources for downstream users as the Raman River flows into the Rangit River approximately 4 kilometres downstream of the proposed diversion barrage, and two other streams, Ramam Khola and Chhoti Rangit flow into the Rangit River within this 4 kilometre stretch. In addition provisions have been made for approximately 0.3 cumecs of sacrificial discharge throughout the year. To ensure there is no negative impact on local fish populations, a hatchery (including hatchery, nursing ponds, rearing ponds and stocking ponds) is proposed to be built in the vicinity of Rangit River.
- A greenbelt of approximately 24.74 ha will be created around the reservoir, to mitigate soil erosion and prevent landslips.

- The project will not involve the construction of any major roads, except for a small length of approach road and minor link roads. The project will carry out maintenance and upgrade of existing roads, which will improve access to the area whilst limiting environmental disturbance.
- Twelve percent of the total electricity generated will be provided free to the Sikkim State Government as a royalty.
- Local villages partially depend on firewood for their daily energy needs, which can lead to adverse ecological impacts, such as forest degradation, soil erosion and reduction in soil fertility. Increased availability and reliability of power supply from this project to the villages will reduce the need for firewood.

The project is being developed in line with India's National Electricity Policy[1]. Section 5.2.5 of the policy outlines the Government's emphasis on the full development of feasible hydro potential in the country. Section 5.2.6 of the policy states that harnessing hydro potential is a priority as it will facilitate economic development, particularly in the North-Eastern States, Sikkim, Uttaranchal, Himachal Pradesh, Jammu and Kashmir, where a large proportion of India's hydro power potential is located. In addition the
Ministry of Power has outlined several policy measures to accelerate the capacity addition from hydro-electric projects[2].

A.3. Project participants:

Please refer to the Table A.1 below:

Table A1 Parties Involved in the Project

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)	DANS Energy Private Limited	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.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

[1] http://powermin.nic.in/indian_electricity_scenario/national_electricity_policy.htm

[2] http://powermin.nic.in

India

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

Region : Eastern Region of India
State : Sikkim
Province (District) : West District

A.4.1.3.	City/Town/Community etc:

Community (Village): Piple Village
Community (Town): Jorethang Town

A.4.1.4.	Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The proposed Jorethang Loop Hydroelectric project will be located in the Namchi sub-division of the West District in the state of Sikkim. The project is to be developed on the Rangit River, a major tributary of Teesta River, which is the main river traversing Sikkim. The project area will be located between 27^0 09' to 27^0 39' N Latitude and 88^0 1' to 88^0 31' E Longitude.

The diversion barrage site will be situated in the lower reaches of the Rangit River, upstream of its confluence with Ramam River, close to the village of Piple. Piple is approximately 5 km upstream of Jorethang Town. The power generating units will be located in a surface power house approximately 13.5km downstream of the proposed barrage site, which is approximately 1.5 km downstream of the village of Manjhitar (Figure A1 and Figure A2).

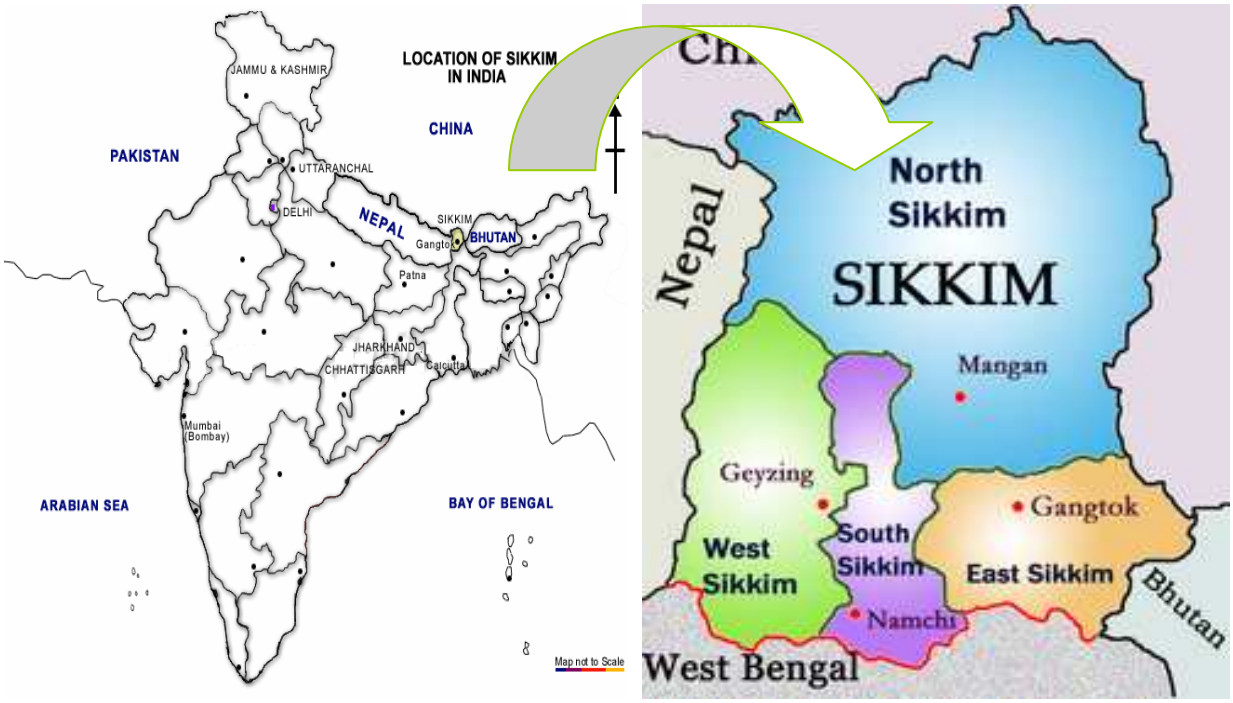

Figure A1: Location of Sikkim and its Districts

Figure A2: Location of the Project

A.4.2. Category(ies) of project activity:

Sectoral Scope 1: Energy industries (renewable - / non-renewable sources)

A.4.3. Technology to be employed by the project activity:

The proposed project is a hydroelectric project which will utilize the potential energy from a natural height drop of approximately 84m over a 12.8km stretch of the Rangit River. A diversion barrage, 108 m in length and 13m in height, will be constructed which will create a reservoir of approximately 10.1 ha. The flow will be directed from the reservoir, through an intake tunnel on the east bank of the river, into a 7.1 km head race tunnel, through a surge shaft and pressure shaft to the powerhouse. The powerhouse will house 2 x 48 MW vertical shaft type Francis turbines, that will be coupled with synchronous

generators. The flow will be discharged via a 40m tail race channel back into the Rangit River. The project components from the head race tunnel to the flow discharge will be located underground.

The power which is generated by the project will be rated at 11kV. This will be stepped up to 220 kV at the switchyard of the power house, which is located above ground. The electricity will be exported through a 15 km double circuit 220 kV transmission line to the Melli sub-station on the Eastern Regional Grid.

The proposed project will have an installed capacity of 96 MW and a gross generation of 444.03 GWh per annum.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Estimated emission reductions over the chosen crediting period are shown in Table A2.

Table A2 Estimated Emission Reductions over the Crediting Period

Year	Annual Estimate of Emission Reductions (tonnes of CO_2)
2010	465,961
2011	465,961
2012	465,961
2013	465,961
2014	465,961
2015	465,961
2016	465,961
Total estimated reductions (tonnes of CO_2)	3,261,727
Total number of crediting years	7 years
Annual average over the crediting period of estimated reductions (tonnes of CO_2)	465,961

In the above table, the year 2010 represents one full year period from the project activity start date, i.e. 01 January 2010 to 31st December 2010. Subsequent years represent full year periods between January and December.

A.4.5. Public funding of the project activity:

The project will be financed through private sources and as such no public funding will be required.

SECTION B. Application of a baseline and monitoring methodology

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

Approved consolidated baseline methodology ACM0002, "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 6, 19 May 2006).

Tool for the demonstration and assessment of additionality (Version 03; EB29).

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The choice of baseline methodology ACM0002 is justified for the JLHEP as it satisfies the required applicability criteria, namely:

- The project is a new grid connected hydro project.
- The JLHEP has an installed capacity of 96MW and will result in an impoundment of 10.1 hectares. This equates to a power density of 950 W/ m^2 which is greater than the minimum requirement specified by the methodology.
- The geographic and system boundaries of the eastern regional grid are clearly identified and information on the characteristics of the grid are available.

As a renewable energy project it is appropriate to follow Paragraph 48 of Marrakech Accords and use existing actual or historical emissions, since the project activity will serve to reduce actual emissions. On this basis the conditions of applying ACM0002 are met.

B.3. Description of the sources and gases included in the project boundary

	Source	Gas	Included ?	Justification/Explanation
Baseline	Fossil Fuel Fired Power	CO_2	Yes	In accordance with ACM0002, the baseline should only include CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity.
		CH_4	No	
		NO_2	No	
Project Activity	Hydro-Electric Power Project	CO_2	No	The project is a new hydro-electric project with a power density far greater than 10 W/m^2. Therefore in accordance with ACM0002 no project emissions need to be accounted for.
		CH_4	No	
		NO_2	No	

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 6, 19 May 2006) identifies two options for defining the baseline scenario, dependent on whether the project activity is a new project or a modification or retrofit of an existing generation facility.

Since the JLHEP does not involve the modification or retrofit of any existing electricity generation facilities, the baseline scenario is defined as: "Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources."

The baseline scenario is calculated as a combined margin (CM) consisting of the combination of operating margin (OM) and build margin (BM) factors calculated using the steps described in ACM0002, which are outlined in detail in Section B6.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

The JLHEP will generate electrical power without the emission of greenhouse gases. The power generated will be exported to the Eastern Regional grid where it will displace the electricity generated from a fossil fuel dominated generation mix, thereby reducing the carbon intensity of the grid, on a per megawatt basis, and the quantity of greenhouse gases emitted.

In the Eastern Regional grid there has been a 46% increase in capacity in the last 10 years. 87% of these capacity additions have been coal fired thermal power stations[3]. In the absence of the project activity, it is most likely that the required capacity additions to the grid will be met through the development of large thermal power stations, due largely to relatively high returns on investment, economies of scale and the availability of project finance. Furthermore, there are a limited number of feasible opportunities to develop hydroelectric power in India. This is further limited when potential project sites are screened for environmental or social reasons.

In total, the Project is estimated to result in a reduction in emissions of greenhouse gases of 3,261,727 tonnes of CO_2 over a crediting period of 7 years. To demonstrate the additionality of the project the steps prescribed in "Tool for the demonstration and assessment of additionality" (Version 03; EB 29) have been used.

[3] Information obtained from the CEA Baseline Calculations *Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0*aseline Carbon Dioxide Emission from Power Sector - Version 2 [http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm]

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

DANS Energy is a local hydropower developer. As such, the only realistic and credible alternatives to the project activity are:

- Alternative 1 - the proposed 96MW JLHEP is not undertaken as a CDM project activity.
- Alternative 2 –the 96MW JLHEP is not implemented and electricity demand would have to be continued to be met through the current carbon intensive grid mix.

Two additional alternatives were also considered:

- Grid-connected power projects utilizing other renewable sources (wind, biomass) supplying the same amount of electricity as the project activity.
- Grid-connected fossil fuel-fired power plant supplying the same annual amount of electricity as the project activity.

However, as DANS Energy was established with the specific objective of providing services to the hydro power sector in India these two additional alternatives could not be deemed to be realistic or credible in accordance with the provisions of the tool for the demonstration and assessment of additionality and were not considered further.

Sub-step 1b. Consistency with mandatory laws and regulations:

All of the alternatives to the project activity comply with all mandatory applicable legal and regulatory requirements for electricity generation in India.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method:

The option chosen to prove additionality is Option III – "Benchmark Analysis", as the only plausible investment decision for DANS Energy Private Ltd is whether or not to develop the project.

Sub-step 2b.- Option III Apply benchmark analysis:

The financial indicator chosen for this activity is the project internal rate of return (IRR). The benchmark used to compare the project IRR is the Prime Lending Rate (PLR) published by the Reserve Bank of India, which is an average of the PLR's of five major nationalised banks in India.

The PLR quoted by the Reserve Bank of India on April 20th 2007 was 12.75-13.25%[4].

Sub-step 2c. Calculation and comparison of financial indicators:

[4] http://rbidocs.rbi.org.in/rdocs/Wss/PDFs/77110.pdf

The project IRR of the JLEP without additional revenue from the sale of CERs is 9.62%, which is lower than the PLR specified by the Reserve Bank of India.

Sub-step 2d. Sensitivity analysis

A sensitivity analysis on the financial model was conducted by altering the following parameters:

- total annual electricity generation (plus and minus 10%);
- the electricity tariff (plus and minus 10%); and
- project capital and operational costs (plus and minus 10%).

The results of the sensitivity analysis are presented in Table B1, which shows that the project IRR remains below the PLR even in the case where these parameters change in favour of the project.

Table B1 Project IRR Using Alternative Project Parameters

Scenario	Parameter change	IRR
Base case		9.62%
Total annual electricity generation	Plus 10%	10.96%
	Minus 10%	8.18%
Electricity tariff	Plus 10%	10.96%
	Min 10%	8.18%
Project capital and operational costs	Plus 10%	8.17%
	Minus 10%	11.38%

The investment comparison analysis clearly demonstrates that the proposed CDM project activity is unlikely to be considered as a financially attractive course of action. As such, Step 3 – Barrier Analysis is not required.

Step 4. Common practice analysis

The majority of investments in the Indian power sector are focused on medium to large-scale thermal power projects due largely to relatively high returns on investment, economies of scale and the availability of project finance. The favoured development of thermal power projects is illustrated through a consideration of five-year plans over the last 50 years (Table B2). Five-year plans are developed by the Planning Commission to identify the planned capacity additions to the national and regional grid. As Table B2 indicates, thermal power has dominated the planned development of the national and regional grid, with the contribution of the hydro sector steadily falling over the last 35 years.

Table B2 National and Regional Electricity Grid Composition Over the last 50 Years

Plan and Year	Hydro (%)	Thermal (%)	Other (Nuclear and Wind) (%)
1st Plan 1956	35	65	0
3rd Plan 1966	46	54	0
5th Plan 1979	41	57	2
7th Plan 1990	29	69	2

9th Plan 2002	25	71	4

Source: http://powermin.nic.in (see *Plans to augment power generation; Accelerating the Development of Hydro Projects)*

This lack of development of hydropower has occurred despite the existence of substantial undeveloped hydro resources in India, especially in the Eastern and North-Eastern states. The CEA estimates that as of April 2007, only 2.0 per cent of Sikkim's hydro potential has been developed, with another 14.2 per cent currently under development[5].

Table B3 of the PDD describes other large hydro power projects with an installed capacity greater than 25MW and less than 500 MW that have been developed or are in the process of being developed by the private sector to date that are/will connect to the Eastern Regional grid.. As the table indicates all of the projects listed have a substantially lower installed cost/MW than that of the project activity. The reasons for the higher installed cost/MW of the JLHEP are listed below:

- Gross Head: All other projects listed in table B3 (for which data is publicly available) have higher "gross head" in comparison to the project activity. As a result, the electro-mechanical equipment (Francis turbines) to be used by the project activity is more expensive due to the lower revolutions per minute (rpm) required. .
- Discharge: Due to the lower head associated with the project activity a considerably greater volume of discharge water is required to achieve a rated power comparable to other projects listed in Table B3. This requires a larger water carrying system, including the intake and head race tunnel, surge shaft, and pressure shaft, resulting in higher civil costs for the JLHEP compared to other projects
- Cost of Infrastructure: In the case of the first 3 projects listed in the Table B3, the Sikkim Government has agreed to construct roads, bridges, and transmission and distribution lines required by the projects at its own cost. This facility has not been provided to the JLHEP.

This higher installed cost/MW represents a serious change in the circumstances under which the JLHEP will be implemented compared to the circumstances under which these other similar projects will be carried out and supports the claim that the project activity is financially unattractive.

[5] http://www.cea.nic.in/hydro/Status%20of%20Hydroelectric%20Potential%20Development.pdf

Table B3 Private Sector Hydro Power Projects (greater than 25MW and less than 500MW) Connected to the Eastern Regional Grid

Project Name	Installed Capacity	Year of Commissioning	Project Developer	Cost/MW	Gross Head	Nominal Discharge	Comment	Source
Chujachen HEP	99 MW	NA	M/w. Gati Infrastructure Pvt. Ltd	Rs. 4.53 Crores/MW (US$1.12 million)	297.5 meters	39.5 cumecs	The project has been awarded and is yet to start construction. The contractor has completed the preliminary mobilization at the site. Come civil works have been started. The estimated cost is Rs. 4.53 Crores/MW (US$1.12 million) compared with Rs. 5.71 Crores/MW (US$1.41 million) for the JLHEP.	Project Cost: http://www.cea.nic.in/hydro/project_monitoring/Status%20of%20Hydroelectric%20Projects%20under%20Execution.pdf Gross Head and Nominal Discharge (see Page 6): http://www.colenco.ch/_pdf/colencoinfo/ColencoInfo2004-11.pdf
Sada-Mangder HEP	71 MW	2009-2010	M/w. Gati Infrastructure Pvt. Ltd	Rs. 4.93 Crores/MW (US$1.22 million)	546 meters (sada) and 144 meters (Mangder)	11.5 (Sada) and 13.7 (Mangder) cumecs	The estimated cost is Rs. 4.93 Crores/MW (US$1.22 million) compared with Rs. 5.71 Crores/MW (US$1.41 million) for the JLHEP.	Project Cost: http://www.gatiinfra.com/financials.htm http://northeast.nic.in/writereaddata/eventimages/17.pdf Gross Head and Nominal Discharge (see Page 6)http://www.colenco.ch/_pdf/colencoinfo/ColencoInfo2004-11.pdf
Bhasmey HEP	51 MW	2010-2011	M/w. Gati Infrastructure Pvt. Ltd	Rs. 4.90 Crores/MW (US$1.21 million)	113 meters	55 cumecs	The estimated cost is Rs. 4.90 Crores/MW (US$1.21 million) compared with Rs. 5.71 Crores/MW (US$1.41 million) for the JLHEP.	http://www.gatiinfra.com/financials.htm http://northeast.nic.in/writereaddata/eventimages/17.pdf Gross Head and Nominal Discharge (see Page 6) http://www.colenco.ch/_pdf/colencoinfo/ColencoInfo2004-11.pdf
Rongni chu HEP	98 MW	2013-2014	Chhattisgarh Electricity Company Ltd	Rs. 5.10 Crores/MW (US$1.26 million)	NA	NA	The estimated cost is Rs. 5.10 Crores/MW (US$1.26 million) compared with Rs. 5.71 Crores/MW (US$1.41 million) for the JLHEP.	http://northeast.nic.in/writereaddata/sublink3images/30.pdf http://northeast.nic.in/writereaddata/eventimages/17.pdf
Jorethang Loop HEP	96MW	2010	DANS Energy Private Limited	Rs. 5.71 Crores/MW (US$1.41 million)	84 meters	154 cumecs	NA	NA

Additionality Conclusion

As shown in Step 2 and 4 above, the JLHEP project is not a financially attractive project. The impact of registration of the project as a CDM project is as follows:

- If DANS Energy was able to sell certified emission reduction (CERs) from the project activity, the additional revenue generated by carbon sales would increase the project IRR to 12.92% (assuming a price of $US10/CER). The additional CDM revenue will increase the attractiveness of the project from an investment point of view by decreasing the installed cost/MW and mitigating some of the risk associated with developing a hydro power project in India, such as hydrological and geological risk, and the lack of key supporting infrastructure around remote hydro sites.

- DANS Energy only decided to invest and go ahead with the project after taking into account the additional revenue from the sale of CERs.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

In accordance with ACM0002, the emission reductions attributable to the project during any given year (y) are calculated as the difference between the Baseline Emissions (BE_y), the Project Emissions (PE_y) and the Leakage (LE_y), in that year. This section outlines the step-wise methodology used to determine these factors.

The spatial extent of the proposed project boundary includes the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to. JLHEP will be connected to the eastern regional grid. The eastern regional grid is controlled by the Eastern Regional Load Dispatch centre (ERLDC).

Baseline Emissions

The data used for the calculation of the baseline emission factor was obtained from the baseline calculations published by the CEA, *Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0*[6], which uses ACM0002. The relevant parts of the calculations are referenced in the methodology outline below, with detailed data provided in Annex 3. A complete explanation of the assumptions employed by the CEA can be obtained from the *CO_2 Baseline Database for the Indian Power Sector User Guide - Version 2.0* [7].

Step 1 – Calculate the Operating Margin Emission Factor

ACM0002 provides four options to calculate the Operating Margin. For the proposed project activity the information required to compute a dispatch data analysis is not available to the public. Therefore, option (a), simple Operating Margin, has been selected.

[6] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

[7] http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver2.pdf

The simple Operating Margin can only be used where low-cost/must run resources constitute less than 50% of total generation in the eastern regional grid in either the average of the five most recent years or based on long-term normals for hydroelectricity production.

In accordance with the CEA baseline calculations hydro and nuclear generation qualify as low-cost/must-run sources. Their share of the total generation of the eastern regional grid over the last five years is shown in Table B4. As the data indicates, low cost/must run resources constitute an average of 9.8% of total generation and thus the simple Operating Margin method can be used.

Table B4 Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2001-02	2002-03	2003-04	2004-05	2005-06
Eastern Regional Grid	13.4%	7.5%	10.3%	10.5%	7.2%
5 Year Average	9.8%				

1. *Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0*

The simple Operating Margin emission factor is therefore calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the grid, not including low-operating cost and must-run power plants using the following formula:

$$EF_{OM,\,y} = \frac{\sum_{i,j} F_{i,\,j,\,y}\, COEF_{i,\,j}}{\sum_{j} GEN_{j,\,y}}$$

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 CO_2 emission coefficient of fuel i (tCO_2 / 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 CO_2 emission coefficient $COEF_i$ is obtained as:

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

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 (default values from page 1.29 in the 1996 Revised IPCC Guidelines are used); and

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

The simple Operating Margin emission factor was calculated based on generation data from 2003-04, 2004-05 and 2005-06 which, in accordance with ACM0002, are the most recent three years for which data is available at the time of PDD submission (detailed data is provided in Annex 3).

The values used for the calculation of calorific values for each fuel type, and the fuel oxidization factors, are the assumed values used in the CEA baseline calculations (detailed data is provided in Annex 3).

As specified in ACM0002 only net electricity imports from connected electricity systems within the same country must be considered when calculating the Operating Margin. Any imports from a connected electricity system located in another country can be excluded. In 2002-03 the Eastern Regional grid was a net exporter to other regional grids within India, but imported electricity from Bhutan. For 2003-04 and 2004-05 the Eastern Regional grid was a net exporter. Accordingly, no imports are included in the calculation of the Operating Margin emission factor.

Step 2 – Calculate the Build Margin Emission Factor

According to ACM0002, project participants can choose between two given options for calculating the Build Margin for the project. In this case, option 1 has been chosen (i.e. calculate the Build Margin emission factor *ex-ante* based on the most recent information available on plants already built for the sample group (m) at the time of PDD submission).

Under option 1 there are two alternatives for selecting the sample group (m). Project proponents should utilize the larger sample of either the five power plants that have been built most recently or the power plant capacity additions that comprise of 20% of the system generation and that have been built most recently.

In accordance with the CEA baseline calculations, the build margin sample group consists of the 20% most recent capacity additions to the eastern regional grid. The sample group is provided in Table B5 (detailed data is provided in Annex 3).

Table B5 20% of Net Generation (GWh)

	2005-06
Eastern Regional Grid	17,203

1. *Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0*

The Build Margin is calculated as:

$$EF_{BM,\,y} = \frac{\sum_{i,m} F_{i,\,m,\,y}\, COEF_{i,\,m}}{\sum_{m} GEN_{m,\,y}}$$

Where:

$F_{i,m,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources m in year(s) y;

m refers to the power plant additions that comprise 20% of the system generation and that have been built most recently;

$COEF_{i,m}$ is the CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources m and the percent oxidation of the fuel in year(s) y; and

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

The CO_2 emission coefficient $COEF_i$ is obtained as:

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

Where:

NCV_i is the net calorific value per mass or volume of fuel;
$OXID_i$ is the oxidation factor of the fuel; and
EF_{CO2} is the CO_2 emission factor per unit of energy of fuel i.

The values used for the calculation of calorific values for each fuel type, and the fuel oxidization factors, are the assumed values used in the CEA Baseline calculations (detailed data is provided in Annex 3).

Step 3 – Calculate the Baseline Emission Factor

The baseline emission factor (EF_y) is calculated as the weighted average of the OM emission factor ($EF_{OM,y}$) and the BM emission factor ($EF_{BM,y}$), according to the following formulae:

$$EFy = w_{OM} . EF_{OM,y} + w_{BM} . EF_{BM,y}$$

Where:

ω_{OM}: is the operating margin weight, which is 0.5 by default;
$EF_{OM,y}$ is the operating margin emission factor (tCO_2 / MWh) as calculated in Step1;
ω_{BM} is the build margin weight, which is 0.5 by default;
$EF_{BM,y}$ is the build margin emission factor (tCO_2 / MWh as calculated in Step3; and
Y represents a given year.

Step 4 – Calculate the Baseline Emissions

As per methodology ACM0002, the estimated baseline emissions are calculated using the following formula:

$$BE_y = EG_y * EF_y$$

Where the baseline emissions (BEy in tCO_2) are the product of the baseline emissions factor (EFy) in tCO_2/MWh) times the electricity supplied by the project activity to the grid (EGy in MWh).

Project Emissions

The JLHEP is a hydropower project and as such does not result in the combustion of fossil fuels. As the power density of the project is 950 W/ m^2, which is greater than 10 W/ m^2, the emissions associated with the inundation of land are not required to be quantified.

On this basis, project emissions $PE_y = 0$.

Leakage

The main sources of emissions which could potentially give rise to leakage are associated with construction of the power plant and land inundation. However, ACM0002 states that project participants do not need to consider these sources of emissions as leakage in applying this methodology.

Thus $L_{y=}0$

Emission Reductions

In accordance with ACM0002, the emission reductions attributable to the project are calculated using the formula*:*

$$ER_y = BE_y - PE_y - L_y$$

As PE_y and L_y equal zero, the total emission reductions during the crediting period are equal to the baseline emissions.

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

Data / Parameter:	**EF_{OMy}**
Data unit:	tCO_2/MWh
Description:	Simple Operating Margin Emission Factor for the eastern regional grid
Source of data to be used:	CEA's *Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0*
Value of data applied :	1.16
Justification of the choice of data or description of measurement methods and procedures actually applied:	The simple OM emission factor ($EF_{OM,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the grid, not including low-operating cost and must-run power plants. The value is the three year average for 2003-2004, 2004-2005 and 2005-2006. Data obtained from "*Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0"* published by the CEA.
Any comment:	

Data / Parameter:	**EF_{BMy}**
Data unit:	tCO_2/MWh
Description:	Build Margin Emission Factor for the eastern regional grid
Source of data to be used:	CEA's *Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0*
Value of data applied :	0.97
Justification of the choice of data or description of measurement methods and procedures actually applied:	The BM emission factor ($EF_{BM,y}$) is calculated as the emissions per electricity unit (tCO_2/MWh) of the power plant capacity additions that comprise of 20% of the system generation for the period 2005-2006. Data obtained from "*Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0"* published by the CEA.
Any comment:	

Data / Parameter:	**EF_y**

Data unit:	tCO_2/MWh
Description:	Baseline Emission Factor for the eastern regional grid
Source of data to be used:	CEA's *Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0*
Value of data applied :	1.06
Justification of the choice of data or description of measurement methods and procedures actually applied:	The baseline emission factor (EF_y) is calculated as the weighted average of the simple OM emission factor ($EF_{OM,y}$) and the BM emission factor ($EF_{BM,y}$). By default, both margins have equal weights (50%). Data obtained from "*Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0"* published by the CEA.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The ex-ante emission reductions were calculated using the steps described in Section B6.1 and the parameters described in Section B6.2. When these formulas, and data parameters, are applied the baseline emissions during the first crediting period are 465,961 tonnes of CO_2 per year, or 3,261,727 tonnes of CO_2, for the first crediting period, as outlined in Table B6 below.

Table B6 Baseline Emissions Factors and Baseline Emissions during the first crediting period

Electricity Generated Emissions Reductions	Per Year	Crediting Period (7 years)
Baseline Emissions Factor (EF_y in tCO_2/MWh)	1.06	-
Net Electricity Supplied to the Grid by the Project (EG_y MWh)	439,587	3,077,106
Baseline Emissions (*BEy* tCO_2)	**465,961**	**3,261,727**

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

A summary of the estimated ex-ante emission reduction for the crediting period is provided in Table B7:

Table B7: Ex-ante Emission Reductions for the Crediting Period

Year	Estimation of Project activity Emission reductions (tonnes of CO_2e)	Estimation of baseline emission reductions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of emission reductions (tonnes of CO2 e)
2010	0	465,961	0	465,961
2011	0	465,961	0	465,961
2012	0	465,961	0	465,961
2013	0	465,961	0	465,961
2014	0	465,961	0	465,961
2015	0	465,961	0	465,961
2016	0	465,961	0	465,961

Total	0	**3,261,727**	0	**3,261,727**

In the above table, the year 2010 represents one full year period from the project activity start date, i.e. 01 January 2010 to 31 December 2010. Subsequent years represent full year periods between January and December.

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

The monitoring methodology to be used is approved consolidated baseline methodology ACM0002, "Consolidated baseline methodology for zero-emissions grid-connected electricity generation from renewable sources" (Version 6, 19 May 2006).

Section B.7.1 outlines the data and parameters that will be monitored, and Section B.7.2 contains a detailed monitoring plan which describes how the monitoring of the project activity will be performed.

The selected methodology is appropriate for the proposed project as the Project activity is a grid-connected hydropower project with a power density greater than 4W/ m^2, where the grid's geography and system boundaries are explicit and information on characteristics of the grid are available. On this basis the conditions for applying ACM0002 are met.

B.7.1 Data and parameters monitored:

Data / Parameter:	**EGy**
Data unit:	MWh
Description:	Net electricity supplied to the grid by the Project
Source of data to be used:	Metered on site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	439,587 MWh per annum
Description of measurement methods and procedures to be applied :	The electricity will be recorded monthly. It will be metered using state-of-the-art sealed and tested meters. The metering system will comprise of two sets of meters. The main meters will record the net electricity exported by the project to the grid and the second set of meters will record the gross electricity generated by the project. The net metered electricity export data will be used to calculate and monitor the greenhouse gas emission reductions from the project.
QA/QC Procedures to be applied:	Both sets of meters will include a main meter and a back-up meter. All meter data will be stored in electronic and paper formats as specified in the monitoring plan. Meters will be calibrated prior to synchronization of the project and then recalibrated every 6 months. The calibration certificates of the meters will be stored. Invoices for the quantity of electricity exported and sold will also be stored and will allow cross checking of the net metered generated electricity. The gross metered electricity generation data (minus estimates for auxiliary loads and losses) can also be used as a further cross check of the net metered exported electricity.
Any comment:	Further details of the data collection, recording and storage procedures and the QA/QC procedures are contained in the Monitoring Plan, in

	Section B7.2

Data / Parameter:	**A**
Data unit:	m^2
Description:	Surface area of the reservoir at full volume
Source of data to be used:	To be measured by DANS Energy
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	10.1 hectares = 101,000 m^2
Description of measurement methods and procedures to be applied :	A detailed topographical survey will be undertaken on project commissioning to confirm the size of the reservoir.
QA/QC Procedures to be applied:	As described in the project monitoring plan, Section B7.2.
Any comment:	The surface area of the reservoir will vary depending on drawdown of water by the turbines. The area of 10.1 ha is the maximum area of submergence.

Data / Parameter:	**EF_y**
Data unit:	tCO_2/MWh
Description:	Baseline Emission Factor for the eastern regional grid
Source of data to be used:	The current baseline emission factor is sourced from the CEA (as outlined in Section B6.2). If this data is unavailable in future years the baseline emission factor will be calculated in accordance with ACM0002 and the methodology stipulated in B6.1.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1.06
Description of measurement methods and procedures to be applied:	The baseline emission factor (EF_y) is calculated as the weighted average of the simple OM emission factor ($EF_{OM,y}$) and the BM emission factor ($EF_{BM,y}$). This figure is calculated annually by the CEA and made publicly available. If data from the CEA is unavailable in future years the baseline emission factor will be calculated in accordance with ACM0002 and the methodology stipulated in B6.1.
QA/QC procedures to be applied:	As described in the project monitoring plan, Section B7.2.
Any comment:	This value remains fixed for the first crediting period and will need to be recalculated at the renewal of the crediting period in accordance with the requirements of ACM0002.

B.7.2 Description of the monitoring plan:

The purpose of the monitoring plan is to ensure that the required data is accurately monitored and recorded to enable the calculation of the emission reductions achieved by the project.

Operational and Management Structure

DANS Energy proposes to appoint a CDM Management Team with the responsibility of overseeing the collection, recording and storage of the data required to calculate and monitor the greenhouse gas emission reductions from the project activity. The data that is required to be monitored is described in detail in Section B7.1. The team consists of three key positions and will be supported by the company's Quality Assurance Officer. An outline of responsibilities and reporting function of each of these key positions are contained in Table B8. The specific monitoring provisions are described in more detail following the table.

Table B8 CDM Management Team

Position	Outline of Responsibilities	Reporting
CDM Monitoring Officer	• Overseas the collection, recording and storage of data. • Reviews the monthly reports and investigates any irregularities. • Ensures ongoing compliance with the CDM monitoring plan. • Prepares surface area at full reservoir level report at project commissioning • Supervises meter calibration requirements • Prepares Emission Reduction Quarterly Report • Prepares Baseline Emission Factor report at the end of each crediting period	Reports to the General Manager (Projects).
Site Supervisor	• Responsible for the completeness and reliability of the data. • Responsible for carrying out meter calibration. • Calculates Emission Reductions on a daily basis. • Generates monthly reports.	Reports to the CDM Monitoring Officer.
Shift Supervisor (Shift Based)	• The person appointed for each shift must be an experienced officer involved in the operation and maintenance of the hydro power plant. • Responsible for monitoring hourly measurements, generating daily reports, and ensuring that meters are functioning correctly.	Reports to the Site Supervisor.
Quality Assurance Officer	• Undertakes regular internal audits of the project. • Ensures compliance with Company Quality Assurance Procedures.	Reports to the General Manager (Projects).

Monitoring Provisions

Training

All persons that form part of this CDM Project Team will be suitably qualified and trained in the operation and maintenance of the plant. The training for operating and maintaining the plant will be provided by the supplier of electro-mechanical and hydro-mechanical equipment, which is a part of the contract terms with the equipment suppliers. All members of the CDM Project Team shall also receive appropriate training in the CDM monitoring requirements, which will include an overview of the CDM and all elements of the monitoring plan in detail. A copy of the project monitoring plan will be distributed to all of the CDM Project Team during the training, and an additional copy will be easily accessible at appropriate locations on site.

Specific Data Monitoring Procedures

Installation of the Meters: The electricity will be monitored through state-of-the-art sealed and tested meters. The metering system will comprise of two sets of meters. The main meters will record the net electricity exported by the project to the grid and the second set of meters will record the gross electricity generated by the project. Both sets of meters will include a main meter and a back-up meter. The accuracy class of electricity meters shall be as defined in applicable IEC/Indian Standards.

Calibration of Meters: The CDM Monitoring Officer will ensure that a manufacturer's test certificate accompanies all purchased meters. A report summarising meter calibration requirements will be prepared by the CDM Monitoring Officer on project commissioning, and updated with each recalibration.

Surface Area at Full Reservoir Level: The surface area of the reservoir at full volume at project commissioning will be measured from a detailed topographical survey. This data will be used to confirm that the power density of the project is greater than the minimum requirement specified by the ACM0002.

Metered Net Electricity Export Data: Metered net electricity export data will be measured continuously. A monthly report of metered net electricity export data will be generated by the Site Supervisor, and saved in electronic and paper form. The monthly report will be generated using a template, approved by the CDM Monitoring Officer, to ensure that the data is reported consistently and can be compared to previous months. The CDM Monitoring Officer will review this report on a monthly basis and cross check the data against the invoices for the quantity of electricity exported and sold. Any irregularities will be investigated as described below in "Review of Reports and Treatment of Uncertainty". The auxiliary loads and losses (gross metered electricity generation minus net generated electricity) will be recorded in the monthly report, to be used in the event of meter failure, as described below in "Emergency Preparedness".

Emission Reductions: Emission reductions will be calculated on a daily basis using the project and baseline emission data. Emission reductions occurring as a result of the project activity will be summarized in a quarterly report that will be prepared by the Site Supervisor. The quarterly report will be generated using a template, approved by the CDM Monitoring Officer, to ensure that the data is reported consistently and can be compared to previous quarters. The quarterly report will be reviewed by the CDM Monitoring Officer and submitted to the General Manager (Projects).

Updating the Baseline Emission Factor: The baseline emission factor will be updated at the end of the each crediting period through reference to data supplied by the CEA. If this data is unavailable the baseline emission factor will be calculated in accordance with ACM0002 and the methodology stipulated in A6.1. A report summarizing this information will be prepared at the end of teach crediting period by the CDM Monitoring Officer. The report will be submitted to the General Manager (Projects).

Emergency Preparedness: The project has the necessary provisions for emergency preparedness to deal with any unforeseen events such as fire or an electrical blackout. These provisions include installed fire fighting systems, and standby features for critical items. In the situation where an emergency causes unintended emissions, these emissions will be quantified and recorded on a daily basis by the Site Supervisor and summarized in a discrete section of the Emission Reductions quarterly report.

In the event that the main meter, which is used to record the net electricity exported by the project, is found to be faulty it will be repaired or replaced and the data from the backup meter will be used in its place. In the unlikely event that the backup meter fails it will also be repaired or replaced and the net electricity will be obtained from the gross generation data, minus the average the auxiliary loads and losses. The average auxiliary loads and losses will be calculated as the average over the most recent six months, using the values recorded in the Metered Net Electricity Generation monthly reports, described above. In the event of meter failure, the details will be recorded by the Site Supervisor and summarized in a discrete section of the Emission Reductions quarterly report.

Reporting

A summary of the monitoring reports is contained in Table B9. All reports will be reviewed by the CDM Monitoring Officer and then sent to DANS Energy's General Manager (Projects) for review and acceptance.

Table B9 Monitoring Reports

Report	Responsibility	Frequency
Surface Area at Full Reservoir Level	CDM Monitoring Officer	At project commissioning
Meter Calibration Report	CDM Monitoring Officer	At project commissioning and updated with each recalibration.
Metered Net Electricity Export Data	Site Supervisor	Monthly
Emission Reductions	Site Supervisor	Quarterly
Baseline Emission Factor	CDM Monitoring Officer	End of each crediting period
Emergency Report: Unintended Emissions	Site Supervisor	Daily (as required)
Emergency Report: Meter Failure	Site Supervisor	Daily (as required)
Internal Audit Report	Quality Assurance Officer	Quarterly

Review of Reports and Treatment of Uncertainty

When reviewing the Metered Net Electricity Export Data and Emission Reductions report the CDM Monitoring Officer will examine the report for data anomalies and compare the report with previous months for consistency.

If any discrepancies are found they will be investigated and corrected. The discrepancies and corrective actions will be recorded in an appendix to the relevant report. If the corrective actions result in any adjustments to monitoring data then the relevant report will be revised, after the adjustments have been made.

The company's Quality Assurance Officer will undertake an internal audit of the project every three months to ensure the operational and maintenance regime of the project and data collection and recording practices are compliant with the content of this Project Design Document. The results of the audit will be summarised in a report, which will be sent to the General Manager (Projects) for review. The report will also list any corrective actions required to ensure project compliance.

Record Storage

A paper copy of all documentation will be stored in a secure area within the site head office. All reports will be signed and date stamped after review by the CDM Monitoring Officer, prior to being filed in storage. All electronic reports will be backed-up on a monthly basis and sent to DANS Energy's Head Office. All archived data will be kept until two years after the last issuance of CERs for this project. The documents that will be stored include:

- Surface area of reservoir at full volume
- Manufacturer's test certificate accompanies and meter calibration reports
- Monthly report of metered net electricity export data
- Quarterly report of emission reductions
- Internal audit reports
- Baseline emission factor

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

Date of completion of the Baseline Development: 17/07/2007

Details of the person/entity determining the baseline:

Contact Person : Mr. Srinath N. Anekal
Company Name : SMEC International Pty Limited
Mobile Number : +91-98801 94404
E-mail Address : srinath@smecindia.com

Contact Address
Head Office : 5th Floor, Tower C, DLF Building No.8,
DLF Cyber City, Phase II
Gurgaon-122002 (Haryana)
India
Telephone Number: +91 124 438 0042, 450 1100,
Fax Number: +91 124 438 0043

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

Project construction is scheduled to commence on 1st October 2007. The project is expected to be operational 1st January 2010.

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

35 years

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

C.2.1. Renewable crediting period

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

1st January 2010.

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

In accordance with the *Environmental (Protection) Act (1986)*, the proposed project submitted an application for approval to the Ministry of Environment and Forests (MoEF). As part of the approval process, a comprehensive environmental assessment of the Project was prepared in accordance with the requirements of MoEF[8]. Relevant documents submitted to MoEF include:

- Environmental Impact Assessment Report;
- Environmental Management Plan; and
- A report on the proceedings of the public hearing.

Copies of each document are available upon request.

Environmental clearance was obtained from MoEF on July 26th 2006.

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

The EIA study report has identified several environmental impacts which will occur as a result of the project. The report also identifies a number of positive environmental impacts associated with the project. These range from environmental benefits in the form of mitigation of climate change, to a number of socio-economic benefits for the area in which the project is located.

Measures to mitigate the environmental impacts that were identified in the EIA have been addressed in the Environmental Management Plan (EMP). Approximately Rs. 3.28 Crores ($US 921,951) has been allocated by the project developer to implement these measures, a summary of which is outlined below.

(i) Biodiversity Conservation Management Plan

The proposed project aims to mitigate any potential disturbance or pressure on land and biological resources and ensure conservation and preservation of natural ecosystems. The conservation policies and plans for the State are administered by the Department of Forests and Wildlife. The Project Developer will allocate funding to the Department of Forests and Wildlife to manage and execute biodiversity conservation issues associated with the Project.

A Board, chaired by the Chief Wildlife Warden of Sikkim shall govern the conservation work. It shall include appropriate representation from the State Forest Department, Ecologists/Conservationists and local NGOs. The main activity/responsibility of the board will be to define a conservation area, monitor and enforce regulatory provisions relating to the protection of this area and ensure that the natural ecosystem structure and functions are not changed or subjected to any threat.

[8] http://www.envfor.nic.in/legis/eia/so-60(e).html

Documentation of the existing biological diversity in the area (flora/fauna surveys) will be carried out and special attention will be paid to the prevention of overexploitation of forest resources. The inhabitants of the area will be encouraged to adopt sustainable forest conservation practices. This will ensure that the habitat is protected and will minimise the disruption, disturbance and fragmentation of the wildlife habitats. South and West Sikkim Forest Divisions are rich in a variety of medicinal plants and in order to augment the natural stock of medicinal plants in the forests, it is proposed to take up planting of medicinal plants and establish a medicinal plants nursery.

(ii) Action Plan for Catchment Area Treatment

Due to the terrain of the area the Rangit River catchment is susceptible to erosion and landslides. Project related construction activities have the potential to accentuate natural erosion processes, and may also trigger minor landslides.

The catchment area treatment plan has been formulated with the main objective of arresting soil erosion in the catchment area. Suitable remediation measures will be implemented as necessary, including construction of check dams/walls, retaining walls and wire crates for gully control; and stabilisation of flood prone nallahs, landslides/slopes, river banks and roads.

(iii) Fisheries Development

The Rangit River is a known breeding ground for several fish species. In order to ensure protection of these populations, trash racks will be fitted before the power intake to prevent any fish from being sucked in. In addition, it is proposed to build a hatchery (including nursing ponds, rearing ponds and stocking ponds) in the vicinity of Rangit River. Sufficient funding has been allocated by the Project Developer for this purpose.

(iv) Public Health Delivery System

Existing health services in the project area are insufficient to cater for an influx of labour force from outside of the area. The project proposes to have all labourers, including their family members registered, quarantined, tested and vaccinated prior to registration. The project authorities will ensure that the contractors follow this strict quarantine procedure with a clause included in the award of contracts/works. Sufficient medical facilities will be provided by the project authorities for this purpose, in addition to upgrading existing medical facilities in the area.

(v) Solid Waste Management

The project authorities will ensure that the colony of labourers and workers will be provided with proper sewage treatment including septic tanks and soak pits for individual dwellings; waste disposal; and sanitary facilities. Four community latrines, of adequate size, will be constructed at suitable locations in the colony area.

(vi) Provision for Fuel wood/ LPG Depots and Energy Conservation Measures

The consumption of fuel wood by the local population has been identified as a significant environmental concern. Consequently it is likely that the influx of a labour force will exert immense pressure on the

forest areas in the vicinity of the project. In order to meet the labourers' fuel wood requirements, it is proposed to provide free fuel wood/kerosene/ LPG from depots. This will discourage illicit tree felling and removal of fuel wood and timber from the adjoining forests.

(vii) Relocation and Rehabilitation of Dumping Sites

Material which is excavated during construction of the project will be relocated and rehabilitated. Most of the excavated material will be piled at four suitable locations identified specifically for this purpose. Efforts will be made to relocate and rehabilitate the material within short distances from the generation site, and a detailed work plan for revegetation has been formulated.

(viii) Landscaping and Restoration of Construction Areas

Project construction activities can potentially result in modification of the existing landscape of the area. The project authorities have therefore made provisions to ensure that restoration works will be carried out at the completion of construction to return disturbed areas to similar or near-similar pre-construction conditions and land use.

(ix) Creation of Green Belt around Reservoir

A green belt of approximately 24.74 ha will be created around the reservoir to prevent soil erosion and land slips from spilling directly into the reservoir. The green belt will start from the immediate vicinity of the reservoir rim on both the banks, up to the tail of the reservoir, wherever moderately steep slopes are available for plantation. Indigenous, economically important, soil binding tree species, which are able to thrive well under high humidity and flood conditions, will be planted. The creation and maintenance of the greenbelt involves a high level of technical expertise and therefore will be carried out by the South & West Sikkim Forest Divisions, with funding set aside by DANS Energy. Their staff are suitably trained and experienced.

(x) Resettlement and Rehabilitation Plan

A total of approximately 36.87 ha of land is required for the project. Of this, 4.82 ha of the required land belongs to private landholders, with the remaining 32.05 ha belonging to forest land. A plan for compensation and rehabilitation has been formulated in consultation with the project-affected families. No family will become landless as a result of the project.

(xi) Environmental Monitoring Programme

In order to monitor the impact and efficacy of the above mentioned plans the project authorities have specified detailed monitoring parameters, which are contained in the EMP. Additionally, the developer shall deploy trained staff for monitoring and implementation of the EMP under guidance of the CISMHE (Centre for Inter-Disciplinary Studies of Mountain & Hill Environment), University of Delhi.

SECTION E. Stakeholders' comments

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

A public hearing was conducted by the State Pollution Control Board of Sikkim, on the 9th April 2006. The meeting took place in the village of Pipley, which is the nearest village to where the project will be located (see Section A.4.1). At the pubic meeting the proposed project was presented and comments were invited.

Participants in the meeting included local villagers and representatives from:

- State Land Use and Environment Board
- Area MLA, Jorethang – Nayabazar Constituency
- State Pollution Control Board
- Sikkim Power Development Corporation
- Department of Forest and Environment
- Sub-Divisional Magistrate, Soreng
- Sub-Divisional Magistrate, Namchi
- Delhi University
- Sikkim Government College
- Panchayats
- Senior Citizens
- NGO (local area) - Shri S.P. Shestra, Sadbhavana Samithi, Pipaley-Rothak.

101 local attendees signed the register as present at the meeting.

No Objection Certificates (NOCs) were obtained from the Panchayats have been obtained from the following local villages: Tinik Chisopani, Poklok Denchong, Salaghari, Majithar and Lower Goom.

E.2. Summary of the comments received:

A summary of issues raised by the stakeholders at the meeting is given below:

1. It was stated that the employment, supply and contract of the works pertaining to the project should be preferentially allotted to locals of area.
2. Concern was expressed with regards to the provisions made to address any potential drying up of the river and quarry, and the quantum of water that would be released.
3. A question was asked about the provisions for the prevention of pollution.
4. Concerns were raised about landslides, slips and settlement problems that could be caused by the project activity.
5. A question was asked regarding the acquisition of private land for the project.
6. Concerns were raised with regards to the migration of people to the area and resultant social consequences. It was stated that no changes to the social fabric should occur.
7. It was stated that the Catchment Area Treatment plan (CAT plan) should be vetted by the Forest Department.
8. A concern was raised that the description of the flora and fauna surveyed was too general.

9. A concern was raised with regards to the aquatic ecosystem management. It was stated that the impact on migratory fish populations will be dependent on the project authorities releasing adequate water down stream of the project and that aquatic specialists may need to be consulted to confirm whether the potential threats to the migratory fish population will be mitigated by the proposed fisheries development.
10. Concerns were raised with regards to dumping the silted muck beside the river. It was suggested that an alternative dumping location be identified away from the river.
11. It was suggested that the measures proposed in the Environmental Management Plan for solid waste management, provision for fuel wood, LPG, energy conservation measures, landscaping and restoration of construction areas and creation of green belts need revision and enhancement.
12. Concerns were raised regarding the definition of area in the CAT.
13. It was stated that the basis for the rates used in the CAT was not as per the Forest Department of the Government of Sikkim.
14. Concerns were raised that the EIA is only based on models and not actual measurement
15. Concerns were raised regarding the methods used for testing the water samples. Storing water samples beyond a certain time period has a bearing on the validity of the data.

A report containing detailed proceedings of the public hearing is available on request.

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

The project proponents have taken due account of the suggestions and views expressed during the Public Hearing as follows:

1. A committee is to be formed under the local Minister and MLA to supervise the provision of employment opportunities for local people. A Memorandum of Understanding has also been signed with the Sikkim government outlining the agreed terms with regards to employment.
2. The project will not compromise access to the river resources for downstream users as the Raman River flows into the Rangit River approximately 4 kilometres downstream of the proposed diversion barrage, and two other streams, Ramam Khola and Chhoti Rangit flow into the Rangit River within this 4 kilometre stretch. In addition provisions have been made for 0.3 cumecs of sacrificial discharge throughout the year. All the provisions for prevention of pollution which are outlined in the Environmental Management Plan will be implemented.
3. The EMP which has been prepared for the project, and approved by the MoEF, outlines specific provisions for the prevention of pollution that will be implemented as part of the project.
4. Provisions shall be made to address the potential problems of slips and landslides, as outlined in the EMP.
5. The project will not render any people landless or homeless. Owners of the private land required for the project shall be suitably compensated.
6. The project will not lead to any permanent immigration. A committee will be established to ensure there is no change to social fabric. The NGO who raised the concern has been invited to participate in the committee.
7. The CAT has been presented to the State committee constituted for EIA and EMPs. They have provided the necessary feedback.
8. The flora and fauna information was from the executive summary. Further detail is provided in the full report and the DPR.
9. A meeting of the Expert Committee for River Valley and Hydroelectric Projects (of MoEF) on the 17th May 2006 concluded that the Biodiversity Management and Conservation Management

Plan contained sufficient provisions to mitigate the negative environmental impacts of the project and that sufficient provisions have been made in the EMP to maintain the ecosystem. This includes the release of sufficient water into the downstream stretch of the river to maintain the aquatic ecosystem. It was also stated that the Ramam Khola River discharges sufficient water into the Rangit River at Jorethang, to sustain the aquatic ecology.

10. Muck from the project will only be dumped in allocated areas where retaining walls have been constructed. The dumping sites have been revised according to community requests.
11. Sufficient provisions have been made for activities such as solid waste management, fuel wood, LPG, landscaping and creation of a green belt as outlined in the EMP.
12. The CAT has been prepared for the free draining catchment of the Project in accordance with the Government norms.
13. The rates which have been adopted are approved by the Himachal Pradesh Forest Department. These rates are appropriate for Sikkim as the terrain in Himachal Pradesh and Sikkim are similar. However, if there is any discrepancy, only approved rates will be used in the CAT.
14. The models used within the EIA have been recommended by the Centre for Atmospheric Sciences, IIT, Delhi, as appropriate for the project, as there is a high level of correlation between the estimated data and actual data.
15. Most of the physical-chemical water sample parameters were recorded in the field. The chemical characteristics were tested in the lab. The samples were properly preserved and maintained at a low temperature during transport to minimise any degradation. The analysis of biological characteristics was also conducted offsite. These characteristics are not affected by the time period required for transportation and analysis.

A community development plan is currently being negotiated that documents all the commitments made by the project developer to the local community.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	DANS Energy Private Limited
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding, either national or international, was sourced in order to undertake any aspect of this Project Activity. The project will be funded solely by private entities.

Annex 3

BASELINE INFORMATION

Tables A3-1 to A3-8 contains the data published by the CEA that is used to calculate the Baseline Emission Factor for the eastern regional grid.

All data is taken from the *Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0*[9]. Assumptions are contained within the *CO_2 Baseline Database for the Indian Power Sector User Guide - Version 2.0*[10].

Table A3-1 Fuel Emission Factors (EF)

	Unit	Coal	Lignite	Gas	Oil	Diesel	Naphta	Corex
EF based on NCV	gCO2 /MJ	95.8	106.2	56.1	77.4	74.1	73.3	0.0
Delta GCV NCV	%	3.6%	3.6%	10%	5%	5%	5%	n/a
EF based on GCV	gCO2 /MJ	92.5	102.5	51.0	73.7	70.6	69.8	0.0
Oxidation Factor	-	0.98	0.98	1.00	1.00	1.00	1.00	n/a
Fuel Emission Factor	gCO2 /MJ	90.6	100.5	51.0	73.7	70.6	69.8	0.0

n/a = not applicable (i.e. no assumptions were needed)

[9] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

[10] http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver2.pdf

Table A3-2 Annual Data for the Eastern Regional Grid (2003-04, 2004-05, 2005-06)

Table A3-2 contains the annual data for the eastern regional grid extracted from the 'data' worksheet in the *Baseline Carbon Dioxide Emissions from Power Sector - Version 2.0* file. The columns included are the net generation in GWh of the identified power station and the absolute carbon dioxide emissions in metric tonnes, for the relevant Fiscal Years 2003-04 to 2005-06. In addition, there are columns to indicate whether the station is included in the operating margin in the respective year, and an additional column indicating which units are included in the build margin in 2005-06 (indicated by a 1 in the respective column).

								2003-04			2004-05			2005-06			
Name	Unit_No	Dt_ Comm	Capacity Mw As On 31/03/2006	REGION	State	Type	Fuel 1	Net Generation Gwh	Absolute Emissions T Co2	In Operating Margin	Gross Generation Gwh	Absolute Emissions T Co2	In Operating Margin	Net Generation Gwh	Absolute Emissions T Co2	In Operating Margin	In Build Margin
Patratu	**0**		**840**	**ER**	**Jharkhand**	**Thermal**	**Coal**	**885**	**1,714,887**	**1**	**743**	**1,203,019**	**1**	**706**	**1,356,368**	**1**	
Patratu	1	1-Oct-66	50	ER	Jharkhand	Thermal	Coal				0						
Patratu	2	1-Jun-67	50	ER	Jharkhand	Thermal	Coal				239						
Patratu	3	1-Feb-69	50	ER	Jharkhand	Thermal	Coal				0						
Patratu	4	1-Jan-70	50	ER	Jharkhand	Thermal	Coal				0						
Patratu	5	17-Dec-71	100	ER	Jharkhand	Thermal	Coal				6						
Patratu	6	13-Mar-72	100	ER	Jharkhand	Thermal	Coal				88						
Patratu	7	17-Jan-77	110	ER	Jharkhand	Thermal	Coal				0						
Patratu	8	2-Mar-78	110	ER	Jharkhand	Thermal	Coal				121						
Patratu	9	30-Mar-84	110	ER	Jharkhand	Thermal	Coal				262						
Patratu	10	2-Mar-86	110	ER	Jharkhand	Thermal	Coal				27						
Barauni	**0**		**320**	**ER**	**Bihar**	**Thermal**	**Coal**	**248**	**514,576**	**1**	**153**	**326,600**	**1**	**96**	**242,342**	**1**	
Barauni	1	31-Oct-69	50	ER	Bihar	Thermal	Coal				0						
Barauni	2	30-Nov-71	50	ER	Bihar	Thermal	Coal				0						
Barauni	3	1-May-83	110	ER	Bihar	Thermal	Coal				39						
Barauni	4	31-Mar-85	110	ER	Bihar	Thermal	Coal				114						
Kahalgaon	**0**		**840**	**ER**	**Bihar**	**Thermal**	**Coal**	**5,591**	**5,554,064**	**1**	**6,420**	**5,694,568**	**1**	**6,020**	**6,090,761**	**1**	
Kahalgaon	1	31-Mar-92	210	ER	Bihar	Thermal	Coal				1,551						
Kahalgaon	2	17-Mar-94	210	ER	Bihar	Thermal	Coal				1,509						
Kahalgaon	3	24-Mar-95	210	ER	Bihar	Thermal	Coal				1,569						
Kahalgaon	4	18-Mar-96	210	ER	Bihar	Thermal	Coal				1,454						
Tenughat	**0**		**420**	**ER**	**Jharkhand**	**Thermal**	**Coal**	**1,202**	**1,282,774**	**1**	**1,326**	**1,295,726**	**1**	**1,311**	**2,002,824**	**1**	

Tenughat	1	14-Apr-94	210	ER	Jharkhand	Thermal	Coal				1,326						
Tenughat	2	10-Oct-96	210	ER	Jharkhand	Thermal	Coal				0	0					
Jojobera Imp.	**0**		**427.5**	**ER**	**Jharkhand**	**Thermal**	**Coal**	**1,596**	**1,731,147**	**1**	**1,950**	**1,885,744**	**1**	**2,126**	**2,307,939**	**1**	
Jojobera Imp.	1	22-Dec-95	67.5	ER	Jharkhand	Thermal	Coal				446						
Jojobera Imp.	2	9-Oct-00	120	ER	Jharkhand	Thermal	Coal				762	715,273		702	736,794		1
Jojobera Imp.	3	27-Aug-01	120	ER	Jharkhand	Thermal	Coal				742	696,113		702	736,794		1
Jojobera Imp.	4	23-Sep-05	120	ER	Jharkhand	Thermal	Coal				0			363	381,518		1
Chandrapura	**0**		**780**	**ER**	**Jharkhand**	**Thermal**	**Coal**	**1,089**	**2,152,666**	**1**	**1,894**	**2,633,923**	**1**	**1,775**	**2,538,987**	**1**	
Chandrapura	1	30-Sep-64	140	ER	Jharkhand	Thermal	Coal				549						
Chandrapura	2	30-Nov-64	140	ER	Jharkhand	Thermal	Coal				711						
Chandrapura	3	30-Jun-68	140	ER	Jharkhand	Thermal	Coal				634						
Chandrapura	4	31-Mar-74	120	ER	Jharkhand	Thermal	Coal				0						
Chandrapura	5	31-Mar-75	120	ER	Jharkhand	Thermal	Coal				0						
Chandrapura	6	29-Mar-79	120	ER	Jharkhand	Thermal	Coal				0						
Durgapur	**0**		**350**	**ER**	**West Bengal**	**Thermal**	**Coal**	**1,479**	**2,331,501**	**1**	**1,471**	**1,969,529**	**1**	**1,601**	**2,243,952**	**1**	
Durgapur	1	31-May-67	140	ER	West Bengal	Thermal	Coal				688						
Durgapur	2	5-Dec-81	210	ER	West Bengal	Thermal	Coal				783						
Bokaro B	**0**		**630**	**ER**	**Jharkhand**	**Thermal**	**Coal**	**2,398**	**4,014,038**	**1**	**2,468**	**3,725,350**	**1**	**2,365**	**3,751,554**	**1**	
Bokaro B	1	24-Mar-86	210	ER	Jharkhand	Thermal	Coal				562						
Bokaro B	2	7-Nov-90	210	ER	Jharkhand	Thermal	Coal				887						
Bokaro B	3	31-Mar-93	210	ER	Jharkhand	Thermal	Coal				1,019						
Maithon Gt	**0**		**90**	**ER**	**Jharkhand**	**Thermal**	**Disl**	**6**	**6,298**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	
Maithon Gt	1	8-Mar-89	30	ER	Jharkhand	Thermal	Disl										
Maithon Gt	2	13-Mar-89	30	ER	Jharkhand	Thermal	Disl										
Maithon Gt	3	20-Mar-89	30	ER	Jharkhand	Thermal	Disl										
Mejia	**0**		**840**	**ER**	**West Bengal**	**Thermal**	**Coal**	**3,586**	**5,019,671**	**1**	**4,643**	**5,311,316**	**1**	**5,262**	**5,741,686**	**1**	
Mejia	1	21-Dec-95	210	ER	West Bengal	Thermal	Coal				1,599						
Mejia	2	24-Mar-97	210	ER	West Bengal	Thermal	Coal				1,282	1,466,347					
Mejia	3	25-Mar-98	210	ER	West Bengal	Thermal	Coal				1,583	1,811,305					
Mejia	4	12-Oct-04	210	ER	West Bengal	Thermal	Coal				179	204,787		1,435	1,565,349		1
Talcher	**0**		**470**	**ER**	**Orissa**	**Thermal**	**Coal**	**2,445**	**3,130,765**	**1**	**3,196**	**3,542,605**	**1**	**3,174**	**3,899,070**	**1**	
Talcher	1	17-Dec-67	62.5	ER	Orissa	Thermal	Coal				488						
Talcher	2	28-Mar-68	62.5	ER	Orissa	Thermal	Coal				472						

Talcher	3	11-Jul-68	62.5	ER	Orissa	Thermal	Coal				424						
Talcher	4	11-Apr-69	62.5	ER	Orissa	Thermal	Coal				345						
Talcher	5	24-Mar-82	110	ER	Orissa	Thermal	Coal				719						
Talcher	6	24-Mar-83	110	ER	Orissa	Thermal	Coal				748						
I.B.Valley	**0**		**420**	**ER**	**Orissa**	**Thermal**	**Coal**	**2,678**	**2,814,744**	**1**	**3,165**	**2,929,295**	**1**	**2,773**	**2,844,741**	**1**	
I.B.Valley	1	22-May-94	210	ER	Orissa	Thermal	Coal				1,618						
I.B.Valley	2	22-Oct-95	210	ER	Orissa	Thermal	Coal				1,548						
Talcher Stps	**0**		**3000**	**ER**	**Orissa**	**Thermal**	**Coal**	**8,890**	**9,792,795**	**1**	**16,248**	**14,783,118**	**1**	**19,703**	**18,809,830**	**1**	
Talcher Stps	1	19-Feb-95	500	ER	Orissa	Thermal	Coal				3,811						
Talcher Stps	2	27-Mar-96	500	ER	Orissa	Thermal	Coal				3,597						
Talcher Stps	3	4-Jan-03	500	ER	Orissa	Thermal	Coal				3,316	3,017,037		3,425	3,270,166		1
Talcher Stps	4	25-Oct-03	500	ER	Orissa	Thermal	Coal				3,664	3,333,662		3,339	3,187,703		1
Talcher Stps	5	13-May-04	500	ER	Orissa	Thermal	Coal				1,856	1,688,576		3,519	3,359,381		1
Talcher Stps	6	6-Feb-05	500	ER	Orissa	Thermal	Coal				3	2,730		2,480	2,367,573		1
Bandel	**0**		**540**	**ER**	**West Bengal**	**Thermal**	**Coal**	**1,509**	**1,892,479**	**1**	**2,151**	**2,515,327**	**1**	**1,853**	**2,525,307**	**1**	
Bandel	1	30-Nov-65	82.5	ER	West Bengal	Thermal	Coal				315						
Bandel	2	31-May-66	82.5	ER	West Bengal	Thermal	Coal				249						
Bandel	3	30-Nov-65	82.5	ER	West Bengal	Thermal	Coal				304						
Bandel	4	31-May-67	82.5	ER	West Bengal	Thermal	Coal				0						
Bandel	5	8-Oct-82	210	ER	West Bengal	Thermal	Coal				1,282						
Santaldih	**0**		**480**	**ER**	**West Bengal**	**Thermal**	**Coal**	**1,039**	**1,628,468**	**1**	**1,338**	**1,766,983**	**1**	**1,046**	**1,576,619**	**1**	
Santaldih	1	1-Jan-74	120	ER	West Bengal	Thermal	Coal				416						
Santaldih	2	16-Jul-75	120	ER	West Bengal	Thermal	Coal				248						
Santaldih	3	6-Dec-78	120	ER	West Bengal	Thermal	Coal				391						
Santaldih	4	30-Mar-81	120	ER	West Bengal	Thermal	Coal				283						
Kolaghat	**0**		**1260**	**ER**	**West Bengal**	**Thermal**	**Coal**	**6,222**	**8,895,054**	**1**	**7,386**	**10,301,662**	**1**	**6,508**	**9,988,356**	**1**	
Kolaghat	1	13-Aug-90	210	ER	West Bengal	Thermal	Coal				1,281						
Kolaghat	2	16-Dec-85	210	ER	West Bengal	Thermal	Coal				1,227						
Kolaghat	3	24-Jul-84	210	ER	West Bengal	Thermal	Coal				1,017						
Kolaghat	4	28-Dec-93	210	ER	West Bengal	Thermal	Coal				1,142						
Kolaghat	5	17-Mar-91	210	ER	West Bengal	Thermal	Coal				1,225						
Kolaghat	6	16-Jan-93	210	ER	West Bengal	Thermal	Coal				1,494						
Bakreswar	**0**		**630**	**ER**	**West Bengal**	**Thermal**	**Coal**	**3,903**	**4,434,095**	**1**	**4,175**	**4,643,818**	**1**	**3,947**	**4,699,567**	**1**	
Bakreswar	1	18-Jul-99	210	ER	West Bengal	Thermal	Coal				1,596	1,776,260		1,291	1,536,780		

Bakreswar	2	20-May-00	210	ER	West Bengal	Thermal	Coal				988	1,099,590		1,493	1,777,702		
Bakreswar	3	1-Apr-01	210	ER	West Bengal	Thermal	Coal				1,590	1,769,583		1,163	1,385,160		1
D.P.L.	**0**		**395**	**ER**	**West Bengal**	**Thermal**	**Coal**	**1,745**	**2,538,569**	**1**	**2,029**	**2,979,085**	**1**	**1,958**	**3,322,327**	**1**	
D.P.L.	1	31-Mar-60	30	ER	West Bengal	Thermal	Coal				122						
D.P.L.	2	30-Apr-60	30	ER	West Bengal	Thermal	Coal				44						
D.P.L.	3	12-Jun-64	75	ER	West Bengal	Thermal	Coal				421						
D.P.L.	4	1-Sep-64	75	ER	West Bengal	Thermal	Coal				410						
D.P.L.	5	31-May-66	75	ER	West Bengal	Thermal	Coal				485						
D.P.L.	6	3-Jul-85	110	ER	West Bengal	Thermal	Coal				548						
Newcossipore	**0**		**160**	**ER**	**West Bengal**	**Thermal**	**Coal**	**436**	**835,786**	**1**	**481**	**870,631**	**1**	**406**	**813,574**	**1**	
Newcossipore	1	31-Oct-49	30	ER	West Bengal	Thermal	Coal				94						
Newcossipore	2	30-Nov-49	30	ER	West Bengal	Thermal	Coal				110						
Newcossipore	3	31-Oct-50	50	ER	West Bengal	Thermal	Coal				8						
Newcossipore	4	30-Apr-63	50	ER	West Bengal	Thermal	Coal				269						
Titagarh	**0**		**240**	**ER**	**West Bengal**	**Thermal**	**Coal**	**1,574**	**1,888,426**	**1**	**1,792**	**1,948,138**	**1**	**1,671**	**2,023,357**	**1**	
Titagarh	1	12-Dec-82	60	ER	West Bengal	Thermal	Coal				420						
Titagarh	2	26-Apr-83	60	ER	West Bengal	Thermal	Coal				470						
Titagarh	3	16-Jan-84	60	ER	West Bengal	Thermal	Coal				462						
Titagarh	4	17-Mar-85	60	ER	West Bengal	Thermal	Coal				440						
Southern Repl.	**0**		**135**	**ER**	**West Bengal**	**Thermal**	**Coal**	**842**	**1,012,016**	**1**	**998**	**1,092,840**	**1**	**902**	**1,080,120**	**1**	
Southern Repl.	1	12-Aug-90	67.5	ER	West Bengal	Thermal	Coal				504						
Southern Repl.	2	10-Apr-91	67.5	ER	West Bengal	Thermal	Coal				494						
Budge Budge	**0**		**500**	**ER**	**West Bengal**	**Thermal**	**Coal**	**3,190**	**3,277,789**	**1**	**3,784**	**3,547,271**	**1**	**4,000**	**4,082,263**	**1**	
Budge Budge	1	16-Sep-97	250	ER	West Bengal	Thermal	Coal				1,977	1,852,565					
Budge Budge	2	6-Mar-99	250	ER	West Bengal	Thermal	Coal				1,807	1,693,679					
Farakka Stps	**0**		**1600**	**ER**	**West Bengal**	**Thermal**	**Coal**	**8,712**	**8,896,179**	**1**	**9,701**	**8,990,312**	**1**	**10,660**	**10,575,971**	**1**	
Farakka Stps	1	1-Jan-86	200	ER	West Bengal	Thermal	Coal				1,331						
Farakka Stps	2	24-Dec-86	200	ER	West Bengal	Thermal	Coal				1,316						
Farakka Stps	3	6-Aug-87	200	ER	West Bengal	Thermal	Coal				1,282						
Farakka Stps	4	25-Sep-92	500	ER	West Bengal	Thermal	Coal				2,874						
Farakka Stps	5	16-Feb-94	500	ER	West Bengal	Thermal	Coal				2,898						
Muzaffarpur	**0**		**220**	**ER**	**Bihar**	**Thermal**	**Coal**	**70**	**108,252**	**1**	**0**	**0**	**1**	**0**	**0**		
Muzaffarpur	1	31-Mar-85	110	ER	Bihar	Thermal	Coal										

Muzaffarpur	2	17-Mar-86	110	ER	Bihar	Thermal	Coal										
Bokaro A	**0**		**175**	**ER**	**Jharkhand**	**Thermal**	**Coal**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**		
Bokaro A	1	30-Nov-51	45	ER	Jharkhand	Thermal	Coal										
Bokaro A	2	30-Nov-51	45	ER	Jharkhand	Thermal	Coal										
Bokaro A	3	30-Nov-52	45	ER	Jharkhand	Thermal	Coal										
Bokaro A	4	31-Oct-60	40	ER	Jharkhand	Thermal	Coal										
Mulajore	**0**		**120**	**ER**	**West Bengal**	**Thermal**	**Coal**	**43**	**44,970**	**1**	**0**	**0**	**1**	**0**	**0**		
Mulajore	1	1-Jul-92	30	ER	West Bengal	Thermal	Coal										
Mulajore	2	1-Jul-92	30	ER	West Bengal	Thermal	Coal										
Mulajore	3	1-Jul-92	30	ER	West Bengal	Thermal	Coal										
Mulajore	4	1-Jul-92	30	ER	West Bengal	Thermal	Coal										
Kosi	**0**		**20**	**ER**	**Bihar**	**Hydro**		**7**	**0**		**3**	**0**		**17**	**0**		
Kosi	1	1-Mar-70	5	ER	Bihar	Hydro											
Kosi	2	16-Apr-71	5	ER	Bihar	Hydro											
Kosi	3	20-Oct-73	5	ER	Bihar	Hydro											
Kosi	4	1-Oct-78	5	ER	Bihar	Hydro											
Sone West Canal	**0**		**6.6**	**ER**	**Bihar**	**Hydro**		**16**	**0**		**13**	**0**		**17**	**0**		
Sone West Canal	1	1-Mar-93	1.65	ER	Bihar	Hydro											
Sone West Canal	2	8-Mar-93	1.65	ER	Bihar	Hydro											
Sone West Canal	3	28-Aug-93	1.65	ER	Bihar	Hydro											
Sone West Canal	4	30-Mar-94	1.65	ER	Bihar	Hydro											
Sone East Canal	**0**		**3.3**	**ER**	**Bihar**	**Hydro**		**11**	**0**		**12**	**0**		**12**	**0**		
Sone East Canal	1	26-Jun-96	1.65	ER	Bihar	Hydro											
Sone East Canal	2	29-Feb-96	1.65	ER	Bihar	Hydro											
E.G. Canal	**0**		**15**	**ER**	**Bihar**	**Hydro**		**18**	**0**		**21**	**0**		**28**	**0**		
E.G. Canal	1	4-Aug-95	5	ER	Bihar	Hydro											
E.G. Canal	2	22-Jun-96	5	ER	Bihar	Hydro											
E.G. Canal	3	12-Nov-97	5	ER	Bihar	Hydro					7						
Subernrekha I&Ii	**0**		**130**	**ER**	**Jharkhand**	**Hydro**		**141**	**0**		**148**	**0**		**51**	**0**		
Subernrekha-I	1	14-Oct-77	65	ER	Jharkhand	Hydro											
Subernrekha - Ii	2	18-Oct-80	65	ER	Jharkhand	Hydro											

Panchet	**0**		**80**	**ER**	**Jharkhand**	**Hydro**		**117**	**0**		**135**	**0**		**86**	**0**		
Panchet	1	14-Sep-59	40	ER	Jharkhand	Hydro											
Panchet	2	8-Mar-91	40	ER	Jharkhand	Hydro											
Maithon	**0**		**63.2**	**ER**	**Jharkhand**	**Hydro**		**117**	**0**		**114**	**0**		**85**	**0**		
Maithon	1	28-Oct-57	20	ER	Jharkhand	Hydro											
Maithon	2	21-May-58	20	ER	Jharkhand	Hydro											
Maithon	3	12-Dec-58	23.2	ER	Jharkhand	Hydro											
Tillaya	**0**		**4**	**ER**	**Jharkhand**	**Hydro**		**8**	**0**		**12**	**0**		**3**	**0**		
Tillaya	1	21-Feb-53	2	ER	Jharkhand	Hydro											
Tillaya	2	10-Jul-53	2	ER	Jharkhand	Hydro											
Balimela	**0**		**360**	**ER**	**Orissa**	**Hydro**		**1,138**	**0**		**1,527**	**0**		**1,048**	**0**		
Balimela	1	14-Aug-73	60	ER	Orissa	Hydro											
Balimela	2	25-Jan-74	60	ER	Orissa	Hydro											
Balimela	3	24-Aug-74	60	ER	Orissa	Hydro											
Balimela	4	26-Mar-75	60	ER	Orissa	Hydro											
Balimela	5	7-May-76	60	ER	Orissa	Hydro											
Balimela	6	7-May-76	60	ER	Orissa	Hydro											
Hirakud I&Ii	**0**		**331.5**	**ER**	**Orissa**	**Hydro**		**788**	**0**		**842**	**0**		**904**	**0**		
Hirakud-I	1	1-Nov-58	49.5	ER	Orissa	Hydro											
Hirakud-I	2	11-Nov-57	49.5	ER	Orissa	Hydro											
Hirakud-I	3	18-Dec-56	24	ER	Orissa	Hydro											
Hirakud-I	4	13-May-57	24	ER	Orissa	Hydro											
Hirakud-I	5	19-Apr-62	37.5	ER	Orissa	Hydro											
Hirakud-I	6	5-Aug-63	37.5	ER	Orissa	Hydro											
Hirakud-I	7	13-Sep-90	37.5	ER	Orissa	Hydro											
Hirakud-Ii	8	15-Jul-62	24	ER	Orissa	Hydro											
Hirakud-Ii	9	26-Nov-62	24	ER	Orissa	Hydro											
Hirakud-Ii	10	1-Feb-64	24	ER	Orissa	Hydro											
Rengali	**0**		**250**	**ER**	**Orissa**	**Hydro**		**1,046**	**0**		**749**	**0**		**674**	**0**		
Rengali	1	27-Aug-85	50	ER	Orissa	Hydro											
Rengali	2	26-Mar-86	50	ER	Orissa	Hydro											
Rengali	3	10-Aug-89	50	ER	Orissa	Hydro											
Rengali	4	19-Mar-90	50	ER	Orissa	Hydro											
Rengali	5	24-Jul-92	50	ER	Orissa	Hydro											

Upper Kolab	**0**		**320**	**ER**	**Orissa**	**Hydro**		**653**	**0**		**896**	**0**		**621**	**0**		
Upper Kolab	1	10-Mar-88	80	ER	Orissa	Hydro											
Upper Kolab	2	14-Apr-89	80	ER	Orissa	Hydro											
Upper Kolab	3	10-Aug-90	80	ER	Orissa	Hydro											
Upper Kolab	4	12-Jan-93	80	ER	Orissa	Hydro											
Uppar Indravati	**0**		**600**	**ER**	**Orissa**	**Hydro**		**2,121**	**0**		**2,850**	**0**		**1,754**	**0**		
Uppar Indravati	1	9-May-99	150	ER	Orissa	Hydro					713						
Uppar Indravati	2	23-Dec-99	150	ER	Orissa	Hydro					713			439			
Uppar Indravati	3	30-Sep-00	150	ER	Orissa	Hydro					713			439			
Uppar Indravati	4	30-Mar-01	150	ER	Orissa	Hydro					713			439			1
Jaldhaka I&Ii	**0**		**35**	**ER**	**West Bengal**	**Hydro**		**158**	**0**		**163**	**0**		**169**	**0**		
Jaldhaka -I	1	31-Mar-67	9	ER	West Bengal	Hydro											
Jaldhaka -I	2	3-Mar-67	9	ER	West Bengal	Hydro											
Jaldhaka -I	3	26-Nov-72	9	ER	West Bengal	Hydro											
Jaldhaka -Ii	4	5-Aug-83	4	ER	West Bengal	Hydro											
Jaldhaka -Ii	5	5-Aug-83	4	ER	West Bengal	Hydro											
Rammam	**0**		**50**	**ER**	**West Bengal**	**Hydro**		**239**	**0**		**241**	**0**		**196**	**0**		
Rammam	1	5-Sep-95	12.5	ER	West Bengal	Hydro											
Rammam	2	28-Sep-95	12.5	ER	West Bengal	Hydro											
Rammam	3	13-Jan-96	12.5	ER	West Bengal	Hydro											
Rammam	4	28-Jan-96	12.5	ER	West Bengal	Hydro											
Teesta I-Iii	**0**		**67.5**	**ER**	**West Bengal**	**Hydro**		**92**	**0**		**104**	**0**		**101**	**0**		
Teesta -I	1	14-Dec-97	7.5	ER	West Bengal	Hydro					12						
Teesta -I	2	25-Jan-98	7.5	ER	West Bengal	Hydro					12						
Teesta -I	3	19-Apr-98	7.5	ER	West Bengal	Hydro					12						
Teesta -Ii	4	10-Apr-98	7.5	ER	West Bengal	Hydro					12						
Teesta -Ii	5	22-Oct-98	7.5	ER	West Bengal	Hydro					12						
Teesta -Ii	6	30-Mar-99	7.5	ER	West Bengal	Hydro					12						
Teesta -Iii	7	23-Jul-99	7.5	ER	West Bengal	Hydro					12			11			
Teesta -Iii	8	7-Sep-99	7.5	ER	West Bengal	Hydro					12			11			
Teesta -Iii	9	13-Oct-99	7.5	ER	West Bengal	Hydro					12			11			
Lower	**0**		**12**	**ER**	**Sikkim**	**Hydro**		**12**	**0**		**31**	**0**		**18**	**0**		

Lagyap																	
L.Lagyap	1	1-Sep-79	6	ER	Sikkim	Hydro											
L.Lagyap	2	2-Nov-79	6	ER	Sikkim	Hydro											
U.Rognichu	**0**		**8**	**ER**	**Sikkim**	**Hydro**		**12**	**0**		**13**	**0**		**11**	**0**		
U.Rognichu	1	5-Mar-93	2	ER	Sikkim	Hydro											
U.Rognichu	2	21-Nov-93	2	ER	Sikkim	Hydro											
U.Rognichu	3	2-Mar-94	2	ER	Sikkim	Hydro											
U.Rognichu	4	26-Mar-94	2	ER	Sikkim	Hydro											
Moyagchu	**0**		**4**	**ER**	**Sikkim**	**Hydro**		**12**	**0**		**18**	**0**		**4**	**0**		
Moyagchu	1	1-Jul-93	2	ER	Sikkim	Hydro											
Moyagchu	2	1-Jul-93	2	ER	Sikkim	Hydro											
Rangit-Iii	**0**		**60**	**ER**	**Sikkim**	**Hydro**		**343**	**0**		**371**	**0**		**350**	**0**		
Rangit-Iii	1	5-Feb-00	20	ER	Sikkim	Hydro					124			117			
Rangit-Iii	2	5-Feb-00	20	ER	Sikkim	Hydro					124			117			
Rangit-Iii	3	5-Feb-00	20	ER	Sikkim	Hydro					124			117			

Table A3-3 Gross Generation Data (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	144,292	151,185	155,385	165,735	168,438	179,751
East	58,936	64,048	66,257	75,374	85,776	93,902
South	129,035	131,902	136,916	138,517	144,086	147,355
West	162,329	165,805	177,399	172,682	183,955	188,606
North-East	5,319	5,332	5,808	5,867	7,883	7,778
India	499,911	518,272	541,764	558,175	590,138	617,392

Table A3-4 Share of Must-Run (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	25.9%	25.7%	26.1%	28.1%	26.8%	28.1%
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	42.2%	41.7%	45.8%	41.9%	55.5%	52.7%
India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%

Table A3-5 Simple Operating Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.98	0.98	1.00	0.99	0.97	0.99
East	1.22	1.22	1.20	1.23	1.20	1.16
South	1.02	1.00	1.01	1.00	1.00	1.01
West	0.98	1.01	0.98	0.99	1.01	0.99
North-East	0.73	0.71	0.74	0.74	0.71	0.70
India	1.02	1.02	1.02	1.03	1.03	1.02

Table A3-6 Build Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.53	0.60
East					0.90	0.97
South					0.71	0.71
West					0.77	0.63
North-East					0.15	0.15
India					0.70	0.68

Table A3-7 Combined Margin (tCO2/MWh) (excl. imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.76	0.76	0.77	0.76	0.75	0.80
East	1.06	1.06	1.05	1.07	1.05	1.06
South	0.87	0.85	0.86	0.86	0.85	0.86
West	0.87	0.89	0.88	0.88	0.89	0.81
North-East	0.44	0.43	0.44	0.44	0.43	0.42
India	0.86	0.86	0.86	0.86	0.86	0.85

Table A3-8 Imports/Exports Eastern Regional Grid (Net, in GWh)

Year 2003-2004

From \ To	Northern	Eastern	Southern	Western	North-Eastern	Bhutan	Nepal
Northern		-116.5	13.2	962.4	0.0	0.0	58.4
Eastern	116.5		-56.7	0.0	0.0	-1,748.4	0.0
Southern	-13.2	56.7		0.0	0.0	0.0	0.0
Western	-962.4	0.0	0.0		0.0	0.0	0.0
North-Eastern	0.0	0.0	0.0	0.0		0.0	0.0
Bhutan	0.0	1,748.4	0.0	0.0	0.0		0.0
Nepal	-58.4	0.0	0.0	0.0	0.0	0.0	
Net imports	-917.5	1,688.6	-43.4	962.4	0.0	-1,748.4	58.4
Total Imports	116.5	1,805.1	13.2	962.4	0.0	0.0	58.4

Year 2004-2005

From \ To	Northern	Eastern	Southern	Western	North-Eastern	Bhutan	Nepal
Northern		-3,042.6	-120.4	-320.4	172.5	0.0	40.2
Eastern	3,042.6		286.2	120.4	2,105.6	-1,735.1	0.0
Southern	120.4	-286.2		305.3	0.0	0.0	0.0
Western	320.4	-120.4	-305.3		-179.5	0.0	0.0
North-Eastern	172.5	-2,105.6	0.0	179.5		0.0	0.0
Bhutan	0.0	1,735.1	0.0	0.0	0.0		0.0
Nepal	-40.2	0.0	0.0	0.0	0.0	0.0	
Net imports	3,615.7	-3,819.8	-139.5	284.8	2,098.6	-1,735.1	40.2
Total Imports	3,655.8	1,735.1	286.2	605.2	2,278.1	0.0	40.2

Year 2005-2006

From \ To	Northern	Eastern	Southern	Western	North-Eastern	Bhutan	Nepal
Northern		-4,260.3	0.0	-1,558.6	0.0	0.0	71.3
Eastern	4,260.3		99.8	10,142.0	-818.0	-1,762.7	137.7
Southern	0.0	-99.8		3,398.8	0.0	0.0	0.0
Western	1,558.6	-10,142.0	-3,398.8		0.0	0.0	0.0
North-Eastern	0.0	818.0	0.0	0.0		0.0	0.0
Bhutan	0.0	1,762.7	0.0	0.0	0.0		0.0
Nepal	-71.3	-137.7	0.0	0.0	0.0	0.0	
Net imports	5,747.6	-12,059.1	-3,299.0	11,982.2	-818.0	-1,762.7	209.0
Total Imports	5,818.9	2,580.8	99.8	13,540.8	0.0	0.0	209.0

Annex 4

MONITORING INFORMATION

All details of the monitoring plan are provided in Section B7.2.

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