

Teesta-V Hydro Power Project in Sikkim by NHPC Limited, India

Document Prepared By M/s. NHPC Limited

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Project Title	Teesta-V Hydro Power Project in Sikkim by NHPC Limited, India
Version	1.2
Date of Issue	27/10/2012
Project ID	766
Monitoring Period	01/10/2009 to 31/05/2012
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1 PROJECT DETAILS

1.1 Summary Description of Project

The Teesta HE project - Stage V is a run of the river scheme connected to the NEWNE grid. Stage V of the Teesta river project has installed a capacity of 510 MW (3×170 MW turbines). The power house is located near Singtam (about 4 km upstream of the confluence of Rongnichu with Teesta). The dependable discharge available throughout the year has been assessed as 60 cumecs and gross head available is 216.73 m; for the installed capacity of 510 MW. The project consists of concrete gravity dam across river Teesta with a 17.2 km long head race tunnel and an underground power housing three generating units of 170 MW capacity each.

The Teesta HE project Stage V is a run of the river scheme and will be producing energy to be absorbed into the Eastern region, part of the NEWNE grid. The project consists of 96.45 m high concrete gravity dam across river Teesta with a 17.2 km long head race tunnel and an underground power housing three generating units of 170 MW capacity each. The three tail race tunnels are D-shaped and 155m, 165m, 175m long. The penstock is of vertical pressure shaft type.

The total emission reductions for the monitoring period (01/10/2009 to 31/05/2012) account to 5,082,827 tCO₂e.

1.2 Sectoral Scope and Project Type

- **Sectoral scope:** 1, Energy industries (renewable - / non-renewable sources)
- **Category:** ACM0002/Version 10, EB 47¹ "Consolidated monitoring methodology for grid- connected electricity generation from renewable sources"
- This is not a grouped project.

1.3 Project Proponent

NHPC Limited

Chief Engineer

R&D Division, NHPC Limited

Sector-33, Faridabad – 121 003

Haryana, India

Fax: +91-129-2278594

Roles/responsibility:

The project participant overseas the overall functioning and maintenance of the project activity, the dedicated team formed under his supervision will work on specified tasks.

¹ <http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT>

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Roles/responsibility:

Overall assistance in registration, verification and issuance of VERs

1.4 Other Entities Involved in the Project

None

1.5 Project Start Date

Project Start date: 1st March 2008 which is the start date of commercial operation of the plant.

1.6 Project Crediting Period

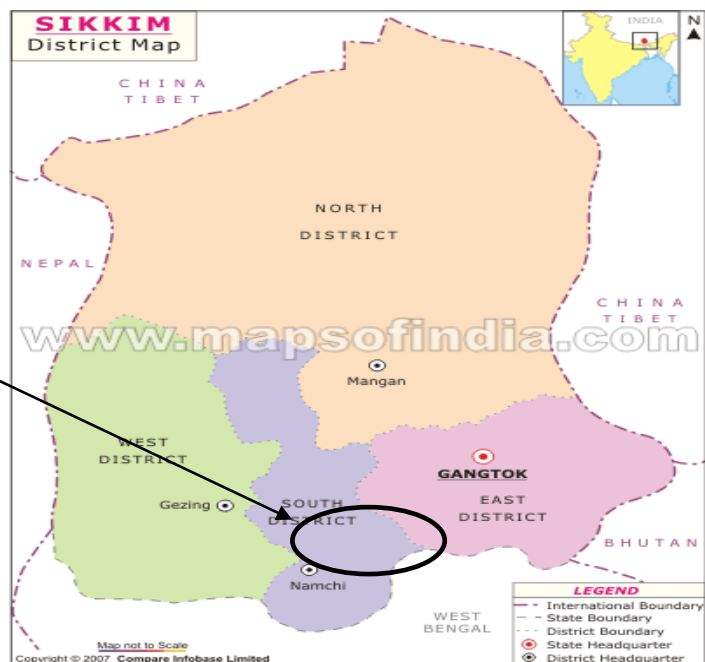
First crediting period: 01/04/2008 – 31/03/2018 (ten years)

10 years, renewable (twice) crediting period.

1.7 Project Location

The project is located in East district of Sikkim state on the major river system in Teesta in Sikkim. The power house site is located at 88°27'30" E and 27°15'00" N. The project site is accessible from Bagdogra Airport and is situated at a distance of 140 km from the airport (power house site being 110 km away). The nearest railway points are New Jalpaiguri and Siliguri.

The location of the proposed project activity is given in the following maps:



1.8 Title and Reference of Methodology

Title: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

Reference: Approved consolidated baseline methodology ACM0002/Version 10

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The plant was successfully commissioned as follow:

S.N.	Technical Description of the Units	Type	Serial number of Turbine	Date of commissioning	Implementation status
1	Unit 1	VF-1RS	M223600CR1101	10/04/2008	Operational
2	Unit 2	VF-1RS	M223600CR2101	25/02/2008	Operational
3	Unit 3	VF-1RS	M223600CR3101	03/04/2008	Operational

The plant has been in operation continuously since commissioning. No major equipment has been replaced or exchanged since commissioning.

The downtime details, based on the performance report from 01/10/2009 - 31/05/2012 are as follows:

Month	Unit # 1				Unit # 2				Unit # 3			
	Planned outage	Forced outage	Miscellaneous outage	Total Outage	Planned outage	Forced outage	Miscellaneous outage	Total Outage	Planned outage	Forced outage	Miscellaneous outage	Total Outage
	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr	Hr
Oct-09	29.65	13.40	39.53	82.58	31.70	0.00	182.30	182.30	33.12	0.00	260.47	293.58
Nov-09	24.00	0.00	413.45	437.45	0.00	0.00	435.40	435.40	0.00	0.00	400.02	400.02
Dec-09	449.28	0.00	165.50	614.78	0.00	0.00	495.90	495.90	264.00	0.00	274.07	538.07
Jan-10	0.00	0.00	489.20	489.20	418.53	0.00	243.00	661.53	133.03	0.00	456.10	589.13
Feb-10	0.00	0.00	545.98	545.98	0.00	0.00	543.78	543.78	0.00	0.00	552.18	552.18
Mar-10	0.00	0.00	459.72	459.72	0.00	0.00	539.90	539.90	0.00	0.00	513.15	513.15
Apr-10	0.00	2.43	264.83	267.27	0.00	441.95	195.70	637.65	0.00	0.00	254.27	254.27
May-10	37.18	0.00	91.83	129.02	24.08	283.03	44.57	351.68	37.57	0.00	113.12	150.68
Jun-10	73.92	0.40	0.00	74.32	62.22	0.00	1.85	64.07	78.68	1.22	17.40	97.30
Jul-10	44.48	0.00	5.60	50.08	55.67	0.00	10.38	66.05	56.52	0.32	0.00	56.83
Aug-10	32.15	2.22	0.00	34.37	44.68	13.63	0.00	58.32	33.82	23.28	0.00	57.10
Sep-10	38.77	0.00	0.00	38.77	39.78	0.00	0.00	39.78	26.68	0.00	2.57	29.25
Oct-10	16.38	0.00	262.62	279.00	17.43	0.00	89.98	107.42	18.45	0.00	7.70	26.15
Nov-10	0.00	0.00	515.13	515.13	0.00	0.00	523.92	523.92	0.00	0.00	108.47	108.47
Dec-10	0.00	0.00	411.88	411.88	0.00	0.00	565.18	565.18	359.98	0.75	304.63	665.37
Jan-11	0.00	1.17	473.07	474.23	336.00	1.15	340.97	678.12	327.88	0.00	282.40	610.28
Feb-11	194.98	3.58	359.55	558.12	69.12	0.00	436.87	505.98	0.00	0.00	522.97	522.97
Mar-11	162.38	0.00	392.65	555.03	88.92	0.00	464.17	553.08	74.93	50.22	479.00	604.15
Apr-11	0.00	0.00	286.77	286.77	0.00	0.00	326.67	326.67	0.00	665.22	23.32	688.53
May-11	0.00	0.00	134.55	134.55	0.00	0.00	91.43	91.43	0.00	329.88	22.80	352.68
Jun-11	42.35	4.55	78.72	125.62	42.02	2.02	66.67	110.70	41.53	0.00	48.73	90.27
Jul-11	40.35	0.00	0.00	40.35	40.80	0.00	0.00	40.80	41.08	1.78	0.00	42.87
Aug-11	14.65	0.00	0.00	14.65	14.42	0.00	0.00	14.42	14.20	0.00	0.00	14.20

Sep-11	156.33	8.08	18.10	182.52	155.22	6.55	17.92	179.68	154.75	37.50	17.65	209.90
Oct-11	33.17	0.00	120.20	153.37	33.45	0.00	176.85	210.30	33.60	0.00	227.72	261.32
Nov-11	0.00	0.00	264.13	264.13	0.00	0.00	412.73	412.73	0.00	0.00	520.82	520.82
Dec-11	0.00	0.00	442.25	442.25	48.00	0.00	492.97	540.97	48.00	0.00	551.17	599.17
Jan-12	20.95	0.52	394.18	415.65	180.17	0.00	404.33	584.50	521.72	6.20	175.00	181.20
Feb-12	284.08	0.00	359.38	643.47	69.17	0.00	443.38	512.55	140.40	0.00	368.65	509.05
Mar-12	96.00	0.00	396.78	492.78	90.85	0.00	357.02	447.87	90.37	0.00	494.82	585.18
Apr-12	17.48	2.52	223.53	243.53	18.63	13.28	145.77	177.68	17.73	2.03	446.90	466.67
May-12	14.17	2.82	156.43	173.42	7.62	3.15	2.67	13.43	0.00	373.40	236.05	609.45
Total	1,822.7 2	41.68	7,765.58	9,629.9 8	1,888.47	764.77	8,052.27	10,673.80	2,548.0 5	1,491.8 0	7,682.1 2	11,200.25

There are no changes that have happened in project activity which may impact the applicability of the methodology.

2.2 Deviations from the Monitoring Plan

There is no deviation from the monitoring plan in the project description.

2.3 Grouped Project

This is not a grouped project and hence not applicable.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO ₂ /MWh
Description:	Fixed ex-ante combined margin emission factor of NEWNE grid
Source of data:	CO ₂ Baseline Database published by CEA
Value applied:	0.803
Purpose of the data:	Data are used for Baseline emission Calculation
Any comment:	-

3.2 Data and Parameters Monitored

Data / Parameter:	EG_{PJ, y}
Data unit:	MWh
Description:	Net Electricity supplied to the grid by the project activity during the year y
Source of data:	Joint Meter Reading (JMR)/ Monthly Special Energy Meter statement (SEM) from the energy meters/ monthly Regional energy account statements
Frequency of monitoring/recording:	Monitoring: continuous Recording: monthly
Value monitored:	6,329,820.783 (cumulative value for the complete monitoring period)

Monitoring equipment:	Refer annex-1
QA/QC procedures to be applied:	The main meters and the check meters are maintained and will be calibrated at least once in three years. ²
Calculation method:	The SEM meters measures the net electricity delivered to the grid³ The monthly SEM statement (issued by Eastern region load dispatch center – ERLDC) and monthly Regional energy account statements (issued by Eastern regional power committee – ERPC) forms the basis for calculation of the emission reductions. The lower of the electricity generation values out of the two statements is considered for emission reductions for the respective months. This is a conservative approach.
Any comment:	-

3.3 Description of the Monitoring Plan

NHPC adopts the following structure for data monitoring, collection, data archiving and calibration of equipments for this project activity.

Data to be reported –

- Net Electricity Exported in MWh
- Periodical calibrations of monitoring equipments.

Origin of data and monitoring including estimation approach- The basis of the net electricity exported will be the Joint Meter Readings/ monthly statements which are taken in the presence of Electricity Board personnel and a representative of the proponent every month.

Monitoring times and periods - The data will be monitored on a continuous basis but will be recorded on a monthly basis with the energy meters installed at the site.

Data Accuracy - The meters recording the electricity exported will be calibrated at least once 3 years.

Calibration of meters: As per clause 4.0, Metering Arrangement of the Power Purchase Agreement (PPA) the metering arrangement including its installation, testing, maintenance and collection transportation and processing of data required for energy exchange shall be governed

² http://cdm.unfccc.int/EB/035/eb35_repan35.pdf , Page 3

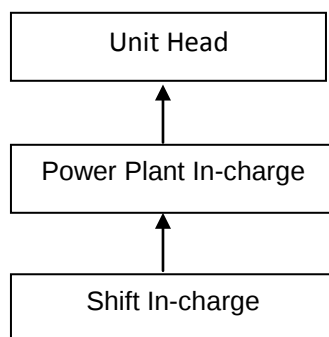
³ http://www.erlhc.org/Commercial-ER/User_Manual_of_SEMs_in_ER.pdf

as per the notification/ directives issued/or to be issued by Central Electricity Regulatory Commission and as per relevant provisions contained in IEGC as amended from time to time. The Central Electricity Authority (CEA) notification regarding Installation and Operation of meters regulations, 2006, says that meters are required to be tested once in 5 years (refer clause 18 of the guideline)⁴ The registered PD defines a 3 year calibration regime, which is more conservative, thus this calibration regimen is followed by this project activity.

Monitoring roles and responsibilities: A project team is constituted for the monitoring of the project. This team is responsible for data collection and archiving. The team meets periodically to review the data collected. In case of any irregularity observed by any of the team members, it is informed to the concerned person for necessary actions to be taken. The following is the team structure for project monitoring:

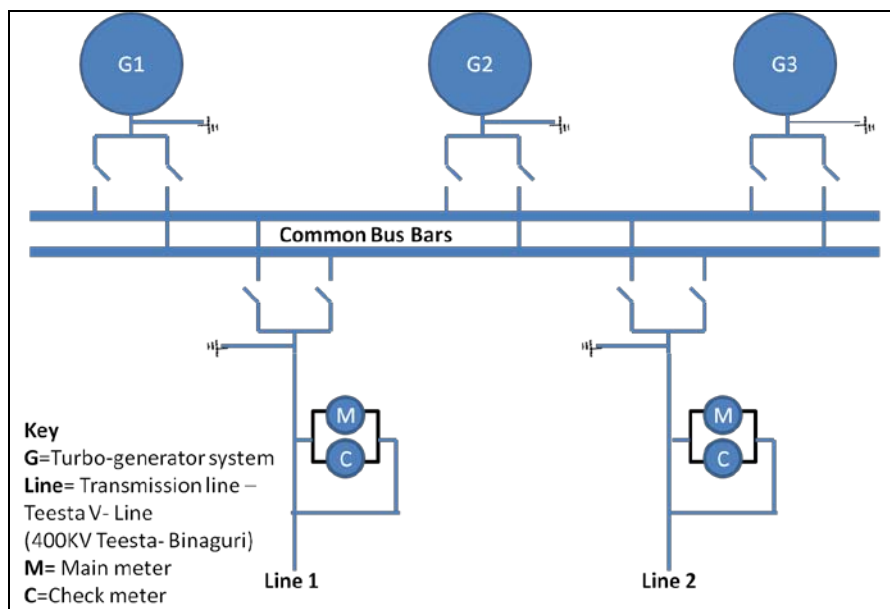
- Unit Head: Overall responsibility of compliance with the monitoring plan.
- Power Plant In-charge: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation.
- Shift In-charge: Responsibility of daily report generation from the SCADA system/ log-books

Managing Data Quality: The Power plant In-charge would prepare the report pertaining to the recorded values of the monitored parameters as by the shift-in-charge. The day to day records would be verified by Unit Head, compiled and documented. The company will introduce a safe storage of data. NHPC is an ISO – 9000, and ISO – 14000 certified company having an integrated management system. It will ensure also requirements are met for the project also.



⁴ CEA metering regulation clause 18 on page 12 of the regulation, The regulation is available on http://www.powermin.nic.in/whats_new/pdf/Metering_Regulations.pdf.

Line diagrams showing all relevant monitoring points:



Training:

Need based training sessions are being organized for the staff and training details are being recorded and made available in document.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions due to displacement of grid electricity (BE_y) are the product of the baseline emission factor (EF_y) times the electricity supplied by the project activity to the grid (EG_y), over the monitoring period.

Sample calculation for Calculating baseline emissions for the complete monitoring period:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

$$= 6,329,820.783 \text{ MWh} \cdot 0.803 \text{ tCO}_2/\text{MWh}$$

$$= 5,082,827 \text{ tCO}_2$$

Where, Grid Emission Factor = 0.803 tCO₂/MWh (as per the registered PD)

Baseline emissions for the current monitoring period:

Month	Net Electricity supplied to the grid by the project activity during the year y (EG _{PJ,y})	EF _{grid,CM,y}	Baseline Emissions ⁵ (BE _y)
	MWh	tCO ₂ /MWh	tCO ₂ e
Oct-09	263,311.0	0.803	211,438
Nov-09	142,412.6	0.803	114,357
Dec-09	94,909.3	0.803	76,212
Jan-10	75,720.9	0.803	60,803
Feb-10	58,768.4	0.803	47,191
Mar-10	118,303.6	0.803	94,997
Apr-10	155,313.6	0.803	124,716
May-10	267,058.6	0.803	214,448
Jun-10	320,301.1	0.803	257,201
Jul-10	344,824.3	0.803	276,893
Aug-10	350,150.5	0.803	281,170
Sep-10	344,255.2	0.803	276,436
Oct-10	304,524.3	0.803	244,533
Nov-10	167,562.9	0.803	134,553
Dec-10	100,297.1	0.803	80,538
Jan-11	77,554.1	0.803	62,275
Feb-11	69,739.6	0.803	56,000
Mar-11	85,076.3	0.803	68,316
Apr-11	142,588.9	0.803	114,498
May-11	273,982.3	0.803	220,007
Jun-11	308,090.2	0.803	247,396
Jul-11	354,901.5	0.803	284,985

⁵ Baseline emissions are rounded down for each month.

Aug-11	367,610.2	0.803	295,190
Sep-11	265,515.0	0.803	213,208
Oct-11	269,741.5	0.803	216,602
Nov-11	160,666.0	0.803	129,014
Dec-11	105,755.9	0.803	84,921
Jan-12	86,752.3	0.803	69,662
Feb-12	86,356.6	0.803	69,344
Mar-12	116,770.1	0.803	93,766
Apr-12	210,307.4	0.803	168,876
May-12	240,699.4	0.803	193,281
Total	6,329,820.783		5,082,827

4.2 Project Emissions

The project emission calculation as per the methodology includes the CH₄ emission from the reservoir. However since the project activity does not involve the installation of a new reservoir, it does not result in any project emissions.

Thus, $PE_y = 0$.

4.3 Leakage

As specified in ACM0002, The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects – see applicability conditions above).

Hence project participants do not need to consider leakage in applying this methodology.

Thus $L_y = 0$

4.4 Summary of GHG Emission Reductions and Removals

$$ER_y = BE_y - PE_y - L_y$$

Month	Baseline Emissions (BE _y)	Project Emission (PE _y)	Leakage Emission (L _y)	Emission Reductions (ER _y)
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
Oct-09	211,438	0.00	0.00	211,438
Nov-09	114,357	0.00	0.00	114,357
Dec-09	76,212	0.00	0.00	76,212
Jan-10	60,803	0.00	0.00	60,803
Feb-10	47,191	0.00	0.00	47,191
Mar-10	94,997	0.00	0.00	94,997
Apr-10	12,4716	0.00	0.00	124,716
May-10	214,448	0.00	0.00	214,448
Jun-10	257,201	0.00	0.00	257,201
Jul-10	276,893	0.00	0.00	276,893
Aug-10	281,170	0.00	0.00	281,170
Sep-10	276,436	0.00	0.00	276,436
Oct-10	244,533	0.00	0.00	244,533
Nov-10	134,553	0.00	0.00	134,553
Dec-10	80,538	0.00	0.00	80,538
Jan-11	62,275	0.00	0.00	62,275
Feb-11	56,000	0.00	0.00	56000
Mar-11	68,316	0.00	0.00	68316
Apr-11	114,498	0.00	0.00	114,498

May-11	220,007	0.00	0.00	220,007
Jun-11	247,396	0.00	0.00	247,396
Jul-11	284,985	0.00	0.00	284,985
Aug-11	295,190	0.00	0.00	295,190
Sep-11	213,208	0.00	0.00	213,208
Oct-11	216,602	0.00	0.00	216,602
Nov-11	129,014	0.00	0.00	129,014
Dec-11	84,921	0.00	0.00	84,921
Jan-12	69,662	0.00	0.00	69,662
Feb-12	69,344	0.00	0.00	69,344
Mar-12	93,766	0.00	0.00	93,766
Apr-12	168,876	0.00	0.00	168,876
May-12	193,281	0.00	0.00	193,281
Total	5,082,827	0.00	0.00	5,082,827

Total baseline emissions: 5,082,827 tCO₂e

Total project emissions: 0 tCO₂e

Total leakage: 0 tCO₂e

Total emission reductions: 5,082,827 – 0 – 0 = 5,082,827 tCO₂e

Year wise breakup of VERs:

Year	VERs
2009	402,007
2010	2,093,479
2011	1,992,412
2012	594,929
Total	5,082,827

5 ADDITIONAL INFORMATION

Not applicable.

Annex-1

Meter number	Type	Accuracy Class	Make of meter	Calibration frequency	Location	Calibration dates ⁶
NP-5896-A	ER300P	0.2S	L & T	Once in three years	Teesta V - Line 1 (400 KV Teesta – Binaguri) main meter,	13/12/2010 12/10/2006
NP-5895-A	ER300P	0.2S	L & T	Once in three years	Teesta V - Line 1 (400 KV Teesta – Binaguri) check meter,	13/12/2010 12/10/2006
NP-5898-A	ER300P	0.2S	L & T	Once in three years	Teesta V - Line 2 (400 KV Teesta – Binaguri) main meter	13/12/2010 12/10/2006
NP-5897-A	ER300P	0.2S	L & T	Once in three years	Teesta V - Line 2 (400 KV Teesta – Binaguri) check meter	13/12/2010 12/10/2006

⁶ Maximum permissible error of 0.2% has been considered for non calibrating period from October 2009 to December 2010. This is in line with GUIDELINES FOR ASSESSING COMPLIANCE WITH THE CALIBRATION FREQUENCY REQUIREMENTS Annex: 60, EB52.