

Odisha Generation Phase - II Transmission Limited_Indigrid Trust

Technical Due Diligence (OGPTL)

Indigrid Trust
Delhi | INDIA

RESTRICTED

31 December 2018

REPORT
Final

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TECHNICAL DUE DILIGENCE



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Client : «Indigrid Trust»
Project : **Odisha Generation Phase – II Transmission Limited**
Subject : **Submission of DDR**
Comments:

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**765 kV D/C Transmission Line from Raipur Pooling Station to
Jharsuguda Pooling Station (Sundergarh) and 400 kV D/C
Transmission Line from IB Thermal Power Station to
Jharsuguda Pooling Station (Sundergarh)**

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1. EXECUTIVE SUMMARY

Odisha Generation Phase II Transmission Limited (OGPTL) is a Special Purpose Vehicle incorporated for providing grid connectivity for “Common Transmission System for phase – II Generation projects in Odisha and Immediate Evacuation System for OPGC (1320 MW) Projects in Odisha”. Central Electricity Authority, Government of India had notified PFC Consulting Limited (wholly owned subsidiary of PFC Limited) as the Bid Process Coordinator (BPC) for the purpose of selection of bidder as Transmission Service Provider (TSP) for the aforementioned transmission system through tariff based competitive bidding process.

Indigrd Trust (IT) has appointed Tractebel Engineering Pvt. Ltd. (TEPL) as Independent Engineer (IE) to undertake Technical Due Diligence study for the above mentioned 400 kV and 765 kV Transmission System Project.

The Project involves construction of the following transmission lines.

Name of the Transmission Element	Completion Target	Conductor per phase
765 kV D/C Transmission Line from 765/400 kV Substation at Jharsuguda (Sundergarh) – 765/400 kV Raipur Pooling Station (304.95 Kms as per check survey)	40 months from effective date (i.e. 8 th August, 2019)	Hexa Zebra ACSR Conductor or equivalent AAAC. The transmission lines to be designed for a maximum operating conductor temperature of 85°C for both ACSR as well AAAC.
400 kV Transmission Line from IB Thermal Power Station (OPGC) 400 kV substation – 765/400 kV D/C Jharsuguda Substation (51.35 Kms as per check survey)	July, 2017	Triple Snowbird ACSR Conductor or equivalent AAAC. The transmission lines to be designed for a maximum operating conductor temperature of 85°C for both ACSR as well AAAC.

As per TSA the effective date is 8th April, 2016 i.e. the date of signing of Share Purchase Agreement.

The project has been awarded under tariff – based competitive bidding process wherein annual tariffs have been quoted for the next 35 years. OGPTL, the TSP has entered into Transmission Service Agreements (“TSA”) with the Long Term Transmission Customers (LTTCS) on 20th November, 2015. TSA has been signed with seven LTTCS.

The contracts of Engineering, Supply, Erection and Civil Works have been executed separately between Odisha Generation Phase II Transmission Limited (Owner) and Sterlite Power Grid Ventures Limited (Contractor) on 11th April, 2016. The scope of work includes:

- i. Laying of 765 kV D/C Hexa Zebra Conductor Transmission Line from 765/400 kV Raipur Pooling Station at Bhilai to 765/400 kV Jharsuguda Station (Sundergarh). (approximately 304 km)

- ii. Laying of 400 kV D/C Triple Snowbird Conductor Transmission Line from OPGC (IB Thermal Power Station) to 765/400 kV Jharsuguda Pool Station. (approximately 51.96 km)

The effective date of the contract was 08.01.2016. The “Completion Date” for 400 kV D/C Transmission Line is 30th June, 2017 and 765 kV D/C Transmission Line is 6th June, 2019. The EPC SCOD is 3 months prior to the TSA and CERC order schedule COD, accommodating a sufficient cushion for any un – anticipated interruptions.

Back to back contract for the EPC works for both, the 400 kV D/C and 765 kV D/C Lines, was placed to M/s. L&T ECC.

The construction works for 400 kV D/C Transmission Line from IB Thermal Power plant to Jharsuguda Pooling Station, of line length 51.35 kms, is physically complete. CEA had conducted the site inspection on 25th July, 2017 and accorded the energization letter vide letter dated 23rd August, 2017. The POSOCO letter dated 4th January, 2018, states that 400 kV D/C Ckt – I & Ckt – II from IB (OPGC) to Jharsuguda, has successfully completed the 24 hours trial – run test on 20th December, 2017. IE observes that the SCOD as per TSA for 400 kV D/C line was on July, 2017, however due to delay in completion of 400 kV Bays at PGCIL 765/400 kV Pooling Station at Jharsuguda, under the purview of PGCIL, the line got charged during December, 2017.

The construction for 765kV D/C Transmission progress of various activities as on 14th November 2018 is given in the table below.

Activity	Total Target	Cumulative Progress till 14.11.2018		Balance
		Plan (L2)	Actual	
Total Foundation (No)	782	782	782	-
Tower Erection (No.)	782	782	782	-
Final Stringing (km)	304.95	304.95	304.95	-

The construction works are 100% physical complete for both lines as on 14th November 2018.

Project Company has received all the pre – requisite Permits and Clearances like Approval under Section 68, 164 and Section 63 of EA Act, 2003, Transmission License, Stage – 1 Forest Clearance for Odisha and Chhattisgarh section, PTCC, Civil Aviation, Defence and Crossings for successful commissioning and operation of 400 kV D/C & 765 kV D/C Transmission Lines.

The O&M Contract for both 400 kV D/C and 765 kV D/C Line is awarded to M/s. JBS Enterprise Private Limited. The O&M works for 400 kV Line started from 10th March, 2017, while the works for 765 kV Line shall start after the commissioning of the same.

As per the specification provided by the Project Company, the Transmission lines and Towers have been designed, installed and tested in accordance with International Standards and Indians Standards. The design has also met statutory requirements such as the Indian Electricity Rules, Indian Factory Act and Indian Electricity Grid Code etc. IE is of the opinion that the final design and specifications of equipment/ systems installed in the Transmission Line are in line with the technical specification and the drawings & documents reviewed and approved by the Project Company and Owner's Engineer.

All the transmission line assets are designed as per IS:802 Part 1 & 2 with a reliability factor of 1.0 which ensures the reliability period of the transmission line for 50 years and for the Substation Equipment for 35 years. As per the TSA, the Term of Applicability of the TSA is 35 years from the Schedule COD of the Project. Hence, IE confirms that the Transmission Assets are technically designed and are reliable as per the TSA.

The life extension of the asset beyond 35 years can be assessed based on the Residual Life Assessment (RLA) results, Load Studies and the Technological advancements after 35 years of Project Operation. Maintenance records like checklist for patrolling (Civil & Electrical works), monthly patrolling program, monthly patrolling actual log – book of line defects, Emergency patrolling report of tripping, monthly project progress etc records are being regularly maintained and monitored.

The actual availability has been considered at 99.25% against a target availability of 98%. IE is of the view that 99.25% availability is achievable with proper maintenance planning. IE is of the view that O&M expense is reasonable considering Sterlite experience in maintaining multiple Transmission lines.

2. INTRODUCTION

2.1. Background

Odisha Generation Phase II Transmission Limited (OGPTL) is a Special Purpose Vehicle incorporated for providing grid connectivity for “Common Transmission System for phase – II Generation projects in Odisha and Immediate Evacuation System for OPGC (1320 MW) Projects in Odisha”. Central Electricity Authority, Government of India had notified PFC Consulting Limited (wholly owned subsidiary of PFC Limited) as the Bid Process Coordinator (BPC) for the purpose of selection of bidder as Transmission Service Provider (TSP) for the aforementioned transmission system through tariff based competitive bidding process.

Indigrd Trust (IT) has appointed Tractebel Engineering Pvt. Ltd. (TEPL) as Independent Engineer (IE) to undertake Technical Due Diligence study for the above mentioned 400 kV and 765 kV Transmission System Project.

2.2. Definition

Project	: 765/400 kV Jharsuguda Substation – 765/400 kV D/C Raipur Pooling Station. Around 304.95 Kms. (referred as “ Bigger Line ”) 400 kV IB (TPS) substation – 765/400 kV Jharsuguda Substation. Around 51.35 kms (referred as “ Smaller Line ”).
SPV	: Odisha Generation Phase – II Transmission Ltd. (OGPTL)
Sponsors	: Indigrd Trust
Lender’s Engineer	: Tractebel Engineering Pvt. Ltd.

2.3. Scope of Service

The scope of services of IE has been detailed as follows:

- Assessment of technical terms of the EPC contract including the Technical requirements/specifications (System parameters)
- Insights on the EPC contractor based on general industry experience and review of warranties and guarantees in the contracts
- Testing and Maintenance Records
- Outage/ tripping records since commissioning
- Construction schedules and if any Penalties levied
- Operation & Maintenance Philosophy and Arrangements
- Review of status all of clearances, permits
- Major ROW issues, Court Cases, pending Insurance claim etc.

2.4. Basis of Report

This Due Diligence Report is prepared by IE based on its assessment of work at site during the site visits, discussions with representatives of the Project Company, Contractors, review of the documents/ information provided by the Project Company.

Following Documents are received from the Project Company:

- EPC Contracts
- Transmission Service Agreement
- Share Purchase Agreement
- Technical Specification
- Route Survey Report
- L 2 schedules
- Tower Schedules
- Project Progress Report
- Updated status of permits and clearances

2.5. Risk Categories

Based on the detailed review of the technical documents/ information provided, the IE proposes to identify in this Report, issues if any and the associated risks for the Project. Accordingly, three Risk Categories have been assigned as indicated in Table 2.1 below:

Table 2.1 – Risk Categories

Risk Category	Risk Category	Risk type
Risk Category –A	Development Risk	Matters which are dependent on external factors/ agencies and can affect the development/ schedule of the Project.
Risk Category –B	Technology Risk	Matters that are related to technical aspects of the Project which can affect performance/ availability significantly.
Risk Category –C	Operational Risk	Matters related to O&M which can lead to poor performance/ lower availability

DISCLAIMER

IE has made no search of any public records nor independently validated the information provided by Project Company with any external source, and save for the reviewed documents listed above, IE has not examined any other documents relating to the matters of the Project Company for the purpose of this Report.

IE's findings is strictly limited to the matters stated herein and is not to be read as extending by implication to any other matter. It is given as on the date of writing this Report solely for the benefit of the Lenders and may not be disclosed to or relied upon by anyone else without IE's prior consent, provided that, this opinion may be disclosed to the auditors or any professional advisors of any of the Addressees or to any regulatory authority (as may be required by such regulatory authority) or otherwise pursuant to a court order or legal process.

3. DESCRIPTION OF PROJECT

3.1. Background

Odisha Generation Phase II Transmission Limited (OGPTL) is a Special Purpose Vehicle incorporated for providing grid connectivity for “Common Transmission System for phase – II Generation projects in Odisha and Immediate Evacuation System for OPGC (1320 MW) Projects in Odisha”. Central Electricity Authority, Government of India had notified PFC Consulting Limited (wholly owned subsidiary of PFC Limited) as the Bid Process Coordinator (BPC) for the purpose of selection of bidder as Transmission Service Provider (TSP) for the aforementioned transmission system through tariff based competitive bidding process.

As per the tariff based bidding process Sterlite Grid 3 Limited was selected as TSP vide Letter of Intent dated 6th January, 2016 to establish the Transmission System as mentioned in the Table below on build, own, operate and maintain basis and to provide transmission services on a long term basis to the Long Term Transmission Customers (LTTCS).

Name of the Transmission Element	Completion Target	Conductor per phase
765 kV D/C Transmission Line from 765/400 kV Substation at Jharsuguda (Sundergarh) – 765/400 kV Raipur Pooling Station (304.95 Kms as per check survey)	40 months from effective date (i.e. 8 th August, 2019)	Hexa Zebra ACSR Conductor or equivalent AAAC. The transmission lines to be designed for a maximum operating conductor temperature of 85°C for both ACSR as well AAAC.
400 kV Transmission Line from IB Thermal Power Station (OPGC) 400 kV substation – 765/400 kV D/C Jharsuguda Substation (51.35 Kms as per check survey)	July, 2017	Triple Snowbird ACSR Conductor or equivalent AAAC. The transmission lines to be designed for a maximum operating conductor temperature of 85°C for both ACSR as well AAAC.

Note:

- Effective date is the date of signing of the Share Purchase Agreement i.e. 8th April, 2016.
- CTU (PGCIL) would provide 2 nos. 765 kV line bays at each Jharsuguda Substation and Raipur Pooling Station for termination of Jharsuguda – Raipur 765 kV D/C Transmission Line.
- CTU (PGCIL) would provide 2 nos. of 400 kV line bays (GIS) at Jharsuguda substation of PGCIL for termination of OPGC – Jharsuguda 400 kV D/C Transmission Line.
- CTU (PGCIL) would provide 2X240 MVar switchable line reactor along with NGR at Jharsuguda (sundergarh) end on Jharsuguda – Raipur Pool 765 kV D/C Line.

- CTU (PGCIL) would provide 2X240 MVar switchable line reactor along with NGR at Raipur Pool end on Jharsuguda – Raipur Pool 765 kV D/C Line.
- 2 nos. 400 kV line bays at OPGC generation switchyard are to be provided by the generation developer (OPGC).

The key details of the project have been shown in below table 3:1:

Table 3.1 – Key details

SCOD	:	August, 2019 as per TSA
Route Length	:	Around 304.95 Kms (765 kV D/C, Bigger Line) (23.26 kms of Forest stretch) Around 51.35 Kms (400 kV D/C, Smaller Line) (7 kms of Forest Stretch)
Transmission Service Agreement tenor	:	35 years from Scheduled COD

3.2. Transmission and Sale of Power

The project has been awarded under tariff – based competitive bidding process wherein annual tariffs have been quoted for the next 35 years. OGPTL, the TSP has entered into Transmission Service Agreements (“TSA”) with the Long Term Transmission Customers (LTTCS) vide Agreement dated 20th November, 2015. TSA has been signed with seven LTTCS.

S. No.	Name of Long – Term Transmission Customers
1.	North Bihar Power Distribution Company Limited
2.	South Bihar Power Distribution Company limited
3.	Jharkhand Bijli Vitran Nigam Limited
4.	Damodar Valley Corporation
5.	GRIDCO Limited
6.	Energy and Power Department, Govt. of Sikkim
7.	West Bengal State Electricity Distribution Company Limited.

3.3. EPC Contract

The contracts of Engineering, Supply, Erection and Civil Works have been executed separately between Odisha Generation Phase II Transmission Limited (Owner) and Sterlite Power Grid Ventures Limited (hereinafter referred as “SPGVL” or “EPC Contractor”) on 11th April, 2016. The scope of work includes:

- Laying of 765 kV D/C Hexa Zebra Conductor Transmission Line from 765/400 kV Raipur Pooling Station at Bhilai to 765/400 kV Jharsuguda Station (Sundergarh). (approximately 304.95 km)

- Laying of 400 kV D/C Triple Snowbird Conductor Transmission Lines from OPGC (IB Thermal Power Station) to 765/400 kV Jharsuguda Pool Station. (approximately 51.35 km)

SPGVL (EPC Contractor) has further subcontracted the Engineering, Procurement and Construction of both the Bigger and Smaller Lines on M/s. Larsen and Toubro Limited (hereinafter referred to as “Sub – Contractor”) vide Letter of Awarded dated 13th January, 2016.

The sub – contracts for Supply, Civil and Erection Works for Bigger Line was separately signed on 23rd June, 2016 respectively. The Project Start date for the sub – contractor was 1st February, 2016 for the Bigger Line and for the smaller line the Supply, Civil and Erection Contracts were separately signed on 11th July, 2016.

3.4. Current Status of the Project

3.4.1. 400 kV D/C Transmission Line from IB Thermal Power Station to Jharsuguda Pooling Station

The construction works for 400 kV D/C Transmission Line from IB Thermal Power plant to Jharsuguda Pooling Station, of line length 51.35 kms, is physically complete. CEA had conducted the site inspection on 25th July, 2017 and accorded the energization letter vide letter dated 23rd August, 2017. The POSOCO letter dated 4th January, 2018, states that 400 kV D/C Ckt – I & Ckt – II from IB (OPGC) to Jharsuguda, has successfully completed the 24 hours trial – run test on 20th December, 2017.

3.4.2. 765 kV D/C Transmission Line from Raipur Pooling Station to 765/400 kV Jharsuguda Pooling Station

The construction progress of various activities as on 14th November, 2018 is given in the table below.

Activity	Total Target	Cumulative Progress till 14.11.2018		Balance
		Plan (L2)	Actual	
Total Foundation (No)	782	782	782	-
Tower Erection (No.)	782	782	782	-
Final Stringing (km)	304.95	304.95	304.95	-

The construction works are 100% physical complete for both lines as on 14th November 2018.

4. EPC CONTRACT

The contracts of Engineering, Supply, Erection and Civil Works have been executed separately between Odisha Generation Phase II Transmission Limited (Owner) and Sterlite Power Grid Ventures Limited (Contractor) on 11th April, 2016. The scope of work includes:

- Laying of 765 kV D/C Hexa Zebra Conductor Transmission Line from 765/400 kV Raipur Pooling Station at Bhilai to 765/400 kV Jharsuguda Station (Sundergarh). (approximately 304.95 km)
- Laying of 400 kV D/C Triple Snowbird Conductor Transmission Lines from OPGC (IB Thermal Power Station) to 765/400 kV Jharsuguda Pool Station. (approximately 51.35 km)

4.1. Supply Contract

The Supply Contract dated 11th April, 2016 has been placed on M/s Sterlite Power Grid Ventures Ltd., Dadar & Nagar Haveli-396230 for Design, Manufacturing, Procurement and Supply of all the equipment/materials for the above facilities under Odisha Generation Phase II Transmission Limited (OGPTL) Project.

4.1.1. Scope of Work

The scope of work is to be carried out by the Contractor pursuant to the terms of this Contract comprises of the complete scope as mentioned in the RFP (Request for Proposal under tender no. OGPTL/EPC/15-16/001), subsequent amendments, clarifications and minutes of meetings, it includes but is not limited to the following:

- Design, Fabrication, proto-assembly, proto – witnessing and supply of all types of 400kV D/C and 765 kV D/C transmission line towers, including river crossing towers (wherever applicable) including fasteners, step bolts, hangers, D – shackles etc., as per Owner's design/ drawings.
- Mandatory Spares as specified in the tender documents and its subsequent amendments and clarifications
- Supply of all types of tower accessories like phase plate, circuit plate (where ever applicable), number plate, danger plate, anti – climbing device, Bird guard (where ever applicable).
- Supply of Insulators, Insulator Hardware's for the 400kV D/C and 765 kV D/C transmission line.
- Supply of Zinc rich primer and enamel paint.
- Supply of Earth wire & Earth wire Accessories, ACSR Conductor (Zebra and Snowbird) & Conductor accessories, OPGW & OPGW Accessories and Spacer Damper for 400kV D/C and 765 kV D/C transmission line.
- Project Insurance as indicated in the GCC and subsequent amendments to the tender documents. (Transit Insurance for the Contractor's supplied items of the complete Project will be in the scope of Contractor).

- All other misc. items not specifically mentioned in the Specifications but are required for the successful commissioning of the transmission line, unless specifically excluded in the Contract required for completion of job, shall be deemed to be included in the Contract Value and in the scope of the Contractor.

IE noted that the scope of Supply covered in the contract is found to be in order and fulfils requirement of the scheme as per RFP.

4.1.2. Responsibility for Completeness

Any scope of supplies (including the above scope of works) which has not been specifically mentioned but is required, in the opinion of the Owner under the purview of the Contract, for the completion of the work and/or for safe, trouble free, normal operation shall be supplied by the Contractor at no extra cost or time to the Owner, unless expressly excluded in the supply Contract. Such work shall not be cause for delay or reason to seek extension of time from the Owner.

Any approval by the Owner at any stage for any works by sub – Contractors appointed by the Contractor or their representative/employees/agents shall not relieve the Contractor of its obligations under the Supply Contract. In case of sub –contracting, the Contractor shall continue to be liable for all the compliances under the Contract and shall be Single Point of Contact (SPOC) to the Owner on behalf on any sub - Contractor(s) which Contractor engages.

The performance of the sub – supplier/sub-Contractors of the Contractor or their representative/employees/agents shall not relieve the Contractor of its obligations under the Contract.

IE noted that the responsibility for completeness of the scope of work covered in the contract will benefit the Owner towards the smooth completion of the Project.

4.1.3. Effective Date of Contract

The effective date of the contract is 08.01.2016.

The period from the Effective date to the Operational Acceptance and handing over of the Facilities shall be referred as the “Contract Period”.

The “Operational Acceptance” shall be considered after 1 month from COD.

The “Completion Date” for 400 kV D/C Transmission Line is 30th June, 2017 and 765 kV D/C Transmission Line is 6th June, 2019.

IE found that the schedules are well within the schedules of TSA and CERC order.

4.1.4. Guarantees

The Advance Guarantee ("AG") shall initially be kept valid up to Completion Period of the complete transmission line. The validity of the AG shall be extended by the Contractor from time to time till the actual date of Completion of the Facility in accordance with the Contract.

Project Company informed that advance payment Guarantee for defect liability period is considered in the form Corporate Guarantee.

The Performance Guarantee ("PG") shall be for a sum equivalent to 10% of the Contract Value and shall be submitted in two parts: (a) During the execution of Contract till Operational Acceptance. (b) During the Defect Liability period.

Project Company informed that Performance Guarantee for defect liability period is considered in the form Corporate Guarantee.

The Performance Guarantee for the performance of Contract during execution shall be valid up to Operational Acceptance date under this contract. This Guarantee shall be returned on submission of PG for the Defect Liability Period of Twenty Four (24) months.

IE is of the view that Defect Liability Period of Twenty Four (24) months is as per Industry practice.

The Contractor understands and accepts that the submission of the Guarantees are the integral part of the Contract and any delay on this account will lead to the breach of the Contract and would expose Contractor to other actions available under this Contract and in law.

4.1.5. Contractors' Covenant to Supplies for 765 kV and 400 kV D/C Transmission Line

In consideration of the payments to be made by the Owner to the Contractor as provided in the Agreement, the Contractor covenants with the Owner to supply the equipment/ materials in conformity in all respects.

Contractors Covenant to design assemble and witness the proto of each tower.

The contractor hereby represents and undertakes to indemnify the Owner for any loss such as theft, transit loss, excess utilization loss (optimum use) for which the Owner have made the payments on behalf of the Contractor.

For Tower Design for Manufacturing & supply of towers, the Contractor shall provide structural drawings, shop drawings & Bill of materials of all type of transmission line towers and its extension, river crossing towers/ special towers.

4.1.6. Liquidated Damages

Time being the essence of the Contract, in the event the completion schedule (set out in the contract are not met, Owner shall be entitled to levy liquidated damages on the Contractor as mentioned in the subsequent articles:

If the Contractor fails to achieve the following due to reasons attributable to him:

Overall Completion of work on the completion date as defined in the contract, the Contractor shall pay to Owner a sum calculated @1% of the Contract Value for each week of delay or part thereof subject to a maximum of 10% of the Contract Value as liquidated damages for such default and not as penalty, without prejudice to the Owner's other remedies available under this Contract.

4.1.7. Insurance

The perils required to be covered under the transit insurance shall be as mentioned in clause 30 of GCC and shall include but not be limited to cover for fire and allied risks, miscellaneous accidents, loss or damage in transit, theft, pilferage, riot and strikes and malicious damages, civil commotion, weather conditions, accidents of all kinds etc. The scope of such insurance shall be adequate to cover the replacement/reinstatement cost of the equipment for all risks up to and including delivery of goods and other costs till the equipment is delivered at Site.

The insurance policies to be taken should be on 110% of the Contract Value plus value of Owner Supplied Material and incorporating 40% escalation clause. Notwithstanding the extent of insurance cover and the amount of claim available from the underwriters, the Contractor shall be liable to make good the full replacement/rectification value of all equipment/materials and to ensure their availability as per project requirements. Without limiting any of his obligations under the Contract, the Contractor, at its cost, shall arrange, secure and maintain all insurance as may be pertinent to the Facility and obligatory in terms of law to protect its interest and interests of the Owner against all perils detailed herein, within Thirty (30) days after the start of the work.

4.1.8. Defect Liability

The Contractor shall be liable to remedy or compensate the Owner for the remedy of any defect, imperfection, deficiency, shortcoming or any other fault in the Items or the material(s) or in the execution of the works or a breach of any obligations under the scope of work of this contract (collectively called "Defects") in accordance with this clause.

The Defects Liability Period for Element shall be twenty four (24) months from the date of Taking Over of such Element.

If during the Defects Liability Period any Defect is found, the Contractor shall promptly, in consultation and agreement with the Owner regarding appropriate remedy of the Defects and at the cost of the Contractor, repair, replace or otherwise make good such Defect as well as any damage to the Element caused by such Defect and losses suffered by the Owner thereby and shall ensure that the Element is in accordance with the requirements of this Contract.

The Owner shall give the Contractor a notice stating the nature of any such Defect together with all available evidence thereof, promptly following the discovery thereof. The Owner shall afford all reasonable opportunity for the Contractor to inspect any such Defect.

If the repair, replacement or making good is of such a character that it may affect the efficiency of any Element, the Owner may give to the Contractor a notice requiring to tests the defective part of such Element and the same shall be made by the Contractor, whereupon the Contractor shall carry out such tests at its own risk and cost.

If such defective part fails the tests, the Contractor shall remedy the Defect or carry out such replacement or make good (as the case may be) until that part of the material(s) passes such tests.

4.1.9. Contractor's Responsibilities

It is understood that the Contractor has duly inspected the location of supplies, its surroundings and has satisfied themselves as to all technical, commercial and general condition affecting the work and materials necessary for carrying out the Works, the means of communication, and in general all risks and contingencies influencing or affecting the Scope of Work. The Contractor shall not be entitled to any extension of the Completion Schedule or to any adjustment of the Contract Value on grounds of misinterpretation or misunderstanding under this clause and the Agreement.

For all technical clarifications, the Contractor shall report to Owner's Project Manager. All works under this Contract shall be carried out under his instructions.

The Contractor shall prepare a Quality Assurance Plan and get approval by the Owner, which will form the basis for stage wise inspections and final inspections and preparation of respective protocols. Notwithstanding the aforesaid, at any stage of execution, Owner shall be free to inspect the quality of material supplied and can ask the necessary modification if the Owner is of the opinion that the current work does not meet the quality standards.

The Contractor shall submit detailed activity-wise bar chart for approval of Owner. The Contractor shall also submit monthly progress report and other documents as required from time to time by the Owner.

4.1.10. Latent Defects

At the end of the Defects Liability Period, the Contractor's liability in respect of Defects ceases except for Latent Defects. The Contractor's liability for Latent Defects shall be applicable during the Latent Defects Liability Period, which shall be for a period often (10) years from the expiry of the Defects Liability Period and the terms shall be as per the GCC.

4.1.11. Contractor's/ Owner's representation and warranties

The Contractor hereby warrants to the Owner that the Scope of Work will be carried out uninterrupted without any delay and that it shall otherwise perform its obligations under this Contract as per the terms of GCC in this regard.

The Owner hereby warrants to the Contractor that it shall meet its obligations, commitments under this Contract as per the terms of the GCC in this regard and be responsible for its scope of work.

4.2. Erection Contract

The Erection Contract dated 11th April, 2016 has been placed on M/s Sterlite Power Grid Ventures Ltd., vide contract No. OGPTL/2016-17/ERE/001

The Erection Contract is for construction of 765 kV D/C Transmission Line from 765/400 kV Raipur Pooling station to 765/400 kV D/C Jharsuguda Pooling Station and 400 kV D/C Transmission lines from OPGC (IB Thermal Power Station) to 765/400 kV D/C Jharsuguda Pooling Station.

4.2.1. Scope of Work

The scope of work to be carried out by the Contractor pursuant to the terms of this Contract comprises of the complete scope of services as mentioned in the RFP (Request for Proposal under tender no OGPTL/EPC/15-16/001), subsequent amendments, clarifications and minutes of meetings occurred between the parties for the project which forms an integral part of this Contract. It includes but is not limited:

- ✓ Erection works and necessary site preparation including mobilization, right of way, forest clearance if any, and provision of all Labour, materials, consumables, tools and plants as required for the Erection Works of transmission lines of the size and scope of the Project, other construction services and management for the Project and the remedy of defects within agreed Defect Liability Period. The detailed scope of the Works shall be as per the Technical Specifications of the Owner, and subsequent amendments, which forms integral part of this Contract.
- ✓ The Contractor has carefully studied the technical parameters of the equipments/ materials to be erected under this Contract and agrees that the service rendered by it shall be fit for the said purpose.
- ✓ The Contractor shall also be responsible for stringing and associated works for the 765 kV D/C Transmission Line from 765/400 kV Raipur Pooling station to 765/400 kV D/C Jharsuguda Pooling Station and 400 kV D/C Transmission lines from OPGC (IB Thermal Power Station) to 765/400 kV D/C Jharsuguda Pooling Station .
- ✓ All statutory approvals related to PTCC, Road, Railway, Civil aviation, river, shut down, electrical inspectorate and any other agency, Land Acquisition, ROW clearance and related issues including crop/tree compensation payment/clearance etc. is in Contractor's scope. Any approvals from RLDC/CTU/LTCC/SLDC shall be in the scope of the Contractor including all related documentation and paperwork for the same.
- ✓ Project Insurance as indicated in the GCC and subsequent amendments to the tender document (OGPTL/EPC/15-16/001). (EAR insurance of the complete Project will be in the scope of Contractor).
- ✓ EHV Crossings:
 - Arranging the Shutdown activities for crossings of the EHV/ HVDC/ HV/LT etc. from the state utilities, PGCIL, private transmission lines, RLDC shall be in the scope of the Contractor. Including all paperwork.
 - Compensation for loss of revenues during the shutdown period for working on EHV crossings demanded by the utilities/PGCIL/ private transmission line owner shall be borne by the Contractor.
 - The Contractor shall ensure compliance with all the relevant acts, laws, rules, regulations, guidelines at its own cost and expenses and furnish all certificates in support of the compliance done for further submission with the concerned authorities.
- ✓ Apart from the activities listed above, the Contractor shall also undertake the following activities within the Forest:
 - Contractor shall undertake the work of tree cutting, its transportation etc. and liaising for the construction of foundations, erection & stringing. The deforestation charges to be paid to the forest authorities for the construction of line through the forest shall be in Owner's scope.

- Complete Detail Survey, Check Survey, erection & stringing in forest area is in the scope of the Contractor.
- Expediting & assistance in preparation of Application case for the forest shall be in the scope of Contractor. Any liaising work for forest application is included in Contractor's scope
- ✓ Detail Survey and Check Survey of the route.
- ✓ Terminating the transmission lines at the respective substation gantries.
- ✓ Testing and commissioning of the erected transmission.
- ✓ The Contractor shall submit to the Owner all complete as built drawings, O&M manuals, detailed tower profile etc. before Operational Acceptance.
- ✓ All other misc. items not specifically mentioned in the Specifications and/or BOQ but are required for the successful commissioning of the transmission line, unless specifically excluded in the Specifications required for completion of job, shall deemed to be included in the contract Value and in the scope of the Contractor.
- ✓ The Contractor shall be responsible for the complete integration of material supplied for the project. (Owner's and Contractor's supplied) and its installation/erection at site.

IE observed that the scope of work covered in the Contract is in order.

4.2.2. Responsibility for Completeness

Any scope of work/services (including the scope of works as mentioned in this contract) ("Works") which has not been specifically mentioned but is required, in the opinion of the Owner under the purview of this Contract, for the completion of the work/services and/or for safe, trouble free, normal operation shall be rendered at no extra cost or time to the Owner, unless expressly excluded in this Contract. Such work shall not be cause for delay or reason to seek extension of time from the Owner.

Any approval by the Owner at any stage for any works by sub – Contractors appointed by the Contractor or their representative/employees/agents shall not relieve the Contractor of its obligations under this Contract. In case of sub contracting, the Contractor shall continue to be liable for all the compliances under this Contract and shall be Single Point of Contact (SPOC) to the Owner on behalf on any sub Contractor (s) which Contractor engages.

The performance of the Sub-Contractors of the Contractor or their representative/employees/agents shall not relieve the Contractor of its obligations under the Contract.

4.2.3. Contractor's Covenant to Erection Works for 400 kV and 765 kV D/C Transmission Lines

In consideration of the payments to be made by the Owner to the Contractor as provided in the Agreement, the Contractor covenants with the Owner to complete the Works in conformity in all respects with the provision of the Contract.

Contractor shall submit to the Owner on quarterly basis, documents pertaining to statutory compliances viz. ESI, EPF etc., without any failure.

Contractor shall submit to the Owner on quarterly basis cash-flow statement, stock statement pertaining to work progress in the specific quarter along with progress report of the Project.

Preparation of the forest application for the forest approval shall be in the Contractor's scope.

Approval from RLDC/CTU/LTTC/SLDC in the scope of Contractor, also all related documentation and paper work for the same shall be done by the Contractor.

Arranging the Shutdown activities for crossings of the EHV/ HVDC/ HV /LT etc. from the state utilities, PGCIL, private transmission lines, RLDC shall be in the scope of the Contractor.

Compensation for loss of revenues during the shutdown period for working on EHV crossings demanded by the utilities/PGCIL/ private transmission line Owner shall be borne by the Contractor.

ROW resolution and Crop/Tree Compensation shall be in the scope of Contractor. Contractor shall depute their best team for obtaining and resolving ROW Clearances & Other issues /Tree/Crop compensation. Contractor's team shall ensure that there is no time and cost escalation in the project on account of this activity. Contractor shall speedily resolve all ROW issues. ROW resolution and Crop/Tree Compensation shall be reimbursed plus facilitation charge by the Owner on submission of documents.

4.2.4. Effective date and Completion Schedule

The Effective Date of Erection Contract is 08/01/2016. ("Effective Date").

The period from the Effective Date to the Operational Acceptance and handing over of the Facilities shall be referred to as the "Contract Period" herein. The "Operational Acceptance" (As mentioned in GCC of RFP) shall be considered after One (1) month from the COD.

The Contractor agrees that time is the essence of this Contract. The Contractor shall ensure that the entire Scope of Work shall be completed by 30th June, 2017 for 400 kV D/C Line and 6th June, 2019 for 765 kV D/C Transmission Line, which shall also be referred to as "Completion Date". The period from the Effective Date of the Contract to the Completion Date shall be referred as "Completion Period".

IE found that the schedules are well within the schedules of TSA and CERC order.

4.2.5. Guarantees

The Advance Guarantee ("AG") shall initially be kept valid up to Completion Period of the complete transmission line. The validity of the AG shall be extended by the Contractor from time to time till the actual date of Completion of the Facility in accordance with the Contract.

Project Company informed that Advance Guarantee is in the form of Corporate Guarantee.

The Performance Guarantee ("PG") shall be for a sum equivalent to Ten Percent (10%) of the Contract Value and shall be submitted in two parts:-

- ✓ During the execution of Contract till Operational Acceptance.
- ✓ During the Defect Liability period.

Project Company informed that Performance Guarantee is in the form of Corporate Guarantee.

The Performance Guarantee for the performance of Contract during execution shall be valid up to Operational Acceptance date under this contract. This Guarantee shall be returned on submission of PG for the Defect Liability Period of Twenty Four (24) months.

4.2.6. Liquidated Damages

Time being the essence of the Contract, in the event the completion schedule as set out in this contract are not met, Owner shall be entitled to levy liquidated damages on the Contractor as mentioned in the subsequent articles.

If the Contractor fails to achieve the following due to reasons attributable to him:

- ✓ Overall Completion of work on the completion date as defined in this contract, the Contractor shall pay to Owner a sum calculated @ 1% (One percent) of the Contract Value for each week of delay or part thereof subject to a maximum of 10% of the Contract Value as liquidated damages ("Liquidated Damages") for such default and not as penalty, without prejudice to the Owner's other remedies available under this Contract.

The Owner may without prejudice to any other method of recovery, deduct the amount of such damages from any amount due or becoming due to the contractor or from any securities / guarantees under this contract. The payment deduction of such damages shall not relieve the Contractor from its obligation to complete the works and remedy the defects in the works or from any other of its obligations and liabilities under the Contract.

IE observes that 400 kV Transmission Line is commissioned and charged while 765 kV line is ready for commissioning, the CEA Electrical Inspector visit is complete, hence no implication of LD.

4.2.7. Site Requirement

Keeping in view of the project time lines and to meet the milestones, the Contractor shall follow the below aspects diligently during the execution of works at site.

Separation of ROW resolution team and work execution team is required to be put in place for making the work front available continuously for smooth execution of the work. The Contractor shall be dealing & liaising with the relevant Govt. authorities/ private entities as and when required for ROW resolution. The Construction Manager shall be enabled suitably with sufficient team and resources. Detailed plan of forming the teams for execution of the things shall be submitted by the Contractor to the Project Manager of the Owner before commencement of works for acceptance.

Necessary evaluation mechanism of deciding the compensations payable under section 10(d) & 16(3) of the Telegraph Act, 1885 shall be devised, right in the beginning of the Project. Contractor shall ensure timely disbursement of compensations, tree or crop, diminution in value of land for the reason of the drawal of overhead power line across the land or any other well in time so as to avoid any public agitation/ unrest for the execution of works. The Contractor's Construction Manager at site shall be adequately enabled/empowered for doing all the needful in this matter. The Owner shall be provided the record of the compensations released for maintaining as a licensee for reference as may be sought by various authorities. Separate team for disbursing the compensation payments shall be engaged without mixing the responsibilities with execution team members.

For all ROW issues, and compensations to be paid as per section 10(d) & 16(3) of the Telegraph Act, 1885 for crop/tree cutting or any other or related compensations for the total line length, the Contractor shall take the complete responsibility of the same upto 6 months after the Operational Acceptance of the line, after which the Contractor shall submit an indemnity bond to the Owner regarding these payments and any unresolved issues.

Safety and security of the work place and work men will have to be ensured by the Contractor for smooth execution of the works. Necessary preventive and proactive measures shall be put in place by the Contractor as per the directions of the Project/ site in charge from time to time based on the site conditions.

Separate teams shall be engaged for enumeration, preparation of documentation & submission of tree cutting applications to the concerned officers for approval shall be arranged much in advance as directed by the site in charge. A suitable program in this respect shall be submitted by the Contractor for acceptance by the site in charge. Clearance of the corridor be done well in advance before initiating the stringing works so as to maintain no damages happen to the conductors during stringing.

Detailed planning of executing the EHV power line crossings shall be done much in advance considering the inputs of seasonal load flows and staggering days. The plan shall be submitted to the site in charge for acceptance. All EHV crossings outage be arranged by the EPC turnkey Contractor as per requirement. All other power line crossings LT/11kV/33kV outages should be timely arranged by the Contractor so that it does not hamper planned stringing schedule even if it amounts to providing temporary arrangements like cable bypass etc. for uninterrupted works.

Any issues from time to time during the course of execution as directed by the Project Manager in the interest of the Works for faster execution shall be implemented by the Contractor diligently.

The Contractor can demobilize its erection gangs upon completion of the work only after approval of the Owner; however the site establishment shall not be demobilized as Contractor is required to provide relevant and specialized manpower for the smooth and efficient COD of the line.

4.2.8. Service Level Agreement

It is recognized and understood between Contractor and Owner that deployment of qualified and experienced manpower as per the project management chart is necessary and essential to execute the Scope of Work as per specified standards and the time schedule and key human resources as approved by the Owner such as Project Manager, Construction Manager, line in-charge etc. will be continuously deployed during execution of contract.

Penalties for Safety non-compliance/ non addressal of Quality Non- Compliance report are as mentioned below:

Description	Grace Period	Penalty
Availability of TSE Machine of suitable tonnage in working condition & its related man-power	15 days from resource mobilization schedule	Rs.10,000 per day per machine
Delay in Labour Payments	15 days from the due date	Rs. 200 per day of delay per labour
Project Manager/ Construction Manager	6 Weeks from Resource mobilization schedule	Rs.5000/- per day line
Safety Non Compliance to be addressed	30 days from Non Compliance Report	As per the EHS SOP
Quality Auditing by the surveillance team on a random manner basis	15 days from Non Compliance Report	Rs.5000/- per NCR per incident on Non rectification
Steel Drums of Conductors to be returned to main stores	Within 30 days of its use	Rs.20,000/-per drum

The provision of this Article does not stop Owner to initiate any other action for Safety non – compliance/ non addressal of Quality Standards against the Contractor as available under this Contract and in law.

4.2.9. Insurance

The Contractor shall take necessary insurance policies for an appropriate value so as to cover all risks required as per statute as well as may be required by the Owner. The said insurance policies shall also cover fire and allied risks, miscellaneous accidents workman compensation risks, loss or damage in transit, theft, pilferage, riot and strikes and malicious damages, civil commotion, weather conditions, accidents of all kinds, comprehensive risks during transportation, handling, storage, erection and commissioning. Besides, the Contractor shall also take an "All Risks" insurance, Third Party Liability insurance, Personal Accident Insurance in respect of Contractor's Supervisory Personnel and workmen and such other insurance as required as per.

The Owner shall be the principal beneficiary of the policy along with the Contractor and shall reserve the exclusive right to assign the policy.

In the event of loss or damage, the Contractor shall be solely responsible to lodge the claims and settle the same. The Contractor shall proceed with repair or replacement of the goods without waiting for settlement of the claim. It is further clarified that neither extension of completion schedule nor any extra claim shall be admissible on account of insurance.

Copy of such insurance policies shall be submitted to Owner prior to commencement of the work

Without limiting any of his obligations under the Contract, the Contractor, at its cost shall arrange, secure and maintain all insurance as may be pertinent to the Works and obligatory in terms of law to protect its interest and interests of the Owner against all perils detailed herein within Thirty (30) days from the notification of the Award.

The Contractor shall take the insurance for 110% of complete contract Value and Owner issue material with 40% escalation.

4.2.10. Contractor's Responsibility during Execution

It is understood that the Contractor has duly inspected the land and other places over which the Scope of Works have to be executed and/or the Facilities are to be installed ("Site") and its surroundings and has satisfied themselves as to all technical, commercial, ROW and general condition affecting the Site and the Works including the nature of the ground and sub-soil, the extent and nature of the work and materials necessary for carrying out the Scope of Works, the means of communication, and in general all risks, ROW issues and contingencies influencing or affecting the Scope of Work. The Contractor shall not be entitled to any extension of the Completion Schedule or to any adjustment of the Contract Value on grounds of misinterpretation or misunderstanding under this clause.

The Contractor shall employ local labour to the maximum extent possible.

For all technical clarifications, the Contractor shall report to Owner's Project Manager. All Works under this Contract shall be carried out under his instructions.

The Contractor shall prepare a Quality Assurance Plan and get approval by the Owner, which will form the basis for stage wise inspections and final inspections and preparation of respective protocols. Notwithstanding the aforesaid, at any stage of execution, Owner shall be free to inspect the quality of material supplied and can ask the necessary modification if the Owner is of the opinion that the current work does not meets the quality standards.

The Contractor shall submit detailed activity-wise bar chart for approval of Owner. The Contractor shall also submit monthly progress report, daily labour report and other documents as required from time to time.

4.2.11. Defect Liability

The Contractor shall be liable to remedy or compensate the Owner for the remedy of any defect, imperfection, deficiency or any other fault in the Work or the Element(s) or in the execution of the works or a breach of the requirements of this Contract (collectively called "Defects") in accordance with this clause.

The Defects Liability Period for each Element shall be twenty four (24) months from the date of Taking Over of such Element.

The Defects Liability Period of twenty four (24) months is in line with Industry practice.

If during the Defects Liability Period any Defect is found, the Contractor shall promptly, in consultation and agreement with the Owner regarding appropriate remedy of the Defects and at the cost of the Contractor, repair, replace or otherwise make good such Defect as well as any damage to the Element caused by such Defect and losses suffered by the Owner thereby and shall ensure that the Element is in accordance with the requirements of this Contract.

The Owner shall give the Contractor a notice stating the nature of any such Defect together with all available evidence thereof, promptly following the discovery thereof. The Owner shall afford all reasonable opportunity for the Contractor to inspect any such Defect.

If the repair or making good is of such a character that it may affect the efficiency of any Element, the Owner may give to the Contractor a notice requiring that such Element and the same shall be made by the Contractor, whereupon the Contractor shall carry out such tests at its own risk and cost.

If such defective part fails the tests, the Contractor shall remedy the Defect or carry out such replacement or make good (as the case may be) until that part of the material(s) passes such tests.

If the Contractor fails to commence the work necessary to remedy such Defect or any damage to the material(s) caused by such Defect within fifteen (15) days) or if after having so commenced fails to remedy the Defect in the manner satisfactory to the Owner, within a reasonable period of time, the Owner may, following notice to the Contractor, proceed to carry out such work either by itself or through any other person at the risk and costs of the Contractor. In addition to its obligation to remedy Defects hereunder, the Contractor shall also be responsible for all costs incurred by the Owner in connection with such Defects including all costs of dismantling any Items, clearing it from the Site and returning such Items to the Contractor and such costs shall be paid to the Owner by the Contractor or may be deducted by the Owner from any amount due to the Contractor.

If any part Element cannot be commercially used by reason of such Defect and/or failure in making good of such Defect, the Defects Liability Period of such Element shall be extended by a period equal to the period during which such Element or such part cannot be used by the Owner because of any of the aforesaid reasons. Upon rectification of the Defects in an Element by repair, such repaired Element shall have the Defects Liability Period extended by a period mentioned in this clause, from the time of such repair of such Element.

4.2.12. Latent Defects

At the end of the Defects Liability Period, the Contractor's liability in respect of Defects ceases except for Latent Defects. The Contractor's liability for Latent Defects shall be applicable during the Latent Defects Liability Period, which shall be for a period of ten (10) years from the expiry of the Defects Liability Period and other terms shall be as per the GCC.

IE is of the view that Latent Defect Liability Period of ten (10) years from the expiry of the Defects Liability Period is good for the Project and Owner.

4.3. Civil Contract

The Civil Contract dated 11.04.2016 has been placed on M/s Sterlite Power Grid Ventures Ltd., for Civil works for Construction of 765 kV D/C Transmission Line from Raipur to Jharsuguda and 400 kV D/C Transmission Line from OPGC (IB TPS) to Jharsuguda associated with Odisha Generation Phase II Transmission Limited.

4.3.1. Scope of Work

The scope of work broadly covers the following:

1. Civil work for construction as per requirement, necessary site preparation including mobilization of manpower, machineries, Labour, materials, consumables, tools and plants, as required for the construction of transmission lines of the size and scope of the Facility and handing over of the Facility which shall be complete in all respects, arranging complete ROW and Statutory Approvals, if any and also other construction services and management for the Facility.
2. The scope also includes the remedy of defects within agreed Defect Liability Period for the 400 kV D/C Transmission lines as per the technical specifications, subsequent amendments, agreed conditions of this Contract and correspondences and the recorded minutes of meeting occurred between the parties.
3. Design, Classification and Casting of foundation for different types of tower and casting of foundation for tower footings as per foundations drawings.
4. All statutory Approvals related to PTCC, Road, Railway, Civil aviation, river, shut down, electrical inspectorate and any other agency, ROW including crop/ tree compensation payment/ clearance etc. is in Contractors scope.
5. Project Insurance as indicated in the GCC
6. Forest:
 - Forest clearance is in Contractor's scope. Contractor shall undertake the work of tree cutting, its transportation etc. and liasioning for the construction of foundations for the purpose of laying of line. The deforestation charges to be paid to the forest authorities for the construction of line through the forest shall be in the scope of the Contractor.
 - Complete Detailed Survey, Check Survey & Casting of Foundation for tower footing as per foundation drawings, in forest area is in the scope of the Contractor.
 - Expediting & assistance in preparation of Application case for the forest shall be in the scope of Contractor. Any liaising work for forest application shall be in Contractor's scope.
7. EHV Crossing
 - Arranging the Shutdown activities for crossings of the EHV/ HVDC/ HV/LT etc. from the state utilities, PGCIL, private transmission lines, RLDC shall be in the scope of the Contractor. Including all paperwork.
 - Compensation for loss of revenues during the shutdown period for working on EHV crossings demanded by the utilities/PGCIL/ private transmission line owner shall be borne by the Contractor.

- The Contractor shall ensure compliance with all the relevant acts, laws, rules, regulations, guidelines at its own cost and expenses and furnish all certificates in support of the compliance done for further submission with the concerned authorities.
- 8. The Contractor shall be solely responsible for the complete integration of materials supplied for the project as per the pre – defined parameters of this Contract including any modifications, if any.
- 9. The contractor shall submit to the Owner all complete as built drawings, O&M manuals, detailed tower profile etc. before Operational Acceptance.

IE observed that the scope of work covered in the contract is in order.

4.3.2. Effective Date and Completion Schedule

The effective date of this contract is 08.01.2016.

The period from the Effective Date to the Operational acceptance and handing over of the Facilities shall be referred to as the “Contract Period”. The “Operational Acceptance” shall be considered after 1 month from COD.

The Contractor shall ensure that the entire Scope of Work shall be completed by 30th June, 2017 for 400 kV D/C Transmission Line and by 6th June, 2019 for 765 kV D/C Transmission Line, which shall be referred to as “Completion Date”.

Regarding the 765 kV D/C Transmission Line, LIE observed the civil contract has been placed to M/s. L&T ECC and the works have started. Till 19th June, 2016 around 223 foundations were complete at site. The scheduled COD for sub – contracts is October, 2017, hence there a cushion for the SPGVL to accommodate any un – anticipated interruptions.

IE found that the schedules are well within the schedules of TSA and CERC order.

4.3.3. Advance Guarantee

The Advance Guarantee shall initially be kept valid up to Completion Period of the complete transmission line. The validity of the AG shall be extended by the Contractor from time to time till the actual date of Completion of the Facility in accordance with the Contract.

Project Company informed that the Advance Guarantee is in the form of Corporate Guarantee.

4.3.4. Contract Performance Guarantee

The contractor has to submit an unconditional and irrevocable Contract Performance Bank Guarantee for a sum equivalent to 10% of the Contract Price and shall be submitted in two parts:

- During the execution of Contract till Operational Acceptance
- During the Defect Liability period

Project Company informed that the Performance Guarantee is in the form of Corporate Guarantee.

The PG for the performance of Contractor during execution shall be valid up to Operational Acceptance date under this contract. This Guarantee shall be returned on submission of PG for the Defect liability Period of 24 months.

4.3.5. Liquidated Damages

If the Contractor fails to achieve the following due to reasons attributable to him:

Overall Completion of work on the completion date, the Contractor shall pay to Owner a sum calculated @ 1% (One percent) of the Contract Value for each week of delay or part thereof subject to a maximum of 10% of the Contract Value as liquidated damages for such default and not as penalty, without prejudice to the Owner's other remedies available under this Contract.

The Owner may without prejudice to any other method of recovery, deduct the amount of such damages from any amount due or becoming due to the Contractor or from any securities/guarantees under this Contract. The payment deduction of such damages shall not relieve the Contractor from its obligation to complete the works and remedy the defects in the works or from any other of its obligations and liabilities under the Contract.

IE observes that 400 kV Transmission Line is commissioned and charged while 765 kV line is ready for commissioning, the CEA Electrical Inspector visit is complete, hence no implication of LD.

4.3.6. Insurance

The scope of insurance shall be adequate to cover for fire and allied risks, riot and strikes and malicious damages, civil commotion, weather conditions, accidents of all kind, miscellaneous accidents, theft, pilferage, comprehensive risk during transportation, handling, storage, erection and commissioning etc. besides, the Contractor shall also take an "All Risks" insurance, Third Party Liability Insurance, Personal Accident Insurance in respect of Contractor's Supervisory Personnel and workmen and such other insurance as required as per statute.

It is mentioned in the contract that the value of the insurance policy shall be as per the GCC.

4.4. Overall Observation

IE has reviewed the clauses pertaining to Force Majeure, Arbitration and Termination and found the same to be in order.

IE found the other provisions are in line with other Transmission line project contracts and are in order.

IE found that if the Project is delayed by 180 days beyond schedule COD as per TSA reasons solely attributable to Project Company, the maximum LD imposed as per TSA is Rs 106.85 Crores.

If the Project is delayed beyond schedule COD as per EPC Contract reasons solely attributable to EPC Contractor, the maximum LD recovered as per EPC Contract (combined Supply, Erection and Civil works contract) is Rs 104.30 Crores.

IE found that there is a shortfall of Rs 2.55 crores. The contingency in the Project Cost is adequate to cover the same. **(Risk Category – A)**

IE observed that Provisional Acceptance and Financial Acceptance is not envisaged in the EPC Contract. However, once the Transmission line is commissioned and approved by the concerned Authority is obtained, the Provisional Acceptance achieved. The Final Acceptance can be achieved as per the payment terms.

Based on the experience, IE is of the view that the main reason for delay in Transmission line is due to the following

- Delay in obtaining of Forest Clearance
- Delay in obtaining RoW clearance
- Schedule of other permits and clearances like PTCC, Power line crossing, Railway crossing, NH crossing etc

IE observed that EPC Contractor has taken responsibility for obtaining RoW and all permits and clearances, which is beneficial for the Owner in achieving the SCOD.

5. DESIGN PHILOSOPHY

5.1. Technical requirements for Transmission Line

The Tower shall be fully galvanized using mild steel or/and high tensile steel sections. Bolts and nuts with spring washer are to be used for connection.

IS Steel section of tested quality in conformity with IS 2062:2006, grade E 250 (Designated Yield Strength 250 Mpa) and/or grade E 350 (Designated Yield Strength 350 Mpa) are to be used in towers, extensions, gantry structures and stub setting templates. The contractor can use other equivalent grade of structural steel angle sections and plates conforming to latest International Standards. However, use of steel grade having designated yield strength more than that of EN 10025 grade S355 JR/JO (designated yield strength 355 Mpa) is not permitted. The steel used for fabrication of towers shall be manufactured by primary steel producers only.

Towers shall be designed as per latest revision of IS-802 considering wind zone as per IS – 875. In addition to design conditions & stipulations in present IS – 802, tower design wind pressure under security condition shall be 75% of full wind pressure for suspension towers. As per CEA's technical standards for construction of lines Regulation 2010, Transmission Service Provider (TSP) may adopt any additional loading/ design criteria for ensuring reliability of the line, if so desired and/ or deemed necessary.

The Project Company has followed the CBIP guideline in classifying the different types of Transmission towers. The quantity of each tower type & associated extensions has been finalized based on the survey and route profiling.

It is of the view point that the towers are designed for Reliability, Security & Safety Conditions as per IS: 802 and CBIP Manual 323 (latest) to take care of broken wire, dead end and anti-cascading effects. In line with the prevailing practices in the country, the Project Company has considered the use of a combination of MS and HT steels in the structural materials to achieve optimum tower designs with minimum weights.

The conductor configuration shall be as below:

Line configuration	ACSR Conductor specified	Equivalent AAAC conductor based on 53.5% conductivity of Al Alloy	Stranding details of AAAC Conductor	Sub – Conductor or Spacing
400kV D/C (Triple Snowbird)	Snowbird: Stranding 42/3.99mm – Al + 7/2.21 mm Steel, 525.2sqmm, Aluminium area 30.56 mm dia.	31.95mm diameter; 604 sq.mm Aluminium alloy area	61/3.55mm	457 mm
765 kV D/C (Hexa Zebra)	Zebra: Stranding 54/3.18 mm – Al + 7/3.18 mm – Steel, 428 sqmm,	28.71 mm diameter, 487.5 sqmm Aluminium Alloy area	61/3.19 mm	457 mm

Aluminium Area 28.62
mm

Note: The transmission lines shall have to be designed for a maximum operating conductor temperature of 85 deg C for both ACSR as well as AAAC.

The required phase to phase spacing and horizontal spacing for 765 kV D/C line shall be governed by the tower design as well as minimum live metal clearances for 765 kV voltage levels respectively under different insulator swing angles.

a) For 765 kV Transmission Line

The minimum live metal clearances for 765 kV D/C line shall be as follows:

i) Under stationary conditions

From tower body: For 765 kV D/C: 6.1 m

For 765 kV S/C: 5.6 m

ii) Under swing conditions

Wind pressure Condition	Minimum electrical clearance
Swing angle corresponding to 2 years return period	4.4 mts
Swing angle corresponding to 50 years return period	1.3 mts

However, the phase to phase spacing for 765 kV line shall be less than 15 mts.

b) For 400 kV Transmission Line

The minimum live metal clearances for 400 kV D/C line shall be as follows:

i) Under stationary conditions

From tower body: 3.05m

ii) Under swing conditions

Wind pressure Condition	Minimum electrical clearance
Swing angle (22°)	3.05 mts
Swing angle (44°)	1.86 mts

However, the phase to phase spacing for 400 kV line shall be less than 8 mts

The minimum ground clearance for 765 kV transmission lines shall be 15 mts so that maximum electric field does not exceed 10 kV/m within the ROW and does not exceed 5 kV/m at the edge of the ROW as per International guidelines.

The minimum ground clearance for 400kV D/C transmission lines shall be 8.84m. The minimum mid span separation between earthwire and conductor shall be 9.0m. Shielding angle shall not exceed 20 deg for 400 kV D/C line

The minimum mid span separation between earthwire and conductor shall be 9.0m for 765 kV D/C transmission line. Shielding angle shall not exceed 10 deg for 765 kV D/C line.

The switching impulse withstand voltage (wet) for 765 kV line shall be 1550 kVp.

The switching impulse withstand voltage (wet) for 400kV line shall be 1050 kVp.

The Fault current for design of line shall be 50 kA for 1 sec for 765 kV.

The Fault current for design of line shall be 50 kA for 1 sec for 400 kV.

Minimum level of pollution for design of lines shall be medium pollution (creepage of 20mm/kV as per IEC - 60815). For locations in light/ medium pollution areas, porcelain/glass insulators shall be used while for locations coming in areas with higher pollution level, antifog type insulators with higher creepage distance or silicone rubber polymer insulators depending on the level of pollution shall be used.

In order to meet the requirement for grid management and operation of substation, Transmission Service Provider (TSP) shall conform to the following requirements.

For Jharsuguda (Sundargarh) – Raipur Pool 765/400 D/C line (Hexa Zebra Conductor)

- a. On Jharsuguda (Sundargarh) – Raipur Pool 765/400 D/C line (Hexa Zebra Conductor) transmission line, one OPGW containing 24 Fibres is to be installed by the TSP in place of conventional earth wire during the construction of line for grid management and substation operation purpose by CTU. The installation of OPGW shall be done from gantry of Jharsuguda (Sundargarh) Substation up to gantry of 765 kV Raipur pooling Station and shall be terminated in a Joint Box by TSP at both the ends. These Joint Boxes shall be installed at a height of around 10m above ground and shall conform to IP66.
- b. All these fibres of the OPGW shall be utilized for grid management purpose. The maintenance of the OPGW shall be the responsibility of TSP.

For OPGC – Jharsuguda (Sundargarh) 400 kV D/C (Triple Snowbird Conductor)

- (i) On OPGC – Jharsuguda (Sundargarh) 400 kV D/C (Triple Snowbird Conductor) transmission line, one OPGW containing 24 Fibres is to be installed by the TSP in place of conventional earth wire during the construction of line for grid management and substation operation purpose by CTU. The installation of OPGW shall be done from gantry of Jharsuguda Substation up to gantry of 400 kV OPGC Substation and shall be terminated in a Joint Box by TSP at both the ends. These Joint Boxes shall be installed at a height of around 10m above ground and shall conform to IP66.
- (ii) All these fibres of the OPGW shall be utilized for grid management purpose. The maintenance of the OPGW shall be the responsibility of TSP.

IE is of the view that the technical design specifications is in line with Industry standards. IE found that each major equipment component envisaged above has been operating commercially under similar conditions and there is no expected system degradation.

5.1.1. Tower Design and Tower Type Test

For all the Transmission Lines elements of the Project, following types of towers have been used –

- DA type
- DB type
- DC type
- DD type

Following parameters are consider for Tower Design, and accordingly the critical loadings are identified to conduct the Tower Type Testing:

1. Wind Zone
2. Conductor Type
3. Conductor Bundle
4. Voltage Level
5. Span between the Towers

Accordingly, w.r.t to 765 kV Transmission Line, following were the consideration –

1. Wind Zone – test was conducted for WZ 2
2. Conductor Type – Zebra
3. Conductor Bundle – Hexa bundle
4. Voltage Level – 765 kV Voltage level
5. Span between the Towers – avg. span of 400 mts

The test was carried out by Gammon India Limited during August, 2011. The entire tower type test was carried out successfully.

The type test was conducted considering a factor of safety of 1.02 with the following conditions:

1. Reliability (Normal condition) – this test is carried out for 0°/ 30°/ 45° wind incidence, with 100% wind velocity and implication of Transverse, Vertical and Longitudinal Forces. Load is being applied in steps of 50%, 75%, 90%, 95% (with a waiting period of 2 minutes at each step) and 100% (with a waiting period of 5 minutes).
2. Security (Break – Wire Condition) – under this condition 75% of wind velocity as per Tower design is considered. For suspension tower 1 Ground Wire and 1 Conductor is broken. For tension towers – 1 Ground wire and 1 conductor or 2 conductors is broken. For the dead – end tower where maximum tension is encountered, 1 Ground wire and 2 Conductors OR 3 Conductors is broken. Under broken condition correspondingly the longitudinal forces increase.
3. Safety condition – is a conventional/ ideal tower condition with no wind velocity and just applying the stringing loads, assuming the loads encountered during execution works to ensure the safety of works.
4. Anti – Cascading – under this condition, all the conductors are intact with 100% loads and no wind velocity, applicable for tension type towers.

5. Narrow Front Wind – under this condition, maximum narrow face wind velocity applicable particularly for suspension towers.
6. Destructive test – based on the above all loading condition, the maximum critical load is identified to conduct the destructive test. Accordingly, the loads were increased beyond 100%. Hence as per Test Certificates, under Reliability condition with maximum vertical load and Full Wind, towers could successfully withstand 100% design loads. The loads were increased in steps of 5% after 100% (i.e. 105%) with holding period of 5 mins. No deformation was seen in tower till 110% further loading was stopped and loads were released.

IE observed from the Type Test Report that both the sides of the tower with various combinations of loads was tested which ensured more factor of safety. IE observed that no critical observation was encountered and could withstand all designed load conditions. IE noted that Tower Deflection on both Transverse and Longitudinal direction was measured and was found to be within limits.

Accordingly, w.r.t to 400 kV D/C Transmission Line, following were the consideration –

1. Wind Zone – test was conducted for WZ 2
2. Conductor Type – Snowbird
3. Conductor Bundle – Triple bundle
4. Voltage Level – 400 kV Voltage level
5. Span between the Towers – avg. span of 370 mts

The test was carried out by Jyoti Structure Limited during July, 2009. The entire tower type test was carried out successfully.

The type test was conducted considering a factor of safety of 1.02 with the following conditions:

- a) Reliability (Normal condition) – this test is carried out for 0°/ 30°/ 45° wind incidence, with 100% wind velocity and implication of Transverse, Vertical and Longitudinal Forces. Load is being applied in steps of 50%, 75%, 90%, 95% (with a waiting period of 2 minutes at each step) and 100% (with a waiting period of 5 minutes).
- b) Security (Break – Wire Condition) – under this condition 75% of wind velocity as per Tower design is considered. For suspension tower 1 Ground Wire and 1 Conductor is broken. For tension towers – 1 Ground wire and 1 conductor or 2 conductors is broken. For the dead – end tower where maximum tension is encountered, 1 Ground wire and 2 Conductors OR 3 Conductors is broken. Under broken condition correspondingly the longitudinal forces increase.
- c) Safety condition – is a conventional/ ideal tower condition with no wind velocity and just applying the stringing loads, assuming the loads encountered during execution works to ensure the safety of works.
- d) Anti – Cascading – under this condition, all the conductors are intact with 100% loads and no wind velocity, applicable for tension type towers.
- e) Narrow Front Wind – under this condition, maximum narrow face wind velocity applicable particularly for suspension towers.

- f) Destructive test – based on the above all loading condition, the maximum critical load is identified to conduct the destructive test. Accordingly, the loads were increased beyond 100%. Hence as per Test Certificates, under Reliability condition with maximum vertical load and Full Wind, towers could successfully withstand 100% design loads. The loads were increased in steps of 5% after 100% (i.e. 105%) with holding period of 5 mins. No deformation was seen in tower till 110% further loading was stopped and loads were released.

IE observed that the above type test was conducted based on the design of RTCL project, considering 400 kV D/C Twin Moose Conductor with WZ – 4, while 400 kV D/C Line from OPGC to Jharsuguda is designed for Triple Snowbird at WZ – 2.

Project Company calculated the Sag and Tension effect for both the Lines with their respective system design parameters and deduced that both Sag & Tension values for 400kV D/C Triple ACSR Snowbird Transmission line are lesser than the 400kV D/C Twin ACSR Moose line. Hence, same towers designed for WZ – 4 with 400m span can be utilized in this line of WZ – 2 with reduced span of 370m.

IE observed from the Type Test Report that both the sides of the tower with various combinations of loads was tested which ensured more factor of safety. IE observed that no critical observation was encountered and could withstand all designed load conditions. IE noted that Tower Deflection on both Transverse and Longitudinal direction was measured and was found to be within limits.

5.2. Tower Foundation

The Foundation Design Calculations and drawings have been developed as per Indian standards / CBIP Manual on Transmission Tower Line for Soil types Normal Dry Soil, Wet Soil, Fully submerged Soil, Partially submerged Soil, Dry Fissured Rock & Wet Fissured Rock. Conventional RCC Spread type foundations have been adopted. For foundation design calculation tower leg extension provision for 3M, 6M & 9M have been adopted. The foundation designs are based on actual soils met during the construction and Standard type of foundations classifications of soils as per CBIP Manual on Transmission Lines. M20 grade concrete and Fe415/500 grade reinforcement steel adopted for RCC foundations.

The bay extension civil & structural works are small in magnitude when compared to Transmission line works and attended as per the PGCIL/ TS Transco specifications to match with existing designs.

IE observed that the designs for both Transmission line towers (wind zone – 2 & Wind zone – 4) and its foundation adopted for the above lines are meeting Indian standards and as per the good Industry Standards.

The Project is technically viable with the deployment of above materials as envisaged in the report

5.3. Quality Assurance and Safety Aspects

5.3.1. Quality Control

The Project Company is adhering to the Quality Assurance Program which is in line with the industry standards and practices and is complying with the requirements of the Indian and International Standards. IE observed that, during execution of work, the Project Company has adopted appropriate measures to keep a strict vigil in implementing the Field Quality Plan & Material Quality Plans and in supervising the construction work. The Material Quality Plans (MQP) of different components were reviewed by the IE and opines that the requisite tests and inspections are in line with Indian and International standards at various stages of the manufacturing process. This includes stringent quality control via Raw Material Inspection, In – process Inspection, Final Inspection and Testing and Checks conducted during Packing & Despatch. IE is satisfied with the QAP followed for implementation of the Project.

5.3.2. Safety Aspects

Safety practices have been followed by the Project Company as per their Safety Standards which is in line with the industry standards and practices. IE is of the opinion that the safety rules and norms have been followed in the Project. During the execution of the project, all stores were properly fenced and provided with adequate lights. Safety equipment / accessories were used by site workers.

5.4. Useful Life of Asset

The review of the Technical documents pertaining to the project by IE including the Technical Specifications, Type Test Certificates and Quality Plan of the different equipment/ components of Transmission Lines confirm the quality of components and technical suitability of Transmission Lines.

All the transmission line assets are designed as per IS:802 Part 1 & 2 with a reliability factor of 1.0 which ensures the reliability period of the transmission line for 50 years and for the Substation Equipment for 35 years. As per the TSA, the Term of Applicability of the TSA is 35 years from the Schedule COD of the Project. Hence, IE confirms that the Transmission Assets are technically designed and are reliable as per the TSA.

The life extension of the asset beyond 35 years can be assessed based on the Residual Life Assessment (RLA) results, Load Studies and the Technological advancements after 35 years of Project Operation.

5.5. Technical Guarantee

Typically contract for Transmission Project does not envisage any performance guarantee parameters. However, the project has been implemented in line with the technical specifications with proper quality checks.

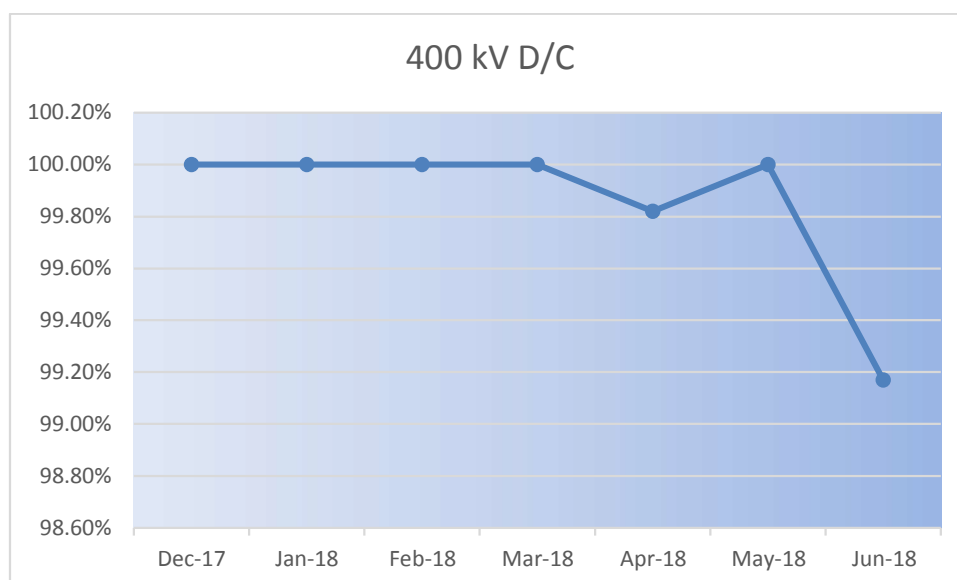
The Certificate for approval for Energization from CEA ensures the completeness and technical acceptability of the project. IE observed that 400 kV D/C Transmission Line from IB Thermal Power Station to Jharsuguda Pooling station has obtained the CEA approval vide letter dated 23rd August, 2017.

The CEA inspection for 765 kV D/C Transmission Line is due shortly.

5.6. Availability of Transmission Lines

Normative availability of each element has been considered as 99%. This is in line with CERC Notification. The target availability of the project as per Transmission Service Agreement is 98%.

The Project Company has submitted the monthly availability data for the 400 kV D/C Transmission Line from IB Thermal Power Station to Jharsuguda Pooling station, from December, 2017 to June 2018 and is indicated in the Graph below:



IE observed that the Project Company has planned proper O&M procedures and an effective O&M organization set – up to maintain the availability of the Transmission Lines. IE observed that the Availability is maintained more than 99%. IE is of the view that with prudent maintenance practices and deployment skilled manpower, maintaining 98% availability is achievable.

5.7. Assessment of Technology Risk

Based on the technical assessment of the project, IE does not foresee any Technology risk.

6. TIME SCHEDULE AND PROJECT PROGRESS

6.1. Schedule as per TSA

As per TSA, the scheduled COD of the project is 40 months from the effective date of TSA.

As per TSA conditions the effective date is 8th April, 2016.

IE found that the scheduled COD for the overall Project is 8th August, 2019 which is 40 months from effective date.

6.2. Schedule as per EPC Contracts

The schedule completion date as EPC Contract is 30th June, 2017 for 400 kV D/C Transmission Line and 6th June, 2019 for 765 kV D/C Transmission Line.

6.3. Schedule as per CERC tariff order 31.05.2016

The scheduled completion target as per CERC order dated 31st May, 2015 is as mentioned below:-

Name of the Transmission Element	Completion Target	Conductor per phase
765/400 kV D/C Substation at Jharsuguda (Sundargarh) – 765/400 kV D/C Raipur Pooling Station (304.95 Kms as per check survey)	40 months from effective date	Hexa Zebra ACSR Conductor or equivalent AAAC. The transmission lines to be designed for a maximum operating conductor temperature of 85°C for both ACSR as well AAAC.
IB Thermal Power Station (OPGC) 400 kV substation – 765/400 kV D/C Jharsuguda Substation (51.35 Kms as per check survey)	July, 2017	Triple Snowbird ACSR Conductor or equivalent AAAC. The transmission lines to be designed for a maximum operating conductor temperature of 85°C for both ACSR as well AAAC.

IE observed that the main EPC Contract SCOD for 765 kV transmission line is 3 months prior to the TSA and CERC order schedule COD, accommodating a sufficient cushion for any un – anticipated interruptions.

6.4. Present Progress Status

6.4.1. 765 kV D/C Transmission Line from Raipur Pooling Station to 765/400 kV Jharsuguda Pooling Station:

The construction progress of various activities as on 14th November, 2018 is given in the table below.

Activity	Total Target	Cumulative Progress till 14.11.2018		Balance
		Plan (L2)	Actual	
Total Foundation (No)	782	782	782	-
Tower Erection (No.)	782	782	782	-
Final Stringing (km)	304.95	304.95	304.95	-

6.4.2. 400 kV D/C Transmission Line from IB Thermal Power Station to Jharsuguda Pooling Station:

The construction works for 400 kV D/C Transmission Line from IB Thermal Power plant to Jharsuguda Pooling Station, of line length 51.35 kms, is physically complete. CEA had conducted the site inspection on 25th July, 2017 and accorded the energization letter vide letter dated 23rd August, 2017. As per the POSOCO letter dated 4th January, 2018, stating that 400 kV D/C Ckt – I & Ckt – II from IB (OPGC) to Jharsuguda, has successfully completed the 24 hours trial – run test on 20th December, 2017. ***IE observed that due to the delay in completion of the GIS substation (PGCIL), Jharsuguda Pooling Station, under the purview of PGCIL, the 400 kV OGPTL line could not get charged as per the SCOD i.e. August, 2017.***

The construction works are 100% physical complete for both lines as on 14th November 2018.

7. PROJECT MANAGEMENT ARRANGEMENT

7.1. Project Organization

This section presents the Project Organization arrangement adapted during the execution of the project.

The 400 kV D/C OPGC (Jharsuguda) Sundergarh Transmission Line is commissioned and is operational. The O&M philosophy and activities carried out for the Line is indicated herewith.

The Main Hub office and store for the line is at Jharsuguda where the O&M Team is stationed. The common services such as Accounts, Commercial, Safety, and Quality are catered from the Hub office. The Line has a sub – hub at OPGC, Banaharpali end, wherein two technicians along with one Supervisor is deployed.

IE opines that the Project Company has taken adequate measures for management of the complete project by allocating separate teams at separate location for supervision of the transmission line.

7.2. Organization Set – up and its Adequacy

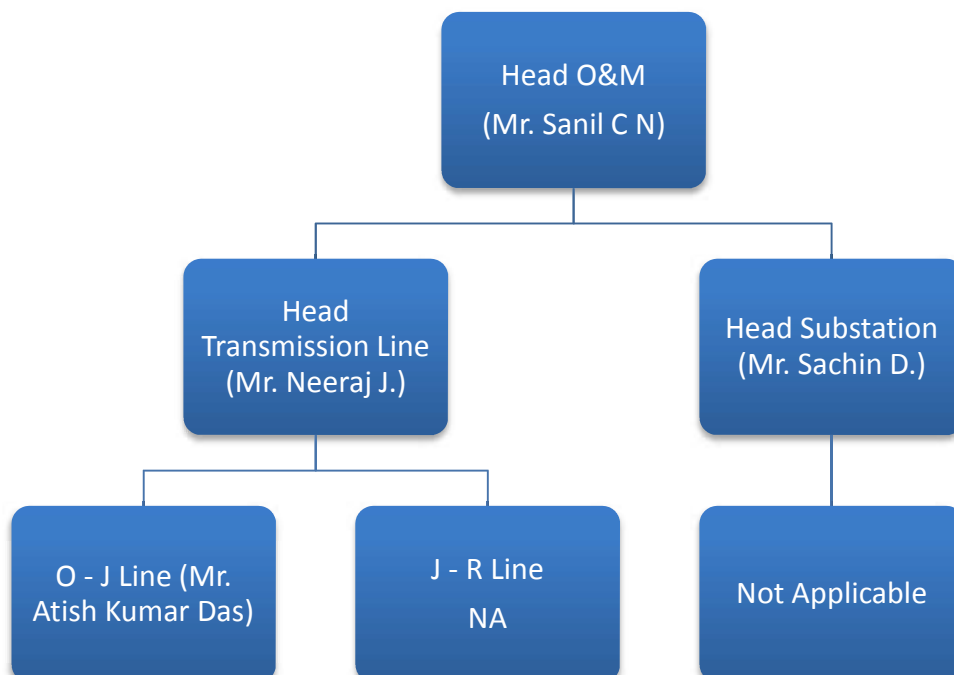
The Head (O&M) of Sterlite Power Grid Ventures Ltd. shall be responsible for the Operation & Maintenance for OGPTL and other projects of SPGVL.

The operation and maintenance of the transmission lines is done by the O&M contractor. Supervision of operation and maintenance work being carried out by the contractor is done by the SPGVL in-house team.

For trouble free operation and proper maintenance, SPGVL is taking up the following measures:

- a) Routine, Periodic, Preventive & Predictive maintenance shall be done by O&M contractor as per guide lines provided by SPGVL and under the supervision of SPGVL team.
- b) Close monitoring of agency, maintaining data and analysis to reduce down time shall be done by SPGVL Team.
- c) Mandatory spares shall be provided by SPGVL to the contractor. However, the contractor at his own cost, shall make provision of all other spares and consumables as may be required for O & M during the contract duration.
- d) Break down / Emergency shall be handled jointly by O&M contractor, SPGVL O&M & EHS (Environment, Health & Safety) Team

7.2.1. Organization Chart for O&M of Transmission Line



OGPTL has outsourced the maintenance works of 400kV D/C OPGC (Jharsuguda) Sundergarh Transmission Line to M/s. JBS Enterprise Private Limited, vide Work Order dated 21st February, 2016, for maintenance works of 765 kV D/C Jharsuguda – Raipur Transmission Line (304.95 kms) and 400 kV D/C Triple ACSR Snowbird OPGC – Jharsuguda Transmission Line (51.35 kms). As per the Contract the effective date for the works shall be the actual date of Site Mobilization. As informed by the Project Company the effective date 10th March, 2017. The Contract shall remain valid for a period of 36 months i.e. Three years from effective date, further extension of 2 years will depend on the performance of the Contractor.

The brief scope of the contractor includes –

- i. Routine patrolling and maintenance
- ii. T&P
- iii. Stores
- iv. Vehicles
- v. Transportation of material
- vi. Security of stores
- vii. Insulator cleaning
- viii. Corridor cleaning (vegetation), cutting of trees
- ix. ROW issues in scope of Contractor
- x. Replacement of mission members
- xi. Tightening of nuts and bolts
- xii. Visual inspection for hot spots
- xiii. Breakdowns
- xiv. Inspection of foundations
- xv. Strengthening of tower foundation and civil works
- xvi. Night Patrolling
- xvii. Thermo vision once in six months
- xviii. Signature analysis as and when required

- xix. Measurement of tower footing resistance
- xx. Mock drill
- xxi. Thorough inspection of the corridor during pre – monsoon and post monsoon
- xxii. Tree cutting if required
- xxiii. Checking of foundation and ground clearance.

At extra cost, the following works shall be covered:

- i. ERS erection
- ii. ROW & compensation
- iii. Spares to be provided by SGL
- iv. Major Breakdowns and failures
- v. Major Civil Works

The Incentive for increase in Availability over the target Annual Availability Value, limited to an overall Annual availability of 99.75 % and no incentive shall be paid over and above 99.75%. The Target Annual Availability shall not be less than 99.0%, during each Financial Year.

IE is of the opinion that the proposed O&M organization set-up is adequate. The division of responsibility of SPGVL O&M personnel for different line sections and the supervision of the O&M contractor by the SPGVL In-house team shall be effective in the smooth and trouble-free operation of the lines. Additionally, the proposal for providing mandatory spares by SPGVL to the contractor shall facilitate in reducing the down-time of the lines.

7.3. Operation and Maintenance Activities

The Operation and Maintenance Activities have been classified under the following heads:

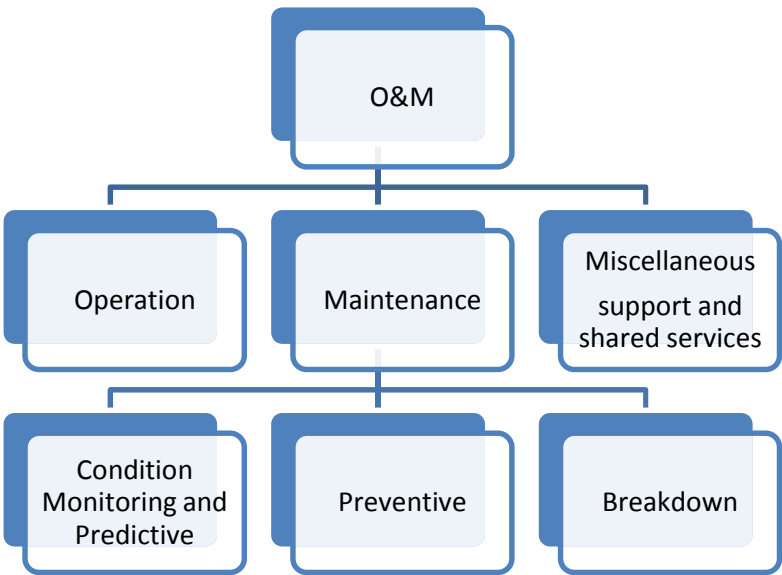


Figure 7.1 – Operation & Maintenance Activities

The day to day operation of the transmission systems is the primary responsibility of the Regional Load Dispatch Centre (RLDC). Consequently, the O&M strategy of OGPTL will focus primarily on the maintenance aspect.

The objective of the O&M strategy is indicated below:

- To achieve the system availability as specified in the TSA at the most economic cost,
- To carry out periodic 'preventive maintenance' so as to maximize the life of transmission lines
- To minimize the down time of the Transmission Lines for maintenance purpose

The maintenance activities are classified as follows to maximize the availability of the Transmission lines.

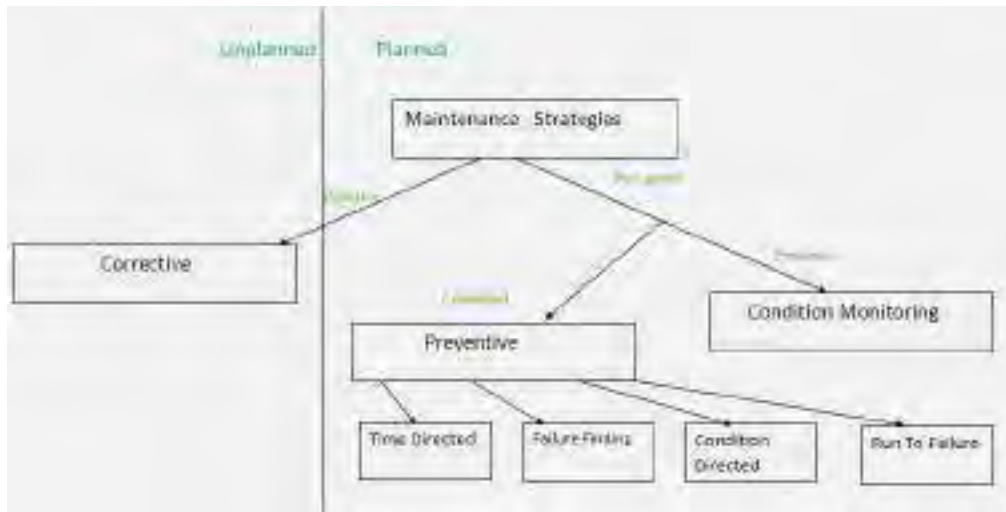


Figure 7.2 – Maintenance Strategy

7.3.1. Routine Maintenance (Preventive Maintenance)

OGPTL shall adopt proven practices such as regular patrolling of the lines, periodically removal of vegetation over growth, thermo-vision scanning, live line washing, on-line insulator failure detection and hot line maintenance techniques etc. Project Company plans to maintain a team of trained manpower along with adequate spares to swiftly attend to unforeseen eventualities/ natural calamities.

The patrolling frequency as followed by the Project Company is indicated below:

S. No.	Type of Patrolling	Visit Plan
1	Ground Patrolling	Monthly
2	Night Patrolling	45 Days
3	Monkey Patrolling	2 Month
4	Ground Patrolling (critical location)	Weekly
5	Emergency Patrolling	Immediate

OGPTL shall carry out regular maintenance of each of the Transmission Lines suiting to the nature of terrain, environment, surroundings, etc so as to achieve the desired level of performance. The following are examples of routine maintenance activities:

- Routine ground patrols to inspect structural and conductor components. Such inspections generally require either an all-terrain vehicle (ATV) or pickup and possibly additional support vehicles travelling on access and service roads and may rely on either direct line-of-sight or binoculars. In some cases, the inspector may walk the ROW. Follow – up maintenance is scheduled depending on the severity of the problem either as soon as possible or as part of routine scheduled maintenance.
- Patrolling in most vulnerable terrain is to be completed on monthly basis. Patrolling sequence is such that each and every most vulnerable location shall be re patrolled in three to five weeks. Photographs of such location are taken using Digital Camera and Hard/Soft copies of the same are preserved to have the history of location.
- 100% Transmission Line towers and Spare are checked by concerned Lineman/ technician/ Engineer once in patrolling cycle. 20% Transmission Line Towers, spans in normal and vulnerable sections and all vulnerable towers are checked by concerned Transmission Line Maintenance In – Charge in each patrolling cycle of Three/four months.
- Climbing surveys may be necessary to inspect hardware or make repairs. Personnel generally access these structures by pickup, ATV, or on foot.
- Structure or conductor maintenance typically occurs manually. The maintenance vehicle may be located on or off a road, and no-to-minimal grading is necessary to create a safe work area.
- Cathodic protection surveys to check the integrity and functionality of the anodes and ground beds. These surveys typically require personnel to use an ATV or pickup and make brief stops.
- Routine cyclical vegetation clearing to trim or remove tall shrubs and trees to ensure adequate ground-to-conductor clearances. Vegetation clearing cycles vary from 3 to 5 years or as needed (dependent upon the vegetation present). Personnel generally access the area by pickup, ATV, or on foot; use chainsaws to clear the vegetation; and typically spend less than half a day in any one specific area. In some cases vegetation may be cleared using mechanical means.
- Removal of individual trees or snags (hazard trees) that pose a risk of falling into conductors or structures and causing outages or fires. Personnel generally access hazard trees by truck, ATV, or by foot from an access or service road, and cut them with a chainsaw or similar tool. Any felled trees or snags are left in place as sources of large woody debris or as previously directed by the land management agency. Felled green trees are limbed to reduce fire hazard.
- Rusting of tower parts: At some places, it was observed that rusting of tower parts/stubs have occurred due to direct contact of wet soil with tower parts. Therefore, it was ensured that the mandatory clearance from top of the coping of each leg and present ground level was maintained.
- Norms for tower top patrolling:- Tower top patrolling of the lines was carried out in case of repeated tripping/ auto – reclosure (twice or more in same section/area) to find the untraceable faults during ground patrolling and in stretches having component failure history/ to examine pollution level on Insulators.
- Ground patrolling after line faults:- Emergency ground patrolling of the line to be carried out for +/-5% towers both sides of the faulty tower indicated by online fault locator to trace the fault. In case of permanent faults, off-line fault locator were utilized by Maintenance Engineer to correlate the finding of on-line fault locator.

- Norms for Thermovision scanning:-Thermovision scanning of the lines to be carried out after three month of the charging and noticed defects were attended on priority. Subsequent Thermovision scanning of high capacity lines (quadruple conductor) and highly loaded lines (90% or above of SIL rating) were carried out at every five year interval. Hotspots identified through Thermovision scanning were attended by HLM/ Earliest Opportunity.
- Norms for Punctured Insulator Detection:- PID scanning of Transmission lines having Insulator decapping incidents irrespective of age were carried out immediately to ascertain the healthiness of Insulators. However PID of Lines which are 15 years old were carried out irrespective of decapping incidents. Defective Insulators were replaced on priority.
- Condition Monitoring of Polymer insulators:- Condition monitoring of Polymer Insulators were carried out using Corona camera.
- Procedure for Transmission Line Patrolling:- Transmission Line maintenance Engineer prepares a program of transmission line patrolling/ Maintenance for the lines under his/her jurisdiction to complete patrolling cycle as per operation system norms and maintenance activities planned during the month and send copies to concerned employee and Delhi (O & M). Patrolling/ Maintenance of Transmission Line was carried out as per the plan.
- Checklist for Ground patrolling: Formats for the ground patrolling were filled up by the person who has patrolled the section immediately after patrolling and submitted to line In charge on daily basis.

7.3.2. Corrective Maintenance

Corrective maintenance activities are relatively large-scale efforts that occur infrequently, may result in more extensive vegetation clearing or earth movement and associated activities. Such activities shall be scheduled in the Maintenance Schedule for Transmission Lines. The following are examples of corrective maintenance:

- a) Non-cyclical vegetation clearing to remove saplings or larger trees in the ROW.
- b) Structure or conductor maintenance in which earth must be moved, such as the creation of a landing pad for construction or maintenance equipment.
- c) Structure (e.g., cross-arm, insulator, structure) replacement.

7.3.3. Tripping Details

Project Company furnished the tripping details, the route cause analysis and corrective action plan, as indicated in the table below –

400 kV D/C OPGC – Sundergarh	Event Date	Event Time	Restoration Date	Restoration Time	Loss hrs.	Reasons/ RCA
Ckt – 2			11/24/2017	3:26:00 PM		Idle charged from Jharsuguda end
Ckt – 1			12/5/2017	18:55		Anti – Theft charging from Jharsuguda end

400 kV D/C OPGC – Sundergarh	Event Date	Event Time	Restoration Date	Restoration Time	Loss hrs.	Reasons/ RCA
Ckt – 2	11/30/2017	9:50	12/5/2017	18:10		Anti – Theft charging from Jharsuguda end
Ckt – 1	12/15/2017	12:36	12/15/2017	18:22	5:46:00	Outage for reconnecting the jumpers in order to facilitate the first time charging of OPGC switchyard
Ckt – 2	12/15/2017	12:37	12/15/2017	18:24	5:47:00	Outage for reconnecting the jumpers in order to facilitate the first time charging of OPGC switchyard
Ckt – 1	19.12.17	17:30	19.12.17	19:05		First time synchronization from OPGC End
Ckt – 2	19.12.17	17:30	19.12.17	19:22		First time synchronization from OPGC End
Ckt – 2	1/24/2018	16:00	1/25/2018	17:45	25:45:00	Shutdown availed by Sundergarh PGCIL for construction work near ICT.
Ckt – 1	2/22/2018	8:30	2/23/2018	21:35	37:05:00	For overhead crossing of 765kV Raipur-Sundergarh line
Ckt – 2	2/22/2018	8:30	2/23/2018	21:37	37:07:00	For overhead crossing of 765kV Raipur-Sundergarh line
Ckt – 1	4/28/2018	19:32	4/28/2018	22:04	2:32:00	Phase to earth fault. Fault not recorded at OPGC end.
Ckt – 1	4/29/2018	18:27	4/29/2018	21:14	2:47:00	
Ckt – 2	4/29/2018	18:30	4/29/2018	21:18	2:48:00	B – Phase to ground fault and Trying to charge the line at 21:18 hrs SOTF operated
Ckt – 2	4/29/2018	21:18	4/30/2018	9:46	12:28:00	B – Phase to ground fault and Trying to charge the line at 09:46 hrs on 30-04-18 and SOTF operated. One conductor snapped in B phase
Ckt – 2	4/30/2018	9:46	5/2/2018	12:55	51:09:00	B-Phase to earth.SOTF acted.Regarding line charging clearance mail has been sent at12:11 hrs on 02-05-18
Ckt – 2	6/7/2018	14:10	6/7/2018	18:10	4:00:00	Shutdown availed by OPGC for communication checking
Ckt – 1	6/8/2018	12:30	6/8/2018	15:45	3:15:00	Shutdown availed by OPGC for digital protection panel communication.
Ckt – 2	6/8/2018	12:30	6/8/2018	16:38	4:08:00	Shutdown availed by OPGC for digital protection panel communication.
Ckt – 1	6/11/2018	15:26	6/11/2018	16:37	1:11:00	Phase to Earth fault.
Ckt – 2	7/15/2018	12:32	7/22/2018	10:58		Due to voltage regulation

400 kV D/C OPGC – Sundergarh	Event Date	Event Time	Restoration Date	Restoration Time	Loss hrs.	Reasons/ RCA
Ckt – 1	7/22/2018	10:44	7/24/2018	14:58		S/d Availed by OPGC for isolator sparking issue resolving
Ckt – 1	7/17/2018	18:11	7/17/2018	19:02		S/d Availed by OPGC for isolator sparking issue resolving

IE observed, that the major reason for the tripping of the line was due to Phase to Earth Fault. O&M Team should do the Root Cause Analysis and pan and implement the mitigative measures for the same. Regular cutting of trees in the Corridor below the Transmission Line needs to be done after taking proper shutdown of the line.

7.3.4. Emergency situations

Most of the activities, such as routine patrols, inspections, or scheduled maintenance, are planned in advance as per the O&M procedures. However, there will be an occasional need for emergency response in cases where safety and property are threatened, to prevent imminent damage to the transmission line and ancillary facilities, or to restore service in the event of an outage. Such activities which need to be addressed immediately shall be identified in the Maintenance Schedule for Transmission Lines. The following are examples of Emergency situations:

- Failure of conductor splices.
- Damage to structures or conductors from wildfire, high winds, ice, or other weather related conditions.
- Line or system outages or fire hazards caused by trees falling into conductors.
- Breaking or imminent failure of cross-arms or insulators, which could, or does, cause conductor failure.
- Damage to structures or conductors from vandalism

In the case of an emergency where life or substantial property is at risk or there is a potential or actual interruption in service, the Companies will promptly respond to the emergency and conduct any and all activities, including emergency repair requiring heavy equipment access to the structures or other ancillary facilities, needed to remedy the emergency and will implement feasible and practicable Environmental Protection Measures (EPMs).

7.3.5. Consumption of Spares

The List of Spares has been furnished to the IE. The details of the inventory available at store is indicated below –

Table 7.1 – Consumption of Spares

S. No.	Material Handed Over from Sterlite to JBS	Qty.
1	Pipe Type Earthing (in nos.)	2
2	DT fitting	1
3	120 KN 'Single "I" Suspension Pilot Insulator String	4

S. No.	Material Handed Over from Sterlite to JBS	Qty.
4	Counter Weight 25Kgs – (8 Nos = 1 set).	9
5	T-Connector Bolted Type (in nos.)	14
6	T-Connector Comp. Type (in nos.)	12
7	Twin Spacer Damper (in nos.)	0
8	Twin Rigid Spacer 457 mm (in nos.)	3
9	Vibration Damper for 7/3.66 mm Earthwire (in nos.)	5
10	Flexible Copper Bond for Earthwire (in nos.)	1
11	120 KN Polymer Insulator (in nos.)	1
12	160 KN Polymer Insulator (in nos.)	1
13	ACSR Conductor Bit (in m)	606
14	GS. Earthwire 7/3.66 mm Bit (in m)	90
15	Extension Link (in nos.)	6
16	Empty Conductor Drum (in nos.)	5
17	Empty OPGW Drum (in nos.)	4
18	120 KN Single "I" Suspension Pilot Insulator String	
18.1	Arking Horn (in nos.)	2
18.2	Yoke Plate (in nos.)	3
18.3	Suspension Clamp (in nos.)	3
18.4	20MM Dia D-Shackle (in nos.)	3
18.5	Corona Control Ring (in nos.)	3
19	Conductor & OPGW	
19.1	ACSR Zebra/ Snowbird Conductor (in m.)	0
19.2	OPGW Cable (Without Tested) (in m.)	2.25
20	OPGW Hardware Fitting	
20.1	Single Tension/Dead End Clamp (in nos.)	10
20.2	Single Suspension Assembly (in set.)	1
20.3	Joint Box (in nos.)	0
20.4	Down Lead Clamp (in nos.)	34
21	Tower	
21.1	DA+0 (in set.)	5
21.2	DB+0 (in set.)	1
21.3	DC+0 (in set.)	1
21.4	DD+0 (in set.)	1
22	Hardware Fitting	
22.1	MSCJ For Moose (in nos.)	146
22.2	Repair Sleeve for Moose (in nos.)	18
22.3	T-Connector (in nos.)	18
22.4	MSCJ for Earthwire (in nos.)	2
22.5	Repair Sleeve for Earthwire (in nos.)	12
23	Template	
23.1	DA+0-9 (in set.)	1
23.2	DB+0-9 (in set.)	1
23.3	DC+0-9 (in set.)	1
23.4	DD+0-9 (in set.)	1

The stores are provided with necessary Tools and Equipments along with nuts and bolts. The spares recommended by the Project Company are sufficient and in line with standard practices. However, there few recommended spares, which should be available at store for the O&M services –

- a. Lug for CP earthing
- b. Bird Guard
- c. Grading Rings
- d. PG Clamp
- e. Down lead clamp for OPGW
- f. Repair sleeve for ACSR
- g. Twin Rigid Spacer for Jumper
- h. Jumper cone
- i. Dead End with AL & Steel
- j. Vibration Dampers for Earthwire
- k. Flexible Copper Bond
- l. Mid Span Joint for Earthwire
- m. Dead End for Earthwire
- n. CC ring for suspension and tension
- o. Arcing horn for suspension & Tension
- p. Twin Spacer Damper
- q. Clamp cap/ keeper spacer
- r. T – Connector (open type)

7.4. Standard Operating Procedures

The Standard Operating Procedures (SOP) for Operation and Maintenance of the Transmission lines have been laid down by the Project Company. The Standard Operating Procedures elaborate the General Safety Precautions to be followed during the operation and maintenance of the transmission lines. It also includes the detailed procedure and working instructions for the following activities:

- a) Steps to be taken in case of Tower collapse
- b) Method employed to overcome failure of Jumpers
- c) Preventive Maintenance of Tower Foundation
- d) Maintenance Earthing of Transmission Lines
- e) Patrolling of Transmission Lines

The Standard Operating Procedures include the Maintenance Schedule of the Transmission lines and Checklist for Ground Patrolling. It also includes the various standard formats to be filled in during the operation and maintenance of the lines.

- a) Monthly Patrolling Programme
- b) Ground Patrolling report
- c) Tower Climbing Patrolling Report
- d) Log Book of Line Defects
- e) Emergency Patrolling Report on Tripping/ Auto re – closure of Transmission Lines
- f) Summary of Line Defects for the Month
- g) Shut Down Nature Defects
- h) Non-Shut down Nature Defects

- i) Details of Tree cutting
- j) Inspection Report for Major Maintenance/ Breakdown works
- k) Live Line Puncture Insulator Detection
- l) Thermovision scanning
- m) Insulator Washing/ cleaning

7.5. Implementation of the O&M Procedures

For proper implementation of the O&M Procedures, the following initiatives are being taken by the Project Company:

- a) Use of separate IT (Information Technology) based tool is being put in place for O&M, to computerize all the formats for the purpose of storage for easy access and for centralization of the information.
- b) To promote knowledge sharing within the team, a Knowledge management portal is already in place.
- c) Document management system in “WRENCH” software is already implemented for storage and retrieval of documents like engineering drawings, tower schedules, commissioning reports etc.
- d) Regular training programs are being held to train the personnel on the latest techniques for effective maintenance of the transmission lines and safety measures to be adopted during maintenance.

The O&M philosophy and methodology being adopted by the Project Company is in line with the widely accepted practices followed for similar projects. The Standard Operating Procedures laid down by the Project Company are comprehensive and include all major aspects required for effective operation and maintenance of the transmission lines.

7.6. O&M Technology

Project Company informed that they are planning to supervise their transmission assets with the drone based asset management technology developed by Sharper Shape Inc. This technology will enable to monitor the critical asset conditions and ensure full economic optimization of resource deployment in maintenance operations. The drone based asset management technology will improve the reliability, resilience and safety of the transmission lines.

OGPTL plans to implement Aerial Surveillance, through Drones. Sterlite has entered into partnership with Sharper Shape (Finland), for Drone based automated transmission line inspection.



Long distance inspection will be provided through drone based technology. The use of drones will increase the uptime of the grid, and also save the environment by conducting preventive maintenance and reducing deforestation along the line corridors.

Based on review of the O&M arrangement, IE observed that the same is in line with the industry practices and addresses all relevant works and obligations including the schedules of preventive and reactive maintenance activities to be performed for reducing the downtime.

7.7. Disaster Management Plan

Due to ever growing expanse of our operating territory and the variety of climatic conditions our transmission lines are subjected to, these lines may fail sometimes due to natural disasters. Failures can occur due to

- High wind loading or floods
- Storm damage
- Earthquake or Rock slides
- Mud slides
- Erosion of foundations
- Corrosion of towers
- Vandalism or sabotage

Total losses resulting from an extended outage of a key transmission line is site specific and can be considerable. Major monetary losses may depend directly or indirectly on the lost revenue due to unavailability of the line and cost of restoration. The total losses may be more than just the direct losses of the utility, especially if the utility is answerable to customers and government entities.

While the cost to rebuild or restore a failed transmission line is inversely proportional to the restoration time, the total losses are directly proportional to the outage time. In almost all cases, it is best to restore the transmission line as quickly as possible.

Therefore, Sterlite Power has derived a well laid out crisis management plan to tackle difficult scenarios arising out of any emergencies such as natural disasters, equipment failures, multiple tripping etc.

7.7.1. Objective and Scope of Disaster Management Manual

The following are the objective and scope of this Manual:

- To improve state of preparedness to meet any contingency;
- To reduce response time in organizing the assistance;
- To identify major resources, man power material & equipment needed to make the plan operational;
- Making optimum use of the combined resources

7.7.2. Inventory Management and Procedures

To perform any unplanned emergency work, critical materials have been identified and have been made available for restoration, for example, standardized conductor sizes in appropriate quantities including all terminations and splices are in stock. Project Company has variety of different types of Transmission towers, one plan that has proved effective is to maintain only tower steel for the heavier types and classes of permanent towers.

Emergency Materials for Transmission Lines –

- Mandatory T & P's (as per SOP's) for each and every activity related to Transmission Lines.
- Conductor of various type used in sufficient quantities.
- Hardware of all types
- Tower members (as per requirement and criticality)

External Resources

In excess to all the internal resources available, special arrangement with the external O & M contractors, agencies etc. has been tied up to provide assistance in case of emergencies.

Storage Locations

In case of any emergencies, inventory of recovery equipment and spares are available at critical locations so that these could be pressed into service within the shortest possible time.

All the required Emergency materials are available in the Stores identified for each and every Transmission lines or in the stores managed by O & M contractors.

Logistics

Arrangements for adequate number of vehicles for movement of people and materials are ensured. Medical facilities around the clock shall be made available to the staff engaged in the restoration activities. Arrangements for drinking water supply shall also be ensured.

Emergency Procedures for restoration of Lines

The various activities in response to an emergency shall include:

- The Central Control Room for monitoring the various lines is at Bhopal Substation. In case on any outages or tripping, it receives the information from the nearest substation and accordingly alerts the Line-in-Charge.

- Upon receiving preliminary information about the damage/tripping, site visit is done by Line in charge along-with the O&M gang located nearer to the location within a maximum of 02 hrs after receiving of information.
- After site visit exchange of information in terms of event description and its severity, takes place among the Head-O&M, Head-O&M (TL), Head-O&M(SS) & the Line-in-Charge and an action plan is worked out and it is communicated to all internal as well as external stake-holders.
- In case of Conductor snapping, upon receiving instructions, Gangs, T & P's and required materials to be mobilized to the site immediately within shortest possible time.
 - Meanwhile, Site survey and damage assessment is carried out by Safety Officer regarding the safe working conditions.
 - Safe working conditions for the Transmission Line Gangs are ensured. Medical facilities in case of emergencies are tied up. Basic amenities like drinking water etc. to be procured.
 - Site preparedness is done before the commencement of work.
 - Restoration Strategy is derived.
 - Restoration work is started immediately as soon as the required materials, T & P's reaches the location.
- In case of Tower failure, after receiving the confirmation from the Line In charge, detailed Damage assessment to be done and action plan to be formulated within 2 days.
 - Identification of resources need and their deployment viz, technical experts, manpower, equipment, spare parts & other material is done.
 - All Heads from O&M, Safety & Quality functions jointly develop a comprehensive disaster management plan and garner support from other internal/external agencies.
 - Restoration Models and Restoration Strategy are derived depending upon the scenario of Tower damage.
 - Restoration-activities are finalized & Restoration-team is formed with resources from various functions as per requirement. Daily log is maintained and control-room for monitoring the situation and for exchange of information internally/externally is created.
 - Site survey and damage assessment to be carried out by Safety Officer regarding the safe working conditions.
 - Safety Plan is finalized and put into action as soon as the assessment is completed.
 - O & M functional Heads to coordinate for any assistance in terms of men & materials.
- Restoration of Transmission Line should be completed within the desired timeline
- All the erection, construction, stringing activities is to be carried out within the stipulated safe working conditions.
- Once the restoration of the Transmission Line has been completed, Post investigation and analysis to be initiated to avoid such instances in the future.

IE observed that various safety measures have been covered in Disaster Management Manual which needs to be adopted to avoid any crisis/ disaster, ways and means to tackle a crisis/ disaster, if it occurs in spite of preventive measures.

8. ENVIRONMENTAL AND SOCIAL ASPECT

8.1. Environmental Impacts and Mitigation Measures

The operation of the transmission line shall have no environment impact and hence, no clearance or mitigation measures are required.

8.1.1. Environment, Health & Safety Assessment

OGPTL has implemented the following procedures to ensure that the Environment, Health & Safety (EHS) aspects are duly taken care of.

8.1.2. Quality, Health, Safety & Environment Scoring System

ENICL follows the QHSE Scoring methodology, wherein Safety Performance Monitoring System is classified in two categories i.e. –

1. Proactive monitoring
 - i. Various safety training as fall from height, electrical safety, fire, first aid training etc.
 - ii. Capturing of near miss incidents
 - iii. Mock drill on fall from height, fire, snake bite, electrocution etc
 - iv. Work place awareness as National safety day celebration, world environment day celebration, tool box talk etc
 - v. Workplace inspection
 - vi. Audit
 - vii. Environmental monitoring
 - viii. Management review meet
 - ix. Operation SOP driven, HIRA, EIA etc
2. Reactive monitoring such as
 - i. Capturing Unsafe acts / unsafe conditions / first aid and analysis for correction
 - ii. Dangerous occurrence and prevention.

8.1.3. EHS Inspection Procedure.

The EHS Inspection Procedure applies to the construction sites. The objective of this instruction is as follows:

- Demonstrate the involvement and commitment of middle managers in safety management
- Deploy common EHS managerial practices within all sites
- Promote the culture and to eradicate deviations and reach 100% compliance level

The EHS Inspection is achieved through

a) Safety Observation Tour (SOT) Process

This is a management process which is used to ensure the application of safety standards, instructions and practices/tools used in a given area. It is an inspection for the frontline engineer & middle management. This is a safety observation visit. The SOT is conducted to check the application of the EHS rules and regulations in the area.

The inspection format is filled by the Engineer & Manager involving channel partner & validated by EHS manager. During SOT, all points are checked in line with the Safety Tour Observation Check List which is provided as a part of the EHS Inspection Procedure. At the end of the SOT, a debrief between the SOT leader and the channel partner of the area visited takes place. All findings are reviewed and a commitment is taken by the channel partner to avoid new occurrences of the deviations found.

b) Intermediary Safety Visit (ISV)

It is a management process which should ensure the application of safety standards, instructions and practices/ tools used in a given area. It is an Intermediary Safety Visit Inspection for the Project Head, Commercial Head and Project Management & Business Head. The objective of the ISV is to make managements commitment visible. Also, the ISV is used to make sure that all the risks are managed, i.e under control. It is used to verify that local standards (workshop, customer site etc) are respected and applied. It helps to identify deviations and unsafe practices. The ISV format is filled and at the end of the ISV, a debrief between the ISV leader and the Line / Station Manager of the area visited take place. All findings are reviewed and a commitment is taken by Line/ Station Manager to implement actions to avoid new occurrences of the deviations found. Any open non compliance follows up & closeout is responsibility of EHS manager through Project Head.

The Project Company submitted sample reports of Safety Observation Tours and EHS Inspection reports for the project.

8.1.4. Work Stoppage or EHS Non conformance Report (NCR) Procedure.

This procedure describes the methods for raising EHS non-conformances at the construction sites with subsequent corrective action. Non-Conformity is any circumstances, material or method within the operation of the construction of Transmission Line which does not comply with the specified requirements contained within the Safe Working Procedure (SOP) and SPGVL EHS manual. This procedure applies to across the SPGVL constriction site.

The responsibility to ensure that the procedure is followed, reported and appropriate records are maintained lies with the Project Head/ Line Manager/ EHS Lead. The responsibility to issue NCR / work stoppages to contractor Line Manager/ Project Manager, EHS Lead in case of any non-conformity, unsafe act/ unsafe condition and recommend corrective and preventive action. When the agreed remedial action is completed, the Engineer/ Line Manager/ Project Manager shall sign off the respective non-conformance report.

IE observed that by this process, the Project Company has been taking adequate measures for ensuring safety at the site.

8.1.5. Review of the status of Environment, Health & Safety Aspects by IE

Upon review of the various EHS documents received from the Project Company, IE is of the opinion that the Project Company is following the EHS Procedures to ensure that the aspects related to Environment, Health and Safety of the project are duly taken care of.

9. PROJECT PERMITS AND CLEARANCES

Following table 9.1 shows the latest status of various Permits and Clearances obtained / to be obtained:

Table 9.1 – Permits & clearances

Sl. No.	Description	Authority	Present Status
1.	Transmission License	Central Electricity Regulatory Commission (CERC)	Recommendation for Transmission License by CERC vide notification dated 30 th June, 2016 has been accorded.
2.	Company Registration	Registrar of Companies	Completed
3.	Environmental Clearance	MoEF	Not Applicable
4.	Forest Clearance	State Govt./ MOEF	Stage 1 Forest Clearance along with Tree Cutting permission received for both 765 kV and 400 kV Transmission Lines.
5.	Wild Life Clearance	State Govt./ MoEF	Not Applicable
6.	Approval under Section 68 of Electricity Act, 2003	GOI, Ministry of Power	Obtained on 3 rd June, 2015
7.	Approval from GoI under section 164 of Electricity Act 2003	GOI, Ministry of Power	Obtained
8.	Transmission Service Agreement (TSA)	OGPTL and LTTCs	Signed on 20 th November, 2015
9.	Approval for adoption of Tariff under Section 63 of EA 2003.	CERC	CERC Order dated 31 st May, 2016
10.	Approval from CERC under Section 17(3)	CERC	Received vide CERC order dated 20 th September, 2016
11.	Power & Telecommunication Coordination Committee Clearance (PTCC)	CEA / Ministry of Power	PTCC for 765 kV line – received PTCC for 400 kV line is received
12.	Railway Crossing	Ministry of Railways	Received
13.	River Crossing	Navigation Authority	Received
14.	Road Crossing	National Highway/ State Road Department	NOC for all the 6 crossings is received
15.	Power Line Crossings	Concerned State Power Utilities / PGCIL	Received
16.	Aviation Clearance	Airport Authority of India	Received on 19 th December, 2016 for 765 kV Line and on 16 th December, 2016 for 400 kV Line.
17.	Defence clearance	Ministry of Defence	Defence Clearance for 400 kV is not applicable. Approval is received vide letter dated 10 th March, 2017 for 765 kV Line.

765 kV D/C Transmission Line

Regarding the NH/ EHV/HVDC/Railway Crossings – There are 58 crossings, out of which, proposals for all the 58 crossings have been submitted and approvals for 53 is received.

S. No.	Name of Proposal	No. of Crossings	Status of Proposal
1.	Power Line Crossing	46	46 proposals approved
2.	Railway Crossing	6	6 proposals approved
3.	NH Crossing	6	6 proposals approved
4.	PTCC Proposal	PTCC received for both Chhattisgarh and Odisha portion	
5.	Forest Proposal	Stage – 1 approval along with Tree cutting Permission for Chhattisgarh portion, vide letter dated 1 st February, 2018 is received. The Stage – 1 approval for Odisha section was received vide letter dated 6 th March, 2018. The Tree cutting permission was received vide letter dated 20 th April, 2018.	

IE observed that Project Company has received all the Permits & Clearances for the commissioning and charging activities.

400 kV D/C Transmission Line

Regarding the NH/ EHV/HVDC/Railway Crossings – There are 21 crossings. Proposal for all the 21 crossings have been submitted and approval for all the crossing and Forest Clearance is received. ***IE observed that Project Company has received all the approvals for operation of 400 kV Transmission Line.***

10. SUMMARY AND MAJOR FINDINGS

- The project comprises of 51.35 kms of 400 kV D/C Triple Snowbird Conductor Transmission Line from OPGC (IB Thermal Power Station) to 765/400 kV Jharsuguda Pool Station and another of around 304.95 kms of 765 kV D/C Hexa Zebra Conductor Transmission Line from 765/400 Raipur Pooling Station at Bhilai to 765/400 kV Jharsuguda Station (Sundergarh)
 - 400 kV D/C Triple Snowbird Conductor Transmission Lines from OPGC (IB Thermal Power Station) to 765/400 kV Jharsuguda Pool Station. (approximately 51.35 km), is commissioned and is operational. The CEA letter for approval for energization was received on 23rd August, 2017 and the POSOCO letter indicating the successful completion of trial – run operation was received on 20th December, 2017.
 - The SCOD as per TSA for 400 kV D/C line was on July, 2017, however due to delay in completion of 400 kV Bays at PGCIL 765/400 kV Pooling Station at Jharsuguda, under the purview of PGCIL, the line got charged during December, 2017.
 - The construction works for 765kV D/C Transmission Lines are 100% complete..
 - If the Project is delayed by 180 days beyond schedule COD as per TSA reasons solely attributable to Project Company, the maximum LD imposed as per TSA is Rs 106.85 Crores. However as per EPC Contract, if the Project is delayed beyond schedule COD reasons solely attributable to EPC Contractor, the maximum LD recovered as per EPC Contract (combined Supply, Erection and Civil works contract) is Rs 104.30 Crores.
 - IE observed that requisite Permits and Clearances for the commissioning and operation of 400 kV D/C and 765 kV D/C Line are received and well in place.
 - Service conditions and system parameters are in line with the TSA and relevant Indian Standards & Practices for similar kind of projects.
 - The O&M Contract for both 400 kV D/C and 765 kV D/C Line is awarded to M/s. JBS Enterprise Private Limited. The O&M works for 400 kV Line started from 10th March, 2017, while the works for 765 kV Line shall start after the commissioning of the same.
 - Maintenance records like checklist for patrolling (Civil & Electrical works), monthly patrolling program, monthly patrolling actual log – book of line defects, Emergency patrolling report of tripping, monthly project progress etc records are being regularly maintained and monitored.
 - IE observed that the reason for majority times of tripping of 400 kV D/C Line was due to Phase to Earth fault. IE opines that proper root cause analysis should be done and mitigative measures to be implemented.
- Risk Category – C**
- IE opines that there no major ROW issues being faced during the O&M of 400 kV Line or during execution of 765 kV Line. The major ROW issue related to 765 kV D/C line are all cleared and works are complete for those section.
 - No displacement of people in the process of finalization of Right of Way and execution of the project took place. As such the socio – economic and external environment shall have no impact on the project and vice – versa
 - A set of photographs taken during the site visit from 16th to 19th May, 2018 is attached as **Annexure – 3**



भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केंद्रीय विद्युत प्राधिकरण
Central Electricity Authority
मुख्य विद्युत निरीक्षणालय प्रभाग
Chief Electrical Inspectorate Division

Telefax: 011-26565183

संख्या: CEI/1/EL/RIO(E/NE)/Insp/2017

दिनांक: 28/08/2017

विद्युत नियम के लिए अनुमोदन

(केंद्रीय विद्युत प्राधिकरण (सुरक्षा तथा विद्युत आपूर्ति संबंधी) विनियम, 2010 (यथा संशोधित) के विनियम 43 के अंतर्गत)

Electrical Installation: -

Electrical Apparatus: - 400 kV D/C OPGC-Jharsuguda Transmission line (length=51.35 km).

Inspected by: - Deputy Director, CEI, CEA, New Delhi on 25.07.2017

Location: - M/s Odisha Generation Phase-II Transmission Ltd.

Reference: -

1. Online Application No- B/2017/0227 dated: 04-07-2017.
2. Our letter to OGPTEL/RIO(W)/Insp 2017/1638 dated: 03-08-2017 - Insp. Rep.
3. Your letter dated: OGPTEL/OJ/EL/2017/0833 dated: 22.08.2017 - Compliance Rep.

With reference to the above, approval under regulation 43 of CEA (Measures relating to Safety and Electric Supply) Regulations, 2010 (as amended) is hereby accorded for energisation of the above mentioned electrical installation.

The consistent compliance of relevant provisions of CEA (Measures relating to Safety and Electric Supply) Regulations, 2010 (as amended) shall be ensured for safety in operation and maintenance of the above electrical installation.

Periodical inspection of the above electrical installation shall be due after 02 years from the date of this inspection under regulation 30 of CEA (Measures relating to safety and Electric Supply) Regulations, 2010 (as amended). This periodicity is subject to change by government notification.

(R K Meena)

Deputy Director &
Electrical Inspector to the GOI

To:-

Shri: 1 A N Reddy, Odisha Generation Phase-II Transmission Ltd., F-1, The Mira Corporate suites, 1 & 2 Ishwar Nagar, Mahura Road, New Delhi-110065

प्रतिलिपि : उप निदेशक, RIO(E), के.वि.प्रा.

पावर सिस्टम ऑपरेशन कॉरपोरेशन लिमिटेड

(भारत सरकार का उद्यम)

POWER SYSTEM OPERATION CORPORATION LIMITED

(A Govt. of India Enterprise)

CIN: U40105DL2009GOI188682



पूर्वी क्षेत्रीय भार प्रेषण केंद्र, 14, गोल्फ क्लब रोड, टॉलीगुंज, कोलकाता 700033

EASTERN REGIONAL LOAD DESPATCH CENTRE, 14, Golf Club Road, Tollygunge, Kolkata 700033

Tel / दूरभाष: 033 2423 5867/5875 • Fax / फैक्स: 033 2423 5809/5704/5029 • E-mail / ई-मेल: erldc@posoco.in

Certificate Number: ERLDC/Trial Operation/2018/January/02

Date: 04/01/18

Certificate of completion of Trial Operation of Transmission Element

Reference:

- Communication dated 23.11.17 from Transmission Licensee to RLDC in Format-I and IA.
- Communication from RLDC dated 24.11.17 to Transmission Licensee in Format-II.
- Communication from Transmission Licensee to RLDC dated 23.11.17 in Format III, IIIA, IIIB, IIIC and IIID.
- Provisional approval dated 01.12.17 from RLDC to Transmission Licensee for charging in real time in Format-IV.
- Real time code issued by RLDC on 19.12.17 respectively.
- Communication dated 26.12.17 from Transmission Licensee in Format-V after trial operation.

Based on the above reference, it is hereby certified that the following Transmission element has successfully completed the trial operation:

Name of the Transmission Asset:	1. 400KV D/C IB-OPGC-Ithasuguda (Sundargarh- PGCIL) Line CKT I 2. 400KV D/C IB-OPGC-Ithasuguda (Sundargarh- PGCIL) Line CKT II
Owner of the Transmission Asset :	Odisha Generation Phase II Transmission Limited
Date and Time of Energization for commencement of successful trial-run operation.	1. 19:05 hrs. of 19.12.2017 2. 19:22 hrs. of 19.12.2017
Date/time of completion of successful trial run operation	1. 19:05 hrs. of 20.12.2017 2. 19:22 hrs. of 20.12.2017

Note:

- Only Line portion (From gantry tower of Ithasuguda 55 to Dead End tower at IB-OPGC 55) is owned by OGPTL.
- As no start-up power was drawn by IB-OPGC, power flow of the lines was zero for mentioned trial run periods. ERLDC has approved drawl of start-up for IB-OPGC (st-2) with effect from 27/12/17. This certificate is being issued in accordance with Regulation 6.3 (A) (5) of CERC (Indian Electricity Grid Code) Regulations, 2010 to certify successful completion of trial operation of transmission element. Usage of this certificate for any other purpose is prohibited.

Signature

Name and Designation of the

Authorized Signatory with official seal

श्री प्रदीप मुखोपाध्याय / P. MUKHOPADHYAY

कार्यपालक निदेशक / Executive Director

Power System Operation Corporation Ltd.

ERLDC, - Kolkata - 700 033

Place: Kolkata

Copy to:

- Head-Asset Management, OGPTL, O&M Office, A-634, Tulip, New Meenal residency, Ayoodya Bypass Road, Bhopal, M.P.-462023.
- MS, ERPC, 14, Golf Club Road, Tollygunge, Kolkata-700033
- ED, NLDC, B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi-110016

पंजीकृत एवं केन्द्रीय कार्यालय : प्रथम तल, बी-9, कुतुब इंस्टिट्यूशनल एरिया, कटवारिया साराई, नई दिल्ली - 110016

Registered & Corporate Office : 1st Floor, B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi - 110016

Website - www.posoco.in, E-mail : posococo@posoco.in

765 kV D/C Transmission Line



Bhilai Gantry to Loc. 1/0 connection – stringing works are in progress





Stretch 1/0 to 4/0 – Stringing complete



Section 2/3 & 3/0 – river crossing stringing complete



Location 104A/0 – Tower erection in progress



Section 105/0 & 106/0 – Stringing works to start



Location 108/3 – Tower erection in progress



108/4 to 108A/0 – Tower erection complete



Location 115/0 – Stringing works are in progress



Stretch 115/6 to 116A/0 – Stringing in progress



Location 128/5 – tower materials are dumped for tower erection in progress in the hills indicated below



400 kV D/C Transmission Line



Sundergarh PGCIL substation – Gantry connection complete




Location 32/0 – Road crossing, Erection and stringing complete



Stretch 32/0 to 33/0 – Stringing complete



Stretch 30/0(DD+18) to 35/0 (DC+0) – stringing complete



At the helm of the Energy Transition, Tractebel provides a full range of engineering and advisory services throughout the life cycle of its clients' projects, including design and project management. As one of the world's leading engineering and advisory companies and with more than 150 years of experience, it's our mission to actively shape the world of tomorrow. With about 5,000 experts and presence in more than 70 countries, we are able to offer our customers multidisciplinary solutions in energy, water and urban.

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