

Indigrid Trust - 2 Nos, 400kV D/C Transmission Line (NRSS XXIX)

Due Diligence Report - NRSS XXIX

Indigrid Trust
Delhi | INDIA

RESTRICTED

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Final

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DUE DILIGENCE REPORT



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Project : **NRSS XXIX Transmission Limited**
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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY.....	7
2. INTRODUCTION.....	11
2.1. Background.....	11
2.2. Definitions	11
2.3. Scope of Services.....	11
2.4. Basis of Report	12
2.5. Risk Categories	12
<i>Disclaimer</i>	12
3. DESCRIPTION OF THE PROJECT.....	14
3.1. Background.....	14
3.2. Transmission and Sale of Power	16
3.3. EPC Contract	17
4. EPC CONTRACT	19
4.1. Supply Contract.....	19
4.1.1. Scope of Work	19
4.1.2. Responsibility for Completeness	21
4.1.3. Effective Date and Completion Period.....	21
4.1.4. Guarantees	22
4.1.5. Liquidated Damages.....	23
4.1.6. Insurance	23
4.1.7. Defect Liability	24
4.1.8. Contractor's Responsibilities	24

4.1.9.	Latent Defects.....	25
4.1.10.	Contractor's/Owner's representation and warranties	26
4.1.11.	Other Provisions	26
4.2.	Erection Contract	26
4.2.1.	Scope of Work	26
4.2.2.	Responsibility for Completeness	28
4.2.3.	Contractor's Covenant to Erection Works for 400 kV D/C Transmission Lines and Sub – station.....	28
4.2.4.	Effect Date and Completion Schedule	29
4.2.5.	Guarantees	29
4.2.6.	Liquidated Damages.....	30
4.2.7.	Site Requirement.....	30
4.2.8.	Service Level Agreement	32
4.2.9.	Insurance	32
4.2.10.	Sub – Contracting	33
4.2.11.	Limitation of Liability	34
4.2.12.	Defect Liability	34
4.2.13.	Latent Defects.....	35
4.2.14.	Contractor's /Owner Representation and Warranties.....	36
4.2.15.	Other Provisions	36
4.3.	Civil Contract	36
4.3.1.	Scope of Work	36
4.3.2.	Contract Period and Completion Schedule	37
4.3.3.	Advance Guarantee.....	37
4.3.4.	Contract Performance Guarantee	37
4.3.5.	Liquidated Damages.....	38
4.3.6.	Insurance	38
4.3.7.	Other Provisions	38
4.4.	Overall Observation	39
4.5.	Back to Back Contracts	40
5.	DESIGN PHILOSOPHY OF TRANSMISSION SYSTEM.....	42
5.1.	Technical Requirements for Transmission Lines	42
5.2.	Review of Tower Design & Type Test Certificate	43
5.3.	Tower Foundation	46
5.4.	Insulator Design	46
5.5.	Quality Assurance and Safety Aspects.....	47
5.5.1.	Quality Control	47
5.5.2.	Safety Aspects.....	47

5.6.	Technical Requirement for Substation	47
5.7.	Technical Requirements for Communication	54
5.8.	Useful Life of Asset	55
5.9.	Technical Guarantee	56
5.10.	Availability of Transmission Lines and Substations	56
5.11.	Assessment of Technology Risk	57
6.	TIME SCHEDULE	58
6.1.	Schedule as per TSA.....	58
6.2.	Schedule as per EPC Contracts.....	58
6.3.	Schedule as per CERC tariff order 10.12.2014	58
7.	PROJECT MANAGEMENT ARRANGEMENT.....	59
7.1.	Project Organization	59
7.2.	O&M Organization Set – up & its adequacy.....	59
7.2.1.	Organization Chart for Transmission Line and sub – station	60
7.3.	Operation & Maintenance (O&M) Activities	62
7.3.1.	Routine Maintenance (Preventive Maintenance).....	63
7.3.2.	Corrective Maintenance	64
7.3.3.	Annual Maintenance Schedule for the Year 2018 – 19	65
7.3.4.	Tripping Details	65
7.3.5.	Uprooting of Towers for Samba – Amargarh Line	66
7.3.6.	Emergency situations	66
7.3.7.	Consumption of Spares	67
7.4.	Standard Operating Procedures	69
7.5.	Implementation of the O&M Procedures	69
7.6.	O&M Technology	70
7.7.	Disaster Management Plan.....	70
7.7.1.	Objective and Scope of Disaster Management Manual	71
7.7.2.	Inventory Management and Procedures	71

8. ENVIRONMENTAL AND SOCIAL ASPECT	74
8.1. Environmental Impacts and Mitigation Measures	74
8.1.1. Environment, Health & Safety Assessment.....	74
8.1.2. Quality, Health, Safety & Environment Scoring System.....	74
8.1.3. EHS Inspection Procedure.	74
8.1.4. Work Stoppage or EHS Non conformance Report (NCR) Procedure.....	75
8.1.5. Review of the status of Environment, Health & Safety Aspects by IE.....	76
9. PROJECT PERMITS AND CLEARANCES	77
10. SUMMARY OF MAJOR FINDINGS	80

LIST OF ANNEXURE:-

Annexure – 1	:	Commissioning Letter of Phase – 1 of the Project from POSOCO
Annexure – 2	:	POSOCO Letter for LILO and 400/220 kV GIS Substation
Annexure – 3	:	POSOCO Letter for 400 kV D/C Samba – Amargarh Line
Annexure – 4	:	Site Photographs

LIST OF TABLES

Table 1.1 – Project Details	7
Table 2.1 – Definition of Risk Categories.....	12
Table 3.1 – List of LTTCs	16
Table 4.1 – List of Sub – Contractors	40
Table 6.1 – Tower types with Deviation Limits as per CBIP Guidelines.....	42
Table 8.1 – Annual Maintenance Plan for Year 18 - 19	65
Table 8.2 – Tripping Details	65
Table 8.3 – Consumption of Spares.....	67
Table 10.1 – Status of Permits and Clearances.....	77

1. EXECUTIVE SUMMARY

NRSS XXIX Transmission Limited (hereinafter referred as “NRSS or Project Company”) a subsidiary of Sterlite Grid 2 Limited (SGL 2) has set up 400 kV Transmission Project consisting of 400 kV D/C transmission lines (134.811 km) from Jalandhar to Samba & from Samba to Amargarh (280.22 kms), LILO of Uri – Wagoora line at Amargarh extending 5.84 kms and one nos. 400/220 kV GIS substations (7x105 MVA) at Amargarh (Jammu and Kashmir) on Build, Own, Operate and Maintain (BOOM) basis for 35 years.

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

The Project consists of construction of following transmission lines and substations being executed by the Project Company (NRSS):

Table 1.1 - Project Details

S. No.	Scheme/ Transmission Works
A.	Transmission Lines:
i.	LILO of both circuits of Uri – Wagoora 400 kV D/C line at Amargarh (on multi-circuit towers) (5.84 kms) (Phase – 2)
ii.	Jalandhar – Samba 400 kV D/C Twin ACSR Moose (134.811 kms) (Phase – 1)
iii.	Samba – Amargarh 400 kV D/C Twin ACSR Moose routed through Akhnoor/ Rajouri (279.19 kms) (Phase – 2)
B.	Sub-station:
	Establishment of 7x105 MVA (1 ph units), with 400/220 kV GIS substation at Amargarh
	400 kV
	- Line Bays: 6 No.
	- 400/220 kV ICT: 7 x 105 (1-ph Units)
	- ICT bays: 2 no.
	- Line Reactor (50 MVAR): 2 no. (for Amargarh Lines)
	- Bus Reactor (63 MVAR): 2 no.
	- Bus Reactor Bay: 1 no. (Two bus reactors on one bay)
	- Space for line/ICT bays: 4 no.
	- Space for ICT: 1 no.
	220 kV
	- Line Bays: 6 no.
	- ICT bays: 2 no.
	- Space for line/ICT bays: 4 no

The Transmission Service Agreement (TSA) is signed between 24 numbers Long Term Transmission Customers (LTTCs) and NRSS XXIX Transmission Limited (NRSS) vide agreement dated on 02.01.2014 for 35 years. The transmission charges shall be paid by the LTTCs in the proportion of their respective allocated Project Capacity.

The scheduled completion date of the transmission line is 38 months from the effective date (4.08.2014) as per TSA which works out to be 04.10.2017. However, as per the amendment to the RFP documents the revised SCOD is 50 months from the effective date. As per the CERC tariff order dated 10.12.2014 the scheduled completion date of the transmission line is 50 months from the effective date which works out to be 04.10.2018.

The contracts of Supply, Erection and Civil Works are executed separately between NRSS-XXIX Transmission Limited (Owner) and Sterlite Power Grid Ventures Limited (Contractor) on 15th January 2015. As per the EPC Contract, the schedule completion of all the construction and commissioning works is 4th October, 2018.

SPGVL (Contractor) signed multiple sub – contracts for supply, erection and construction of the Transmission System as well as the sub – station. The Project Company appointed an external third party surveyor, M/s MNEC Consultants for conducting a detailed walk – over route survey of the project.

The Jalandhar – Samba Transmission Line is indicated as Phase – 1 of the Project and the Samba – Amargarh as Phase – 2 of the Project. Phase – 2 of the project is divided into four packages.

The Samba to Amargarh line along with the Uri – Wagoora LILO Line is about (280.22 kms) and is divided into four packages as mentioned below:

1. Samba Substation to AP 72 (Package 1) – sub – contracted to M/s. KEC International Ltd. Stretch of 83.93 kms
2. AP 73 to AP 270 (Package 2) – sub – contracted to M/s. TATA Transmission Ltd. Stretch of 84.02 kms
3. AP 271 to AP 393 (Package 3) – sub – contracted to M/s. TATA Transmission Ltd. Stretch of 52.60 kms
4. AP 394 to Amargarh Substation – sub – contracted to M/s. Unitech Transmission Ltd. Stretch of around 59.67 kms

As per the substation construction schedule provided by M/s Alstom, IE noted that the final commissioning was expected by January, 2018. IE notes that ICT 1 & 2 of 400/220 kV rating got charged on 10th May, 2018.

IE Conducted the site visit from 16th to 19th May, 2018 for checking the Phase – 1 & Phase – 2 Transmission Lines and the substation. During the site visit, IE visited the Jalandhar – Samba 400 kV D/C and Samba to Amargarh (via Jammu, Akhnoor, Rajouri, Thana Mandi, Bafliaz, Mugal Road, Pir Panjal ranges, Shopian to Amargarh), Substations at Amargarh as well as Project Office at Srinagar. IE visited the 400/220 kV Jalandhar Substation of PGCIL, to monitor the health of J – S Line.

Project Company has successfully completed the trial run of Phase – 1 and Phase – II of the Project as indicated below–

- 400 kV D/C Twin Moose Conductor Jalandhar – Samba Transmission line Phase-I of the Project, successfully completed the trial – run operation on 24.06.2016/ 18:29 Hours

- 400 kV Amargarh (NRSS XXIX) – Samba (PG) ckt – 1, along with 50 MVAR Non – switchable line reactors at Amargarh (NRSS XXIX) end and associated bays on 1st September, 2018 at 20:15 hrs
- 400 kV Amargarh (NRSS XXIX) – Samba (PG) ckt – 2 along with 50 MVAR Non – switchable line reactors at both the ends and associated bay on 22nd August, 2018 at 22:00 hrs
- 400/220 kV, 315 MVA – 1 & 2 (6X105 MVA) along with associated 400 kV bays and 220 kV bay at Amargarh on 18th May, 2018 at 15:35 hrs
- 400 kV, 3 – Ph 63 MVAR Bus Reactor – 1 with associated 400 kV Bay at Amargarh (NRSS XXIX) on 3rd June, 2018 at 11:15 hrs
- 400 kV, 3 – Ph 63 MVAR Bus Reactor – 2 at Amargarh (NRSS XXIX) on 8th June, 2018 at 16:42 hrs
- 400 kV Uri (NHPC) – Amargarh (NRSS XXIX) ckt – 1 and associated bays at Amargarh (NRSS XXIX) and 400 kV Amargarh (NRSS XXIX) – Wagoora (PG) ckt – 1 and associated bays at Amargarh (NRSS XXIX) {Only LILO portion of 400 kV Uri 1(NHPC) – Wagoora Ckt – 1 at Amargarh (NRSS XXIX)} on 10th April, 2018 at 21:00 hrs
- 400 kV Uri 1(NHPC) – Amargarh (PG) ckt – 2 and associated bays at Amargarh (NRSS XXIX) and 400 kV Amargarh (NRSS XXIX) – Wagoora (PG) ckt – 2 and associated bays at Amargarh (NRSS XXIX) {Only LILO portion of 400 kV Uri 1(NHPC) – Wagoora (PG) Ckt – 2 at Amargarh (NRSS XXIX)}, on 18th March, 2018 at 21:30hrs

The transfer of the J – S Line from the Project Team to the O&M Team has been completed, during September & October, 2016. The Project Company has already finalized the arrangements for O&M of the 400kV J – S Line and substation. The O&M Contract is outsourced for maintenance works of 400kV D/C Jalandhar – Samba Line to M/s. Telegence Powercomm Private Limited. Work order dated 27th July, 2016, was awarded for maintenance works from Jalandhar Substation Gantry to AP 66/4 and AP 67/2 to AP 67/3 (106.604 kms) at Punjab. The effective date of the Contract was 27th July, 2016 and valid till 36 months i.e. Three years from effective date.

Similarly another work order dated 23rd December, 2016 was awarded for Maintenance works from AP 67/0 to AP 67/1 and AP 68/0 to Samba substation Gantry (28.206 kms) at Jammu. The effective date of the Contract was 1st August, 2016 and valid for 36 months i.e. three years from effective date.

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.

IE found that the requisite Permits and Clearances for Jalandhar to Samba line are obtained. Regarding the Samba to Amargarh section, IE opines that major permits and consents including Transmission License, Approval under section 68 of Electricity Act, 2003, PTCC, Aviation, crossings etc. have been received and are valid as on date. Signing of TSA has also taken place.

2. INTRODUCTION

2.1. Background

NRSS XXIX Transmission Limited (hereinafter referred as “NRSS or Project Company”) a subsidiary of Sterlite Grid 2 Limited (SGL 2) has set up 400 kV Transmission Project consisting of 400 kV D/C Twin Moose Conductor Transmission Lines (134.811 km) from Jalandhar to Samba & from Samba to Amargarh (279.19 kms), LILO of Uri – Wagoora line at Amargarh extending 5.84 km and one nos. 400/220 kV substations (7x105 MVA) at Amargarh (Jammu and Kashmir) on Build, Own, Operate and Maintain (BOOM) basis.

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

2.2. Definitions

Project	: Total of 419.651 kms. 400 kV D/C Twin Transmission Line from Jalandhar to Samba (134.811 KM) & from Samba to Amargarh (279.19 KM), LILO of Uri-Wagoora line at Amargarh (5.84 KM) and one nos. 400/220 kV substations (7x105 MVA) at Amargarh.
Project Company	: NRSS XXIX Transmission Limited (NRSS)
Client	: Indigrid Trust (SP)
Independent Engineer	: Tractebel Engineering Pvt. Ltd. (TEPL)

2.3. Scope of Services

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, EHV equipment rating, Relay & metering, SAS and communication system)
- Insights on the EPC contractor based on general industry experience and review of warranties and guarantees in the contracts
- Commentary on the technology deployed (substation layout drawing, transformers, switchgear, etc)
- Outage/ tripping records since commissioning
- Project Costs
- Construction schedules and if any Penalties levied
- Operation & Maintenance Philosophy and Arrangements
- Review all status of clearances, permits
- Major ROW issues, Court Cases, pending Insurance claim etc.
- Highlight key risks and mitigation thereof.

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
- Sub – 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
- Stock/Materials statements
- Tripping & Outage data

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 NRSS XXIX Transmission Line Project. Accordingly, three Risk Categories have been assigned as indicated in Table 2.1 below:

Table 2.1 - Definition of 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 THE PROJECT

NRSS XXIX Transmission Limited (hereinafter referred as “NRSS or Project Company”) a subsidiary of Sterlite Grid 2 Limited (SGL 2) has set up 400 kV Transmission Project consisting of 400 kV D/C Twin Moose Conductor transmission lines (134.811 km in length) from Jalandhar to Samba & from Samba to Amargarh (279.19 km), LILO of Uri – Wagoora line at Amargarh extending 5.84 km and one nos. 400/220 kV substations (7x105 MVA) at Amargarh (Jammu and Kashmir) on Build, Own, Operate and Maintain (BOOM) basis.

3.1. Background

Presently the power supply to the Kashmir valley is through Kishenpur – Wagoora 400 kV D/C, Kishanpur – Pampore 220 kV D/C and Udampur – Pampore 132 kV D/C. All the existing and under construction line are rooted through Udampur – Batote – Banihal – Pir Panjal pass. The common corridor of the transmission line is highly prone to snow storm, landslides and other natural calamities making power supply to the Kashmir valley vulnerable. Further power supply to Jammu and Kashmir is basically through 400/220 kV Kishanpur substation and there is an immediate need for providing an alternate route for transfer of power from Jammu region to Kashmir valley. Further the high load growth anticipated in northern part of Kashmir and to cater to projected loads, a 400/220 kV substation at Amargarh in North Kashmir area is required.

Under the present scheme Establishment of 400/220 kV substation at Amargarh along with Loop in Loop out (LILO) Uri – Wagoora 400 kV D/C has been proposed. The substation shall be further connected to the grid through Jalandhar – Samba – Amargarh 400 kV D/C line. The Samba – Amargarh line is routed via Akhnoor and Rajouri. This would have dual benefit i.e. the line would be constructed through a different corridor which is away from the existing line corridor as well as when the demand in Akhnoor/Rajouri increases new 400 kV substations can be established by LILO of proposed 400 kV Samba – Amargarh line. The Power would be flowing from Jalandhar to Samba, and hence the load built up at the nearing Samba region shall be met.

The Project includes construction of following transmission lines and substations being executed by the Project Company (NRSS):

S. No.	Scheme/ Transmission Works
1.	Transmission Lines:
a)	LILO of both circuits of Uri – Wagoora 400 kV D/C line at Amargarh (on multi-circuit towers)
b)	Jalandhar – Samba 400 kV D/C Twin Moose Conductor
c)	Samba -Amargarh 400 kV D/C twin Moose routed through Akhnoor/ Rajouri
2.	Sub-station:
	Establishment of 7x105 MVA (1 ph units), with 400/220 kV GIS substation at Amargarh:
	<ul style="list-style-type: none">• 400 kV• Line Bays: 6 No.• 400/220 kV ICT: 7 x 105 (1-ph Units)

S. No.	Scheme/ Transmission Works
	<ul style="list-style-type: none"> • ICT bays: 2 no. • Line Reactor (50 MVAR): 2 no. (for Amargarh Lines) • Bus Reactor (63 MVAR): 2 no. • Bus Reactor Bay: 1 no. (Two bus reactors on one bay) • Space for line/ICT bays: 4 no. • Space for ICT: 1 no. • 220 kV • Line Bays: 6 no. • ICT bays: 2 no. • Space for line/ICT bays: 4 no

The schematic diagram of NRSS XXIX is indicated below:



3.2. Transmission and Sale of Power

NRSS has entered into a Transmission Service Agreement (TSA) with Long Term Transmission Customers (LTTTC) for 35 years. The transmission charges shall be paid by the LTTTCs in the proportion of their allocated Project capacity.

The scheduled completion date of the transmission line was 38 months from the effective date (4.08.2014) as per TSA which works out to be 04.10.2017. However, as per the amendment to the RFP documents the revised SCOD is 50 months from the effective date. As per the CERC tariff order dated 10.12.2014 the scheduled completion date of the transmission line is 50 months from the effective date which works out to be 4th October, 2018.

The List of 24 LTTTCs (entered TSA) is indicated in Table 3.2 below:

Table 3.1 – List of LTTTCs

S. No.	Name of the LTTTC
1.	AD Hydro Power Limited
2.	Haryana Power Purchase Centre
3.	Punjab State Power Corporation Ltd
4.	Himachal Sorang Power Pvt. Limited
5.	Adani Power Limited, Mundra
6.	Jaipur Vidyut Vitran Nigam Limited
7.	Ajmer Vidyut Vitran Nigam Limited
8.	Jodhpur Vidyut Vitran Nigam Limited
9.	Lanco Anpara Power Limited
10.	Lanco Green Power Private Limited
11.	PTC(EVEREST), PTC India Limited
12.	Himachal Pradesh State Electricity Board
13.	Power Development Dept., Govt. of J&K
14.	North Central Railway
15.	Jaiprakash Power Ventures Limited
16.	BSES Yamuna Power Limited
17.	BSES Rajdhani Power Limited
18.	TATA Power Delhi Distribution Limited
19.	New Delhi Municipal Corporation
20.	Electricity Wing of Engg. Dept, Chandigarh
21.	Power Grid Corporation of India Limited
22.	U.P Power Corporation Limited
23.	PTC(BUDHIL), PTC India Limited
24.	Uttarakhand Power Corporation Limited

The NRSS XXIX Transmission Limited, of which 100% equity shares has been acquired by Sterlite Grid Ltd, shall be responsible as the TSP, for ensuring that it undertakes ownership, financing, development, design, engineering, procurement, construction, commissioning, operation and maintenance of the Project, and to provide Transmission Service on a long term basis to the Long Term Transmission Customers

3.3. EPC Contract

The contracts of Supply, Erection and Civil Works Construction are executed separately between NRSS-XXIX Transmission Limited (Owner) and Sterlite Power Grid Ventures Limited (Contractor) on 15th January 2015. The scope of work includes:

- Laying of 400 kV Double Circuit Twin Moose Conductor Transmission Lines from Jalandhar sub-station in the state of Punjab to Samba sub-station in the state of Jammu & Kashmir (approximately 134.811 km)
- Laying of 400 kV Double Circuit Twin Moose Conductor Transmission Lines from Samba sub-station in the state of Jammu & Kashmir to Amargarh sub-station in the state of Jammu & Kashmir (approximately 279.19 km)
- 400 kV Double Circuit LILO Transmission Lines at Amargarh in the state of Jammu & Kashmir (approximately 5.84 km)
- Establishment of 7x105 MVA (Single Ph units), with 400/220 kV GIS sub-station at Amargarh in the state of Jammu & Kashmir.

IE observed that Laying of 400 kV Double Circuit Transmission Lines from Samba to Amargarh is about 279.19 km as per the Scheme against 307 kms as indicated in the Contract. Similarly, 400 kV Double Circuit LILO Transmission Lines at Amargarh is about 5.84 km against 2 kms indicated in the Contract. Check Survey being a simultaneous process along with the execution of foundation and Tower erection works, sometimes there is change in route length depending upon the change in tower location.

As per the EPC Contract signed between NRSS XXIX Transmission Limited (Project Company) and SPGVL (EPC Contractor), the completion date is 4th October, 2018. ***IE observes that the completion date is in line with TSA.***

The break – up of the EPC Contract Price placed on SPGVL is shown in the Table below:

Contracts	Price in Rs. Crs.	Land, Forest & ROW (Rs. Crs.)
Supply	1396.49	Land – 126.85 Forest – 100
Erection	346.48	ROW – 56.23
Civil	451.79	ROW – 28.12
TOTAL	2188.76	311.22

The above Contract Value is inclusive of all taxes & duties including but not limited to Excise Duty, CST, Sales Tax, VAT, Entry Tax/ Octroi (if applicable).

Further, SPGVL has signed several sub – contracts for the supply, erection and construction of the Transmission System.

As per schedule provided for Phase – 1 (Jalandhar to Samaba 400 kV Transmission Line) by the sub – contractor (M/s KEC International Ltd.), the testing and commissioning was scheduled as 31st December 2016. As per POSOCO letter dated 28th December, 2016, stating successful completion of trial – run operation of 400 kV Jalandhar (PG) – Samba (PG) ckt 1 & 2 on 10th December, 2016, ***the 400kV Jalandhar to Samba Transmission line is charged and commissioned along with the associated bays. The POSOCO Letter is attached as Annexure – 1.***

The Samba to Amargarh line along with the Uri – Wagoora LILO Line is about (280.22 kms) and is divided into four packages as mentioned below:

1. Samba Substation to AP 72 (Package 1) – sub – contracted to M/s. KEC International Ltd. Stretch of 83.93 kms
2. AP 73 to AP 270 (Package 2) – sub – contracted to M/s. TATA Transmission Ltd. Stretch of 84.02 kms
3. AP 271 to AP 393 (Package 3) – sub – contracted to M/s. TATA Transmission Ltd. Stretch of 52.60 kms
4. AP 394 to Amargarh Substation – sub – contracted to M/s. Unitech Transmission Ltd. Stretch of around 59.67 kms.

As per schedule provided by the sub – contractors for Phase – 2 of the Project, the testing and commissioning was expected by 30th November, 2017 for Package 1 to 3 and 31st July, 2017 for package 4 & LILO. However, due to unanticipated insurgency for 6 months during the Year 2016, the construction works got delayed.

However, as per the site visit and information provided by the Project Company, Amargarh – Uri Ckt I & II (LILO connectivity) got charged on 9th April, 2018 and 15th March, 2018 respectively and Amargarh – Wagoora Ckt. I & II (LILO connectivity) got charged on 9th April, 2018 and 15th March respectively. POSOCO Letter is attached as Annexure – 2.

The actual construction progress of Phase 2 (S – A Line) as of 24th September, 2018 is indicated below:

SA line	Scope	UOM	Plan	Actual
Foundation	784	No.	784	784
Erection	784	No.	780	784
Stringing	280.22	KM	273.12	280.22
Overall Progress			99.19%	100.0%

The above planned estimates are as per the L2 schedule agreed between NRSS XXIX and SPGVL. IE observes that the actual construction progress is 100.0% as against the planned construction progress of 99.19% as of 24th September 2018. The CEA approval letter indicating the readiness to Energize was accorded vide letter dated 20th August, 2018. The POSOCO letter indicating the successful completion of trial – run was granted vide letter dated 20th September, 2018. POSOCO Letter is attached as Annexure – 3.

As per the substation construction schedule provided by M/s Alstom, IE noted that the final commissioning was expected by January, 2018. IE notes that ICT 1 & 2 of 400/220 kV rating got charged on 10th May, 2018. POSOCO letter dated 3rd July, 2018, for the successful trial run operation of ICT 1 & ICT 2 of 400/220 kV, Bay No. 403 & 406 is accorded. 2 nos. of reactor of capacity 63 MVAR each is also charged and has successfully complete the trial run operation, as accorded by POSOCO vide letter dated 4th July, 2018. POSOCO letter is attached as Annexure – 2.

4. EPC CONTRACT

The contracts of Supply, Erection and Civil Works Construction Contract have been executed separately between NRSS-XXIX Transmission Limited (Owner) and Sterlite Power Grid Ventures Limited (Contractor) on 15th January 2015. The scope of work includes:

- ✓ Laying of 400 kV Double Circuit Transmission Lines from Jalandhar sub-station in the state of Punjab to Sambha sub-station in the state of Jammu & Kashmir (approximately 134.811 km)
- ✓ Laying of 400 kV Double Circuit Transmission Lines from Sambha sub-station in the state of Jammu & Kashmir to Amargarh sub-station in the state of Jammu & Kashmir (approximately 279.19 km)
- ✓ 400 kV Double Circuit LILO Transmission Lines at Amargarh in the state of Jammu & Kashmir (approximately 5.84 km)
- ✓ Establishment of 7x105 MVA (1 Ph units), with 400/220 kV GIS sub-station at Amargarh in the state of Jammu & Kashmir.

4.1. Supply Contract

The Supply Contract dated 15.01.2015 has been placed on M/s Sterlite Power Grid Ventures Ltd., for Design, Manufacturing, Procurement & Supply of all the equipment/materials for the above facilities.

The Supply Contract is for laying of 400 kV D/C Transmission lines from Jalandhar in the state of Punjab to Samba (Jammu & Kashmir), 400kV D/C Transmission Line from Samba in the state of Jammu & Kashmir to Amargarh in the state of Jammu & Kashmir, 400kV D/C (LILO) Transmission Line at Amargarh (in the state of Jammu & Kashmir) and installation of 400/220 kV GIS substation at Amargarh (in the state of Jammu & Kashmir).

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. NRSS-XXIX/EPC/14-15/001 and NRSS-XXIX/EPC/14-15/002), 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 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 for the 400kV D/C transmission line.
- ✓ Supply of Zinc rich primer and enamel paint.

- ✓ Supply of Earth wire & Earth wire Accessories, ACSR Moose Conductor & Conductor accessories, OPGW & OPGW Accessories and Spacer Damper for 400kV double circuit transmission line.
- ✓ Design, Engineering, Testing and Supply of 400kV, 1-phase, 105MVA Power Transformer.
- ✓ Design, Engineering, Testing and Supply of 400kV, 1-phase, SOMVAR Line Reactor and 400kV, 3-phase, 63MVAR Bus Reactor.
- ✓ Design, Engineering, Testing and Supply of 400/220 kV GIS. All the switchgear such as Circuit Breaker, Isolator, Earth Switch including CT, PT etc. shall be GIS type. Design, Engineering, Testing and Supply of Surge Arrestors for Transformer/Reactor connections shall be AIS or GIS type.
- ✓ Design, Engineering, Testing and Supply of Oil Filtration Machine, BDV Kit, PPM Kit, Count Particle Meter, Resistance Tester and any other testing equipment required for 400kV Transformer and Reactor.
- ✓ Design, Engineering, Testing and Supply of complete Relay & Protection System, Substation Automation including hardware & software.
- ✓ Design, Engineering, Testing and Supply of 400kV Line Bays, Reactor Bays and Transformer Bays and 220kV Line Bays, Reactor Bays and Transformer Bays.
- ✓ Design, Engineering, Testing and Supply 33/433kV LT Transformer along with 33kV Isolator, 33kV Surge Arrestor and Horn Gap Fuse for LT Sub-Station.
- ✓ Supply of Silent Type Outdoor DG set and complete lighting and illumination system.
- ✓ Supply of OPGW system for communication with other end substations, fire protection system, air conditioning system, LT Switchgear (AC/DC Distribution Boards) and Battery & Battery Chargers.
- ✓ Supply of 33kV HT XLPE Power Cables and 1.1kV grade Power & Cables along with complete accessories. Supply of Auxiliary power supply and control cables for control room/Bay Panel room and RTCC panel to respective common marshalling boxes of auto transformers/reactors.
- ✓ Supply of complete earthing material.
- ✓ Design, Engineering, Testing and Supply of support structures (galvanized).
- ✓ Supply of Bus Post Insulators, Insulator Strings and Hardware, Clamps & Connectors, Equipment terminal connectors (including terminal connectors for Bus & Line Reactors and Transformers), Conductors, Aluminium Tubes, Bus Bar, Spacers, Cable Supporting Angles/channels, Cable Trays & Covers, junction Box, buried Cable Trenches.
- ✓ 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 and sub-station, 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 Contract covers all the items exhaustively and is in line with the 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 and Completion Period

The effective date of the contract is 06.12.2014. The Completion date is 04.10.2018 which around 46 months from the effective date. ***IE opines that the completion date is in line with the TSA SCOD.***

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 04.10.2018, 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".

Contractor shall make the best efforts for an early completion of the Facilities and shall support the Owner with the necessary requirements to achieve an early COD of the Facility.

IE found that the completion period works out to be around 46 months. As per TSA, the Jalandhar-Samba line to be completed within 34 months and S – A line along with substation to be completed within 38 months from effective date.

As per CERC order 10/12/2014, the Jalandhar-Samba line to be completed within 34 months and other lines viz. (Samba-Amargarh and LILO of Uri-Wagoora) and Amargarh and substation to be completed within 50 months from effective date.

Regarding Jalandhar – Samba 400 kV D/C Transmission Line, as per site progress, and as per the POSOCO letter dated 28th December, 2016, stating successful completion of trial – run operation of 400 kV Jalandhar (PG) – Samba (PG) ckt 1 & 2 on 10th December, 2016, IE noted the 400kV Jalandhar to Samba Transmission line is charged and commissioned along with the associated bays. The POSOCO letter is attached as Annexure – 1.

Amargarh – Uri Ckt I & II (LILO connectivity) got charged on 9th April, 2018 and 15th March, 2018 respectively and Amargarh – Wagoora Ckt. I & II (LILO connectivity) got charged on 9th April, 2018 and 15th March respectively. POSOCO Letter is attached as Annexure – 2.

For Samba-Amargarh line the CEA approval letter was accorded vide letter dated 20th August, 2018. The POSOCO letter indicating the successful completion of trial – run for this line was granted vide letter dated 20th September, 2018. POSOCO Letter is attached as Annexure – 3

IE found that the project SCOD is 4th October 2018 as per CERC order 10/12/2014 which matches the completion date (4th October 2018) indicated in the Contract.

4.1.4. Guarantees

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

IE observed that the advance payment Guarantee for defect liability period is considered in the form Corporate Guarantee, vide Agreement dated 2nd May, 2015 and is valid till Project Operational Acceptance or Termination of Contract whichever is earlier.

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.

IE observed that the Performance Guarantee for defect liability period is considered in the form Corporate Guarantee, vide Agreement dated 2nd May, 2015 and is valid till Project Operational Acceptance or Termination of Contract whichever is earlier.

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.

E 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 and under this Contract and in law.

4.1.5. 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 completion date as defined in the 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.

IE observed that the obtaining of Forest Clearance and acquisition of land is the responsibility of the Contractor, which depends up on the concerned approval of Government Authorities. IE found that the above clause is better for the Owner.

IE found that if the Project is delayed for 6 months from the SCOD as per TSA reasons solely attributable to Contractor, the maximum LD envisaged in the Supply Contract is Rs 143.4 Crores which is 10% of the Contract Value.

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 opines that the Line Project is commissioned and charged and hence no applicability of LD.

4.1.6. 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.

4.1.7. 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.

The Contractors above obligations shall not apply to:

- ✓ Any materials that are supplied by the Owner and are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein;
- ✓ Any designs, specifications or other data designed, supplied or specified by or on behalf of the Owner or any matters for which the Contract has disclaimed responsibility herein; or
- ✓ Any other materials supplied or any other work executed by or on behalf of the Owner, except for the work executed by the Owner.

4.1.8. 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.

Sub – Contractor:

- ✓ The Contractor shall apply to the Owner for permission to enter into any sub-contract with any proposed Sub-Contractors before the intended date of entering into a contract with such Sub- Contractors. Only after the Owner's approval, the order to the Sub-Contractor shall be placed.
- ✓ It has been agreed that only those manufacturers who have supplied/ and are approved by PGCIL for at least 400 V D/C quad towers in the last 3 years shall be considered for tower supply by the Contractor. In case, any other manufacturer is suggested by the Contractor, the same shall be approved by the Owner after assessment of the factory of the Sub-Contractor.
- ✓ The un-priced copy of all offers and purchase orders, issued to the Sub-Contractors, shall be furnished to the Owner within 15 days of issuance of the same.
- ✓ Notwithstanding any approval granted by the Owner as to the acceptability of Sub- Contractors or of the terms of a sub-contract proposed to be entered into by the Contractor, the Contractor shall be responsible for observance of all Sub-Contractors responsibilities for all the requirements under this Contract and the Contractor shall not be relieved of any of its obligations hereunder. The Contractor shall be solely responsible for the acts or defaults of any Sub-Contractors, its agents or employees, as fully as if they were the acts or defaults of the Contractor, its agents or employees. The Contractor shall remain SPOC (Single Point of Contact) to the Owner

IE observed that the criteria for selection of sub – contractors do not indicate the supply experience of GIS sub – station. Hence, the credential check of the Sub – contractor on grounds for supply of materials for GIS Sub – station will be difficult. However, the sub – contract for supply and erection of GIS sub – station is awarded to M/s. Alstom T&D India Limited, it being a renowned Company for Sub – station works

4.1.9. 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.

4.1.10. 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.

4.1.11. Other Provisions

IE has reviewed the clauses pertaining to Interpretation of Contract Documents, Contracts covenant to supplies for 400 kV D/C Transmission Lines and Sub-station, Key man-power that includes Owner's Manpower and Contractor's Man-power, Indemnity, Confidentiality, Suspension, Termination Force Majeure, Notices to Owner and contractors, Governing Laws and found the same to be in order.

IE found the above provisions are in line with other Transmission line projects and are in order.

4.2. Erection Contract

The Erection Contract dated 15.01.2015 has been placed on M/s Sterlite Power Grid Ventures Ltd., Haveli-396230 under NRSS-XXIX Transmission Ltd. Project.

The Erection Contract is for laying of 400 kV D/C Transmission lines from Jalandhar in the state of Punjab to Samba (Jammu & Kashmir), 400kV D/C Transmission Line from Samba in the state of Jammu & Kashmir to Amargarh in the state of Jammu & Kashmir, 400kV D/C Transmission Line at Amargarh (in the state of Jammu & Kashmir) and installation of 400/220 kV GIS substation at Amargarh (in the state of Jammu & Kashmir).

4.2.1. Scope of Work

The scope of work broadly covers the following:

- It includes but is not limited to 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 major activities to be covered under scope of work but not limited to shall be as follows:

- The Contractor shall also be responsible for stringing and associated works for the 400kV D/C Transmission lines Jalandhar (Punjab) to Samba (Jammu & Kashmir), 400kV D/C Transmission Line from Samba (Jammu & Kashmir) to Amargarh (Jammu & Kashmir), 400kV D/C LILO Transmission Line at Amargarh (Jammu & Kashmir) and 400/220kV GIS substation at Amargarh (Jammu & Kashmir) under NRSS XXIX Transmission Limited (NRSS-XXIX) project.
- The Contractor shall also be responsible for erection of all equipment and material and associated works for the 400kV D/C Transmission lines Jalandhar (Punjab) to Samba (Jammu & Kashmir), 400kV D/C Transmission Line from Samba (Jammu & Kashmir) to Amargarh (Jammu & Kashmir), 400kV D/C Transmission Line at Amargarh (Jammu & Kashmir) and 400/220 kV GIS substation at Amargarh (Jammu & Kashmir) under NRSS XXIX Transmission Limited (NRSS-XXIX) project.
- 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. are in Contractor's scope. Any approvals from RLDC/CTU/LTCC/SLDC shall be in the scope of the Contractor, all related documentation and paperwork for the same shall be done by the Contractor.
- Project Insurance as indicated in the GCC and subsequent amendments to the tender documents (NRSS-XXIX/EPC/14-15/001 and NRSS-XXIX/EPC/14-15/002). (Erection all risks (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 lines and sub-station.
- 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.
- All other misc. works 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 deemed to be included in the Contract Value and in the scope of the Contractor.

IE observed that the obtaining of Forest Clearance and acquisition of land is the responsibility of SPGVL, which depends up on the approval from the concerned Government Authorities. IE found that the above clause is better for the Owner and also, 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 D/C Transmission Lines and Sub – station

- ✓ 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.
- ✓ Land Acquisition, 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. Effect Date and Completion Schedule

The Effective Date of Erection Contract is 06/12/2014. ("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 04.10.2018, 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".

Contractor shall make the best efforts for an early completion of the Facilities and shall support the Owner with all the necessary requirements to achieve an early COD of the Facility.

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.

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 and under this Contract and in law.

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 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.

IE observed that the obtaining of RoW is the responsibility of the Contractor, which depends up on the concerned approval of Government Authorities and tenants. IE found that the above clause is better for the Owner.

IE found that if the Project is delayed for 6 months from the SCOD as per Contract, reasons solely attributable to Contractor, the maximum LD envisaged in this Erection Contract is Rs 58.7 Crores which is 10% of Contract value.

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 opines that the Line Project is commissioned and charged and hence no applicability 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 works. 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 de-mobilized 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	15days 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	15days 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

For the sake of clarity, it is understood by the parties that the provision 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 statute and mentioned in GCC clause 30.

The value of the insurance policy shall be as indicated in the GCC clause 30 and subsequent amendments.

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. Sub – Contracting

The Contractor shall not subcontract the whole of the Scope of Works, unless otherwise stated in this Contract:

- ✓ The Contractor shall apply to the Owner for permission to enter into any sub-contract with any proposed Sub-contractor before the intended date of entering into a contract with such Subcontractor; the Contractor shall submit the details (other than Value) of the subcontract proposed to be entered into and also of the proposed Subcontractor, along with its request for consent of the Owner in respect of the proposed Subcontract.
- ✓ The un-priced copy of all offers and work orders, issued to the Sub-contractors, shall be furnished to the Owner within 15 days of issuance of the same; and
- ✓ The Contractor shall ensure that the Sub-contractors purporting to enter into contracts with other Sub-contractors in respect of any matters falling within the scope of this Contract comply with the provisions applicable to the Contractor in respect of sub-contracting.

Notwithstanding any approval granted by the Owner as to the acceptability of a Sub-contractor or of the terms of a sub-contract proposed to be entered into by the Contractor, the Contractor shall be responsible for observance of all Subcontractor's responsibilities, for all the requirements under this Contract and the Contractor shall not be relieved of any of its obligations hereunder. The Contractor shall be solely responsible for the acts or defaults of any Subcontractor, its agents or employees, as fully as if they were the acts or defaults of the Contractor, its agents or employees. The Contractor shall remain SPOC (Single Point of Contact) to the Owner.

The Contractor shall obtain from its Sub-contractors for the benefit of the Owner, the best possible warranties and guarantees in respect of the equipment and workmanship of such portions of the Contractor's equipment that is procured from, and of such part of the Works that is performed by, the Sub-contractors, provided however that such warranties and guarantees shall be no less stringent than those sought from the Contractor herein.

Nothing contained in these provisions shall be construed to bind the Owner to the Sub-contractor in respect of any of the obligations under the sub-contracts and the Contractor shall be solely responsible for all claims and liabilities raised by the Sub-contractors under the sub-contracts.

If a Sub-contractor has undertaken a continuing and assignable obligation in the nature of a warranty or otherwise, to the Contractor for the Works performed, or materials or services provided, or supply of the Contractor's equipment or any part thereof, by such Sub-contractor, and if such obligation extends beyond the expiry of the Contract Period, the Contractor shall, prior to the issue of the Performance Certificate, assign the benefit of such obligation to the Owner for the unexpired duration of such obligation. All sub-contracts and purchase and work orders in relation to the works shall provide that they are assignable to Owner/the Owner's Representative.

4.2.11. Limitation of Liability

Except in cases of fraud, negligence or misconduct, or strict or absolute liability or obligation of the Contractor to indemnify the Owner, the Contractor shall not be liable to the Owner, whether in contract, tort, or otherwise, for any indirect loss or damage, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Owner. The Owner shall not be liable whether in contract, tort, or otherwise, for any indirect loss or damage suffered by the Contractor.

The aggregate liability of the Contractor to the Owner, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Value, provided that this limitation shall not apply to the cost of repairing, or to any obligation of the Contractor to indemnify the Owner with respect to patent infringement.

4.2.12. 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.

IE is of 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 provided in clause 22 of GCC to the satisfaction of 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

The Contractor's above obligations (under Defect Liability) shall not apply to:

Any materials that are supplied by the Owner and are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein;

Any designs, specifications or other data designed, supplied or specified by or on behalf of the Owner or any matters for which the Contract has disclaimed responsibility herein; or

Any other materials supplied or any other works executed by or on behalf of the Owner, except for the work executed by the Owner.

4.2.13. 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.

4.2.14. Contractor's /Owner Representation and Warranties

The Contractor hereby warrants to the Owner that the Scope of Work will be carried out 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

4.2.15. Other Provisions

IE has reviewed the clauses pertaining to Interpretation of Contract Documents; Key man-power that includes Owner's Manpower and Contractor's Man-power, Indemnity, Confidentiality, Suspension, Termination Force Majeure, Notices to Owner and contractors, Arbitration, Governing Laws and found the same to be in order.

IE found the above provisions are in line with other Transmission line projects and are in order.

4.3. Civil Contract

The above Civil Contract dated 15.01.2015 has been placed on M/s Sterlite Power Grid Ventures Ltd., Haveli-396230 for Civil work Construction of all the equipment/materials for the above facilities as mentioned in the above table under NRSS-XXIX Transmission Ltd. Project.

4.3.1. Scope of Work

The scope of work broadly covers the following:

- ✓ 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.
- ✓ Design, Classification and Casting of foundation for different types of towers, gantries, transformers, reactors, GIS, Lattice Structures, associated SA along with jacking pad and pylon supports, rail track and all other equipments.
- ✓ Civil works for Switchyard panel rooms, GIS room, kiosk and fire resistance wall.
- ✓ Construction of Roads, Cable Trench, Road Rail Tracks, Culverts, Drainage System.
- ✓ Construction of Fire Fighting Pump House, Control Room cum administrative building, fire water tank, security building, store room and boundary wall with gate.
- ✓ Construction of permanent water supply system and rainwater harvesting system.
- ✓ Land Levelling.

- ✓ 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.
- ✓ Forest:
 - Forest clearance is in Contractor's scope. Contractor shall undertake the work of tree cutting, its transportation etc. and liaisioning 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 Owner
 - Complete Check Survey in forest area is in the scope of the Contractor
- ✓ 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.

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

4.3.2. Contract Period and Completion Schedule

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 04.10.2018, which shall be referred to as "Completion Date". The completion period is around 46 months.

IE found that the SCOD is 4th October 2018 as per CERC order 10/12/2014 which matches the completion date (4th October 2018) indicated in the Contract.

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.

4.3.5. Liquidated Damages

If the Contractor fails to achieve 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.

IE observed that obtaining of RoW is the responsibility of the Contractor, which depends up on the concerned approval of Government Authorities and tenants. IE found that the above clause is better for the Owner.

IE found that if the Project is delayed for 6 months from the SCOD as per Contract reasons solely attributable to Contractor, the maximum LD envisaged in the Civil Contract is Rs 47.90 Crore which is 10% of the Contract Value.

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 opines that the Line Project is commissioned and charged and hence no applicability 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 clause 30 of the GCC.

4.3.7. Other Provisions

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.

4.4. Overall Observation

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

The contract also incorporates the implication of introduction of GST during the Contract period. On mutual agreement, GST should be dealt on actual basis on submission of relevant documentary proofs. In case if there is any decrease in the overall taxes and duties, the same shall be passed to the Owner. ***IE opines that cost incurred towards GST should be appropriately dealt by the Project Company in the Project Cost. (Risk Category – A)***

As per TSA, IE observes that if the Project is delayed by 180 days beyond schedule COD reasons attributable to TSP, the maximum LD imposed as per TSA is Rs 324.25 Crores.

However, as per the EPC Contract, if the Project is delayed beyond schedule COD for reasons solely attributable to EPC Contractor, the maximum LD recovered as per EPC Contract (combined Supply, Erection and Civil works contract) is Rs 250.00 Crores. IE found that there is a shortfall of Rs 74.25 crores, which shall be covered by the EPC Contractor, for delay due to any reasons.

As per the terms of Contract, the Contract Value is FIRM and non negotiable for the entire duration of the Contract and the same shall not be subject to escalation or increase on any account whatsoever, at any point of time during the execution of this Contract. The quantity mentioned in BOQ is firm, irrespective of quantity put to use in the said project the total quantity will be billed by contractor to owner. No escalation / overrun compensation shall be paid for the extended duration of Contract, if delay is for the reasons attributable to the Contractor.

Observations of IE regarding the contracts are given below:

- The EPC Contract executed by NRSS with SPGVL is a fixed price turnkey contract and any cost escalation has to be absorbed by SPGVL without passing the same on to NRSS.
- The sub-contracts awarded by SPGVL to various contractors are on BOQ (Bill of Quantities) basis, with the contract value determined based on estimated quantities of required materials & the unit price of each material specified in the contracts.
- The material quantities presently specified in each sub-contract are estimates based on the initial check survey, soil testing etc. carried out by EPC Contractor & sub-contractors and are subject to change during the course of project implementation.
- However, the unit – rate of each material will remain fixed as specified in each sub-contract.
- Considering the hilly & difficult terrain of Phase – II (completely located in J&K) involving high altitudes & snow – clad terrain, EPC Contractor expects an increase of 20% from the estimated material quantity presently specified in each sub – contract and correspondingly, 20% increase in contract values.

IE opines that considering the difficult terrain of Phase – 2, increase of 20% in contract values is reasonable, which can only be evaluated during the Project Completion.

- To insulate the Project SPV's from any cost over – runs & delays, SPGVL provides fixed price turnkey EPC contracts to the SPV's and takes on the risk of land acquisition / right of way & forest clearances on itself. Any increase in project cost is absorbed by SPGVL and not passed on to the SPV. In order to be able to absorb such risks across projects, SPGVL needs to have an element of risk margin built into each contract with Project SPV's, which can enable SPGVL to absorb such un-predictable risks. Recent instance of this was seen in NRSS when ~8% increase in cost of KEC sub-contract for Phase-I & cost of additional 3 towers to be constructed for bypassing the bays at Jalandhar & Samba substation, were absorbed by SPGVL without passing the same on to NRSS.
- Sterlite Group has implemented its earlier transmission projects, namely BDTCL, JTCL & ENICL using the package route – where different reputed contractors were roped in for implementing different sections of the project. Based on the above past experience of projects implementation, complexity of the NRSS & difficult terrain and to minimize implementation risks, Sterlite Group considered it important to have a single point responsibility for co-ordination of EPC activities (including land acquisition, forest clearances & RoW). Hence SPGVL has taken over these responsibilities

Based on the experience, IE is of the view that the main reason which could result in delay of the Project are:

- **Obtaining of Forest Clearance**
- **Obtaining of ROW**
- **Obtaining other permits and clearances as in Power line crossing, Railway crossing, NH crossing etc.**

IE observed that EPC Contractor has taken responsibility for obtaining RoW, and all permits and clearances.

4.5. Back to Back Contracts

SPGVL has signed several sub – contracts for the supply, erection and construction of the Transmission System. The various sub – contracts have been discussed in the table below:

Table 4.1 - List of Sub – Contractors

S. No.	Scope of Work	Sub – Contractor
Phase – 1		
1.	Supply, Civil and Erection work for Jalandhar – Samba 400 kV D/ Line	KEC
2.	Supply of ACSR Moose Conductor (J – S)	STL
3.	Supply of OPGW and Hardware Fittings	STL
4.	Civil Pile Foundation Works	Shreyas
Phase – 2		
5.	Supply, Civil and Erection work for Samba – Amargarh (Package – 1)	KEC
6.	Supply, Civil and Erection work for Samba – Amargarh (Package – 2)	TATA Projects

S. No.	Scope of Work	Sub – Contractor
7.	Supply, Civil and Erection work for Samba – Amargarh (Package – 3)	
8.	Supply, Civil and Erection work for Samba – Amargarh (Package – 4)	Unitech
9.	Supply, Civil and Erection work for LILO of Uri – Wagoora (Part of Package – 4)	
10.	Supply and Erection of GIS sub – station at Amargarh	Alstom T&D
11.	Civil Works of GIS at Amargarh	Shreyas & VCC
12.	Aerial construction Services	Erickson Inc.
13.	Project Execution Consulting Services	Burns McDonnell Inc.
14.	Supply of Conductor (Sambha – Amargarh Line)	Sterlite Technologies Ltd.
15.	OPGW & Hardware	Sterlite Technologies Ltd.
16.	Supply of Hard Ware and Accessories	Mosdorfer
17.	Supply of Insulators	Nanjing Electric
18.	Additional OPGW	STL
19.	Helicopter Running Cost	Himalaya

As per schedule provided for Phase – 1 (Jalandhar to Samaba 400 kV Transmission Line) by the sub – contractor (M/s KEC International Ltd.), the testing and commissioning was scheduled as 31st December 2016. As per POSOCO letter dated 28th December, 2016, stating successful completion of trial – run operation of 400 kV Jalandhar (PG) – Samba (PG) ckt 1 & 2 on 10th December, 2016, **IE noted the 400kV Jalandhar to Samba Transmission line is charged and commissioned along with the associated bays.**

As per schedule provided by the sub – contractors for Phase – 2 of the Project, IE noted that the testing and commissioning was expected by 30th November, 2017 for Package 1 to 3 and 31st July, 2017 for package 4. However, due to unanticipated insurgency for 6 months during the Year 2016, the construction works got delayed. As of 24th September, IE observed that all the mechanical and electrical works were complete for the line. The CEA approval letter for ready to Energize was accorded vide letter dated 20th August, 2018. The POSOCO letter certifying the successful completion of Trial – run operation was accorded vide letter dated 20th September, 2018.

As per the substation construction schedule provided by M/s Alstom, IE noted that the final commissioning was expected by January, 2018.

From the above project completion schedule as approved between the Main EPC Contractor (SPGVL) and the Sub – Contractors for the Transmission Line and the Sub – station, IE opines that the schedule completion is well within the TSA completion schedule with a cushion of 10 months.

5. DESIGN PHILOSOPHY OF TRANSMISSION SYSTEM

5.1. Technical Requirements for Transmission Lines

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.

In general, Transmission Systems in India adopt the guidelines laid down in CBIP Transmission Line Manual while finalizing the types of Transmission Towers. A brief summary of the CBIP Guidelines for different tower types is given below Table:

TABLE 5.1: TOWER TYPES WITH DEVIATION LIMITS AS PER CBIP GUIDELINES

Tower Type	Deviation Limit	Typical Use
DA	0 deg – 2 deg	To be used on straight runs and up to 2° line deviation
DB	0 deg - 15 deg	Small Angle tower with tension insulator string. To be used for line deviation from 0 to 15 degrees For use as section tower
DC	15 deg - 30 deg	Medium angle tower with tension insulator string. To be used for line deviation from 15 to 30 degrees To be used for transposition of transmission line, if required
DD	30 deg - 60 deg	Large Angle and Dead – end (DE) Tower with Tension Insulator string. To be used for line deviation from 30 to 60 degrees Complete dead end. Dead end with 0 deg to 15 deg deviation both on line and substation side (slack span)

Towers shall be designed as per latest revision of IS-802. 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. For line in snowbound area, suitable ice loading (minimum 15mm) on conductor & earth wire shall be considered. 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.

IE 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.

5.2. Review of Tower Design & Type Test Certificate

Jalandhar – Samba 400 kV D/C Transmission Line –

1. Wind Zone – test was conducted for WZ 2 and 4 for J – S line and WZ 2 & 3 for S – A Line
2. Conductor Type – Moose Conductor
3. Conductor Bundle – twin bundle
4. Voltage Level – 400 kV Voltage level
5. Span between the Towers – avg. span of 340 mts

The Tower type test for Jalandhar – Samba Line has been conducted and Certified by M/s. Jyoti Structures Limited. The four tower types DA (+9M Body extension), DB (Angle Tower type with +9.0 M Body Extension), DC (+9.0M Body Extension) and DD (+9.0M Body Extension), 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, 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 115%. While increasing the loads from 115% and above, some shearing effect was observed.

Samba – Amargarh and LILO 400 kV D/C Line –

The Tower type test for Samba – Amargarh and LILO Transmission Lines has been conducted and Certified by M/s. KEC International Limited, who has been assessed and accredited in accordance with the Standard ISO/IEC17025:2005 by National Board for Testing and Calibration Laboratories (NABL).

KEC had prepared the test procedures specific to the site and accordingly has defined all the cases with its criticality which could be encountered at site.

The four tower types DA, DB (Angle Tower type with +3.0 M Body Extension and +3.0M Leg Extension), DB (+6.0M Body Extension and +3.0 M Leg Extension), DD (Heavy Snow Zone with +3.0M Leg Extension and +3.0M Body Extension) and Dead End Tower DD (+6.0M Body Extension and +3.0M Leg Extension) have underwent the test at 28°C maximum temperature 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.

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, for snow bound regions, under Normal Reliability condition with maximum vertical load and minimum temperature +28° wind and ice, 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%.

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.

Project Company has also submitted the sag tension calculation alongwith type test report. IE observed that for wind zone (WZ – 2 & WZ – 4) sag-tension calculations reports as submitted by the Company are found in order.

The conductor configuration shall be Twin Moose or equivalent AAAC. The details of ACSR/ AAAC Moose 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
400kV D/C with Twin conductor	Moose : Stranding 54/3.53mm-Al + 7/3.53 mm-Steel, 528.5 sq mm, Aluminium area, 31.77mm diameter	31.95mm diameter; 604 sq.mm Aluminium alloy area	61/3.55mm

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 400kV D/C line shall be governed by the tower design as well as minimum live metal clearances for 400kV voltage levels respectively under different insulator swing angles.

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

- Under stationary conditions: From tower body: 3.05m & 3.35m for line in snowbound area
- Under swing conditions

Wind pressure Condition	Minimum electrical clearance
a) Swing angle (22°)	3.05m & 3.35m for line in snowbound area
b) Swing angle (44°)	1.86 mtrs

Minimum values of live metal clearance shall be as specified above. Live metal clearance for other conditions viz. maximum operating voltage & swing angle, etc. may be decided by the TSP based on relevant IS standards, prudent utility practices.

Further, the phase to phase spacing for 400kV D/C line shall not be less than 8m.

- 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 switching impulse withstand voltage (wet) for 400kV line shall be 1050 kVp & 1175 kVp for line in snowbound area.
- The Fault current for design of line shall be 40 kA for 1 sec for 400 kV.
- Minimum level of pollution for design of lines shall be medium pollution (creepage of 25mm/kV). 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.

5.3. Tower Foundation

The technical documents of foundation designs were reviewed and generally found to be in order. Following are IE's observations:

- 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
- Detailed foundation designs are done after investigation of soil and assessment of soil bearing capacity at different locations along the route length. The design of foundation is in line with IS: 456 and CBIP Transmission Line Manual 323 (latest).
- M20 grade concrete and Fe415/500 grade reinforcement steel adopted for RCC foundations

IE observed that the foundation designs for both Transmission lines (J – S and S- A lines) (wind zone – 2 & Wind zone – 4) are meeting Indian standards and as per the good Industry Standards.

5.4. Insulator Design

Insulators are used to support the line conductor and provide clearance from ground and structure.

The insulators installed for the Project are of composite polymer type having Electromechanical Strength of 120 KN for suspension strings & 160 KN for Tension string and minimum creepage of 31mm/kV:

For 400 kV D/C Transmission Line with QUAD ACSR Conductor

Sl. No.	Type of String	Min. Creepage of each Disc	Electro-mechanical strength of insulator (KN)	Mechanical Strength of insulator strings along with hardware fittings (KN)
1.	Single tension	315 mm	120	120
2.	Single 'I' suspension Pilot	315 mm	120	120
3.	Double 'I' suspension	315 mm	160	2X160
4.	Quad tension	330 mm	160	4 x 160 (in line strength)

The conductor offered has been subjected to Type Tests, Acceptance Tests and Routine Tests as per National / International Standards as per the specifications.

IE observed that the Suspension/Tension Insulator Strings are designed as per the technical requirement of the 400kV systems based on the required Creepage Distance applicable for the system. IE has reviewed test repots as provided by the Project Company, and the same is generally found to be in order.

5.5. Quality Assurance and Safety Aspects

5.5.1. 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.

5.5.2. 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

5.6. Technical Requirement for Substation

The proposed new sub-station shall be Gas Insulated Switchgear (GIS) type generally confirming to the requirement of CEA regulation for construction of sub-station.

The Project Company has provided the drawings for Single line Diagram (Dwg. No.5427PN067-AMR-E-SYD-SLD-0401-Rev.00) and the Layout for the Amargarh 400/220kV GIS Substation (Dwg. No. 5427PN068-AMR-E-SYD-SYS-0001-GA Rev.03). Based on the review of these drawings IE's observations have been discussed in the below paragraphs.

IE noted that the substation mainly consists of 220kV GIS & 400kV GIS Buildings, LT Switchgear room, Battery room, Gas Insulated Busducts, 7 nos. 105MVA Interconnecting Transformers (ICT), Line & Bus Reactors, Line Gantry space for 400kV & 220kV lines, other miscellaneous switchyard equipments like Bus Post Insulator (BPI), Current Voltage Transformer (CVT), Lightning Arrestor, Wave Trap & Circuit Breaker and Space for staff quarters

400 kV System: -

IE observed that the 400kV GIS Switchyard system has been supplied with one and half breaker scheme system which consists of 5 upcoming diameters and 2 diameters for future consideration.

Out of these 5 diameters there are total of 6 upcoming lines which are mentioned below: -

- 2 nos. 400kV D/C Samba-Amargarh line defined as Samba Circuit Line-1 and Samba Circuit Line-2.
- 2 nos. 400kV D/C LILO line of Uri defined as Uri Circuit Line-1 and Uri Circuit Line-2.
- 2 nos. 400kV D/C LILO line of Wagora defined as Wagora Circuit Line-1 and Wagora Circuit Line-2.

The ICT-1 and ICT-2 is connected with two separate diameters. 2 nos. 63 MVAR bus reactor is been connected with the same diameter. There is also planned connection of ICT-3 for the future.

220 kV System: -

IE observed that the 220V GIS system has been supplied with two main bus scheme systems which consist of 6 upcoming lines and 3 future planned lines.

There are total 9 upcoming bays for the 220 kV system in the substation. 4 no. bays are planned for further future extension. Bay no. 3 is connected to the 220kV side of ICT-1 and Bay no. 9 is connected to the 220kV side of ICT-2. There is also planned bay connection to ICT-3 for the future.

Outdoor Equipments: -

IE observed that there are total 7 nos. ICT of capacity 105 MVA, 1-phase has been provided. 1 no. 105 MVA ICT among these, 7 nos. is kept as a spare transformer and shall be utilized in the event of failure of any of the ICT. Space is also provided for the ICT-3 for future provision in the layout.

There are 2 nos. line reactor of capacity 50 MVAR which are connected to the 2 nos. line for Samba.

Other Equipments: -

IE observed that the switchyard has been provided with electrical switchgear room from where the local power supply of the complete substation will be met. Separate room has been provided to accommodate batteries for 220 V DC System for control & supervision of the switchyard equipment and 48 V DC System for SCADA. A separate DG room is also provided to cater the emergency loads of the substation.

The substation has also marked space for the staff quarters.

IE is of the view that the systems considered under the 400/220kV GIS substation are reasonable and the space for the substation is generally found to be in order

5.6.1.1. SALIENT FEATURES OF 420 KV & 245 KV GIS SUB STATION

The design and specification of substation equipment are to be governed by the following factors:

Insulation Coordination

420 KV System would be designed to limit the Switching overvoltage to 2.5 pu and is expected to decay to 1.5 p.u. in 5 to 6 cycles. Consistent with these values and protective levels provided by lightning arrestors, the following insulation levels are proposed to be adopted for 420 KV & 245 KV systems:

S. No.	Particulars	420 KV	245 kV
a)	Impulse withstand voltage for Transformer and reactors for Other Equipment	1300 kVp 1425 kVp	950 kVp 1050 kVp
b)	Switching surge withstand voltage	1050 kVp	
c)	Minimum creepage distance	10500 mm	6125 mm
d)	Max. fault current	40 kA	40 KA
e)	Duration of fault	1 Sec	1 Sec
f)	Corona extinction voltage	320 kV rms	

To control the steady state, transient and dynamic overvoltage to specified levels, compensation equipment shall be provided.

Switching Scheme

It is essential that the system should remain secure even under conditions of major equipment or bus-bar failure. Substations being the main connection points have large influence on the security of the system as a whole. The selection of the bus switching scheme is governed by the various technical and other related factors. One & Half breaker bus scheme for 400kV and Double Main along with Bus coupler for 220kV system have been generally considered due to their merits in terms of reliability, security, operational flexibility and ease of maintenance of equipments.

The following switching schemes have been considered in various substations:-

Sub-station	420 KV	245 kV
400/220kV Amargarh	One & Half breaker	Double Main

5.6.1.2. SUBSTATION EQUIPMENT AND FACILITIES:

The switchgear shall be designed and specified to withstand operating conditions and duty requirements.

GIS Substation Equipment:

GIS (Gas Insulated Switchgear) shall be indoor type and in accordance to IEC: 62271-203. The switchgear shall be designed and specified to withstand operating conditions and duty requirements. All the switchgear such as Circuit Breaker, isolator, earth switch including CT, PT etc. shall be GIS type. Surge Arrestors used for transformer/Reactor connections will be AIS or GIS type. 400kV scheme shall be designed in such a way that it shall be possible to use line reactors (if provided) as bus reactors, in case of outage of line, to control bus voltage.

Power Transformer

Power transformers shall conform to IEC: 60076 / IS: 2026 in general. These transformers shall have On Load Tap Changer (OLTC). The air core reactance shall be of the order of 20%. Tertiary windings shall be provided for large auto transformers, which shall be capable of being loaded to one third of transformer loading. Insulation level of tertiary winding shall not be less than maximum transferred surge from HV/MV winding to tertiary winding.

Shunt Reactors

Shunt Reactors, wherever provided, shall comply to IEC: 289/IS: 5553 in general. 420 kV Shunt reactors shall have linear characteristics upto 1.5 p.u. voltage. These should be ONAN Cooled. The neutral of line reactors shall be grounded through adequately rated neutral grounding reactors to facilitate single phase reclosure against trapped charges. The neutral of 420 kV class shunt reactors shall be insulated to 550 kV peak for lightning impulse and shall be protected by means of 145 KV Class surge arresters.

Circuit Breakers

Circuit breakers shall in general be of C2-M2 class and comply to IEC-62271-1 and shall be of SF6 Type. The rated break time shall not exceed 40 ms for 420KV and 60 ms for 245kV and 145KV circuit breakers. 420 kV Circuit breakers shall be provided with single phase and three phase auto reclosing. The Circuit breakers controlling 420 KV lines wherever required shall be provided with pre insertion closing resistor of about 400 ohms with 8 ms insertion time. The short line fault capacity shall be same as the rated capacity and this is proposed to be achieved without use of opening resistors. Control switching device shall be required for controlling of ICT/bus reactor and Line reactor as the case may be for Main bay and tie bay of 400kV. Further, it shall be possible to use line reactors as bus reactors, in case of outage of line.

Isolators

The isolators shall comply to IEC 62271-102 in general. All Isolators and earth switches shall be motor operated. Earth switches are provided at various locations to facilitate maintenance. Main blades and earth blades shall be interlocked and interlock shall be fail safe type.

Current Transformers

Current Transformers shall comply with IEC 60044-1 in general. All ratios shall be obtained by secondary taps. Generally, Current Transformers (CT) shall have five cores (four for protection and one for metering) whereas, CT in Tie bays shall have six cores (four for protections & two for metering) suitably distributed on both sides of CB. The burden and knee point voltage shall be in accordance with the requirements of the system including possible feeds for telemetry. Accuracy class for protection core shall be PS and for metering core it shall be 0.2S.

Capacitor Voltage Transformers/ Voltage Transformers

Voltage transformers shall comply to IEC 60044-2 & IEC-6044-5 in general. These shall have three secondaries out of which two shall be used for protection and one for metering. Accuracy class for protection core shall be 3 P and for metering core shall be 0.2. The voltage transformers on lines shall be suitable for Carrier Coupling. The Capacitance of CVT Shall be 4400/8800 pF depending on PLCC requirements.

Surge Arresters

Station class current limiting, heavy duty gapless type Surge arresters conforming to IEC 60099-4 in general shall be provided.

The rated voltage of Surge arrester and other characteristics are chosen in accordance with system requirements. Surge arresters shall be provided near line entrances, transformers so as to achieve proper insulation coordination. These shall be fitted with pressure relief devices and diverting ports suitable for preventing shattering of porcelain housing providing path for the flow of rated currents in the event of arrester failure.

AC & DC power supplies

For catering to the requirements of three phase & single phase AC supply and DC supply for various substation equipments, the following arrangement is envisaged:-

- (a) For LT Supply at each new Substation, two (2) nos. 630 kVA LT Transformers shall be provided out of which one shall be connected with SEB supply and other one shall be connected to tertiary of 400/220kV transformer.
- (b) 2 Nos. batteries of 220V for control & protection and 2 Nos. 48V batteries for PLCC/ Communication equipment shall be provided at each new Substation. Each battery would have a float-cum-boost charger. Battery shall be of VRLA type.
- (c) Suitable AC & DC distribution boards and associated LT Switchgear would be provided at new Substations. For Substation Extensions, existing facilities shall be augmented as required. For new substations following switch boards with minimum rating as is specified here under shall be considered with duplicate supply.
 - (a) 1000 Amps 415V Main switch board – 1 no.
 - (b) 400 Amp AC distribution board – 1 no.
 - (c) 400 Amp main lighting distribution board – 1no.
 - (d) 200 Amp emergency lighting distribution board – 1no.
 - (e) 220 volt DC distribution board – 2nos.
 - (f) 48 volt DC distribution board – 2nos.
- (d) In new Substations, one No. 250 KVA DG set shall be provided for emergency applications.

Sizing of Auxiliary system (like battery, charger, LT switchgear) may be done considering future bay requirements to avoid replacement in future with higher sizes. ACDB/ DCDB modules for future bays are not in the scope, however adequate space in the building shall be considered for future panels.

Fire Fighting System

Fire fighting system in general conforms to fire insurance regulations of India. The fire fighting system is proposed placed in both AC motor & diesel engine driven pumps housed in a fire fighting pump house building along with water storage tank of adequate capacity.

Automatic heat actuated emulsifying system is proposed for transformers & reactors. In addition for alarm system based on heat/smoke detectors are proposed to be installed at sensitive points in a substation e.g. Cable Vault, Control Room building and other buildings etc. Further, adequate water hydrants and portable fire extinguishers shall be provided in the substations. At existing substations the fire fighting systems if already available, would be extended for meeting the additional requirements.

Oil evacuating, filtering, testing & filling apparatus

To monitor the quality of oil for satisfactory performance of transformers, shunt reactors and for periodical maintenance necessary oil evacuating, filtering, testing and filling apparatus would be provided at new substations. Oil tanks of adequate capacities for storage of pure and impure transformer oil would be provided.

Control Room

Substation control room would be provided to house substation work station for station level control (SAS) along with its peripheral and recording equipments, AC & DC distribution boards, DC batteries & associated battery chargers, Fire Protection panels, Telecommunication panels & other panels as per requirements. Air conditioning will be provided in the building as functional requirements.

Protection Relaying & Control System

The protective relaying system proposed to be provided for transmission lines, auto-transformers, reactors and bus bars to minimize the damage to the equipments in the events of faults and abnormal conditions, is dealt in this section. All main protective relays shall be numerical type with IEC 61850 communication interface. All numerical relays shall have built in disturbance recording feature.

a) Transmission Lines Protection

400 kV and 220 kV lines shall have MAIN-I numerical three zone distance protection scheme with carrier aided inter-tripping feature. 400 kV and 220 kV lines shall also have MAIN-II numerical distance protection scheme like Main-I but from different make that of MAIN-I. Line Current Differential as Main-II may be considered, for short lines having Fibre Optic communication link. In case of loop in loop out of transmission lines, the existing protection scheme shall be studied and suitable up-gradation (if required) shall be carried out.

All 400 kV lines shall also be provided with two stages over voltage protection.

Further, all 400/220 kV lines shall be provided with single and three phase auto-reclosing facility to allow reclosing of circuit breakers in case of transient faults. These lines shall also be provided with distance to fault locators to identify the location of fault on transmission lines.

b) Auto Transformer Protection

These shall have the following protections:

- ✓ Numerical Differential protection
- ✓ Numerical Restricted earth fault protection
- ✓ Over-current and earth fault protection on HV & MV side
- ✓ Over fluxing protection on HV & MV side
- ✓ Overload alarm

Besides these, power transformers shall also be provided with BUCHOLZ relay, protection against high oil and winding temperature and pressure relief device etc.

c) 420 kV Reactor Protection

Reactor shall be provided with the following protections:

- ✓ Numerical Differential protection.
- ✓ Numerical Restricted earth fault protection
- ✓ Numerical Back-up impedance protection

Besides these, reactors shall also be provided with Bucholz relay, protection against oil and winding temperatures & pressure relief device etc.

d) Bus bar Protection

The high speed bus bar differential protection, which is essential to minimize the damage and maintain system stability at the time of bus bar faults, shall be provided for 400KV and 220KV buses. Duplicated bus bar protection is envisaged for 400kV bus-bar protection. Bus bar protection scheme shall be such that it operates selectively for each bus and incorporate necessary features required for ensuring security. The scheme shall have the provision for future expansion. For existing substations, the existing bus bar protection shall be augmented wherever required.

e) Local Breaker Back up Protection

This shall be provided for each 420 kV, 245KV and 145 kV breakers and will be connected to de-energize the affected stuck breaker from both sides.

f) Substation Automation System

For all the new substations, state of art Substation Automation System (SAS) conforming to IEC-61850 shall be provided. The distributed architecture shall be used for Substation Automation system, where the controls shall be provided through Bay control units. The Bay control unit is to be provided bay wise for voltage level 220kV and above. All bay control units as well as protection units are normally connected through an Optic fibre high speed network. The control and monitoring of circuit breaker, dis-connector, re-setting of relays etc. can be done from Human Machine Interface (HMI) from the control room. SAS shall be equipped with the facility of remote operation and by providing remote HMI and suitable communication link, the substation can be controlled from a remote location. Necessary gateway & modems (as required) shall be provided to send data to RLDC/SLDC.

The functions of control, annunciation, disturbance recording, event logging and measurement of electrical parameters shall be integrated in Substation Automation System. The Automation System shall be provided with the facility of communication and control for remote end operation. In existing Substations where Substation automation is not provided, control functions shall be done through control panels.

PLCC & PABX

Power line carrier communication (PLCC) equipment complete for speech transmission, line protections, and data channels shall be provided on each 420 KV & 220kV transmission line. The protections for transmission line and the line compensating equipment shall have hundred percent back up communication channels. The PLCC equipment shall in brief include the following:-

Coupling device, line traps, carrier terminals, protection couplers, HF cables, PABX and maintenance and testing instruments.

A telephone exchange (PABX) of 24 lines shall be provided at new substations as means of effective communication among various buildings of the substation, remote end substations and with control centres (RLDC/SLDC) etc.

Coupling devices shall be suitable for 4400pF 420kV CVT & 8800pF 765kV CVT with phase to phase coupling. Coupling devices shall be suitable for 4400pF 220kV CVT & 8800pF 132 kV CVT with Phase to Phase or Inter-circuit coupling. In case 132kV line is S/C then Phase-earth coupling is adequate. The pass band of coupling devices shall have sufficient margin for adding communication channel in future if required. Necessary protection devices for the safety of personnel and low voltage part against power frequency voltages and transient over voltage shall also be provided.

The line traps shall be broad band tuned suitable for blocking the complete range of carrier frequencies. Line Trap shall have the necessary protective devices such as lightning arresters for the protection of tuning device and shall be equipped with corona rings. Decoupling network consisting of line traps and coupling capacitors may also be required at certain substation in case of extreme frequency congestion.

The carrier terminals shall be of single side - band (SSB) amplitude modulation (AM) type and shall have 4 KHz band width.

Wherever Fibre Optic/OPGW based telecommunication terminal equipment (i.e. SDH/MUX) are being provided; the same shall be utilized for Data, Voice and line protection applications. For protection purposes, both end Digital Protection Couplers (DPCs) shall be included. However, for line protection application, back up communication channel/link may be considered as per requirement so as to take care of OPGW/Telecommunication equipment outage.

Addition /Modification /shifting/re-commissioning etc. of PLCC due to LILO of Uri – Wagoora line shall be covered under TBCB scope. PLCC carrier equipment for Jallandhar – Samba – Amargarh 400 kV D/C Line shall be under Powergrid scope, however CVT, coupling device, Land Trap and HF cable at Amargarh s/s shall be covered under TBCB scope.

5.7. Technical Requirements for Communication

5.7.1.1. SAMBA –AMARGARH 400KV D/C LINE:

- i. On Samba-Amargarh 400kV D/c 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 400kV Samba Substation up to gantry of 400kV Amargarh 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 OPGW shall be at the disposal of CTU. The maintenance of the OPGW shall be the responsibility of TSP (Transmission Service Provider).

5.7.1.2. LILO OF BOTH CIRCUITS OF URI - WAGOORA 400 KV D/C LINE AT AMARGARH S/S:

- i. On LILO of both circuits of Uri - Wagoora 400 kV D/c line at Amargarh S/s, 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 on LILO portion up to gantry of 400kV Amargarh 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 OPGW shall be at the disposal of CTU. The maintenance of the OPGW shall be the responsibility of TSP.

5.7.1.3. 400/220KV GIS SUBSTATION AT AMARGARH GIS SUBSTATION:

- i. SSP (Substation Service Provider) shall provide one STM-16 equipment alongwith necessary interfaces to meet the voice and data communication requirement and shall be integrated with the CTU communication equipments at remote ends.
- ii. SSP shall provide FODP and Approach Cable (24F), which shall be connected with OPGW to be installed on LILO portion of Uri - Wagoora 400 kV D/c upto gantry of 400kV Amargarh substation gantry by other TSP.
- iii. SSP shall install Phasor Measurement Units (PMUs) at the Amargarh GIS substation for all the bays (line/feeders & transformers) of the substation and shall support IEEE C-37.118.2011 protocol. These PMUs shall be integrated with the PDC (Phasor Data Concentrator) located at NRLDC (Northern Region Load Despatch Center).
- iv. SSP shall install RTU/SAS with necessary interfaces which shall be integrated with NRLDC SCADA System on IEC 60870-5-101/104 protocol

5.8. 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 the Substations & Transmission Lines confirm the quality of components and technical suitability of the Substation & 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.

The useful life of the different substation equipment is indicated below:

Equipment	Approx. life period
Circuit Breaker (All types and ratings)	10000 operations
Isolators with Earth switches (All types and ratings)	35years
ICT's (765/400 kV)	35 years
Reactors (All Types and ratings)	35 years
Current Transformer (All types and ratings)	35 years
Capacitor Voltage Transformers (All types and ratings)	35 years
Lightening Arrestors (400 kV)	35 years
Lightening Arrestors (765 kV)	35 years
33/11 kV Distribution Transformer	35 years
Battery Charger (220 V and 48 V)	35 years
Battery Banks (220 V and 48 V)	1000 cycles
ACDB panels	35 years
DCDB panels	35 years
MLDB panels	35 years
320 kVA Diesel Generator	35 years
Relays	35 years
PLCC Panels	35 years
FOTE panels	35 years
SAS system	35 years
NIFPS (for Transformers and Reactors)	35 years
Hydrant Fire Protection system (for Buildings)	35 years

Project Company is advised to continue with the prudent maintenance practice and follow the OEM recommendation to achieve the useful life.

5.9. Technical Guarantee

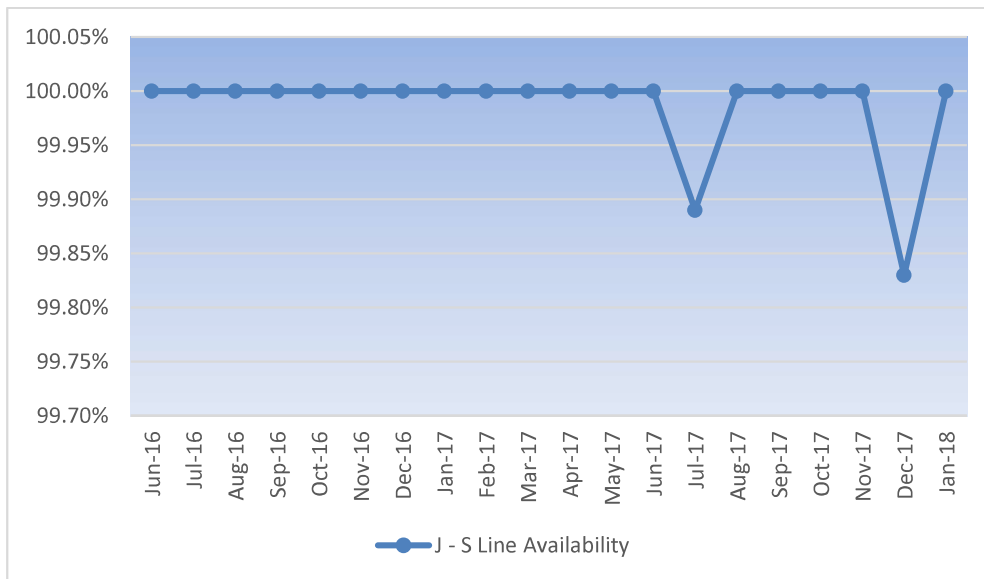
Typically contract for Transmission Project does not envisage any performance guarantee parameters. However, the project has been implemented in line with the technical specifications with proper quality checks.

The Certificate for approval for Energization from CEA ensures the completeness and technical acceptability of the project. IE observed that all the elements have received the CEA approval for the same,

5.10. Availability of Transmission Lines and Substations

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 Jallandhar – Samba 400 kV D/C Transmission Line of NRSS XXIX. The availability of transmission line from June, 2016 to January 2018 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 substations and the 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.

5.11. Assessment of Technology Risk

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

6. TIME SCHEDULE

6.1. Schedule as per TSA

As per TSA, the scheduled COD of the project is 38 months from the effective date of TSA. The effective date of TSA is 4th August, 2014. Therefore, the SCOD works out to 4th October, 2017.

However as per CERC tariff order dated 10.12.2014 the completion target of the Project is 50 months from the effective date. Therefore, the SCOD works out to be 4th October, 2018.

6.2. Schedule as per EPC Contracts

The schedule completion date as EPC Contract is 04.10.2018 which is within the SCOD date as per TSA.

6.3. Schedule as per CERC tariff order 10.12.2014

The details of the completion target as per CERC tariff order dated 10/12/2014 is as mentioned below:-

Sl. No.	Transmission Elements	Completion Target
1.	Jalandhar – Samba 400kV D/C	34 months from effective date
2.	LILO of both circuits of Uri – Wagoora 400kV D/C line at Amargarh (on multi circuit towers)	50 months from effective date
3.	Samba-Amargarh 400kV D/C line routed through Akhnoor/ Rajouri	50 months from effective date
4.	II. Substation Establishment of 7X105MVA (1-Ph units) with 400/220kV GIS Substation at Amargarh 400kV - Line bays 6 no. - 400/220kV ICT 7X105MVA (1-Ph units) - ICT Bays 2 no. - Line reactor (50 MVAR): 2 no. for Amargarh line - Bus Reactor (63 MVAR): 2 no. - Bus Reactor Bay: 1 no.(2 bus reactor on 1 bay) - Space for line/ICT bays: 4 no. - Space for ICT: 1 no. 220kV Bay - Line bays 6 no. - ICT Bays 2 no. - Space for line/ICT bays: 4 no.	50 months from effective date

IE found that the completion target for the transmission line is in line with the EPC contract.

7. PROJECT MANAGEMENT ARRANGEMENT

7.1. Project Organization

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

The Jallandhar – Samba 400 kV D/C Transmission Line (Phase – 1) is commissioned and is operational. The O&M philosophy and activities carried out for the Phase – 1 of the project is indicated herewith.

The Main Hub office and store of J – S line is at Gurdaspur where the personnel of NRSS are stationed. The common services such as Accounts, Commercial, Safety, and Quality are catered from the Hub office.

The line is operational and was executed through following two sub-hubs.

- a) **Jallandhar:** This office had one supervisor and 2 nos. Technician.
- b) **Samba:** This office had one supervisor and 2 nos. Technician.

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. O&M Organization Set – up & its adequacy

The Project Manager of Indigrd. shall be responsible for the Operation & Maintenance for NRSS.

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.

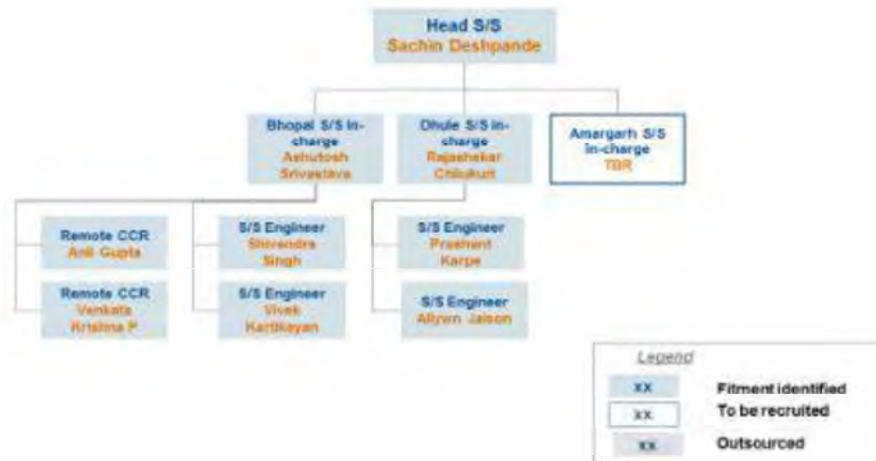
For trouble free operation and proper maintenance, SPGVL is taking up the following measures:

- 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 Transmission Line and sub – station



Organization structure for O&M S/S team



NRSS has outsourced the maintenance works of 400kV D/C Jalandhar – Samba Line to M/s. Telegence Powercomm Private Limited. Work order dated 27th July, 2016, was awarded for maintenance works from Jalandhar Substation Gantry to AP 66/4 and AP 67/2 to AP 67/3 (106.604 kms) at Punjab. The effective date of the Contract was 27th July, 2016 and valid till 36 months i.e. Three years from effective date.

Similarly another work order dated 23rd December, 2016 was awarded for Maintenance works from AP 67/0 to AP 67/1 and AP 68/0 to Samba substation Gantry (28.206 kms) at Jammu. The effective date of the Contract was 1st August, 2016 and valid for 36 months i.e. three years from effective date.

The total work order Period is valid for 36 months i.e. 3 years from the date of successful commissioning of the respective lines. The extendable period of 2 yrs is based on the performance.

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. Replacement of mission members
- x. Tightening of nuts and bolts
- xi. Visual inspection for hot spots
- xii. Breakdowns
- xiii. Inspection of foundations
- xiv. Strengthening of tower foundation and civil works
- xv. Night Patrolling
- xvi. Thermo vision once in six months
- xvii. Signature analysis as and when required
- xviii. Measurement of tower footing resistance
- xix. Mock drill
- xx. Thorough inspection of the corridor during pre monsoon and post monsoon
- xxi. Tree cutting if required
- xxii. 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.

The 400kV D/C Jalandhar – Samba Transmission Line shall be managed by NRSS as follows:

To optimize costs, the contractor has deployed manpower at Gurdaspur (in state of Punjab) and Jammu. The gangs at these hubs shall look after the maintenance of transmission lines. The contractor shall maintain manpower and stores at Sub – hubs wherever required to have optimum maintenance. Each section shall be taken care of by Section In- charge from the SPGVL In-house O&M team. The O&M contractor shall take care of all the O&M activities under the guide lines of the Section In- charge.

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 & Maintenance (O&M) Activities

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

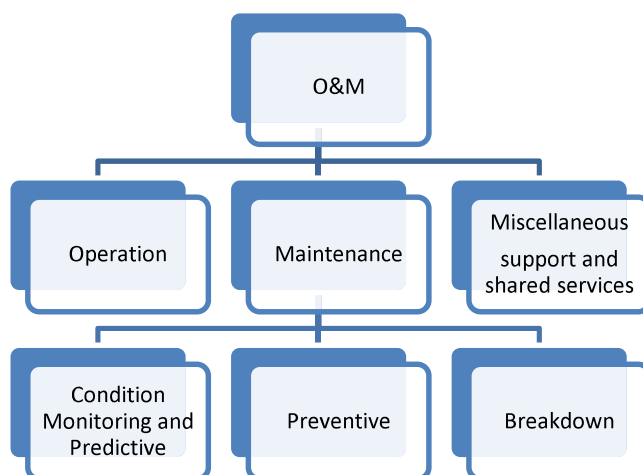


Figure 4.1 – Operation & Maintenance Activities

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 NRSS will focus primarily on the maintenance aspect.

The objective of the O&M strategy of NRSS is:

- 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/sub-stations for maintenance purpose

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

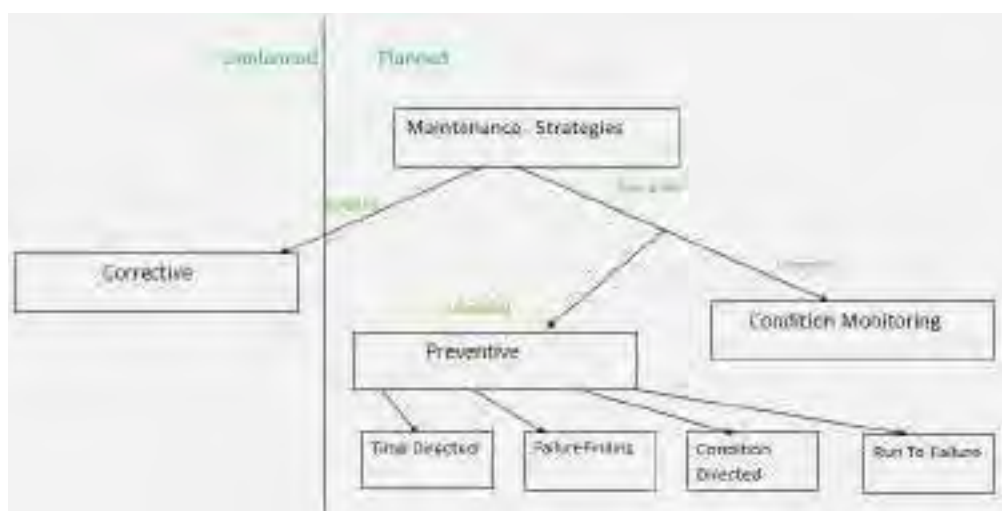


Figure 4.2 – Maintenance Strategy

7.3.1. Routine Maintenance (Preventive Maintenance)

NRSS 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

NRSS 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 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 were taken using Digital Camera and Hard/Soft copies of the same were preserved to have the history of location.
- 100% Transmission Line towers and Spare were checked by concerned Lineman/ technician/ Engineer once in patrolling cycle. 20% Transmission Line Towers, spans in normal and vulnerable sections and all most vulnerable towers were 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:

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

7.3.3. Annual Maintenance Schedule for the Year 2018 – 19

Project Company plans to carry out the following Annual Maintenance for checking, tightening and rectification of jumper nut & bolts, hardware fitting, each phase conductors, earthwire and other accessories of line –

Table 7.1 – Annual Maintenance Plan for Year 18 - 19

Sr. no.	Line/Equipment name	From date	To date	Duration
1.	Jalandhar-Samba line, CKT-1	19.06.2018 (09:00)	19.06.2018 (12:00)	3 Hrs
2.	Jalandhar-Samba line, CKT-2	20.06.2018 (09:00)	20.06.2018 (12:00)	3 Hrs
3.	Jalandhar-Samba line, CKT-1	25.09.2018 (09:00)	25.09.2018 (12:00)	3 Hrs
4.	Jalandhar-Samba line, CKT-2	26.09.2018 (09:00)	26.09.2018 (12:00)	3 Hrs
5.	Jalandhar-Samba line, CKT-1	18.12.2018 (09:00)	18.12.2018 (13:00)	4 Hrs
6.	Jalandhar-Samba line, CKT-2	19.12.2018 (09:00)	19.12.2018 (13:00)	4 Hrs
7.	Jalandhar-Samba line, CKT-1	26.03.2018 (09:00)	26.03.2018 (12:00)	4 Hrs
8.	Jalandhar-Samba line, CKT-2	27.03.2018 (09:00)	27.03.2018 (12:00)	4 Hrs

7.3.4. Tripping Details

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

Table 7.2 – Tripping Details

Element	Event Date	Event Time	Restoration Date	Restoration Time	Loss hrs.	Reasons/ RCA
Jalandhar Samba Line 1	1-Dec-16	8:47	9-Dec-16	16:45	199:58:00	Normalization of the Line
Jalandhar Samba Line 2	1-Dec-16	8:47	9-Dec-16	17:45	200:58:00	Normalization of the Line
Jalandhar Samba Line 1	5-Jul-17	21:09	5-Jul-17	22:44	1:35	The relays showed that the fault occurred at a distance of 4.99 Kms from Jalandhar end. The Fault was a R phase to Y phase fault. no reason was found for the line tripping.
Jalandhar Samba Line 1	21-Dec-17	9:37	21-Dec-17	18:08	8:31:00	Maintenance Activity. OPGW rectification work
Jalandhar Samba Line 2	21-Dec-17	9:36	21-Dec-17	18:30	8:54:00	Maintenance Activity. OPGW rectification work
Jalandhar Samba Line 1	24-Feb-18	18:50	24-Feb-18	23:20	4:30:00	The relays showed that the fault occurred at a distance of 40.91 Kms from Jalandhar end. The Fault was a R phase to Y phase fault. Tripping was due to bad weather.

Element	Event Date	Event Time	Restoration Date	Restoration Time	Loss hrs.	Reasons/ RCA
Jalandhar Samba Line 2	22-Mar-18	8:21	22-Mar-18	19:43	11:22:00	Shutdown for Annual Maintenance Program
Jalandhar Samba Line 1	24-Mar-18	8:26	24-Mar-18	19:54	11:28:00	Shutdown for Annual Maintenance Program

IE observed, that the major reason for the tripping of the line was bad weather conditions, which cannot be predicted and controlled. However, O&M team should regularly conduct Line Patrolling in order to minimize these trippings. Regular cutting of trees in the Corridor below the Transmission Line needs to be done after taking proper shutdown of the line.

7.3.5. Uprooting of Towers for Samba – Amargarh Line

During the month of June, 2017, three tower locations for Samba – Amargarh 400 kV D/C Transmission Line, were uprooted from the footing/ pad (Chimney pedestal). Towers were erected, and stringing was complete, however the line was not charged. M/s. Tata Consulting Engineers Ltd. (TCE) was hired by M/s. Sterlite Power Grid Ventures Limited (EPC Contractor) as third party Quality Auditor for the following uprooted locations –

- i. Location 20/3 (DA+0M Ext.)
- ii. Location 20/4 (DA+0M Ext.)
- iii. Location 21/0 (DD+3M Ext.)

TCE had visited the site, reviewed the approved Foundation drawing for the respective locations and verified the physical measurement of RCC, foundation depth, shape, size etc. of each location vis-à-vis the drawing/ specification.

Auditor had recommended for restoration works of all the above location in line with the Foundation Drawings/ specification. During site visit, IE observed that SPGVL had hired M/s Bureau Veritas was hired for entire S – A line and Quality Inspector. Bureau Veritas was responsible for all the quality check of all the foundation locations (casted and under – executed locations in entirety).

Henceforth, IE observed that each foundation works was verified by Contractor, Quality Inspector and SPGVL and then foundation approval was granted.

7.3.6. 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:

- a) Failure of conductor splices.
- b) Damage to structures or conductors from wildfire, high winds, ice, or other weather related conditions.
- c) Line or system outages or fire hazards caused by trees falling into conductors.

- d) Breaking or imminent failure of cross-arms or insulators, which could, or does, cause conductor failure.
- e) 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).

7.3.7. Consumption of Spares

The List of Spares has been furnished to the IE. The details of the inventory available at store as on 30.04.2018 has been given below –

Table 7.3 – Consumption of Spares

Material Details				
S. No.	Material Handed Over from Sterlite to Telegence	Last month Balance Qty.	Material used in April 2018	Closing Balance
1	Pipe Type Earthing (in nos.)	2	0	2
2	DT fitting	1	0	1
3	120 KN 'Single "I" Suspension Pilot Insulator String	4	0	4
4	Counter Weight 25Kgs - (8 Nos = 1 set).	9	0	9
5	T-Connector Bolted Type (in nos.)	14	0	14
6	T-Connector Comp. Type (in nos.)	12	0	12
7	Twin Spacer Damper (in nos.)	0	0	0
8	Twin Rigid Spacer 457 mm (in nos.)	3	0	3
9	Vibration Damper for 7/3.66 mm Earthwire (in nos.)	5	0	5
10	Flexible Copper Bond For Earthwire (in nos.)	1	0	1
11	120 KN Polymer Insulator (in nos.)	1	0	1
12	160 KN Polymer Insulator (in nos.)	1	0	1
13	ACSR Conductor Bit (in m)	606	0	606
14	GS. Earthwire 7/3.66 mm Bit (in m)	90	0	90
15	Extension Link (in nos.)	6	0	6
16	Empty Conductor Drum (in nos.)	5	0	5
17	Empty OPGW Drum (in nos.)	4	0	4
18	120 KN Single "I" Suspension Pilot Insulator String			
18.1	Arking Horn (in nos.)	2	0	2
18.2	Yoke Plate (in nos.)	3	0	3
18.3	Suspension Clamp (in nos.)	3	0	3
18.4	20MM Dia D-Shackle (in nos.)	3	0	3
18.5	Corona Control Ring (in nos.)	3	0	3
19	Conductor & OPGW			
19.1	ACSR Moose Conductor (in m.)	0	0	0
19.2	OPGW Cable (Without Tested) (in m.)	2.25	0	2.25

Material Details				
S. No.	Material Handed Over from Sterlite to Telegence	Last month Balance Qty.	Material used in April 2018	Closing Balance
20	OPGW Hardware Fitting			
20.1	Single Tension/Dead End Clamp (in nos.)	10	0	10
20.2	Single Suspension Assembly (in set.)	1	0	1
20.3	Joint Box (in nos.)	0	0	0
20.4	Down Lead Clamp (in nos.)	34	0	34
21	Tower			
21.1	DA+0 (in set.)	5	0	5
21.2	DB+0 (in set.)	1	0	1
21.3	DC+0 (in set.)	1	0	1
21.4	DD+0 (in set.)	1	0	1
22	Hardware Fitting			
22.1	MSCJ For Moose (in nos.)	146	0	146
22.2	Repair Sleeve for Moose (in nos.)	18	0	18
22.3	T-Connector (in nos.)	18	0	18
22.4	MSCJ for Earthwire (in nos.)	2	0	2
22.5	Repair Sleeve for Earthwire (in nos.)	12	0	12
23	Template			
23.1	DA+0-9 (in set.)	1	0	1
23.2	DB+0-9 (in set.)	1	0	1
23.3	DC+0-9 (in set.)	1	0	1
23.4	DD+0-9 (in set.)	1	0	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:

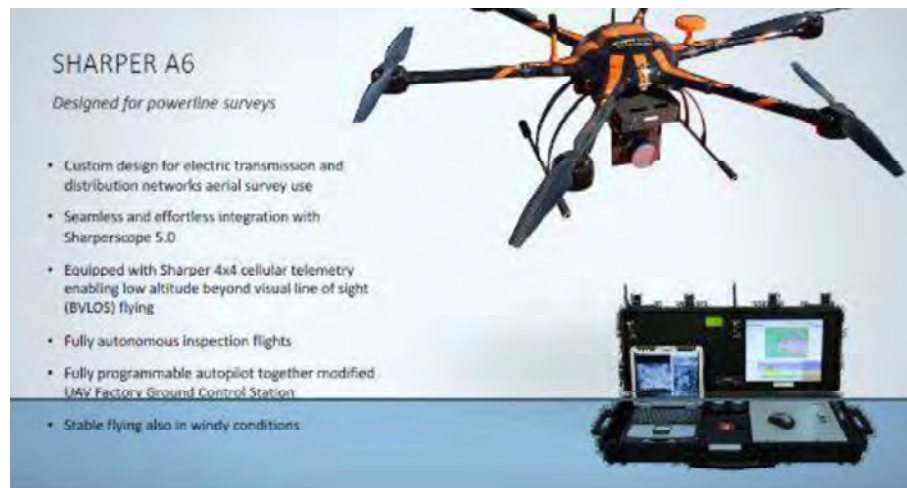
- a) Use of separate IT (Information Technology) based tool is being put in place for O&M, to computerize all the formats for the purpose of storage for easy access and for centralization of the information.
- b) To promote knowledge sharing within the team, a Knowledge management portal is already in 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.

NRSS 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.

Likewise, Transmission lines, various factors that can cause major failures and interruption inside a Substation are:

- High wind loading or floods
- Storm damage
- Earthquakes
- Equipment failure
- Fire hazards
- DC Supply failure
- Vandalism or sabotage

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)

Emergency Materials for Substations –

- Mandatory Spare Equipment and accessories as per the approved list.
- T & P's
- Conductor and IPS tube of various types in sufficient quantities.
- Clamps, Connectors and Hardware of all types
- Structure and Tower members
- SF6 and N2 Gas in sufficient quantity
- Transformer Oil
- Fire Extinguishers and Fire Fighting resources in adequate quantity

The entire inventory, spares, T & P's related to Substation should to be stored inside the Substation premises in properly secured Stores and the location/ identification of the materials should be clearly marked to facilitate the restoration process in case of emergencies.

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

NRSS 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/ Substation 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 10.1 shows the latest status of various Permits and Clearances obtained/ to be obtained:

Table 9.1 – Status of Permits and Clearances

Sl. No.	Description	Authority	Present Status
1.	Aviation Clearance – LOC for 400 KV D/C Jalandhar – Samba Transmission Line	661 Army Aviation Squadron (R&O)	Issued on 22 nd February 2016, letter no – 01206/GS (Ops-Air)/X/AA. NOC is issued and is one-time activity.
2.	PTCC	Central Electric Authority	Letter no – CEA/PCD/PTCC/PNB 333/618 dated 22/03/2016, for J – S Line NOC from PTCC for S – A Line was obtained on 25 th July, 2018, vide letter no. B/46937/Sigs7(b)/422.
3.	CEA Approval for Energisation of 400 kV D/C (Twin Moose) J – S line	CEA	Approval received vide letter dated 30/03/2016
4.	Certificate for completion of trial Operation	Power System Operation Corporation Limited (POSOCO)	POSOCO letter dated 28 th December, 2016, indicates that successful completion of trial run for 400 kV Jalandhar (PG) – Samba (PG) D/C Transmission line was achieved on 10 th December, 2016
5.	Stage – I Forest Clearance for Jalandhar-Samba Line	Ministry of Environment, Forest and Climate Change	Obtained
6.	Stage – II Forest Clearance for Jalandhar-Samba Line	Ministry of Environment, Forest and Climate Change	Obtained
7.	Forest Clearance for Samba –Amargarh Line	State Govt. of J&K	Obtained
8.	Clearance for wild life	State Board for Wildlife (SBWL) and National Board for Wildlife (NBWL)	Final wildlife clearance has been issued on 04/10/2016.
9.	Aviation Clearance – Height Clearance	Airport Authority of India	Letter no – AAI/ RHQ- NR/ATM/NOC/2015/276/156-157 dated 15.02.2016 valid for 7 years from date of issue.
10.	Power Line Crossings	Power Grid Corporation of India	All the Power Line Crossings for Jalandhar – Samba Line is obtained. The permits for Samba to Amargarh section is listed below.
11.	Railway Line Crossing Jalandhar – Samba	Indian Railway	Letter no – 63-Elect/1867 dated 25.02.2016, permission for crossing the location: Track kilometer 58/9 – 59/0 between telegraph post No 58/9 and Telegraph post no 59/0 and between Ghagwal and Samba Railway stations on PKT – JAT section. Letter no – 63-Elect/1867 dated 25.02.2016, permission for crossing the location: Track kilometer 76/8-9 – 76/8 between telegraph post No 76/8 and Telegraph post no 76/9 and between Gurdaspur and Dinanagar Railway stations on ASR – PTK section.

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Sl. No.	Description	Authority	Present Status
12.	Road Crossing Jalandhar to Samba	National Highway Authority of India	Clearances for all the NH/SH crossings are obtained.
13.	Canal Crossing Jalandhar to Samba	Department of Irrigation, Punjab	Letter no: 1970/74 dated 11.05.2011, permission to cross the canal under the Gurdaspur Mandal
14.	River Crossing	Central Water Commission, Ministry of Water Resources, River Development and Ganga Rejuvenation	Letter no: 6/70/CE(IB)/2012/2729 dated 11/08/2015, stating that the Central Water Commission has no network/ activity on the River Beas and Ravi in Punjab State. Hence, the permit should be sought from the Punjab Government. No clearance required as stated by the State Govt.
15.	Section 68 of Electricity Act	Ministry of Power, Government of India	Letter no: 11/33/2013-PG (REC NRSS – XXIX) dated 19th September 2013. The permit is valid for 3 years from the date of issue for commencement of Construction work.
16.	Section 164 of Electricity Act	Central Electric Authority	Gazette order no: S.O. 2671 (E), dated 17 th September 2015. The approval is granted for 25 years.
17.	Section 17 (3) of Electricity Act, 2003	CERC	Project Company has filed petition to CERC for creation of Security Trustee and acknowledgement was received from CERC vide letter dated 30th June, 2016. However, clarification/ approval from JKERC is awaited.
18.	Defense Aviation		NOC received.

Each Section wise permit for Samba to Amargarh Section is indicated below:

1. Samba – Amargarh_PKG1

Description	Details
Railway Crossing – 1 No.	NOC obtained
State Highway Crossing – 1 No.	NOC obtained.
Power Line Crossings – 6 Nos.	NOC obtained for all the crossings

2. Samba – Amargarh_PKG2

Description	Details
SH/BRO Crossings – 9 Nos.	Proposals for all the 9 crossings are submitted to BRO office. NOC obtained for 8 no. of crossings & balance 1 is under consideration by BRO Authority for approval.
Power line Crossing – 6 Nos.	NOC obtained for all the crossings

3. Samba – Amargarh_PKG3

Description	Details
SH/ BRO Crossings – 7 Nos.	NOC obtained for all SH/BRO crossings
Mughal Road Crossing – 3 Nos.	NOC obtained for all the 3 nos.

4. Samba – Amargarh_PKG4

Description	Details
SH crossings – 1 No.	NOC obtained
Power Line Crossings – 5 Nos.	NOC obtained for all the 5 crossings.

IE found that the requisite Permits and Clearances for Jalandhar to Samba and Samba – Amargarh 400 kV D/C Transmission Line, for successful operation, are in place. However, approval under Section 17(3) of EA 2003, is still awaited (**Risk Category – C**)

10. SUMMARY OF MAJOR FINDINGS

- The project comprises of 134.811 kms of 400 kV D/C interstate transmission line with Twin Moose ACSR conductor from Jalandhar (Punjab) to Samba (Jammu) (J – S Line), 279.19 kms of 400 kV D/C transmission line with Twin Moose ACSR conductor from Samba (Jammu) – Amargarh (Kashmir) (S – A Line), LILO of Uri – Wagoor Line at Amargarh of around 6.82 kms and 400/220 kV GIS sub – station at Amargarh.
- Project Company has successfully completed the trial run of Phase – 1 and Phase – II of the Project –
 - 400 kV D/C Twin Moose Conductor Jalandhar – Samba Transmission line Phase-I of the Project, successfully completed the trial – run operation on 24.06.2016/ 18:29 Hours
 - 400 kV Amargarh (NRSS XXIX) – Samba (PG) ckt – 1, along with 50 MVAR Non – switchable line reactors at Amargarh (NRSS XXIX) end and associated bays on 1st September, 2018 at 20:15 hrs
 - 400 kV Amargarh (NRSS XXIX) – Samba (PG) ckt – 2 along with 50 MVAR Non – switchable line reactors at both the ends and associated bay on 22nd August, 2018 at 22:00 hrs.
 - 400/220 kV, 315 MVA – 1 & 2 (6X105 MVA) along with associated 400 kV bays and 220 kV bay at Amargarh on 18th May, 2018 at 15:35 hrs
 - 400 kV, 3 – Ph 63 MVAR Bus Reactor – 1 with associated 400 kV Bay at Amargarh (NRSS XXIX) on 3rd June, 2018 at 11:15 hrs
 - 400 kV, 3 – Ph 63 MVAR Bus Reactor – 2 at Amargarh (NRSS XXIX) on 8th June, 2018 at 16:42 hrs
 - 400 kV Uri (NHPC) – Amargarh (NRSS XXIX) ckt – 1 and associated bays at Amargarh (NRSS XXIX) and 400 kV Amargarh (NRSS XXIX) – Wagoora (PG) ckt – 1 and associated bays at Amargarh (NRSS XXIX) {Only LILO portion of 400 kV Uri 1(NHPC) – Wagoora Ckt – 1 at Amargarh (NRSS XXIX)} on 10th April, 2018 at 21:00 hrs
 - 400 kV Uri 1(NHPC) – Amargarh (PG) ckt – 2 and associated bays at Amargarh (NRSS XXIX) and 400 kV Amargarh (NRSS XXIX) – Wagoora (PG) ckt – 2 and associated bays at Amargarh (NRSS XXIX) {Only LILO portion of 400 kV Uri 1(NHPC) – Wagoora (PG) Ckt – 2 at Amargarh (NRSS XXIX)}, on 18th March, 2018 at 21:30hrs.
- The Project Company has provided the availability Certificate of J – S line for the months of Jun'16 to Jan'18. It is observed that the Asset's Average availability for the above mentioned period is 99% which is greater than the guaranteed availability of 98% as specified in TSA.
- IE found that the requisite Permits and Clearances for Jalandhar to Samba line are obtained and are well in place.
- Regarding S – A Line, IE noted that Clearances like Transmission Service Agreement, Transmission License, Approval under Section 68, Approval under 164 is obtained, however, approval under Section 17(3) of EA 2003, is still awaited (**Risk Category – A**). Non – Statutory Clearances like PTCC, Defense, Aviation, Crossings etc. approvals are received.
- Service conditions and system parameters are in line with the TSA and relevant Indian Standards & Practices for similar kind of projects

- Project Company has established the Project offices at three places, one in Gurdaspur (Punjab) – to monitor the J – S Line, second in Jammu to monitor the S – A line and third in Srinagar – to monitor the S – A Line, LILO and substation. During the site visit it was informed by the Project Company that all the three offices are fully functional with all necessary facilities.
- The O&M Contract for J – S Line was awarded to M/s. Telegence Powercomm Pvt. Ltd. for maintenance works on 27th July, 2016. The work order is valid for 3 years from the date of successful commissioning. The work order can be further extended for 2 years based on the performance.
- 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.
- During site visit and as per the records, that the J – S line had two major faults, since its commissioning, reasons accountable to bad weather, with wind speed beyond 85 m/s, which is beyond the control.
- 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.
- During site visit, IE observed that foundation strengthening activities (revetment) and restoration works were in progress as per the recommendations from Third Party Quality check M/s. Bureau Veritas India.
- A set of photographs taken during the site visit from 16th to 19th May, 2018 is attached as **Annexure – 4**.

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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