सत्यमेव जयते

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
उत्तर क्षेत्रीय विद्युत समिति
Northern Regional Power Committee

सं. उक्षेविस/ वाणिज्यिक/ 209/ आर पी सी (65वीं)/2023/ 5253-5300 दिनाँक: 18, May, 2023

सेवा में / To,

उ.क्षे.वि.स. के सभी सदस्य (संलग्न सूचीनुसार)
Members of NRPC (As per List)

विषय: उत्तर क्षेत्रीय विद्युत समिति की 65वीं बैठक का कार्यवृत ।
Subject: 65th meeting of Northern Regional Power Committee – MoM

महोदय / Sir,

उत्तर क्षेत्रीय विद्युत समिति की 65वीं बैठक दिनांक 21.04.2023 को टिम्बर ट्रेल, परवाणू, हिमाचल प्रदेश में आयोजित की गयी थी । बैठक का कार्यवृत संलग्न है। यह उ.क्षे.वि.स. की वेबसाइट (http://164.100.60.165/) पर भी उपलब्ध है ।

The 65th meeting of Northern Regional Power Committee (NRPC) was held on 21.04.2023 at Timber Trail, Parwanoo, Himanchal Pradesh. MoM of the same is attached herewith. The same is also available on NRPC Sectt. website (http://164.100.60.165/).

भवदीय
Yours faithfully,

18.05.2023

(वी. के. सिंह)
(V. K. Singh)
सदस्य सचिव
Member Secretary

प्रतिलिपि:
Mohammed Shayin, MD, HVPNL & Chairperson, NRPC (md@hvpn.org.in)

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उत्तरी क्षेत्रीय विद्युत समिति की 65वीं बैठक

65th MEETING OF NORTHERN REGIONAL POWER COMMITTEE

Time & Date of NRPC meeting: 21st April 2023

Venue: Timber Trail, Parwanoo, Himachal Pradesh

CGM, SJVNL welcomed all the delegates participating in 65th NRPC meeting and stated that it was their privilege to host this meeting which is also an opportunity to discuss and find solutions of various issues being faced by utilities in Northern Region. He stated that such meetings play vital role in economic, safe and reliable operations in the region.

Member Secretary, NRPC welcomed all the esteemed delegates of Northern Region participating in 65th Meeting of NRPC and thanked SJVNL team under leadership of CMD, SJVNL for hosting the meeting and making a nice comfortable stay arrangement for all the delegates. He stated that till now Northern Grid was able to meet increasing demand with reliability due to efforts of all the players. He appreciated efforts of CEA, GRID-INDIA, and CTU in integration of RE. He appreciated that last major grid incident happened in 2012 and since then there has been no major grid incident. He appreciated efforts of SLDCs and NRLDC for managing real time grid operation smoothly. He quoted that challenges faced in RE integration is being taken up and recently 39 RE plants of NR have corrected their settings for voltage control mode operation. He quoted that he joined in NREB in year 1987 and since then he has deep connect with real time grid operation. He highlighted that adequate and trained manpower in power sector and particularly in LDCs is important and there should be efforts for training and certification in specific areas of power sector. In the end, he thanked CMD, SJVNL and his officers for hosting meeting and making excellent arrangements for the comfortable stay of the delegates.

Chairperson, NRPC and MD, HVPNL welcomed delegates to the 65th NRPC meeting and thanked entire team of SJVNL for the excellent arrangements made by them in organizing the meeting. He stated that mandate of NRPC is to deliberate upon and evolve consensus on the matters concerning the stable & smooth operation of the integrated grid as well as economy & efficiency in the operation of the power system in the region. He highlighted that commercial and technical aspects should be seen together in larger perspective for enabling sustainable growth of power sector.

He stated that challenges for transmission projects including RoW, local administration issues, compensation etc. may also be deliberated in future meetings so that solutions can be derived. He requested for proactive participation in the deliberation, which will facilitate safe, reliable and economic operation of NR power system. He congratulated all delegates for Civil Services Day and appreciated efforts of Engineers in COVID situations.

CMD, SJVNL welcomed the distinguished participants of 65th NRPC Meeting and appreciated the efforts made by power sector utilities during tough times of Covid-19 pandemic. He also informed about fast progress of upcoming Power projects and requested the constituents to consider purchase of power from their projects. Further, he also informed that SJVNL has been designated as Renewable Energy Implementing Agency (REIA) by MNRE, GoI and interested utilities may take services of SJVNL as REIA in coming future. He extended his good wishes to all the delegates for fruitful discussion and resolution of issues during the meeting.

The list of participants is enclosed as **Annexure – A.0**

Minutes of Meeting

A.1 Approval of MoM of 64thNRPC meeting

A.1.1 EE(P&SS), NRPC informed that minutes of 64thNRPC meeting, held on 24.03.2023,has been issued vide letter dtd.12.04.2023.He stated that no comments have been received till the date, however, SJVNL has submitted additional inputs for Agenda 5 regarding payment made by BRPL and BYPL under Force Majeure Clause.

A.1.2 SJVNL stated that at A.5.10, it has been recorded as BRPL stated that SJVNL has never given them any formal communication in this regard, however, the issue has been already communicated vide letter dtd. 01.02.2023 and 12.12.2022.

A.1.3 BYPL representative stated that the issue has been taken up and now they have stopped mentioning Force Majeure clause in the payment intimation.

A.1.4 MS, NRPC stated as letter has not been deliberated in the previous meeting, it may not be appropriate to include it in minutes of 64th NRPC meeting. However, update from BYPL may be noted.

A.1.5 Forum approved the minutes of 64th NRPC meeting as issued.

A.2 Consent for purchase of power from Naitwar Mori Hydro Electric Project (NMHEP), 60 MW (2X30 MW) in Uttarakhand(Agenda by SJVNL)

A.2.1 SJVN informed that Naitwar Mori Hydro Electric Power Project (NMHEP) (2X30 MW) is being executed on the river Tons (a tributary of river Yamuna) in district Uttarkashi in the state of Uttarakhand.

A.2.2 He stated that Naitwar Mori HEP is a run–of- river type scheme and is designed to generate annually 269 MUs in 90 % dependable year. The commissioning activities of the project are in full swing and project is likely to be commissioned in June, 2023. As per Memorandum of Understanding (MoU), 12% of the net energy shall be given to Government of Uttarakhand (GoUK) free of cost. Further, SJVN would be in a position to offer the balance power being generated from project to interested states / UTs as per the prevalent policies of Govt. of India issued from time to time.

A.2.3 He highlighted that MoP, GoI has issued order dtd. 29.01.2021 and 22.07.2022 regarding Renewable Purchase Obligation (RPO) wherein Large Hydro Power (>25 MW) is declared as Renewable Energy Source and Hydro Purchase Obligation (HPO) shall be met only by energy produced from Large Hydro Power Projects commissioned after 08thMarch, 2019.

A.2.4 The levelized tariff of the generated power is around Rs 12 per Kwh. However, after considering the RoE on lower side and optimizing the Loan component the tariff of NMHEP has been worked out around Rs 7 per Unit. SJVN is in a position to offer power from Naitwar Mori HEP under HPO benefits as notified by MoP, GoI after its commissioning at the tariff of Rs. 7 per Unit.

A.2.5 SJVN presented current status of construction through video clips of site and apprised the tariff structure. He emphasized that considering HPO benefits, effective tariff to buyer will be approx. 5.0-5.5Rs throughout the year.

A.2.6 On query from BYPL regarding revision of PIB approval, SJVNL replied that no escalation is expected as of now.

A.2.7 He requested constituent members to consider purchase of power under HPO obligations.

A.2.8 MS, NRPC stated that tariff in this project is on higher side, therefore, in future SJVNL may plan making bunch of such projects with their lucrative projects such as Luhri, Sunni etc. He stated that MoP may be approached to include Naitwar Mori in RRAS in solar hours. As this is a RoR project and spillage of precious water may not be appropriate.

A.2.9 NRLDC representative opined that, SJVNL should workout with DISCOM and can explore lucrative cost as per solar/non-solar hours, peak/other than peak hours. Further during high water in-flow, Northern region (NR) also have high demand period, therefore both solar and hydro can run. In respect to RRAS, Grid-India stated that Hon’ble commission is going for massive change in RRAS and sooner the RRAS

would be obsolete. In such scenario, SJVNL may chose power exchange for selling of power, HPO credit etc.

A.5.1 MS, NRPC emphasized that SJVNL may explore recently launched portal by CEA i.e. PUSHP portal which facilitates buy and sell at tariff rates. He also suggested that SJVNL may explore yearly differential tariff of the HEPs which may be more lucrative.

A.2.10 Punjab representative suggested that seasonal tie-up may also be explored by SJVNL.

A.2.11 Members took note of the information.

A.3 Consent for purchase of power from Luhri Hydro Electric Project Stage-I (LHEP Stage-I), 210 MW in Himachal Pradesh. (Agenda by SJVNL)

A.3.1 Representative from SJVNL stated that Luhri Hydro Electric Project Stage-I, 210 MW on the river Satluj in the downstream of Rampur HPS in the state of Himachal Pradesh and the commissioning of the project is expected in August, 2026.

A.3.2 Luhri Hydro Electric Project Stage-I is a run–of- river with limited pondage type scheme and is designed to generate annually 758.20 MUs. The construction activities of the project are in full swing and the commissioning of the project is expected in August, 2026.

A.3.3 As per Memorandum of Understanding (MoU), 13% of the net energy shall be given to Government of Himachal Pradesh (GoHP) free of cost. Further, SJVNL would be in a position to offer the balance power being generated from project to interested states / UTs as per the prevalent policies of Govt. of India issued from time to time.

A.3.4 SJVNL is in a position to offer power from Luhri Hydro Electric Project Stage-I under HPO benefits as notified by MoP, GoI after its commissioning. The levelized tariff of the generated power is Rs 4.06 per Kwh as per PIB approval.

A.3.5 He presented current status of construction through video clips of site.

A.3.6 He requested the consent of constituent members for purchase of power through PPA / HPO, indicating the quantum of power required from this Hydro project so that Power Purchase Agreement (PPA) can be signed accordingly.

A.3.7 MS, NRPC stated that tariff of the project is lucrative.

A.3.8 Members took note of the information.

A.4 Consent for purchase of power from Dhaulasidh Hydro Electric Project (DSHEP), 66 MW in Himachal Pradesh. (Agenda by SJVNL)

A.4.1 Representative from SJVNL stated that works of Dhaulasidh Hydro Electric Project (DSHEP), 66 MW on the river Beas in district Hamirpur in the state of Himachal Pradesh are in full swing and the commissioning of the project is expected in November, 2025.

A.4.2 It is a run–of- river with limited pondage type scheme and is designed to generate annually 304 MUs. As per Memorandum of Understanding (MoU), 13% of the net energy shall be given to Government of Himachal Pradesh (GoHP) free of cost. Further, SJVN would be in a position to offer the balance power being generated from project to interested states / UTs as per the prevalent policies of Govt. of India issued from time to time.

A.4.3 He highlighted that SJVNL is in a position to offer power from Dhaulasidh Hydro Electric Project under HPO benefits as notified by MoP, GoI after its commissioning. The levelized tariff of the generated power is Rs 4.53 per Kwh, as per PIB approval.

A.4.4 He requested the consent of constituent members for purchase of power through PPA / HPO, indicating the quantum of power required from this Hydro project so that Power Purchase Agreement (PPA) can be signed accordingly.

A.3.9 MS, NRPC stated that tariff of the project is lucrative.

A.4.5 Members took note of the information.

A.5 Consent for purchase of power from Sunni Dam Hydro Electric Project (SDHEP), 382 MW in Himachal Pradesh. (Agenda by SJVNL)

A.5.2 Representative from SJVNL informed that they are executing the works of Sunni Dam Hydro Electric Project (SDHEP), 382 MW on the river Satluj in district Shimla and Kullu in the state of Himachal Pradesh. Sunni Dam Hydro Electric Project is a run–of- river with pondage scheme and is designed to generate Annually 1382 MUs. The Main Packages i.e. Civil & Hydro Mechanical packages has been awarded and construction activities of the project have been started and the commissioning of the project is expected in February, 2028.

A.5.3 As per the condition of Memorandum of Understanding (MoU), 13% of the net energy shall be given to Government of Himachal Pradesh (GoHP) free of cost. Further, SJVN would be in a position to offer the balance power being generated from project to interested states / UTs as per the prevalent policies of Govt. of India issued from time to time.

A.5.4 He stated that SJVNL is in a position to offer power from Sunni Dam Hydro Electric Project under HPO benefits as notified by MoP, GoI after its commissioning. The levelized tariff of the generated power is Rs 3.90 per Kwh, as per PIB approval.

A.5.5 He requested that the consent of constituent members for purchase of power through PPA / HPO, indicating the quantum of power required from this Hydro project so that Power Purchase Agreement (PPA) can be signed accordingly.

A.5.6 Members took note of the information.

A.6 Consent for Purchase of Power from Bikaner Solar Power Project (1000 MW) of SJVNL under Central Public Sector Undertaking (CPSU) Scheme: (Agenda by SJVNL)

A.6.1 Representative from SJVNL stated that SJVNL through its wholly owned subsidiary Company, SJVN Green Energy Limited (SGEL) is executing the works of Bikaner Solar Power Project (1000 MW) under CPSU Scheme Phase-II (Tranche-III) as per the proposals invited by IREDA for setting up of Grid Connected Solar PV projects anywhere in India on "Build Own Operate" (B-O-O) basis. The construction activities of the project are in full swing and the commissioning of the project is expected in January, 2024.

A.6.2 He stated that 1000 MW has been already tied up in past few days and this agenda needs no further discussion.

A.6.3 Members took note of the information.

A.7 Non Opening of Letter of Credit by JKPCL (formally PDD, J & K) for power supplied from NJHPS & RHPS: (Agenda by SJVNL)

A.7.1 Representative from SJVNL stated that as per mutually signed Power Purchase Agreement and order dated 28.06.2019 issued by Ministry of Power, Beneficiary has to follow appropriate Payment Security Mechanism through confirmed, revolving, irrevocable Letter of Credit in favour of SJVNL for an amount equivalent to 105% of average monthly billing of preceding 12 months with appropriate bank as mutually acceptable to parties. The LC shall be kept valid at all the time during the validity of the Power Purchase Agreement. Further, as per CERC regulation for the period 2019-24 in order to avail rebate for early payment, the Beneficiary has to maintain LC for the appropriate amount.

A.7.2 He mentioned that JKPCL has not renewed their Letter of Credit after 13.11.2019 for power supplied from NJHPS and RHPS. Therefore, rebate asked by J&K is not permissible.

A.7.3 JKPCL informed that proposal for LC is under approval and will be done at the earliest. He highlighted that unbundling of J&K and Ladakh is also a factor for the issue.

A.7.4 CMD, RRVUNL and ED, NTPC also raised issue of non-opening of LCs by beneficiaries.

A.7.5 Utilities were requested to open appropriate LCs at the earliest.

A.8 Issuance of Revision of Regional Energy Account (Agenda by SJVNL)

A.8.1 Representative from SJVNL informed that ABT based provisional Regional Energy Account (REA) of previous month is being issued by NRPC in the 1stweek of next

month on monthly basis and thereafter, revised Regional Energy account or Final Regional Energy Account is being issued by NRPC. However, revision of REA accounts is pending for long period.

A.8.2 He highlighted that it becomes difficult to reconcile the energy account at the utility end due to pending REA revisions and annual account is finalized in most of the utilities by May end. As generation and Plant Availability factor is very significant factor for Power Generation companies, these two data need to be finalized within two months of financial year closing, so that correct position of Generation as well as Plant Availability Factor may be reflected in Annual reports.

A.8.3 MS, NRPC informed that issuance of REA and DSM account is based on the data received from the all the stakeholder/utilities of NR. He stated that it is a chain process and data is received at NRLDC who after processing submit it to NRPC for further actions. Hence, any delay in data from any utility or any faulty data may hamper the whole process. NRPC Sectt. Has already written to NRLDC in past for the same.

A.8.4 NRLDC added that due to delay in weekly metered data and AMR data collection, validation of data may take time. NRLDC also stated that weekly emails are also issued for timely submission of meter data to all utilities. NRLDC has also developed a portal for fast uploading of data and further processing for benefits of utilities.

A.8.5 NRLDC highlighted regarding Meja plant data and stated that REA & DSM account is delayed on account of data mismatch as reported by UPSLDC, Data has been shared by UPSLDC on 18thApril 2023 for Oct'22-Feb'23, and NRLDC has issued the revision on 20thApril 2023 for Oct'22 and would update subsequent month one by one.

A.8.6 NTPC requested that open cycle certification and RSD oil compensation may be expedited for NR region.

A.8.7 NHPC apprised difficulty faced by them at NRLDC portal during submission of meter data. The same was replied by NRLDC representative.

A.8.8 Utilities were requested to submit data timely for timely issuance of accounts.

A.9 Revision of DSM account of NJHPS and Rampur HPS w.e.f. 05.12.22 to 22.01.23 (Agenda by SJVNL)

A.9.1 Representative from SJVNL highlighted that there were discrepancies in the calculation of DSM account of SJVNL's Hydro generating stations viz NJHPS and Rampur HPS w.e.f. 05.12.22 to 22.01.23, as these generating stations were considered as Run-of-River generating stations in place of Run-of-River with Pondage Generating stations and there was also discrepancy in the scheduled generation of Rampur HPS on 30.12.22 due to inadvertent error at the end of NRLDC web-based scheduling portal from block no. 38 to 42, 64 to 70 and 76 to 81. The matter was taken up with NRLDC

through e-mail and telephonic communication. Finally, NRLDC have revised the scheduled generation of Rampur HPS for aforesaid block nos. The revision of DSM account in this regard is also pending. SJVNL requested that revised DSM account may be published in respect of NJHPS and Rampur HPS w.e.f. 05.12.22 to 22.01.23.

A.9.2 NRLDC apprised that revised data has been made available at its website.

A.9.3 It was decided that revised DSM accounts may be issued based on revision done by NRLDC.

A.10 Issues faced by SJVN Hydro Power stations due to increased silt, cloud burst etc. (Agenda by SJVNL)

A.10.1 Representative from SJVNL informed that its two operational Hydro Plants viz NJHPS and RHPS are located on Satluj Basin, where problem of high silt is very prominent during the monsoon season. He informed that a joint protocol was signed among NRPC, NRLDC, SJVN & KWHPS for co-ordinated generation reduction of cascaded projects viz NJHPS, KWHPS during High silt condition and Reservoir Flushing in the year 2012. As per the joint protocol, when silt level at intake of KWHPS crosses 4500 ppm, which is being measured by KWHEP, cascading plants viz KWHPS, NJHPS and Rampur HPS have to start shutdown their plants in a co-ordinated manner.

A.10.2 He informed that during FY 2022-23, NJHPS and Rampur HPS plants were shut down due to high silt on 09.08.22, 10.08.22 and 15.08.22 (cloud burst near Reservoir). During such events, there was lesser silt observed at KWHPS intake silt site and higher silt in the downstream of KWHPS silt site i.e. NJHPS Wangtoo site, which is near to NJHPS DAM reservoir. This has resulted into shut down of NJHPS and RHPS unit (s) within few time blocks, as water travelling time between NJHPS Wangtoo site to the Nathpa Reservoir area is about 5 minutes only.

A.10.3 He further stated that during aforesaid circumstances, NJHPS and RHPS were levied heavy penalty around Rs 4.68 Crore on account of DSM charges due to deviation in schedule in compliance of Clause (18) of Regulation 6.5 (Part 6) of CERC IEGC Regulations, as the schedule of the generating station is revised only after 7thor 8thtime block after intimation to NRLDC.

A.10.4 In consideration of above, SJVNL requested for:

i. Review of existing Joint Protocol for improved co-ordination between hydro power stations of KWHEP, NJHPS and Rampur HPS during high silt conditions, signed during the year 2012, so that NJHPS can take its own decision for shutdown on the basis of silt level at its intake and other upstream locations as may be decided.

ii. Revision of scheduled generation from actual generation for the affected time blocks for 09.08.22, 10.08.22 and 15.08.22 in such forced majeure condition of high silt, beyond the control of generator to safeguard the generating plants in long run, avoid spillage of water and penalty on account of DSM charges.

iii. when the silt level is on decreasing trend, generating units may not commence generation due to CERC IEGC Regulations, as revision in generation is allowed only after 7thor 8thtime block. In such situation, available water may be spilled out due to non-allowing of generating station for its schedule. Hence, non-utilisation of available water resource due to aforesaid Regulations, may lead to National loss in terms of water spillage.

iv. Committee may be constituted of Hydro experts from CWC, CEA, NRPC, and NRLDC to identify the state-of-the-art technology for discharge, silt sampling, measurement and for joint sedimentation/silt management.

A.10.5 SJVNL further emphasized that protocol and CERC regulation are in conflict. Protocol says action within 15min, however, CERC allows action from 7/8 time block. He stated that such events are suitable for considering in force majeure as defined in regulation.

A.10.6 CMD, BBMB stated that problem of silt is common to all hydro generators. Generators shall be given decision making authority. He suggested that advisory may be issued to states for managing trash also. It creates havoc for turbines.

A.10.7 NHPC also highlighted heavy penalty due to silt issues and requested for giving relief from penalty.

A.10.8 Regarding SJVNL concerns, NRLDC highlighted that forced majeure definition is not clear. Such events do not occur every year. Moreover, SJVNL has filed a petition in Hon'ble CERC regarding this issue.

A.10.9 SJVNL confirmed that a petition in this regard has been filed in CERC on 02.03.2023 by them. However, the same has not been listed yet.

A.10.10 The prayer of petition was discussed in the meeting.

A.10.11 SE, NRPC stated that since the matter is subjudice, we may not take decision on the issue.

A.10.12 MS, NRPC observed that petition has covered all issues raised by SJVN including penalty amount. He stated that issue of silt is very serious, however, as matter is subjudice, any decision here may not be appropriate.

A.10.13 It was decided that matter may be left at disposal of Hon'ble CERC.

A.11 Issues regarding Automatic Generation Control at Nathpa Jhakri Hydro Power Station. (Agenda by SJVNL)

A.11.1 Representative from SJVNL informed that Automatic Generation Control (AGC) has been fully implemented at Nathpa Jhakri Hydro Power Station and all units of NJHPS are being given in AGC Remote mode during current lean flow season. However, issues are being faced frequently in the AGC by SJVNL.

A.11.2 He highlighted that most of the time, down regulation (lower set point from NLDC than ULSP or –ve Delta P) is being given to the units even when the frequency is low. The primary response of NJHPS i.e. FGMO tends to keep machines on upper side during low frequency but negative Delta P from AGC tends to keep it on lower side.

A.11.3 Grid-India informed members that the reason for Up regulation not being issued to NathpaJhakri was due to unavailability of Up reserves in the plant when frequency was below 50 Hz. On few instances, it was due to incorrect Unit Load Set Point (ULSP) set by NathpaJhakri. Whenever ULSP set by power plant is more than Cap_Max value, continuous negative DeltaP will be observed irrespective of the frequency. In order to clarify the principle of AGC/SRAS operation and SOP to be followed by plants under AGC, Grid India proposed for training of the real time operators at NJHP on AGC/SRAS, if required.

A.11.4 Grid-India informed that it has been generally observed that fluctuations in the communication between NLDC and NathpaJhakri occurs when more than two units come under AGC Remote. Similar fluctuations in the communication were also observed in case of Tehri when more than two units get connected under AGC Remote. Since, none of the plants (under AGC), except Tehri and NJHP have reported this issue, local issue at the plant end is suspected.

A.11.5 Grid-India suggested certain measures such as re-checking of router policy, examining the effect of antivirus, restricting data telemetry strictly to the Input Output Address (IOA) signal list. This is based on the experience of partial resolution of the communication issue observed after adopting above measures at Tehri.

A.11.6 Grid-India further suggested that the communication issue first needs to be identified by OEM and NJHP for working out a resolution plan and necessary coordination shall be extended by NLDC, POWERGRID and CTUIL for identification and resolution of the problems being faced by NJHP.

A.12 Contract for integration of new SEMs and extension of AMC contract for Automatic Meter Reading system (AMR) in Northern Region for 02 years (Agenda by POWERGRID)

A.12.1 POWERGRID informed that Automatic meter reading (AMR) system for collection of SEM data centrally at NRLDC was implemented by POWERGRID as per discussion held in 15th NRPC meeting. The purchase order for installation and commissioning of

AMR system for Northern Region was awarded by POWERGRID to M/s Kalki Communication Technologies Ltd. in February 2012. The initial purchase order was placed for integration of 1250 SEMs at 220 locations of Northern Region at total cost of Rs. 1.87 Cr. With the expanding power network in NR, over 1863 SEMs have been integrated in AMR at 300 locations under this contract. The total amended value of the contract has gone over 3.22 Cr (i.e. 73% variation from original contract). Further, over 375 SEMs have been installed in the system in recent years which have not been integrated in the AMR system.

A.12.2 He highlighted that annual maintenance contract (AMC) period under the original contract was 04 years after the warranty period of 01 year, which was extended from time to time for smooth operation of AMR services. As there is no further provision for extension of the contract, the AMC contract is finally set to expire in June'23.

A.12.3 He stated that CTUIL is in the process of procurement and implementation of 5-minute block SEMs along with AMR service, which is expected to take 2-3 years for completion. In the meantime, the existing system AMR is to be kept in operation. POWERGRID has requested M/s Kalkitech to submit offer for integration of 500 nos. SEMs and AMC services for 02 years. The total estimated cost for the integration of additional 500 SEMs and AMC of the AMR system for next 02 years is 1.72 Cr (with GST).

A.12.4 He requested for approval of forum for the above estimated cost.

A.12.5 MS, NRPC stated that processing of SEM data is necessary and existing AMR services may be continued. NRLDC also agreed to extend the AMR services of M/s Kalkitech for another two years as proposed by POWERGRID.

A.12.6 Forum approved the proposal for integration of additional 500 SEMs and AMC of the AMR system for next 02 years by M/s Kalkitech at estimated cost of Rs 1.72 Cr (with GST).

A.13 Installation of PMU in STATCOM feeders (Agenda by POWERGRID)

A.13.1 POWERGRID briefed that STATCOMs at Bhadla-II, Bikaner-II and Fatehgarh-II substations of POWERGRID in western Rajasthan are expected to be commissioned in near future. In this regard, NRLDC vide letter dtd 24thMar'23 has requested the availability of 05 PMU signals in Coupling transformer of STATCOMs.

A.13.2 He highlighted that the philosophy for placement of PMU was agreed in the Joint Meeting of Regional Standing Committees on Power System Planning held on 5th Mar'12, wherein it was agreed that PMU shall be placed at both ends of the transmission lines of State and ISTS points. Following criteria was finalized for placement of PMUs:

i. All 400 kV stations in State and ISTS grids
ii. All generating stations at 220 kV and above
iii. HVDC terminals and inter-regional and inter-national Tie lines

A.13.3 Subsequently the requirement of PMU was deliberated in 48th meeting of NRPC and 45th meeting of TCC held on 02.09.2020 and it was concluded by NRPC that PMU could be installed for HVDC and FACTS projects in URTDSM Phase-II. Further the issue for finalization of PMU locations were deliberated in 10th meeting of NPC held on 07.11.2022 and it was decided that a Sub-Committee would be formed under the chairmanship of Member Secretary, WRPC with representatives from POSOCO, CTU, POWERGRID, and all RPCs/NPC to discuss on the uniform philosophy of PMU locations, new analytics and requirement of up gradation of Control Centre under URTDSM project and submit its recommendations to the NPC.

A.13.4 The sub-committee report for finalization of PMU locations has been submitted along with 12th NPC meeting dt 15.11.2022 wherein the sub-committee recommendation has to be approved by respective RPCs before recommendation by NPC for implementation.

A.13.5 It may also be noted that presently CTU has covered inclusion of PMUs in all transmission lines through RFP and Connection Agreements. Accordingly, POWERGRID has incorporated PMU requirement at all transmission lines at the project stage. However, provision for PMUs in STATCOM/SVC are yet to be incorporated in RFP and tender documents.

A.13.6 The Bikaner-II STATCOM is being executed under TBCB and Bhadla-II &Fatehgarh-II are being executed under RTM projects. The additional financial implication for installation of PMU at STATCOM stations may be approved by forum to avoid any financial loss to the transmission licensees.

A.13.7 MS, NRPC stated that a Sub-Committee was formed under the chairmanship of Member Secretary, WRPC with representatives from POSOCO, CTU, POWERGRID, and all RPCs/NPC to discuss on the uniform philosophy of PMU locations, new analytics and requirement of up gradation of Control Centre under URTDSM project and submit its recommendations to the NPC. The sub-committee report for finalization of PMU locations has been submitted to the NPC, CEA, however, report is yet to be finalized. However, considering the requirement the proposed PMU may be allowed. Further, he suggested that PMU at Bikaner – II may be adjusted in RTM.

A.13.8 Grid-India highlighted that PMU in STATCOM feeder is very much required for system observability. CTU highlighted that 02 new STATCOMs [at Ramgarh&Fatehgarh-III PS] in RFP (TBCB packages) are in process with BPC, therefore, requirement of inclusion

of the PMU for STATCOM feeders may also be decided. It was proposed that PMU may also be included in the RFP at initial stage itself in above packages. Members agreed for the same.

A.13.9 Forum approved the proposal of PGCIL and allowed for installation of PMUs at STATCOMs at Bikaner-II, Bhadla-II &Fatehgarh-II. Expenditure for the same was allowed to be booked under RTM.

A.14 Export capability of Northern Region-Western Region Corridor (Agenda by NRLDC)

A.14.1 NRLDC presented that at current scenario, Export capability of NR to WR is 4000/3500 MW (TTC/ATC). The limiting constraints for this export capability is N-1 contingency of 400kV Bhinmal-Zerdaand overloading the 400kV Kankroli-Zerda. During Mar-2023, there were various instances of real time violation of export capability of NR to WR and loading of 400kV Bhinmal-Zerda and 400kV Kankroli-Zerda is on the verge of N-1 non-compliance.

A.14.2 In Feb-Mar'23 scenarios, demand is relatively less in NR and load of WR is high therefore during peak solar hours, power flow from NR (Rajasthan) to WR (Gujrat) corridor becomes high. As RE power is being integrated with fast pace and due to delay of planned transmission network for RE evacuation, power is wheeling through different corridor.

A.14.3 Rajasthan informed that some RE power is wheeling through Suratgarh leading to overloading of ICTs/ILTs. Therefore, additional ICT/ILT has to be planned for N-1 compliances. Meanwhile, SPS for ICT/ILT may be propose for Suratgarh.

A.14.4 NRLDC apprised that to overcome the high loading issues of Bhinmal-Kankroli-Zerda corridor, following has been approved in 5thCMETS, 53rdNRPC, and 9thNCT meetings:

i. Bypassing of 400kV Kankroli-Bhinmal-Zerda at Bhinmal to form 400kV Kankroli-Zerda direct line (Timeline: 12th month from NCT approval i.e. Nov'23)

ii. Re-conductoring of 400kV Jodhpur-Kankroli (twin moose) line with HTLS conductor (Timeline :18 months from NCT approval i.e. May'24)

A.14.5 NRLDC requested to expedite the above schemes and other approved/planned network strengthening schemes of this corridor to safely evacuate the renewable power from this complex of Rajasthan to other parts of India.

A.14.6 POWERGRID informed that bypassing of 400kV Kankroli-Bhinmal-Zerda at Bhinmal is expected in Jan'24. CTU informed that as per scheme awarded to POWERGRID, the scheme schedule for bypassing is Nov'23 whereas reconductoring part is by Feb'24 (on best effort basis)/May'24. Therefore, POWERGRID was requested to expedite it to match the timeline as approved/awarded by NCT.

However, NRLDC is requesting to expedite it to match the timeline as approved in 9thNCT meeting.

A.14.7 In meeting, CTU submitted its observation on ATC/TTC calculation of NRLDC and stated that some line length (like Jodhpur-Kankrolietc) is required to be corrected in NLDC PSS/E file, Hybrid RE Contracts as mentioned in NLDC letter dated 30/03/23 should not be considered for more than Connectivity/LTA grant. Further, reversal of Ballia-BhiwadiHVDC may be considered in calculation. CTU also mentioned that they declare ATC/TTC for future time frame on their website however as per studies in NLDC file, with bypassing of Bhinmal scheme, there is significant increase in NR-WR ATC/TTC.

A.14.8 CTUalso raised issue of low rating terminal equipment at RVPN side for many of its high capacity lines.MS, NRPC stated that NRPC has also sent reference regarding the above issue to CMD, RVPN and the issue must be resolved at the earliest. RVPN assured to look into the matter and take expeditious action in this regard.

A.14.9 MS, NRPC also suggested forearly commissioning of above schemes so that issues expected in upcoming winter scenario may get resolved. POWERGRID ensured to further accelerate the progress for timely completion of above approved schemes.

A.15 Expediting Transmission for Rajasthan REZ Ph-II (Agenda by NRLDC)

A.15.1 NRLDC apprised the forum that RE generation is being integrated rapidly at ISTS in Rajasthan however due to delay in commensurate transmission system (Ph-II Part-F/F1 by Powergrid), short term RE power curtailment issues have arisen in view of grid security and stability. To relieve the transmission congestion in Bikaner complex and restrict the RE generation from curtailment, a unique interim arrangement was discussed and agreed in 202ndOCC meeting. As discussed and agreed in previous OCC and NRPC meeting, an interim arrangement is operationalized (till availability of planned Ph-II Part-F/F1 (Bikaner-II onwards system) as given below:

i. Bypass 400kV Bhadla (RS) in 400kV Bhadla(RS)-Bikaner (PG), making direct 400kV Bikaner(PG)-Bikaner (RS).
ii. SPS for limiting the loading of 400kV Bikaner (PG)-Bikaner (RS).

A.15.2 With above interim arrangement, maximum allowable loading on 400kV Bikaner-Bikaner (RS) (under 400kV Bikaner-Sikar one ckt is open) is 1145 MW.

A.15.3 It was informed that as on 11thApril 2023, additional 1057 MW of generation has been allowed after commissioning of this interim arrangement. Loading of 400kV Bikaner-Bikaner (PG) D/C of past 10 days (from 11 to 19thApril 2023) was shown and the flow is in range ~ 1150 MW each ckt. Hence, STOA margin on this complex has been exhausted after interim arrangement. Further, in order to facilitate upcoming RE power integration,

already delayed transmission system of phase-II including Bikaner-II and STATCOM at Bhadla-II &Fatehgarh-II need to expedite.

A.15.4 Apart from expediting transmission system, NRLDC requested PGCILto share the study report along with Steady state and dynamic PSS/e & PSCAD model of STATCOM as per the FTC procedure timely.

A.15.5 PGCIL informed that to commission the 7400/220 kV Bikaner-II, shutdown of 400kV Bikaner-Bikaner PG D/C has been requested for 15 days on continuous basis.

A.15.6 MS, NRPC expressed the concern that this shutdown of Double ckt seems challenging as preliminary simulation studies by NRLDC showing appreciable RE curtailment during the shutdown period. He stated that such high RE curtailment for long 15 days need to reviewed and therefore it was requested to POWERGRID to explore the possibilities to curb down the shutdown period.

A.15.7 Powergrid informed that shutdown would be availed after commissioning of third ICT at Bikaner (PG) and efforts are being made to complete the 400kV Bikaner-II-Khetri-I & II. As advised by CTU, alternate option of ERS has also been explored. Around 8-10 nos of ERS may require and their deployment may take ~ 8 days and therefore may not help much to shorten the shutdown period.

A.15.8 MS, NRPC emphasized to further explore and study for shortening the shutdown period as huge RE generation curtailment may have to carry out in view of inadequate reactive compensation during peak solar hours and on account of depleted transmission system.

A.15.9 Further, MS, NRPC suggested that as per forecast, if there is less demand in coming days, shutdown can be planned before the peak demand period of NR.

A.15.10 In respect of STATCOM, Power grid informed that PSS/e and PSCAD model would be shared as and when available from OEM. However, OEM (SIEMENS) wants to sign NDAby Grid-India for sharing of its models. Grid-India informed that a signed letter has been shared to Power grid in this matter. Power grid expressed the concern that signed letter from Grid-India is not acceptable to SIEMENS.

A.15.11 NRLDC (Grid-India) apprised that the models and respective data submission is regulatory compliances and as per NLDC FTC procedure signing of NDA is not required for Grid-India & CEA.

A.15.12 MS, NRPC directed NRPC Sectt. to convene a separate meeting to discuss the issue under the chairmanship of Chairperson, CEA.

A.16 ISTS RE related First Time charging issues in Northern region (Agenda by NRLDC)

A.16.1 NRLDC presented that as per deliberations in meeting under the Chairmanship of Chairperson, CEA on 01.03.2023, major issues arising in approval of First Time Charging (FTC) are as:

a) Non-submission or incomplete submission of Type Test/Measurement Report.
b) Non-submission or deficiencies in mathematical models.
c) Non-availability of real-time telemetry and/or PMU data.
d) Pending installation of Master Power Plant Controller.
e) Inadequate reactive power support capability at Point of Interconnection.

A.16.2 As per decision in meeting, compliances for (a)-(d) are must for issuing of FTC and conditional FTC approval can be granted w.r.t point (e) for applications received up to 31stMarch, 2023 if the developer submits firm commitment along with supporting documents. In case, the capacitor banks/conditional commitment are not commissioned by 30thJune 2023, the conditional FTC approval shall stand withdrawn w.e.f. 0000 hrs of 1st July 2023 and the complete plant shall be disconnected from the grid.

A.16.3 It is one-time conditional relaxation and provided only for plants whose applications are received by respective RLDCs by 31' March 2023. No conditional FTC shall be issued after 31stMarch 2023.

A.16.4 RE developers shall submit the progress of installation of reactive power compensation to RLDCs/NLDC as per the commitment. RLDCs/NLDC shall review the progress fortnightly.

A.16.5 Accordingly, following conditional FTC has been issued by NRLDC after issuance of above minutes of meeting.

i. Renew Surya Ravi Pvt. Ltd.: 150 MW
ii. Azure Power Maple Private Limited: 43MW
iii. Nokhra Solar Plant, NTPC Ltd: 100 MW

A.16.6 MS, NRPC suggested NRLDC to write a letter to RE developers (who has availed conditional FTC) to complete their commitment latest by 30.06.2023.

A.17 Modification in HVRT and Over Voltage settings of Inverters for RE plants of NR (Agenda by NRLDC)

A.17.1 NRLDC informed that various events of generation loss of RE plants connected at ISTS in Rajasthan has been experienced in past one years. Such generation loss was attributable to various factors i.e. HVRT/LVRT compliances, protection setting, inverter setting, etc. To avoid inadvertent loss of RE generation, it was recommended to increase the HVRT and OV settings of inverters based on PMU data & simulation studies (to keep the settings in co-ordination with POI in order to comply CEA standards at POI).

A.17.2 NRLDC further added that some of the plants have modified the HVRT & OV setting and their response observed during 14thJan 2023 events was better in recovering and

sustaining the generation post fault. After that other plants were also requested and at present, out of 44 RE plants in NR, 39 RE plants have increased the HVRT settings in Norther Region. As per MoM of meeting chaired by Secretary Power on 14thMar 2023, RE plants connected at ISTS level need to enhance their HVRT settings by 10.04.2023.

A.17.3 As no major events occurred post 9thFeb 2023, performance of RE plants may be validated on actual events only. Further, studies are being carried out regarding tuning of K factor for LVRT/HVRT performance, SCR of RE station at PoI, Phase jump in case of Line to line fault etc.

A.17.4 MS, NRPC appreciated the efforts of CEA, and Grid-India to follow up with RE developer to modify HVRT & OV settings.

A.18 Inaccurate/non-availability of Telemetry data from Sub-stations/Generating stations of Rajasthan (Agenda by NRLDC)

A.18.1 NRLDC emphasized that non-availability of telemetry of Rajasthan stations is long pending and the issue was discussed in recent 64th, 63rdNRPC meeting also. In 64thNRPC meeting, RRVPNL updated that STU is facing challenges in AMC of SAS substations and any issues at card level/gateway is not resolved yet. Meantime, RRVPNL has started the process of integration of STNAMS RTU with SLDC, SCADA however improvement in telemetry is yet to appreciate. NRLDC requested RRVPNL to share the timeline for integration and expedite it and also intimate the status of AMC.

A.18.2 RRVPNL informed that telemetry of Babai, Bikaner, kankani would be available by May'2023 end. Data of Heerapura, Suratgarh, Alwar,etc may be restored by Dec'2023. In addition, RRVPNL is in process of inviting representative from OEM for resolution of AMC issues for proprietary resolution or other way round. The whole process may take another 4-5 month period.

A.18.3 NRLDC suggested to have a round of meeting with concerned OEMs for quick resolution for extension of AMC of SAS substation so that SCADA data get restore soon.NRLDC also suggested that till the time of AMC resolution, issues in SAS installed S/s can be resolved on call basis.

A.18.4 MS, NRPC also expressed that data visualization is very important and it is an eye of operator based on which day-to day real time actions are being taken in control room. He stated that visibility of substation/generating station in this complex is very crucial in view of large RE integration in Rajasthan and hence all the efforts shall be made to restore the telemetry of affected substation.

A.19 Transmission system for evacuation of power from ShongtongKarcham HEP (STKHEP) &Tidong HEP in Himachal Pradesh (Agenda by CTUIL)

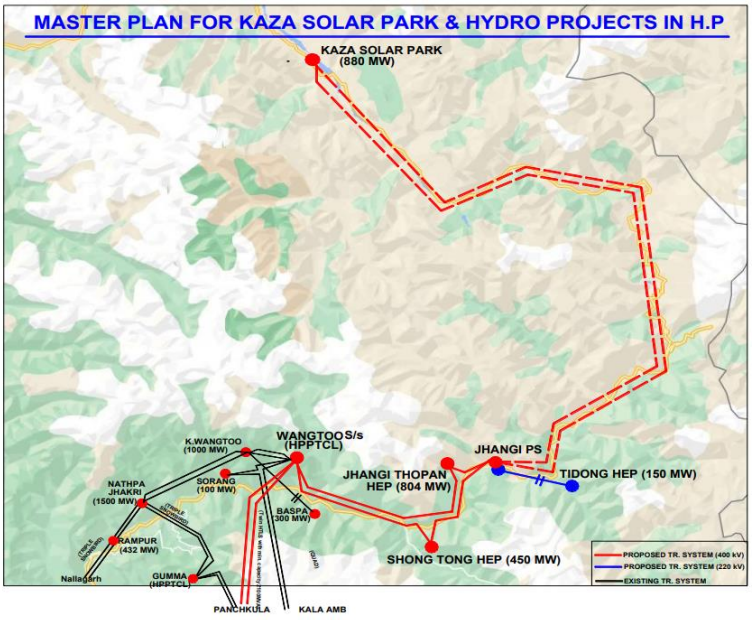
A.19.1 CTU briefed that a comprehensive transmission system (400 kV Jhangi-Wangtoo-Panchkula D/c Corridor) for evacuation of power from two Hydro Electric Projects (HEPs) vizTidong (150 MW) and ShongtongKarcham HEP (450 MW) of HPPCL &Tidong Power Generation Private Limited respectively in Himachal Pradesh was agreed in the 10th Consultation Meeting for Evolving Transmission Schemes in Northern Region meeting held on 30.08.2022, 57th Northern Region Power Committee (NRPC) meeting held on 31.08.2022 & 11thNational Committee on Transmission (NCT) held on 28.12.2022 & 17.01.2023 with following broad scope of works to be implemented in 2 phases with Tidong HEP system in Ph-1 &Shongtong HEP system in Ph-2:

Phase-I (with Tidong HEP and with schedule: 01st July 2026)

- Establishment of 2x315 MVA (7x105 MVA), 400/220 kV GIS Pooling Station at Jhangi
- Jhangi PS – Wangtoo (Quad) 400 kV D/c line
- 2 nos. of 400 kV bays at Wangtoo (HPPTCL) for termination of 400 kV Jhangi PS – Wangtoo D/c line

Phase-II (with Shongtong HEP and with schedule: 31st July 2026]

- LILO of one circuit of Jhangi PS – Wangtoo (HPPTCL) 400 kV D/c (Quad) line at generation switchyard of Shongtong HEP
- Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line (Twin HTLS)
- 400 kV bays at Wangtoo S/s (2 nos.) and Panchkula S/s (2 nos.) for termination of Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line



The transmission scheme was also approved by MOP based on recommendation by the NCT for implementation through TBCB route. Recently, HPPCL vide their letter dated 05.04.2023 intimated that the commissioning date of ShongtongKarcham HEP (STKHEP)

had been revised (preponed) from July'26 to July'25 and requested to review the transmission system for evacuation of power from ShongtongKarcham HEP (STKHEP) in Himachal Pradesh due to the preponement in the commissioning timeline of STKHEP.

A.19.2 CTU further briefed that a meeting was convened by CEA on 12.04.2023 (minutes enclosed as **Annexure-A.1**) regarding the above development in the generation schedule of Shongtong HEP. During the meeting, HPPCL informed that the progress of the STKHEP was reviewed and the various issues/disputes that were delaying the project were resolved and therefore their revised commissioning schedule shall be now July'25. M/s Statkraft (for Tidong HEP) stated that for Tidong HEP, the requirement of Jhangi PS would be from July'26. M/s Statkraft added that since the location of Jhangi Pooling station is not yet been finalized and considering the issue of tough terrain and local RoW issues, constructing dedicated line from Tidong HEP to Jhangi Pooling station would take considerable time and hence, the requirement of transmission system for Tidong HEP would be from July'26.

A.19.3 CTUIL during the meeting informed that these are very high altitude areas with long periods of no activity in winter and monsoon season and considering the various difficulties in construction of transmission line in that area, the completion of the transmission system in July 2025 timeframe does not seem to be practical. Further, the implementation schedule of the transmission system to be implemented in challenging areas like hilly terrain may be taken as 30/36 months. CEA agreed and stated that the minimum timeframe for hilly terrain is to be considered as 30-36 months.

A.19.4 HPPCL stated that from the total length of 54 kms of the 400 kV transmission line from Jhangi PS to Wangtoo (HPPTCL), the 18 km portion from Wangtoo (HPPTCL) to Shongtong HEP could be implemented by July 2025, which would be sufficient for evacuation of power from STKHEP till the completion of complete final transmission system.

A.19.5 CTUIL also stated that the 18 km portion of the line could be considered as an interim arrangement; however, the power transfer from STKHEP could not be committed and would be on real time basis depending on the available margins in the system. STKHEP may have to apply for T-GNA for evacuation of power, till the Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line is implemented.

A.19.6 HPPCL confirmed that they are making all efforts to complete the generation project by Jul'25 and stated that 20 months is sufficient time for completion of 18 km line. As hydro generators is coming earlier, time for line may be squeezed.

A.19.7 MD, HPPTCL stated that a concrete date for completion may be set as the project is crucial and timely completion is necessary.

A.19.8 CTU in the meeting opined that a meeting was held on 25/11/2022 wherein it was agreed that schedule of transmission system to be implemented in challenging areas like hilly terrain may take 30/36 months.

A.19.9 In view of above, CTU presented the transmission scheme. CTU stated that as per earlier approved scheme, reactive compensation & the conductor type isbeing included in the complete scheme, system may be bifurcated in two parts as mentioned below:

(i) Interim Part (For Shongtong HEP: with time frame of 24 months)

- Generation switchyard of Shongtong HEP** to Wangtoo (HPPTCL) 400 kV D/c [Quad[$]] line(about 18 kms)
- 2 nos. of 400 kV bays (GIS) at WangtooS/s (HPPTCL)

(ii) Final System (To be matching with generation schedule i.e..with time frame of 1st July 2026)

- Establishment of 2x315 MVA (7x105 MVA 1-ph units including one spare unit), 400/220 kV GIS Pooling Station at Jhangi^
- Extension of Wangtoo (HPPTCL) - Shongtong HEP 400 kV (Quad[$]) D/c line uptoJhangi PS with one circuit through Shongtong HEP generation switchyard
- Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line(Twin HTLS)*
- 80 MVAR switchable line reactor at Panchkula end on each circuit of 400 kV Wangtoo (HPPTCL) - Panchkula (PG) D/c line
- 400 kV bays at Wangtoo S/s (2 nos.) and Panchkula S/s (2 nos.) for termination of 400 kV Wangtoo (HPPTCL) - Panchkula (PG) D/c line
- 125 MVAR, 420kV Bus reactor at Jhangi PS (1-ph units along with one spare unit)

$ Line capacity shall be 2500 MVA per circuit at Nominal voltage
**** with minimum capacity of 2100 MVA on each circuit at Nominal voltage***
***** Associated 400 kV bays at Shongtong Generation switchyard shall be under the scope of applicant/generation developer***
[##]Tidong HEP- Jhangi PS 220 kV D/C line (along with associated bays at both ends) - under the scope of applicant/generation developer.

A.19.10 MS, NRPC stated that all efforts may be made to reduce the time frame of interim part to ensure that no generation loss happen.

A.19.11 MS (NRPC) stated that implementation of the interim arrangement with the time frame of July'25 matching with the generation project in such hilly terrain though difficult but not impossible. Therefore, NRPC Forum may recommend NCT to give consideration to generation project schedule and accordingly line may be developed suitably.

A.19.12 CTU assured that scheme approval will be taken up in NCT meeting on priorityas per implementation schedule requested by HPPCL.

A.19.13 Forum accorded technical concurrenceto the revised scheme as above subjectto decisionof CMETS-NR.

A.20 Regardingdrawal point of ICTs of PGCILs substations for UP (Agenda by UPSLDC)

A.20.1 UP informed that UP drawal is calculated from approx 139 drawal points consisting of various interstate lines, lCT's of PGCIL & UP-PGCIL lines. He stated that out of these 139 drawal points there are 35 ICT darwal points of PGCIL substations.

A.20.2 He stated that actual drawal points of state at substations of PGCIL are 220kV feeders not ICTs. Hence, SEM installed at 220kV feeders should be taken for purpose of energy drawal and accounting of states. ln case, there is some issue in SEM of 220kV feeders, meters installed at lCTs are to be taken for the purpose of energy accounting and it should be LV side meter in no case it can be HV side meter. SEM of ICT should be used only for the period when there is some issue in interface point meter i.e. 220kV feeders.UP informed that presently SEM are installed on HV side and ICT losses are being

A.20.3 NRLDC stated that as per CEA metering regulation meter is to be installed on HV side of the ICT and if, two or more states are fed, then on feeder. Further, as per CERC Sharing of Inter-State Transmission Charges and LossesRegulations,Transformer component comprises Yearly Transmission Chargesfor inter-connecting transformers (ICTs) planned for drawal of power by theconcerned State.

A.20.4 MS, NRPC stated that issue pertains to philosophy, hence it may be deliberated separately in the upcoming Commercial sub-committee.

A.21 Regarding charging of new element under the jurisdiction of NRLDC/NLDC (Agenda by UPSLDC)

A.21.1 UPSLDC requested to allow the charging clearance for new element as soon as possible in view of increasing demand of UP in summer season.

A.21.2 NRLDC stated that FTC is being issued at the earliest possible subsequent to completion of all statutory clearances.

A.22 Installation of Interface Energy Meters along with AMR equipment at interstate points of Punjab at PGCIL stations. (Agenda by Punjab)

A.22.1 Punjab stated that a meeting with NRPC and PGCIL officers was held on 12.04.23 and it was proposed that being technical matter issue may be discussed in the next TeST meeting. It was also advised to PSTCL to prepare a detailed project report for discussion in TeST meeting. It is proposed that as the installation activity is already delayed the matter may be discussed in upcoming NRPC meeting.

A.22.2 MS, NRPC suggested that issue may be deliberately in TeST meeting which will be convened on priority.

A.23 Modifications in "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2:7.5GW) (Jaisalmer/Barmer Complex)" (agenda by CTU)

A.23.1 CTU informed that in the 61st NRPC meeting held on 26.12.22, transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2:7.5GW) (Jaisalmer/Barmer Complex) was approved.Subsequently, in the 12thNCT meeting held on 24.03.23, transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2:7.5GW) (Jaisalmer/Barmer Complex) was discussed. In the meeting various aspects like system strength (SCR), requirement of Barmer-I PS as well as high angular separation in the proposed 765 kV Jalore-Mandsaur D/C (length 320 kms) inter-regional transmission line was discussed. Grid-India mentioned that in case both lines trip, the angular difference would further increase to 37 degrees. Therefore, in future, in case both lines trip and need to be revived during peak solar generation time, the system may not be stable. The New intermediate substation in between may also be proposed and the transmission line length may be reduced as switching of 320 km long inter-regional transmission line may lead to issues in future.

A.23.2 He stated that in the 12th NCT meeting CTUIL mentioned that 'N-1-1' is a rare contingency and this too may not occur simultaneously during peak solar generation hours. CTUIL also informed regarding possibility of LILO of the above line in future which will reduce the line length and an additional corridor is being planned from Jalore S/s. So, in that condition, angular control will be much better in future.Based on various above aspects in NCT meeting, it was decided that CTUIL would review the transmission scheme in consultation with CEA and GRID-India and the scheme would be discussed in the next NCT meeting.

A.23.3 CTU further informed that various joint study meetings were held for review and phasing of transmission scheme among CEA, CTUIL and GRID-INDIA). List of above meetings is as under:

i. Joint study meeting among CEA, CTUIL and GRID-INDIA on 17.04.2023 under the Chairmanship of Member (PS), CEA.

ii. Joint study meeting among CEA, CTUIL and GRID-INDIA on 17.04.2023 (VC) on 18.04.23 & 19.04.23 (minutes attached as **Annexure-A.II**).

A.23.4 Based on deliberations in NCT meeting, system studies were again carried out and discussed in above joint study meetings. He informed that in the meetings following were deliberated:

i. GRID-INDIA stated that under N-1 contingency with outage of Jalore-Mandsaur line, the angular difference is around 25 degrees and in case both lines trip, the angular difference would further increase to 37 deg which will cause problems in

synchronization of lines during peak solar generation hours. The issue of large voltage rise during charging of this long line (>320 km) was also raised by Grid-India. Grid- India proposed termination of this line at an intermediate sub-station so as to reduce the transmission line length which will in turn result in reduction in both angular separation as well as voltage rise during charging of line. Grid - India also suggested to increase load of Rajasthan in winter/summer solar maximized scenario.

ii. In the reply, CTUIL stated that under N-1 contingency, the angular difference is under the stipulated planning criteria. N-1-1 or N-2 is a rare contingency and this too may not occur simultaneously during peak solar hours and deliberation is required on N-1-1/N-2 compliance in planning studies as it may incur additional investment for strengthening of transmission system. Regarding the high voltage rise issue highlighted by Grid-India during line charging, CTUIL stated that the issue of voltage rise is generally dealt by providing adequate reactive compensation with the line/lines as well as corresponding buses. CTU also stated that there are number of 765 kV lines in NR (>320 km) on which voltage rise is within stipulated voltage limits during charging/restoration, as adequate reactive compensation (bus/line) provided on such transmission lines specially the transmission lines planned for RE evacuation.

iii. CTUIL mentioned that as per the TSP practices, in case of split system restoration, 35-degree angle is kept in the synchroscope for line synchronization whereas in normal cases, it is 15 degrees. GRID-INDIA mentioned that as per the recent experiences gained in Western Rajasthan complexes having low short circuit strength, and problems faced during synchronization of lines it will be prudent to plan the system such that parameters are within limits. Grid-India opined that system may be planned in such a way that split system under N-2 contingency doesn’t exceed 30 degree angular difference so as to keep some operational margins. As per the studies,SCR is observed to be above 5 on Fatehgarh-IV (Section-2) and Barmer-I PS (assuming 50% capacity is evacuated at 220 kV & remaining 50% at 400 kV level pooling stations).

iv. CEA opined that Khavda-IV generation (7 GW) along with its associated transmission may also be considered in study files as now both the schemes being required in same timeframe.

v. CTU stated that as per the inputs provided by SECI, Sirohi and Jalore both have RE potential & proximal to each other. Therefore, location of Jalore PS may be shifted towards Sirohi district, so that length of above line i.e. 765kV Jalore - Mandsaur D/c (Original length: 320kms) reduced by 30-40 kms. With reduction in

line length (new length: 280kms), the angular difference further reduces and may be considered in final proposal. CEA and GRID-INDIA agreed for the same.

vi. CTUIL shared that to control angular difference in N-1-1/N-2 contingency, various alternatives wereconsidered. It was deliberated that in place of 765kV Jalore/Sirohi - Mandsaur D/c line, a new substation near Rishabdeo/Salumbar in Udaipur district may be planned with Sirohi – Rishabdeo/Salumbar 765 kV D/c line (170km) and Rishabdeo/Salumbar S/s – Mandsaur 765 kV D/c line (160 km) along with LILO of one circuit of 765 kV Chittorgarh-Banaskanta D/c line at Rishabdeo/Salumbar S/s (20 km)for additional anchoring.

vii. GRID-INDIA stated that transmission scheme is planned in a such a way that it shall evacuate 7.5GW RE capacity (Fatehgarh-IV: 4GW, Barmer-I: 3.5GW) in all possible scenario (winter/summer solar maximized) irrespective of RE type (Wind/Solar) and BESS capacity as the break up RE capacity (solar/wind) is not yet final and it is possible that whole 7.5 GW capacity may comprise of only solar or solar + BESS. This will result in almost 90-100% dispatch in all scenarios.

viii. CTU stated that RE potential and dispatches are considered based on report of "Transmission system for integration of over 500GW RE capacity by 2030" as well as based on SECI/MNRE inputs.

ix. As per the above report,100% solar dispatch and 50% wind dispatch considered in summer solar max scenario, whereas in winter solar max scenario 100% solar dispatch and 10% wind dispatch considered. Details are as under:

Pooling Station	Total RE Potential (by 2030)		RE Potential (by 2027) for which system is planned	Net (Max) Dispatch Considered by 2027(GW) in summer	Net (Max) Dispatch Considered by 2027(GW) in Winter
	Source	Capacity (GW)	Capacity (GW)		
Fatehgarh-IV	Wind	6	4	4	2.4
	Solar	6	4		
	BESS	4	2		
Barmer-I	Wind	3	3	3.5	2.3
	Solar	4	3		
	BESS	1.5	1		
			Total (GW)	**7.5**	**4.7**

x. At present, comprehensive scheme has been planned with 7.5GW RE dispatch in summer season and 4.7GW RE dispatch in winter seasonas wind contribution reduces significantly in winters. In case scheme is needed to be planned for 7.5GW RE dispatch in winter scenario, additional transmissions system is required due to critical loading beyond Jalore/Sirohi.

xi. CEA stated that as the system is being planned for 4 GW injection at Fatehgarh-IV (Section-2), it should cater to 4 GW injection at any instant. CTUIL stated that with change in above approach on RE dispatch levels and considering all solar injection instead of wind/BESS, transmission requirement in RE Planning studies would increase.

xii. CEA stated that with above change in approach, identified transmission scheme shall be able to cater lower quantum of RE potential. Therefore, RE quantum which can be evacuated through revised transmission scheme may be studied. With development of wind or BESS capacity also in the above complex, evacuation capacity may increase from same transmission system.

xiii. CTU stated that transmission system is adequate for evacuation of about 5.5GW RE power (solar) in summer & winter scenario, however with development of wind or BESS capacity in above complex, evacuation capacity shall increase from 5.5 GW.

Accordingly, studies were found to be in order for the transmission system.

xiv. GRID-India vide mail 20.04.23 informed that the proposed scheme is agreed and the proposal as decided in Joint study meeting on 19.04.23 may be put up to NRPC for further approval. Meanwhile, studies for off-peak scenario may also be carried out and suitable compensation (if voltage related issues are observed) may be planned later on such that same also gets commissioned in matching time frame of the proposed scheme

xv. Based on detailed deliberations, it was agreed that comprehensive transmission scheme (attached as **Annexure-A.III**) is to be considered for evacuation of 5.5 GW RE (Solar) capacity. With development of BESS/Wind capacity in Fatehgarh-IV/Barmer-I Complex, evacuation capacity shall increase in future. Major changes in original scheme vis-vis in revised scheme are as under:

S.No	Original Scope	Revised Scope
1	• Establishment of **4x1500 MVA**, 765/400 kV &**5x500 MVA**, 400/220 kV Barmer-I Pooling Station along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor* • **6 nos. of 220 kV line bays** at Barmer-I PS (for RE connectivity)	• Establishment of **3x1500 MVA**, 765/400 kV &**2x500 MVA**, 400/220 kV Barmer-I Pooling Station along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor* • **4 nos. of 220 kV line bays** at Barmer-I PS (for RE connectivity)

2	Fatehgarh-IV (Section-2) PS – **Jalore PS** 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end **(~200 km)**	Fatehgarh-IV (Section-2) PS – **Sirohi PS** 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end **(~240 km)**
3	Barmer-I PS– **Jalore PS** 765 kV D/c line along with **330 MVAr switchable line reactor for each circuit at Jalore PS end(~165 km)**	Barmer-I PS– **Sirohi PS** 765 kV D/c line along with **240 MVAr switchable line reactor for each circuit at each end(~200 km)**
4	Sirohi PS-Chittorgarh (PG) 400 kV D/c line along with **50 MVAr switchable line reactor for each circuit at each end** (Quad) **(~200 km)**	Sirohi PS-Chittorgarh (PG) 400 kV D/c line along with **80 MVAr switchable line reactor for each circuit at Sirohi end** (Quad) **(~160 km)**
5	**---Not in original scope--**	**Establishment of, 765 kV Substation at suitable location near Rishabdeo/Salumbar (Distt. Udaipur) along with 2x240 MVAr (765 kV) Bus Reactor**
6	**---Not in original scope--**	**LILO of one circuit of 765 kV Chittorgarh-Banaskanta D/c line at Rishabdeo/Salumbar S/s (20 km)**
		Sirohi PS- Rishabdeo/Salumbar 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at Sirohi end (~170 km)
		Rishabdeo/Salumbar - Mandsaur PS 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at Rishabdeo/Salumbar end (~160

		km).

Additional investment from earlier scope: About Rs 900 Cr

(Estimated scheme cost: Rs 14556 Cr (NR portion) & Rs 5967Cr (WR portion).

A.23.5 Forum accorded technical concurrence to the revised scope (attached as **Annexure-A.III**) subject to CMETS-NR decision.

A.24 Hosting of next NRPC meeting

A.24.1 EE, NRPC stated that a roster for hosting of meetings, was agreed in 40thTCC/43rdNRPC meetings held on 29th/30thOctober, 2018. The roster is as below:

1.Member IPP	9. Punjab	17. Member Trader/PTC
2.NPCIL	10.Member IPP	18. Delhi
3.J&K	11. Rajasthan	19.Member IPP
4.THDC	12. POWERGRID	20. BBMB
5.Member IPP	13. UT of Chandigarh	21. Uttarakhand
6. Haryana	14.Member IPP	22. HP
7. SJVN	15. NHPC	
8. NTPC	16. UP	

Roster for Members IPP is as followed:

1.Adani Power	6.LPGCL
2.APCPL	7.NPL
3.CLP	8.PPGCL
4.JSW Power	9.RPSCL
5.LAPL	10.TSPCL

A.24.2 He stated that as per new resolution of RPC meetings are being held monthly hence it is proposed that a physical meeting may be held quarterly as per the roster above.

A.24.3 Forum deliberated and agreed that physical meeting shall be held once in a quarter and remaining two meetings of a quarter may be held via video-conferencing.

A.24.4 It was decided that a letter may be written to UT of Chandigarh for hosting of the next meeting in the month of July, 2023 as per roster.

Meeting ended with vote of thanks by SJVNL.

*****

Annexure-A.0

List of Participants of 65th Meeting of NRPC				
S. No.	**Name of Officer (Mr/Mrs)**	**Designation**	**Organisation**	**E-mail**
1	**NRPC**			
	Mohammed Shayin, MD, HVPNL	Chairperson	NRPC	md@hvpn.org.in
	Naresh Bhandari	Member Secretary	NRPC	ms-nrpc@nic.in
	Santosh Kumar	SE	NRPC	
	Reeturaj Pandey	XEN	NRPC	
	Omkishor	XEN	NRPC	
	Kaushik Panditrao	AXEN	NRPC	
	Vipul Kumar	AXEN	NRPC	
	Omprakash Rajput	AE	NRPC	omprakashrajput002@gmail.com
2	**BBMB**			
	Sanjay Srivastava	Chairman	BBMB	
	Naveen Gupta	Dir/HRD & IT	BBMB	nkg.chcl@gmail.com
	Kuldeep Singh	SE	BBMB	Ksmanderna@gmail.com
	Amandeep Singh	Addl. SE	BBMB	Power@bbmb.nic.in
3	**CTUIL**			
	P.C.Garg	COO (CTUIL)	CTUIL	pcgarg@powergrid.in
	Kashish Bhambhani	GM	CTUIL	kashish@powergrid.in
	Ankita Singh	CM	CTUIL	ankita@powergrid.in
	Sandeep Kumawat	DGM	CTUIL	sandeepk@powergrid.in
4	**DELHI**			
	Mukesh Sharma	Dir(O)	DTL	dir.opr@dtt.gov.in
	Loveleen Singh	GM(T)	SLDC	gm.dsldc@gmail.com
	Rajneesh Kr. Srivastava	GM(T)	IPGCL & PPCL	gmpps3bawana@gmail.com
	Jitendra Nalwaya	VP	BYPL	jitendra.nalwaya@relianceada.com
5	**HARYANA**			
	Atul Pasrija	CE	DHUBN	cepdc@dhbun.org.in
	Anil Yadav	CE	HVPNL	
	Rupesh Khera	SE	HVPNL	
	Anita Chaudhary	XEN	HVPNL	
	Sanjeev Bisht	Dy. Secy	HVPNL	
	Neeraj Hooda	OSD	HVPNL	
6	**HIMACHAL PRADESH**			
	Rugved Milind Thakur	MD	HPPTCL	
	Rajiv Sood	Director (PC)	HPPTLL	directorpc.tcl@gmail.in
	Sandeep Kumar	Dir T	HPSEBL	
	Pratap Chand Thakur	CE	HPSLDC	cehpsldc@gmail.in
	Amit Gautam	CE/SO	HPSEBL	cesysophpsebl@gmail.in
	Praveen Dhiman	Dy. CE	HPSLDC	sehpsldc@gmail.com
	Arun Goyal	Adv. CD	HPPCL	
	Desh Raj	GM(E)	HPPCL	gm-elect@hppcl.in
7	**NHPC**			
	Vijay Kumar	GSM	NHPC	vijayk@nhpc.nic.in
	Navin Kumar Singh	GSM	NHPC	navinksingh@nhpc.nic.in
8	**NLDC**			

	Surajit Banerjee	CGM	GRID-INDIA	surajit.banerjee@grid-india.in
	Anmol	Deputy Manager	GRID-INDIA	anmolsharma@grid-india.in
9	**NRLDC**			
	Rajiv Porwal	Executive Director	GRID-INDIA	rk.porwal@grid-india.in
	Suruchi Jain	DGM	GRID-INDIA	suruchi.jain@grid-india.in
	Ashish	CGM	GRID-INDIA	ashish@grid-india.in
10	**NTPC**			
	Ajay Dua	ED (Comml)	NTDC Ltd	adua@ntpc.co.in
	Shiv Bhavan	ACM (Comml)	NTPC	shivbhavan@ntpc.co.in
11	**PGCIL**			
	R.K. Tyagi	D.R (opr)	POWERGRID	tygir@powergrid.in
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	Abhay Kumar	CGM,NR-2	POWERGRID	abhaykumar@powergrid.in
	A.K. Behera	CGM,NR-1	POWERGRID	akbehera@powergrid.in
12	**PUNJAB**			
	Harikesh Meena	MD	HPPCL	
	E. Paramjeet Singh	Director Generation	PSPCL	directorgeneration@pspcl.in
	AP Singh	CE	SLDC/Punjab	ce-sldc@pstcl.org
	Paramjit Singh	CE	PP & R Punjab	ce-PP&R@gmail.in
	Landeep Kumar	ASE	PP & R Punjab	pcpspcl1@gmail.com
13	**RAJASTHAN**			
	R. K. Sharma	CMD	RRVUNL	
	Ajay Kumar Sharma	Director (Operation)	RVPNL	dir.opr@rvpn.co.in /AKSHOAKS@gamil.com
	Veena Gupta	Dir (F)	RVPNL	dir.fine@rvpnl.co.in
	Mahendra Pratap Singh	Sec (A)	RVPNL	sect.admin@rvpn.gov.in
	Mukul Bhargava	SE (Sold)	RVPNL	se.sold@rvpn.co.in
14	**SJVN**			
	N. L. Sharma	CMD	SJVN	
	Geeta Kapur	Dir/P	SJVN	
	Akhileshwar Singh	Dir/F	SJVN	
	Sushil Sharma	Dir (EC)	SJVN	gmcsosjvn@gmail.com
	Ravi Chander Negi	ED NJHPS	SJVN	hop.njhps@sjvn.nic.in
	V. Sankara Narayanan	ED NJHPS	SJVN	v.sankarnarayanan@sjvn.nic.in
	Shalinder Singh	CMG/HR	SJVN	
	Harish Sharma	CGM (C f S O)	SJVNL	gmcsosjvn@gmail.com
	Ashok Kumar	GM (C f S O)	SJVNL	gmcsosjvn@gmail.com
	Aman Katoch	DGM (C & SO)	SJVN	aman.katoch@sjvn.nic.in
	Rajeev Agarwal	DGM (E)	SJVN	rajeev.agarwal@sjvn.nic.in
	Pintu Das	DGM	SJVN	pintu.das@sjvn.nic.in
	Suresh Kumar	Pr.Consultatnt	SJVN	
15	**UT of J&K**			
	Sanjay Sharma	OSD	JKPDD	osdjkpdd@gmail.com
	Gopal Singh	XEN	JKPCL	ergsj72@gmail.com
16	**UTTAR PRADESH**			
	Pankaj Saxena	SE (O)	UP-STU	smart.saxena@gmail.com
	Ram Sharan Singh	EE (SLDC)	UPSLDC	sera@upsldc.org

	Suneel Kumar	EE(TOM)	UPRVUNL	suneelppmm@gmail.com
17	**UTTARAKHAND**			
	Anupen Singh	CE SLDC	PTCUL	ce-sldc@ptcul.org
	H.S. Hyanki	CE	PTCUL	hitendra0107@gmail.com
18	**ADANI ENTERPRISES**			
	Anshul Garg	Head/Power Sale		anshul.garg@adani.com
19	**ROSA POWER SUPPLY LTD.**			
	Hirday Tomar	SD	RPSCL	hirday.tomar@relianceada.com
20	**PRAYAGRAJ POWER GEN. CO. LTD.**			
	Sanjay Bhargava	Head-Comml. & Regu.	TATA POWER/ PPGCL	sanjay.bhargava@tatapower.com

I/27306/2023

Annexure-A.I

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत प्रणाली योजना एवं मूल्यांकन - I प्रभाग
Power System Planning & Appraisal - I Division

सेवा में / To

1. COO, CTUIL, Saudamini Plot 2, Sector 29, Gurugram-122001
2. The General Manager, HPPTCL, Himfed Bhawan, Panjari, Shimla-171005
3. The Director (Electrical), HPPCL Himfed Building, BCS, New Shimla-171009
4. The Manager, Statkraft, Unit 401, 4th Floor, Salcon Rasvilas, Saket, New Delhi-110017

विषय / Subject: Meeting regarding the transmission system for evacuation of power from Shongtong Karcham HEP (STKHEP) in Himachal Pradesh

महोदय / Sir,

The minutes of the meeting held through VC on 12.04.2023 regarding the transmission system for evacuation of power from Shongtong Karcham HEP (STKHEP) in Himachal Pradesh is attached herewith.

संलग्न / Encl: यथोपरि / as above

भवदीय / Yours faithfully,

18/04/2023

(नितिन देसवाल / Nitin Deswal)
उप निदेशक /Deputy Director

प्रति लिपि / CC: SA to Member (PS), CEA

Minutes of the meeting held on 12.04.2023 regarding the transmission system for evacuation of power from Shongtong Karcham HEP (STKHEP) in Himachal Pradesh

A meeting had been convened on 12.04.2023 regarding the transmission system for evacuation of power from Shongtong Karcham HEP (STKHEP) in Himachal Pradesh.
List of participants is attached as Annexure.

Background:

The transmission scheme 'Transmission system for evacuation of power from Shongtong Karcham HEP (450 MW) and Tidong HEP (150 MW)' was agreed in the 11th meeting of National Committee on Transmission (NCT) held on 28.12.2023 &17.01.2023 with following broad scope of works to be implemented in 2 phases:

Phase-I (with Tidong HEP and with schedule: 01st July 2026)

- Establishment of 2x315 MVA, 400/220 kV GIS Pooling Station at Jhangi
- Jhangi PS – Wangtoo (Quad) 400 kV D/c line
- 2 nos. of 400 kV bays at Wangtoo (HPPTCL) for termination of 400 kV Jhangi PS – Wangtoo D/c line

Phase-II (with Shongtong HEP and with schedule: 31st July 2026]

- LILO of one circuit of Jhangi PS – Wangtoo (HPPTCL) 400 kV D/c (Quad) line at generation switchyard of Shongtong HEP
- Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line
- 400 kV bays at Wangtoo S/s (2 nos.) and Panchkula S/s (2 nos.) for termination of Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line

Note: Tidong HEP- Jhangi PS 220 kV D/C line - under the scope of applicant/generation developer

The transmission scheme had been recommended by the NCT to MoP for implementation through TBCB route.

Subsequently, HPPCL vide their letter dated 05.04.2023 intimated that the commissioning date of Shongtong Karcham HEP (STKHEP) had been revised from July 2026 to July 2025 and requested to review the transmission system for evacuation of power from Shongtong Karcham HEP (STKHEP) in Himachal Pradesh due to the preponement in the commissioning timeline of STKHEP.

Deliberations in the meeting:

HPPCL informed that in the recent deliberations between Govt. of HP and management of HPPCL, progress of the STKHEP was reviewed and the various issues/disputes that were delaying the project were resolved. Further, the civil contractor has committed to complete the project by July 2025 by increasing the manpower, machinery and other resources. In view

of this, HPPCL has revised the commissioning schedule to July 2025 and hence, there would be need for transmission system for evacuation of power from STKHEP by July 2025.

M/s Statkraft (for Tidong HEP) stated that for Tidong HEP, the requirement of Jhangi PS would be from July 2026, which was mentioned in their Connectivity application. Statkraft added that since the location of Jhangi Pooling station has not yet been finalized and considering the issue of tough terrain and local RoW issues, constructing dedicated line from Tidong HEP to Jhangi Pooling station would take considerable time and hence, the requirement of transmission system for Tidong HEP would be from July 2026.

CEA stated that in the case of different timelines for the requirement of transmission system for Tidong HEP and STKHEP, the transmission system could be phased accordingly.

CTUIL opined that the time frame for implementation of the transmission system by July 2025 does not seem feasible; hence, the minimum time in which the transmission system for evacuation of power from STKHEP could be implemented, needs to be determined considering the hilly terrain. CTUIL added that the downstream system i.e. Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line would also be required for evacuation of power from STKHEP.

On a query about the topography of the area, CTUIL (Engg wing) informed that these are very high altitude areas with long periods of no activity in winter and monsoon season. CTUIL opined that considering the various difficulties in construction of transmission line in that area, the completion of the transmission system in July 2025 timeframe does not seem to be practical.

CTUIL stated that in the meeting held on 25.11.2022 wherein implementation schedule of transmission lines was deliberated and it was agreed that the schedule of transmission system to be implemented in challenging areas like hilly terrain may be taken as 30/36 months. CEA agreed and stated that the minimum timeframe for hilly terrain is to be considered as 30-36 months.

CTUIL suggested that the earlier proposed interim arrangement of LILO of one ckt. of Baspa – Wangtoo 400 kV D/c line at Shongtong HEP (with LILO length portion of about 6 kms) could also be explored by HPPCL as an alternative till the commissioning of the final transmission system.

HPPCL stated that from the total length of 54 kms of the 400 kV transmission line from Jhangi PS to Wangtoo (HPPTCL), the 18 km portion from Wangtoo (HPPTCL) to Shongtong HEP could be implemented by July 2025, which would be sufficient for evacuation of power from STKHEP till the completion of complete final transmission system.

CTUIL stated that the Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line is part of the LTA system for STKHEP and would be required for evacuation of power; however, as an interim arrangement, the 18 km section could be considered but sufficient time period should be provided to the TSP for completion of that portion.

HPPCL requested that the small portion of 18 km of the transmission line should be implemented by July 2025 to evacuate power from STKHEP.

On query from CEA about the bifurcation of the transmission scheme in two phases, CTUIL stated that the 18 km portion of the line could be considered as an interim arrangement; however, the power transfer from STKHEP could not be committed and would be on real time basis depending on the available margins in the system. STKHEP may have to apply for T-GNA for evacuation of power, till the Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line is implemented.
Further, CTUIL added that in case the interim transmission system becomes ready for commissioning and the generation (STKHEP) get delayed, then the generator has to pay the charges as per the prevailing regulation.

On the implementation time for construction of transmission line in that area, M/s Statkraft stated that the considering the local issues and no activity period of 3 months during winters, the 24 months' time period is very slim time line. HPPTCL stated that considering the tough terrain, lot of efforts would be required to complete the 18 km portion of transmission line in 24 months; however, for evacuation of power from STKHEP the option could be explored.

After further deliberation following was agreed:

1. The transmission system to be bifurcated in two parts as mentioned below:

   (i) Interim Part (with time frame of 24 months)
   - Generation switchyard of Shongtong HEP to Wangtoo (HPPTCL) 400 kV D/c line (about 18 kms)
   - 2 nos. of 400 kV bays at Wangtoo (HPPTCL)

   (ii) Final System (with time frame of 1st July 2026)
   - Establishment of 2x315 MVA (7x105 MVA 1-ph units including one spare unit), 400/220 kV GIS Pooling Station at Jhangi
   - Completion of remaining portion of 400 kV line i.e. from Shongtong HEP to Jhangi PS so as to form Jhangi PS – Wangtoo (Quad) D/c line with LILO of one circuit of Jhangi PS – Wangtoo (HPPTCL) 400 kV D/c (Quad) line at generation switchyard of Shongtong HEP
   - Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c line
   - 400 kV bays at Wangtoo S/s (2 nos.) and Panchkula S/s (2 nos.) for termination of 400 kV Wangtoo (HPPTCL) - Panchkula (PG) D/c line

2. To expedite the implementation of the transmission scheme, HPPCL/HPPTCL would facilitate the TSP implementing the scheme in obtaining various clearances.
3. In the interim period till the commissioning of the final system, HPPCL would have to apply for T-GNA for evacuation of power from STKHEP.
4. The matter would be taken up for discussion in the next meeting of NCT.

Annexure

List of participants:

- **CEA**

1) Shri Ishan Sharan (Chief Engineer)
2) Smt Manjari Chaturvedi (Director)
3) Shri Nitin Deswal (Dy. Director)
4) Ms Komal Dupare (Asst. Director)

- **CTUIL**

1) Shri Sourov Chakraborty (Sr. GM Engg.)
2) Shri Kashish Bhambhani (GM Plg)

- **HPPTCL**

1) Shri Rajeev Sood (Director P&C)
2) Shri Rajneesh Kumar (GM C&D)
3) Shri Harmanjeet Singh (Dy. Manager)

- **HPPCL**

1) Shri Desh Raj (GM-Electrical)
2) Shri Arun Goyal (Advisor)

- **Statkraft (for Tidong HEP)**

1) Shri Himanshu Puri
2) Shri Anurag Sharma

Annexure-A.II

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत प्रणाली योजना एवं मूल्यांकन-I प्रभाग
Power System Planning & Appraisal-I Division

सेवा में / To,

1. COO (CTUIL), Saudamini, Plot no. 2, Sector -29, Gurgaon-122 001
2. Director (System Operation), Grid-India, B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi- 110010

विषय /Subject: Minutes of the meeting to review the "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2 :7.5GW) (Jaisalmer/Barmer Complex)"

महोदय/ Sir,

Please find enclosed the minutes of the meeting held on 17.04.2023, 18.04.2023 & 19.04.2023 to review the "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2 :7.5 GW) (Jaisalmer/Barmer Complex)".

भवदीय / Yours faithfully,

मंजरी 21/4/2023

(मंजरी चतुर्वेदी/Manjari Chaturvedi)
निदेशक/Director

Minutes of the meeting held on 17.04.2023, 18.04.2023 & 19.04.2023 to review the "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part 2: 7.5 GW) (Jaisalmer/Barmer Complex)"

List of participants is enclosed as Appendix-I.

A. Background:

(i) In the 12th NCT meeting held on 24.03.2023, transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2: 7.5 GW) (Jaisalmer/ Barmer Complex) was deliberated, wherein, various aspects like system strength (SCR), requirement of Barmer-I PS as well as high angular separation in the proposed Jalore - Mandsaur 765 kV D/c line (length 320 kms) inter-regional transmission line were discussed. Grid-India also highlighted the large number the trippings that have taken place in the Rajasthan RE complex during last one year.

(ii) After detailed deliberations, it was decided that CTUIL would review the transmission scheme in consultation with CEA and Grid-India and the scheme would be discussed in the next NCT meeting.

B. Deliberations in the joint study meeting held on 17.04.2023 amongst CEA, CTUIL and Grid - India under the Chairmanship of Member (PS), CEA:

(i) CTUIL stated that the transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part 2: 7.5 GW) (Jaisalmer/Barmer Complex) may be implemented in phases. From the studies, it emerged that in first phase, 3 GW RE potential at Fatehgarh-IV (Section-2) (wind: 2 GW, Solar: 1 GW) may be evacuated with net evacuation capacity of 2 GW.

Broad transmission scheme for 2 GW RE evacuation at Fatehgarh-IV (Section-2) PS in first phase is as under:

Phase-I

- Establishment of 765/400/220 kV Fatehgarh-IV PS (Section-2)
- LILO of both ckts of 765 kV Fatehgarh-III- Beawar D/c line (2nd) at Fatehgarh-IV (Sec-2) PS
- Fatehgarh-IV (Section-2) PS – Bhinmal (PG) 400 kV D/c line
- Beawar- Mandsaur PS 765 kV D/c line
- WR scheme (Mandsaur PS & Kurawar PS along with associated system)

In evacuation of RE capacity beyond 2 GW Fatehgarh-IV PS (Section-2) through above corridor, critical loading is observed on 765 kV Beawar -Mandsaur D/c line (N-1 Contingency ≥3500 MW) due to huge rush of power towards WR. Therefore, for evacuation of balance 5.5 GW RE power, [Fatehgarh-IV (Section-2) PS: 2 GW and Barmer-I PS: 3.5 GW], following corridors are required:

- Establishment of 765/400/220 kV Barmer-I PS and 765/400 kV Jalore PS

- 765 kV Barmer-I-Jalore and 400 kV Fatehgarh-III -Barmer-I D/c line
- 765 kV Fatehgarh-IV -Jalore -Mandsaur D/c line

In case only one of the above corridors is considered, overloading (N-1 contingency) on 765 kV Fatahgarh-III- Fatehgarh-IV line or 400 kV Fatehgarh-III - Barmer-I line is observed. Therefore, both the above corridors are required in same time frame. Details of scheme is as under.

Phase-II: 5.5 GW RE evacuation [Fatehgarh-IV (Section-2) PS (2 GW) and Barmer-I PS (3.5 GW)]

- Establishment of 765/400/220 kV Barmer-I PS and 765/400 kV Jalore PS
- Fatehgarh-IV (Section-2) PS – Jalore 765 kV D/c line
- Fatehgarh-III (Sec-2) PS – Barmer-I 400 kV D/c line
- Barmer-I – Jalore 765 kV D/c line
- Jalore- Mandsaur PS 765 kV D/c line

(ii) CTUIL further stated that at present, 2.6 GW of stage-II connectivity has already been received at Fatehgarh-IV PS (Section-2). However, M/s Adani also submitted their dissent for GNA transition for their 1.5 GW solar project in Fatehgarh-III PS as per CERC (Connectivity & GNA to the ISTS) Regulation 2022. With above developments and GNA effectiveness from 05.04.2023, deliberations are required for phasing of implementation of the scheme proposed as above.

(iii) CTUIL further stated that different methodologies for calculation of SCR were discussed in the meeting held on 11.04.2023 convened by CEA. In the meeting, it was also decided that further deliberations are required to decide on SCR calculation methodology in Indian context. Meanwhile, CTUIL has calculated SCR based on conventional approach for SCR calculation. Further, as discussed in the meeting, in case of hybrid RE contracted capacity i.e. power likely to be injected is being used in SCR calculation and SCR has been observed to be above 5 on Fatehgarh-IV (Section-2) and Barmer-I PS (assuming 50% capacity is evacuated at 220 kV & remaining 50% at 400 kV level pooling stations).

(iv) Grid-India stated that under N-1 contingency, with outage of one circuit of Jalore - Mandsaur 765 kV D/c line, the angular difference is around 25 degrees. However, in case of tripping of both circuits, the angular difference would increase to 37 degrees which may cause problems in synchronization of lines during peak solar generation hours. The issue of large voltage rise during charging of this long line (>320 km) was also raised by Grid-India. Grid-India proposed termination of this line at an intermediate sub-station so as to reduce the transmission line length which will in turn result in reduction in both angular separation as well as voltage rise during charging of line. Grid - India also suggested to increase load of Rajasthan in winter/summer solar maximized scenario.

(v) CTUIL stated that under N-1 contingency, the angular difference is under the stipulated planning criteria. N-1-1 or N-2 is a rare contingency and this too may not occur simultaneously during peak solar hours and deliberations are required on N-1-1/

N-2 compliance in planning studies as it may incur additional investment for strengthening of transmission system. Regarding the "high voltage rise" issue highlighted by Grid-India during line charging, CTUIL stated that the issue of voltage rise is generally dealt by providing adequate reactive compensation with the line/lines as well as corresponding buses. CTU also stated that there are number of 765 kV lines in NR (>320 km) on which voltage rise is within stipulated voltage limits during charging/restoration, as adequate reactive compensation (bus/line) provided on such transmission lines especially the transmission lines planned for RE evacuation.

(vi) Grid-India mentioned that as per Transmission Planning Criteria, 2023:

"The lines for which the angular difference between its terminal buses is more than 20 degree after contingency of one circuit may be selected for performing stability studies."

However, as angular separation is around 25 degrees and transient stability studies are not carried out by CTUIL, it is proposed to plan the system such that angular separation is reduced to less than 20 degrees under N-1 contingency.

(vii) CTUIL mentioned that as per the Transmission Service Provider (TSP) practices, in case of split system restoration, 35-degree angle is kept in the synchroscope for line synchronization whereas in normal cases, it is 15 degrees.

(viii) Grid - India mentioned that as per the recent experiences gained in Western Rajasthan complexes having low short circuit strength and problems faced during synchronization of lines, it will be prudent to plan the system such that parameters are within limits. Grid-India opined that system may be planned in such a way that split system under N-2 contingency doesn't exceed 30 degree angular difference so as to keep some operational margins.

(ix) CEA opined that Khavda -IV generation (7 GW) along with its associated transmission system may also be considered in study files as both the schemes are required in the same timeframe. This may improve the loadings of NR-WR corridors i.e. 400 kV RAPP-Shujalpur and 765 kV Jalore -Mandsaur D/c line.

(x) CTUIL stated that as per the inputs provided by SECI, Sirohi and Jalore both have RE potential and are in proximity to each other. Therefore, location of Jalore PS may be shifted towards Sirohi district, so that length of the Jalore - Mandsaur 765 kV D/c line (Original length: 320 kms) is reduced by 30-40 kms. With reduction in line length (new length: 280 kms), the angular difference further reduces and may be considered in final proposal. CEA and Grid-India agreed that this would help the system and Sirohi PS should be preferred over Jalore.

(xi) After deliberations, it was decided that revised studies will be carried out considering modification suggested by Grid-India and CEA and revised file will be circulated. Based on outcome of revised file, mitigating measures for N-2 non-compliance of Jalore - Mandsaur 765 kV D/c line (Preferably 30 degree or below) shall be explored.

C. Deliberations in the joint study meeting held on 18.04.2023 & 19.04.2023 amongst CEA, CTUIL and Grid - India:

(i) CTUIL stated that in order to control angular difference in N-1-1/N-2 contingency conditions, various options were considered and it is suggested that in place of Jalore/ Sirohi - Mandsaur 765 kV D/c line, a new substation near Rishabdeo/Salumbar in

Udaipur district may be also planned with Sirohi – Rishabdeo/Salumbar 765 kV D/c line (170 km) and Rishabdeo/Salumbar S/s – Mandsaur 765 kV D/c line (160 km) along with LILO of one circuit of 765 kV Chittorgarh - Banaskanta D/c line at Rishabdeo/Salumbar S/s (20 km) for additional anchoring.

(ii) CEA opined that initially, Jalore/Sirohi – Mandsaur 765 kV D/c line may be planned for evacuation of power, which may be LILOed at Rishabdeo/Salumbar S/s at later stage as and when N-1-1 non-compliance issue on 765 kV Sirohi-Mandsaur D/c line arises.

(iii) CTUIL stated that from the studies, it has emerged that LILO would be required if RE injection at Fatehgarh-IV PS (Section-2)/Barmer-I PS exceeds 2.4 GW capacity.

(iv) CEA suggested that phasing may be explored to defer the investment on above LILO at Rishabdeo/Salumbar.

(v) Grid-India stated that transmission scheme should be planned in such a way that it may evacuate 7.5 GW RE capacity (Fatehgarh-IV: 4 GW, Barmer-I: 3.5 GW) in all possible scenario (winter/summer solar maximized) irrespective of RE type (Wind/Solar) and BESS capacity as the breakup of RE capacities (solar/wind) is not yet final and it is possible that whole 7.5 GW capacity may comprise of only solar or solar + BESS. This will result in almost 90-100% dispatch in all scenarios.

(vi) CTUIL stated that RE potential and dispatches are considered based on report of "**Transmission system for integration of over 500 GW RE capacity by 2030**" as well as SECI/MNRE inputs.

As per the above report,100% solar dispatch and 50% wind dispatch considered in summer solar maximum scenario, whereas in winter solar maximum scenario 100% solar dispatch and 10% wind dispatch considered. Details are as under:

Pooling Station	**Total RE Potential (by 2030)**		**RE Potential (by 2027) for which system is planned**	**Net (Max) Dispatch Considered by 2027(GW) in summer**	**Net (Max) Dispatch Considered by 2027(GW) in Winter**
	Source	**Capacity (GW)**	**Capacity (GW)**		
Fatehgarh-IV	Wind	6	4	4	2.4
	Solar	6	4		
	BESS	4	2		
Barmer-I	Wind	3	3	3.5	2.3
	Solar	4	3		
	BESS	1.5	1		
			Total (GW)	**7.5**	**4.7**

At present, comprehensive scheme is planned for Hybrid RE potential (7.5 GW) with 7.5 GW RE dispatch in summer season and 4.7 GW RE dispatch in winter season as Wind contribution reduces significantly in winters. In case the scheme needs to be planned for 7.5 GW RE dispatch in winter scenario also, additional transmissions system is required due to critical loading beyond Jalore/Sirohi.

(vii) CEA stated that as the system is being planned for 4 GW injection at Fatehgarh-IV (Section-2), it should cater to 4 GW injection at any instant under normal operating conditions.

(viii) CTUIL stated that with change in above approach on RE dispatch levels and considering all solar injection instead of wind/BESS, transmission requirement in RE Planning studies would increase.

(ix) CEA stated that with above change in approach, identified transmission scheme shall be able to cater lower quantum of RE potential. Therefore, RE quantum which can be evacuated through revised transmission scheme may be studied. With development of wind or BESS capacity also in the above complex, evacuation capacity may increase from same transmission system.

(x) After conducting studies with incorporation of increased load of Rajasthan as suggested by Grid- India, CTUIL stated that transmission system is adequate for evacuation of about 5.5 GW RE power (solar) in summer and winter scenario. However, with development of wind or BESS capacity in above complex, evacuation capacity shall increase from 5.5 GW. Accordingly, studies were found to be in order for the transmission system given at Annexure-1 for 5.5 GW capacity. Result of system studies are also enclosed at Exhibit-1.

(xi) Grid-India stated that the angular separation is as under in the revised scheme:

Scenario	**Angular Difference Between Jalore/Sirohi & Rishabdeo in February Solar maximum scenario– Scenario 7 Case**	**Angular Difference Between Jalore/Sirohi & Rishabdeo in June Solar maximum scenario– Scenario 4 Case**
Base Case	9.4°	8.3°
N-1 of 765 kV Jalore – Rishabdeo D/C line	14.5°	12.6°
N-2 of 765 kV Jalore – Rishabdeo D/C line	29.3°	25.6 °

Grid- India opined that studies for off-peak scenario may also be carried out and suitable compensation (if voltage related issues are observed) may be planned later on, such that same also gets commissioned in matching time frame of the proposed scheme. The same was agreed.

(xii) After deliberations, following was agreed in above meetings:

a) Comprehensive transmission scheme agreed for evacuation of 5.5 GW RE (Solar) capacity is attached as Annexure-1. In case, wind generation/ RE with BESS gets connected at Fatehgarh-IV/Barmer-I Complex, the same system will be sufficient to evacuate over 5.5 GW Capacity. Major changes in original scheme vis-vis the revised scheme is attached as Annexure-2.

b) Implementation of the transmission scheme may be phased out and Barmer-I PS and associated transmission system may not be required in Phase-1 scheme. However, the evacuation capacity is indicated as per the revised approach for dispatching and considering only solar. The broad elements of Phase-I scheme comprises the following:

Phase-I (1.5 GW RE evacuation capacity)

- Establishment of 765/400/220 kV Fatehgarh-IV PS (Section-2)
- LILO of both ckts of 765 kV Fatehgarh-III- Beawar D/c line (2nd) at Fatehgarh-IV (Sec-2) PS
- Fatehgarh-IV (Section-2) PS – Bhinmal (PG) 400 kV D/c line
- Beawar- Mandsaur PS 765 kV D/c line
- WR scheme (Mandsaur PS & Kurawar PS along with associated system)

Further, in order to evacuate additional 4 GW RE **(**Fatehgarh-IV (Section-2) PS: 2.5 GW and Barmer-I PS: 1.5 GW), comprehensive transmission system including above Phase-I scheme is required as per **Annexure-1.**

Annexure-I

Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)

Fatehgarh-IV (Section-2): 4 GW and Barmer-I PS: 1.5 GW

A. Fatehgarh-IV: 4 GW (Considering 2 GW injection at 400 kV and 2 GW injection at 220 kV level)

- Establishment of 4x1500 MVA, 765/400 kV & 5x500 MVA^, 400/220 kV Fatehgarh- IV (Section-2) Pooling Station along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor*
- Fatehgarh-IV (Section-2) PS – Bhinmal (PG) 400 kV D/c line (Twin HTLS) along with 50 MVAr switchable line reactor on each ckt at each end (~200 km)
- LILO of both ckts of 765 kV Fatehgarh-III- Beawar D/c line(2nd) at Fatehgarh-IV (Section-2) PS along with 330 MVAr switchable line reactors at Fatehgarh-IV PS end of each ckt of 765 kV Fatehgarh-IV- Beawar D/c line** (formed after LILO) (~15 km)
- Beawar- Mandsaur PS 765 kV D/c line along with 240 MVAr switchable line reactor on each circuit at each end (~260 km)
- 6 Nos. of 220 kV line bays at Fatehgarh-IV PS (for RE connectivity)
- 220 kV Sectionalization bay (1 set) along with BC (2 Nos.) and TBC (2 Nos.) at Fatehgarh- IV (Section-2) Pooling Station
- Augmentation by 1x1500 MVA, 765/400 kV ICT at Fatehgarh-II PS (7th)
- 1 set 400 kV Sectionalization bay at Fatehgarh- IV (Section-2) Pooling Station

Future provisions at Fatehgarh-IV PS is already approved in 8th NCT meeting dated 25.03.22

^including 1x500MVA ICT to fulfill 'N-1' requirement

****Including spare one ICT unit (500MVA) and spare one reactor unit (80MVAr) at Fatehgarh-IV PS***

*****Including spare one reactor unit (110MVAr) at Fatehgarh-IV PS***

B. Barmer-I: 1.5 GW (Considering 0.5 GW injection at 400 kV and 1 GW injection at 220 kV level)

- Establishment of 3x1500 MVA, 765/400 kV & 2x500 MVA, 400/220 kV Barmer-I Pooling Station along with 2x240 MVAr (765 kV) Bus Reactor and 2x125 MVAr (400 kV) Bus Reactor*

Future provisions at Barmer-I S/s:

Space for

- 765/400 kV ICT along with bays- 3 no.
- 765 kV line bays along with switchable line reactors – 4 nos.
- 765 kV Bus Reactor along with bay: 1 no.
- 400 kV line bays –4 Nos.
- 400 kV line bays along with switchable line reactor –4 nos.
- 400/220 kV ICT along with bays -8 nos.
- 400 kV Bus Reactor along with bay: 1 no.
- 400 kV Sectionalization bays: 2 sets
- 220 kV line bays for connectivity of RE Applications -10 nos.
- 220 kV Sectionalization bay: 3 sets
- BC (4 nos.) and TBC (4 nos.)
- STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr)

- Fatehgarh-III (Section-2) PS – Barmer-I PS 400 kV D/c line (Quad)(~50 km)
- 4 nos. of 220 kV line bays at Barmer-I PS (for RE connectivity)

Including spare one ICT unit (500 MVA) and spare one reactor unit (80 MVAr) at Barmer-I PS.

C. Common Transmission System for Fatehgarh-IV and Barmer-I in NR

- Establishment of 2x1500 MVA, 765/400 kV Substation at suitable location near Sirohi along with 2x240 MVAr (765 kV) and 2x125 MVAr (400 kV) Bus Reactor *

Future provisions at Sirohi S/s:

Space for

- 765/400kV ICT along with bays- 4 no.
- 765 kV line bays along with switchable line reactors – 4 nos.
- 765kV Bus Reactor along with bay: 1 no.
- 400 kV line bays along with switchable line reactor –4 nos.
- 400 kV line bays –4 nos.
- 400 kV Bus Reactor along with bay: 1 no.
- 400 kV Sectionalization bay: 2 sets
- 400/220 kV ICT along with bay - 6 nos.
- 220 kV line bays -10 nos.
- 220kV Sectionalization bay: 2 sets
- BC (3 nos.) and TBC (3 nos.)
- STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) and MSR (2x125 MVAr)

Including spare one ICT unit (500 MVA) and spare one reactor unit (80 MVAr and 110 MVAr) at Sirohi PS.

- Establishment of 765 kV switching station at suitable location near Rishabdeo/Salumbar (Distt. Udaipur) along with 2x240 MVAr (765 kV) Bus Reactor *

Future provisions at Rishabdeo/Salumbar S/s:

Space for

- 765/400 kV ICT along with bays- 5 nos. along with spare unit
- 765 kV line bays along with switchable line reactors – 4 nos.
- 765 kV Bus Reactor along with bay: 1 no.
- 400 kV line bays along with switchable line reactor –4 nos.
- 400 kV line bays –4 nos.
- 400 kV Bus Reactor along with bay: 3 nos.
- 400 kV Sectionalization bay: 2 sets
- 400/220kV ICT alongwith bay - 6 nos.
- 220 kV line bays -10 nos.
- 220 kV Sectionalization bay: 2 sets

- BC (3 nos.) and TBC (3 nos.)
- STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) and MSR (2x125 MVAr)

Including spare one reactor unit (80 MVAr)

- Fatehgarh-IV (Section-2) PS – Sirohi PS 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end (~240 km)
- Barmer-I PS– Sirohi PS 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)
- Sirohi PS-Chittorgarh (PG) 400 kV D/c line along with 80 MVAr switchable line reactor for each circuit at Sirohi PS end (Quad) (~160 km)
- Sirohi PS- Rishabdeo/Salumbar 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at Sirohi end (~170 km)
- Rishabdeo/Salumbar - Mandsaur PS 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at Rishabdeo/Salumbar end (~160 km)
- LILO of one circuit of 765 kV Chittorgarh-Banaskanta D/c line at Rishabdeo/Salumbar S/s (20 km)

In addition to the above, following transmission scheme is also required in Western region for further dispersal of power for above RE complexes (Fatehgarh-IV and Barmer-I)

D. Common Transmission System for Fatehgarh-IV (4 GW) and Barmer-I (1.5 GW) in Western Region

- Establishment of 765 kV Mandsaur Pooling Station along with 2x330 MVAr (765 kV) Bus Reactors (with 1x110 MVAr and 1x80 MVAr, 765 kV spare single phase reactor unit for line/bus reactor)

  Future Provisions: **Space for**

  - 765/400 kV ICT along with bays- 6 nos.
  - 765 kV line bays along with switchable line reactors – 6 nos.
  - 765 kV Bus Reactor along with bay: 2 nos.
  - 765 kV Sectionaliser bay: 1 - set
  - 400 kV line bays along with switchable line reactor – 12 nos.
  - 400/220 kV ICT along with bays -8 nos.
  - 400 kV Bus Reactor along with bay: 2 nos.
  - 400 kV Sectionalization bay: 1- set
  - 220 kV line bays: 16 nos.
  - 220 kV Sectionalization bay: 2 sets
  - 220 kV BC and TBC: 3 nos.
  - STATCOM (±300MVAr) along with MSC (2x125 MVAr) and MSR (1x125 MVAr): 1 no.

- Mandsaur PS – Indore (PG) 765 kV D/c line (200 km) along with 1x330 MVAr switchable line reactor (SLR) on each ckt at Mandsaur end

- Establishment of 765/400 kV (2x1500 MVA) 400/220 kV (2x500 MVA) and 220/132 kV (3x200 MVA) Kurawar S/s (with 1x500 MVA spare single phase transformer unit) with 2x330 MVAr, 765 kV bus reactor and 1x125 MVAr, 420 kV bus reactor (with 1x110 MVAr and 1x80 MVAr, 765 kV spare single phase reactor unit for line/bus reactor)

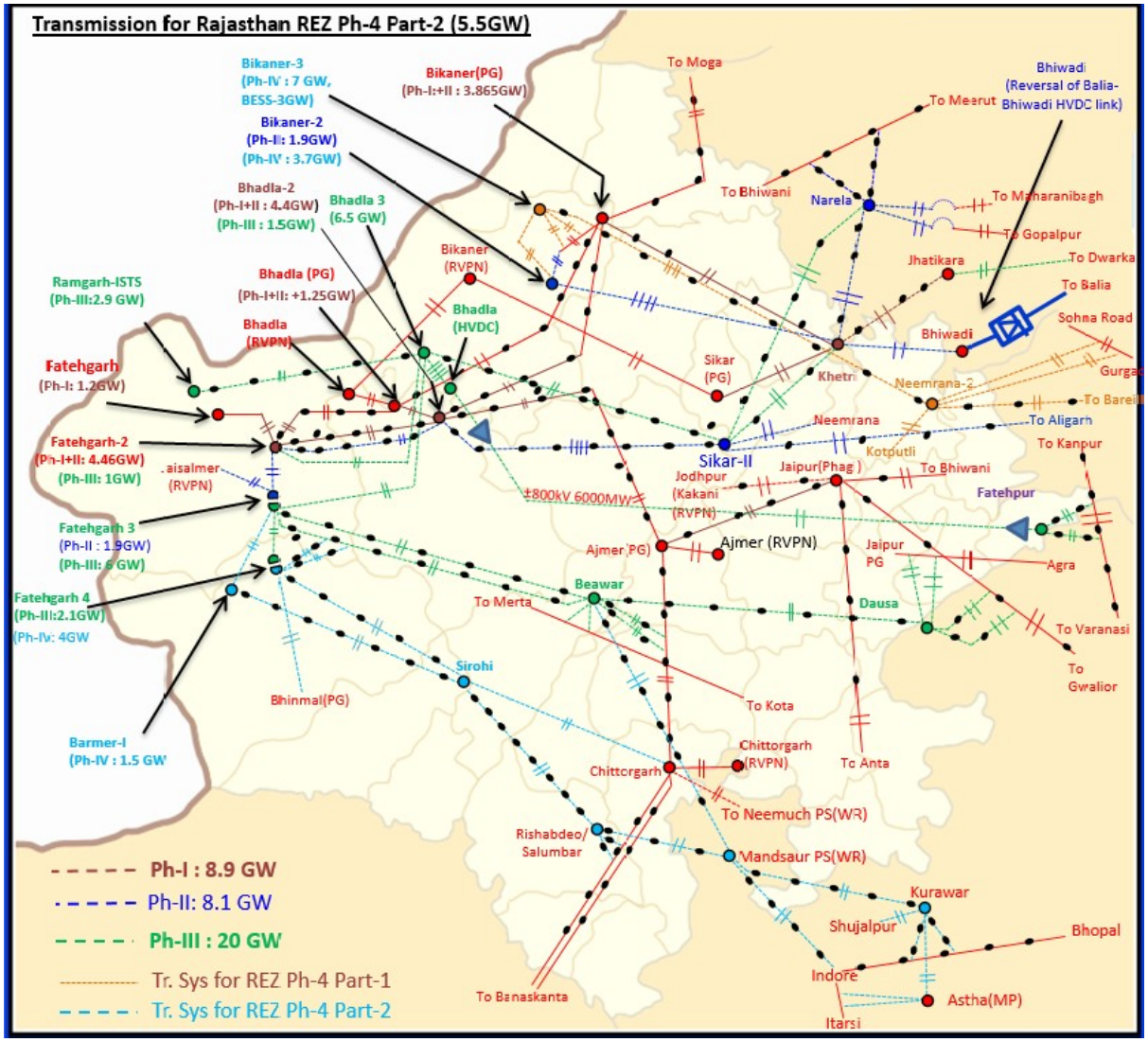
  Future Provisions: **Space for**

  - 765/400 kV ICT along with bays- 4 nos.
  - 765 kV line bays along with switchable line reactors – 8 nos.
  - 765 kV Bus Reactor along with bay: 2 nos.
  - 765 kV Sectionaliser bay: 1 - set
  - 400 kV line bays along with switchable line reactor – 10 nos.
  - 400/220 kV ICT along with bays -6 nos.
  - 400 kV Bus Reactor along with bay: 2 nos.
  - 400 kV Sectionalization bay: 1- set
  - 220 kV line bays: 12 nos.
  - 220 kV Sectionalization bay: 2 sets
  - 220 kV BC and TBC: 3 nos.
  - 220/132 kV ICT along with bays: 3 nos.
  - 132 kV line bays: 8 nos.
  - 132 kV Sectionalization bay: 1 set
  - STATCOM (±300 MVAr) along with MSC (2x125 MVAr) & MSR (1x125 MVAr): 1 no.

- Mandsaur – Kurawar 765 kV D/c line (~235 km) with 240 MVAr switchable line reactors at both ends
- LILO of Indore – Bhopal 765 kV S/c line at Kurawar (LILO route length ~15 km)
- Kurawar – Ashtha 400 kV D/c (Quad ACSR/AAAC/AL59 moose equivalent) line (~65 km)
- LILO of one circuit of Indore – Itarsi 400 kV D/c line at Astha (LILO route length ~ 30 km)
- Shujalpur – Kurawar 400 kV D/c (Quad ACSR/AAAC/AL59 moose equivalent) line (~40 km)

Estimated Cost (NR) : Rs 14556 Cr (NR portion)

: Rs 5967 Cr (WR portion)


Transmission for Rajasthan REZ Ph-4 Part-2 (5.5GW)
Bikaner-3
(Ph-IV : 7 GW,
BESS-3GW)
Bikaner(PG)
(Ph-I:+II : 3.865GW)
Bikaner-2
(Ph-II: 1.9GW)
(Ph-IV : 3.7GW)
Bhadla-2
(Ph-I+II : 4.4GW)
(Ph-III : 1.5GW)
Bhadla 3
(6.5 GW)
Bikaner
(RVPN)
Bhadla (PG)
(Ph-I+II: +1.25GW)
Bhadla
(HVDC)
Bhadla
(RVPN)
Ramgarh-ISTS
(Ph-III:2.9 GW)
Fatehgarh
(Ph-I: 1.2GW)
Fatehgarh-2
(Ph-I+II: 4.46GW)
(Ph-III: 1GW)
Jaisalmer
(RVPN)
Fatehgarh 3
(Ph-II : 1.9GW)
(Ph-III: 6 GW)
Fatehgarh 4
(Ph-II:2.1GW)
(Ph-IV: 4GW
Barmer-I
(Ph-IV : 1.5 GW
Bhinmal(PG)
Sirohi
To Moga
To Meerut
Bhiwadi
(Reversal of Balia-
Bhiwadi HVDC link)
To Bhiwani
Narela
To Maharanibagh
To Gopalpur
Jhatikara
To Dwarka
To Balia
Sohna Road
Bhiwadi
Gurgaon
Khetri
Neemrana-2
To Bareilly
To Aligarh
Sikar
(PG)
Sikar-II
Neemrana
Kotputli
To Kanpur
Jaipur(Phag)
To Bhiwani
Fatehpur
±800kV 6000MW
Jodhpur
(Kakani
(RVPN)
Ajmer (PG)
Ajmer (RVPN)
Jaipur
PG
Agra
Beawar
To Merta
Dausa
To Varanasi
To
Gwalior
To Kota
Chittorgarh
(RVPN)
Chittorgarh
To Anta
To Neemuch PS(WR)
Rishabdeo/
Salumbar
Mandsaur PS(WR)
Kurawar
Shujalpur
Bhopal
Indore
Astha(MP)
Itarsi
To Banaskanta
Ph-I : 8.9 GW
Ph-II: 8.1 GW
Ph-III : 20 GW
Tr. Sys for REZ Ph-4 Part-1
Tr. Sys for REZ Ph-4 Part-2

Annexure-II

S.No	Original Scope	Revised Scope
1	• Establishment of **4x1500 MVA**, 765/400 kV & **5x500 MVA**, 400/220 kV Barmer-I Pooling Station along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor* • **6 nos. of 220 kV line bays** at Barmer-I PS (for RE connectivity)	• Establishment of **3x1500 MVA**, 765/400 kV & **2x500 MVA**, 400/220 kV Barmer-I Pooling Station along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor* • **4 nos. of 220 kV line bays** at Barmer-I PS (for RE connectivity)
2	Fatehgarh-IV (Section-2) PS – **Jalore PS** 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end **(~200 km)**	Fatehgarh-IV (Section-2) PS – **Sirohi PS** 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end **(~240 km)**
3	Barmer-I PS– **Jalore PS** 765 kV D/c line along with **330 MVAr switchable line reactor for each circuit at Jalore PS end (~165 km)**	Barmer-I PS– **Sirohi PS** 765 kV D/c line along with **240 MVAr switchable line reactor for each circuit at each end (~200 km)**
4	**Jalore PS**-Chittorgarh (PG) 400 kV D/c line along with **50 MVAr switchable line reactor for each circuit at each end** (Quad) **(~200 km)**	**Sirohi PS**-Chittorgarh (PG) 400 kV D/c line along with **80 MVAr switchable line reactor for each circuit at Sirohi end** (Quad) **(~160 km)**
5		**Establishment of, 765 kV Substation at suitable location near Rishabdeo/Salumbar (Distt. Udaipur) along with 2x240 MVAr (765 kV) Bus Reactor**
6		**LILO of one circuit of 765 kV Chittorgarh-Banaskanta D/c line at Rishabdeo/Salumbar S/s (20 km)**
7	**Jalore PS- Mandsaur PS 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at each end (~320 km)**	**Sirohi PS- Rishabdeo/Salumbar 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at Sirohi end (~170 km)**
8		**Rishabdeo/Salumbar - Mandsaur PS 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at Rishabdeo/Salumbar end (~160 km)**
7		LILO of one circuit of 765 kV Chittorgarh-Banaskanta D/c line at Rishabdeo/Salumbar S/s (20 km)

Additional investment from earlier scope: Rs 900 Crore

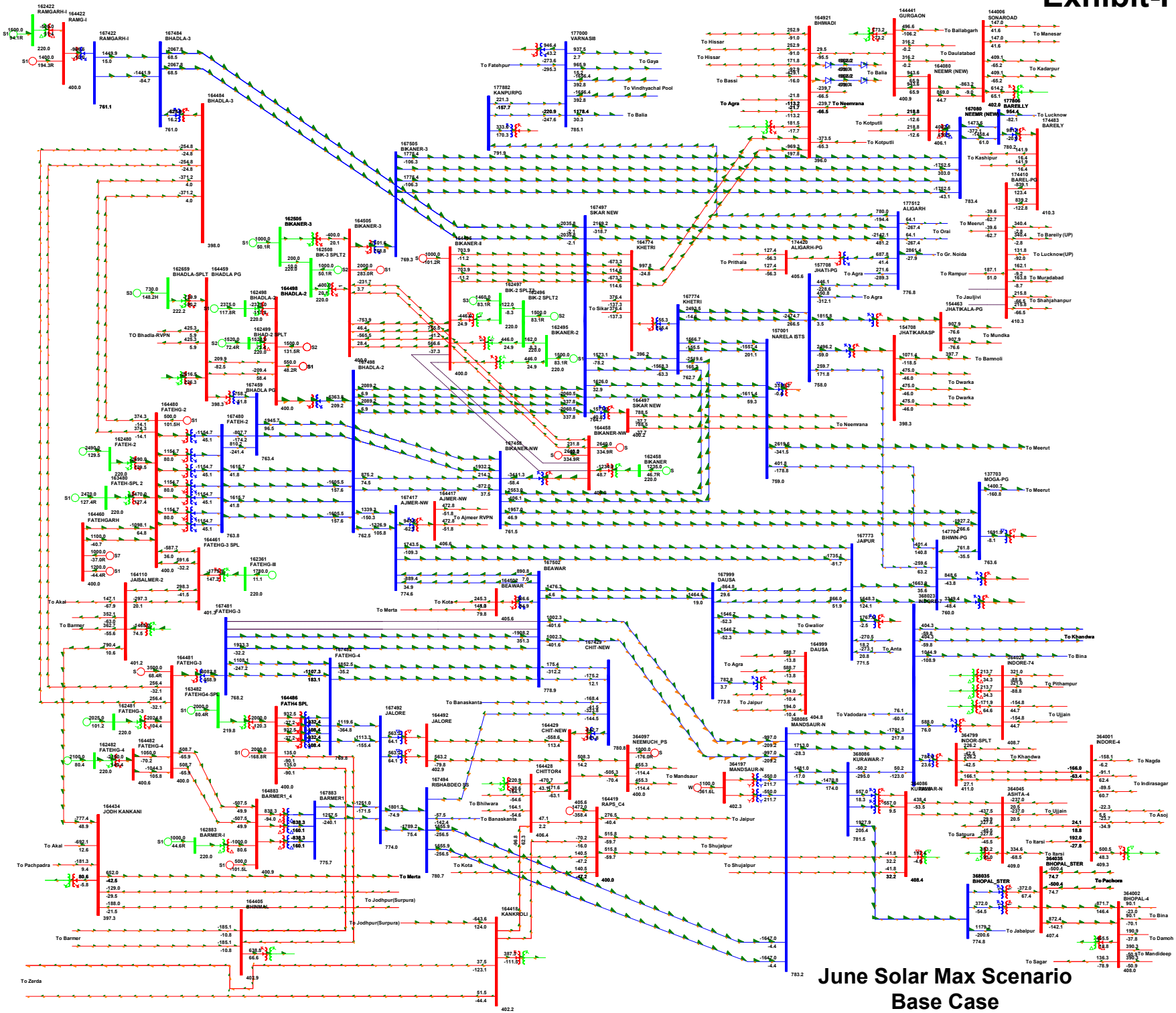
Appendix I

List of participants:

Sl. No.	Name (Smt/ Ms/ Shri)	Designation
CEA		
1	A.K. Rajput	Member (Power Systems)
2	Ishan Sharan	Chief Engineer
3	Manjari Chaturvedi	Director
4	Nitin Deswal	Deputy Director
5	Komal Dupare	Asst. Director
6	Kanhaiya Singh Kushwaha	Asst. Director
CTUIL		
7	Kashish Bhambhani	GM
8	Sandeep Kumawat	DGM
9	Narendra Sathvik	Manager
Grid- India		
10	Surajit Banerjee	CGM (NLDC)
11	Vivek Pandey	GM (NLDC)
12	Alok Kumar	GM (NRLDC)
13	Priyam Jain	Manager (NLDC)
14	Gaurav Singh	Manager (NRLDC)
15	Gaurab Das	Asst. Manager (NLDC)
16	Asif Khan	Asst. Manager (NRLDC)

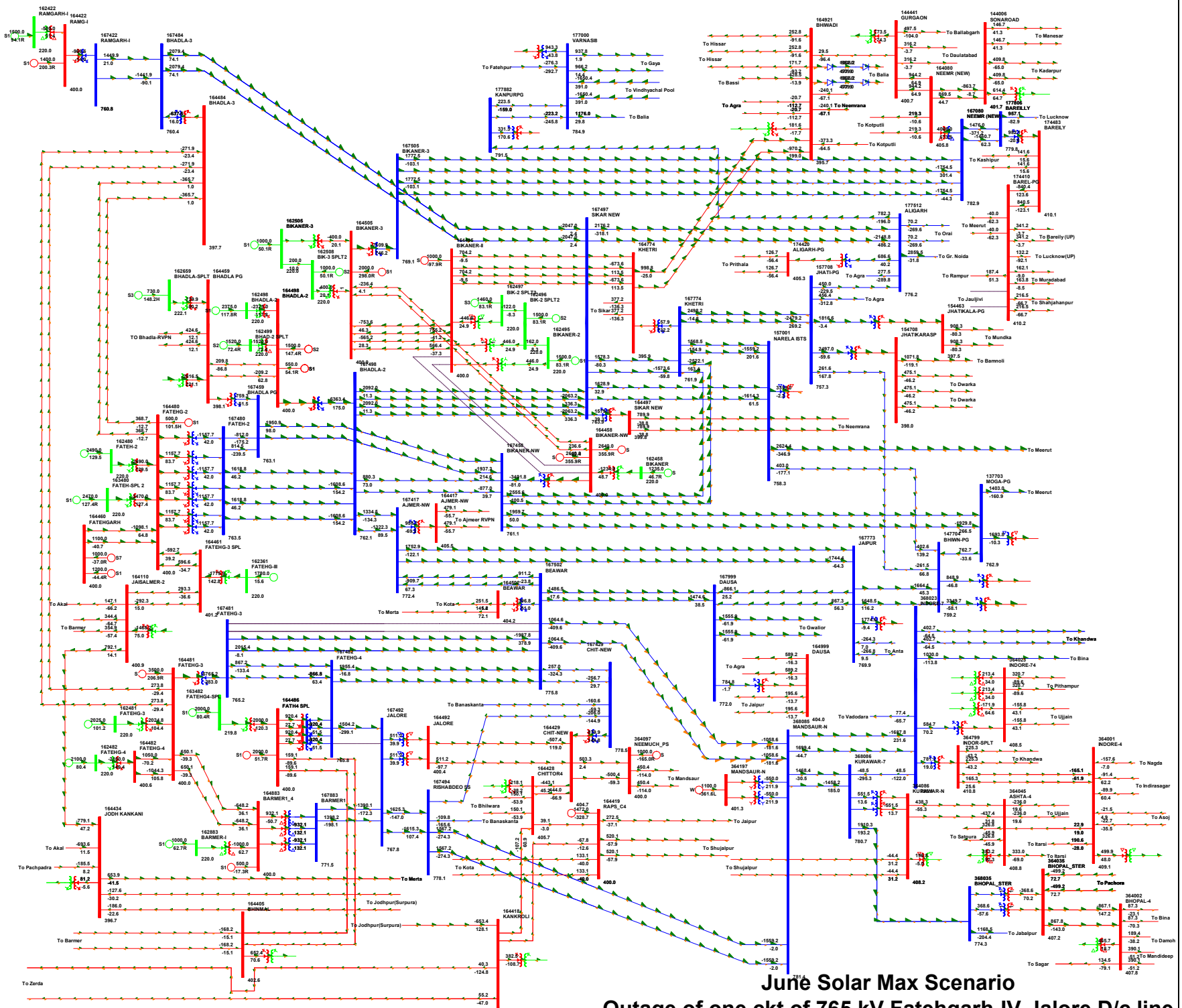
Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)

Exhibit-I



June Solar Max Scenario
Base Case

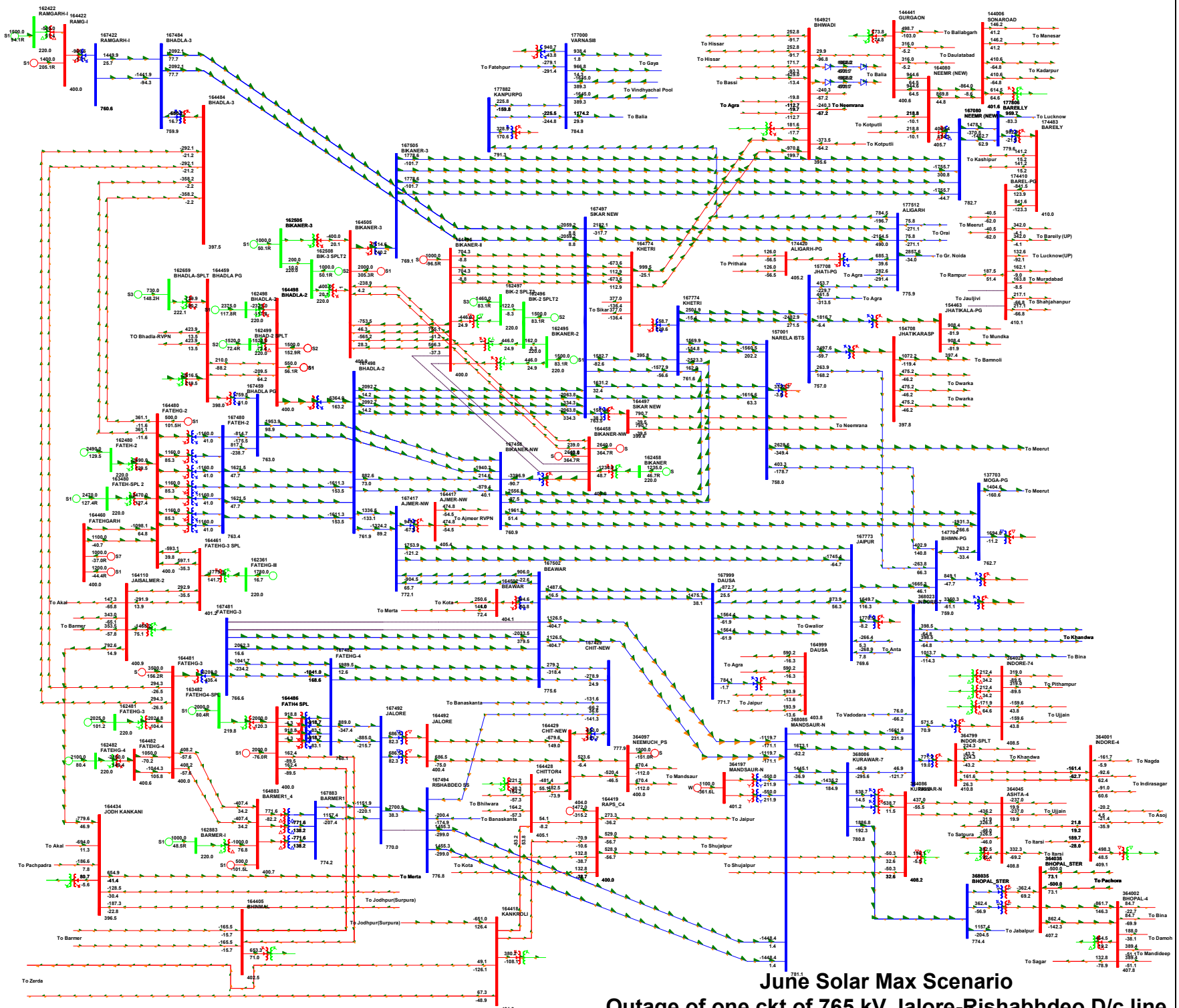
Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



June Solar Max Scenario

Outage of one ckt of 765 kV Fatehgarh-IV-Jalore D/c line

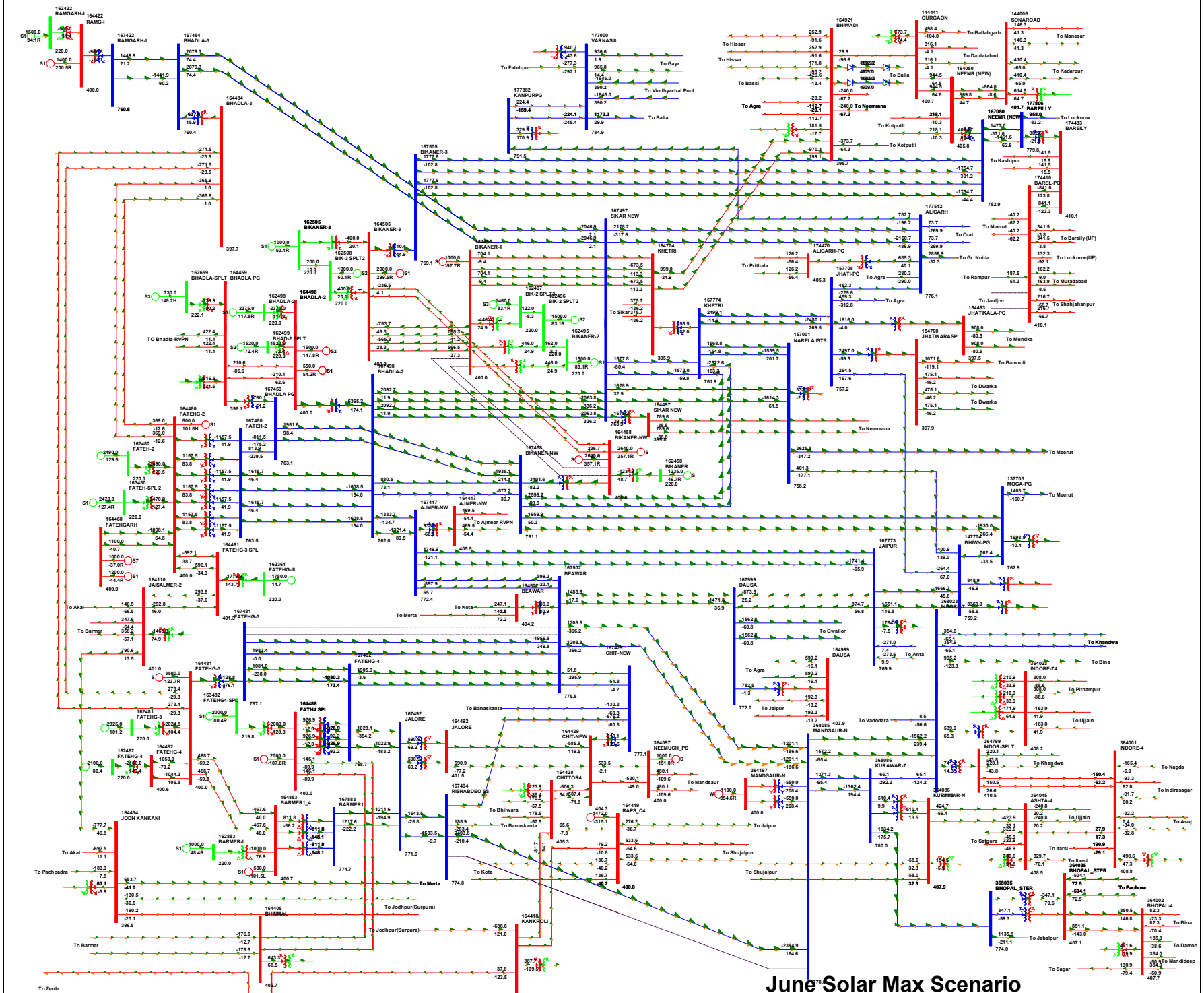
Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



June Solar Max Scenario

Outage of one ckt of 765 kV Jalore-Rishabhdeo D/c line

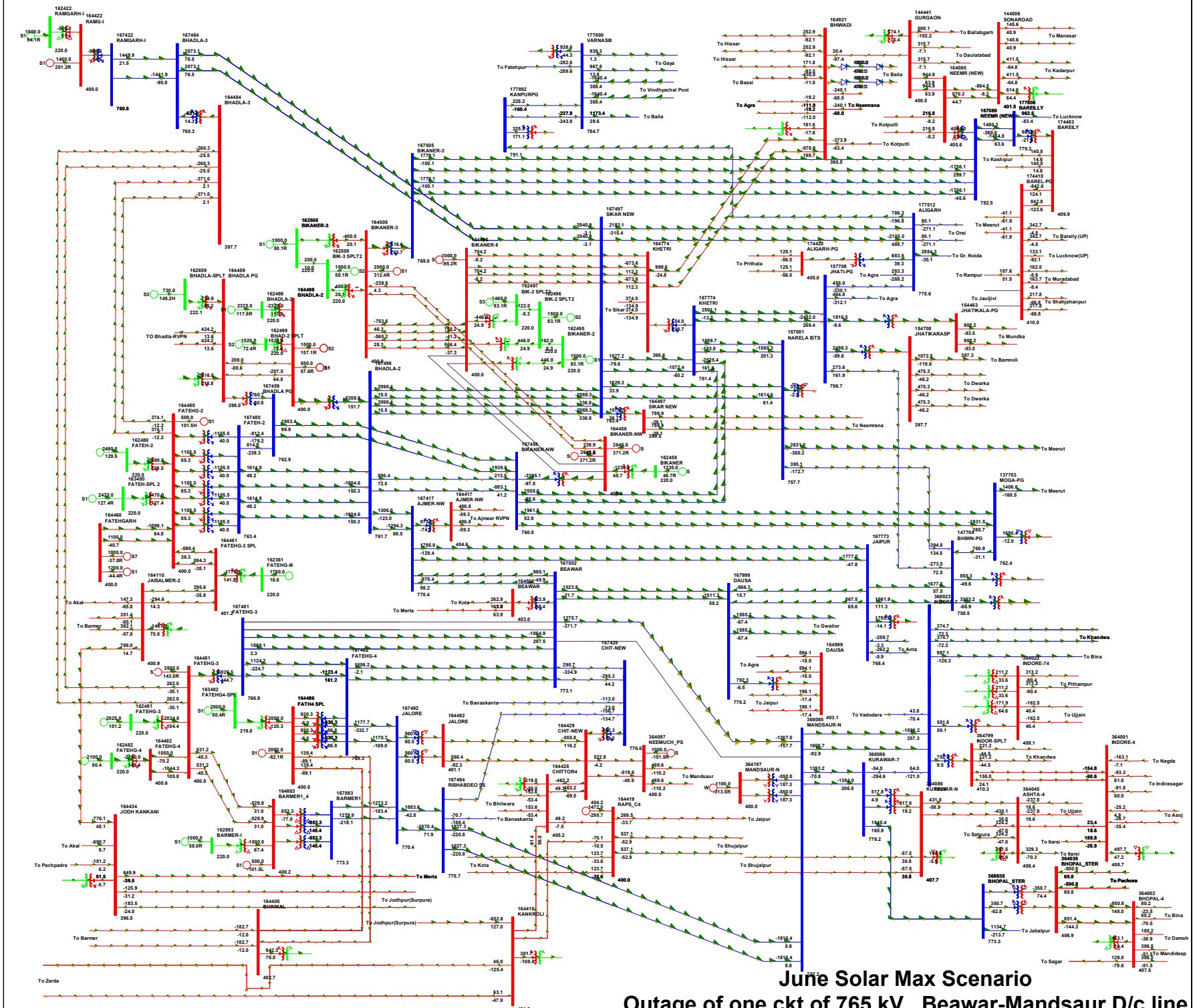
Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



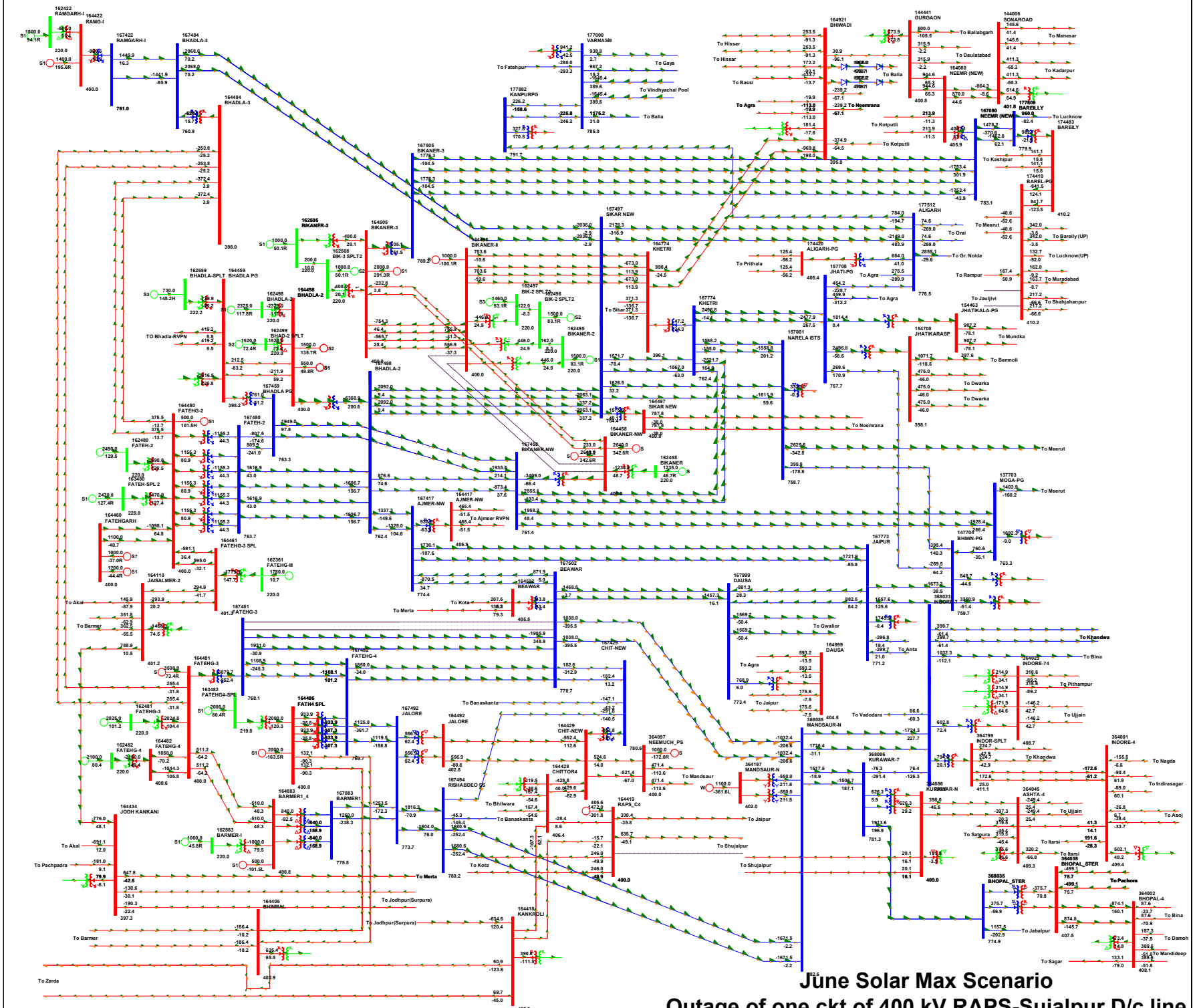
June Solar Max Scenario

Outage of one ckt of 765 kV Rishabhdeo-Mandsaur D/c line

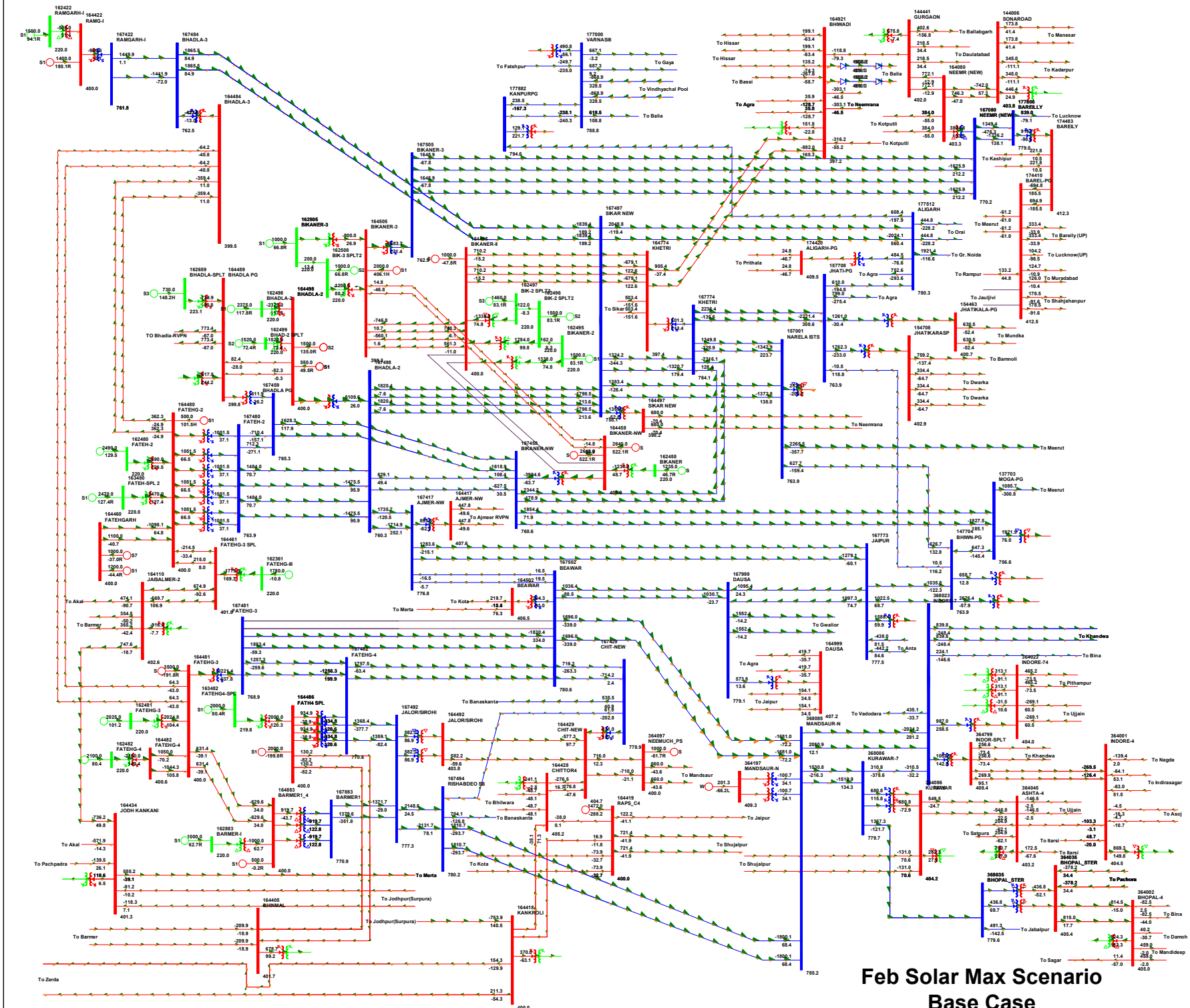
Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)

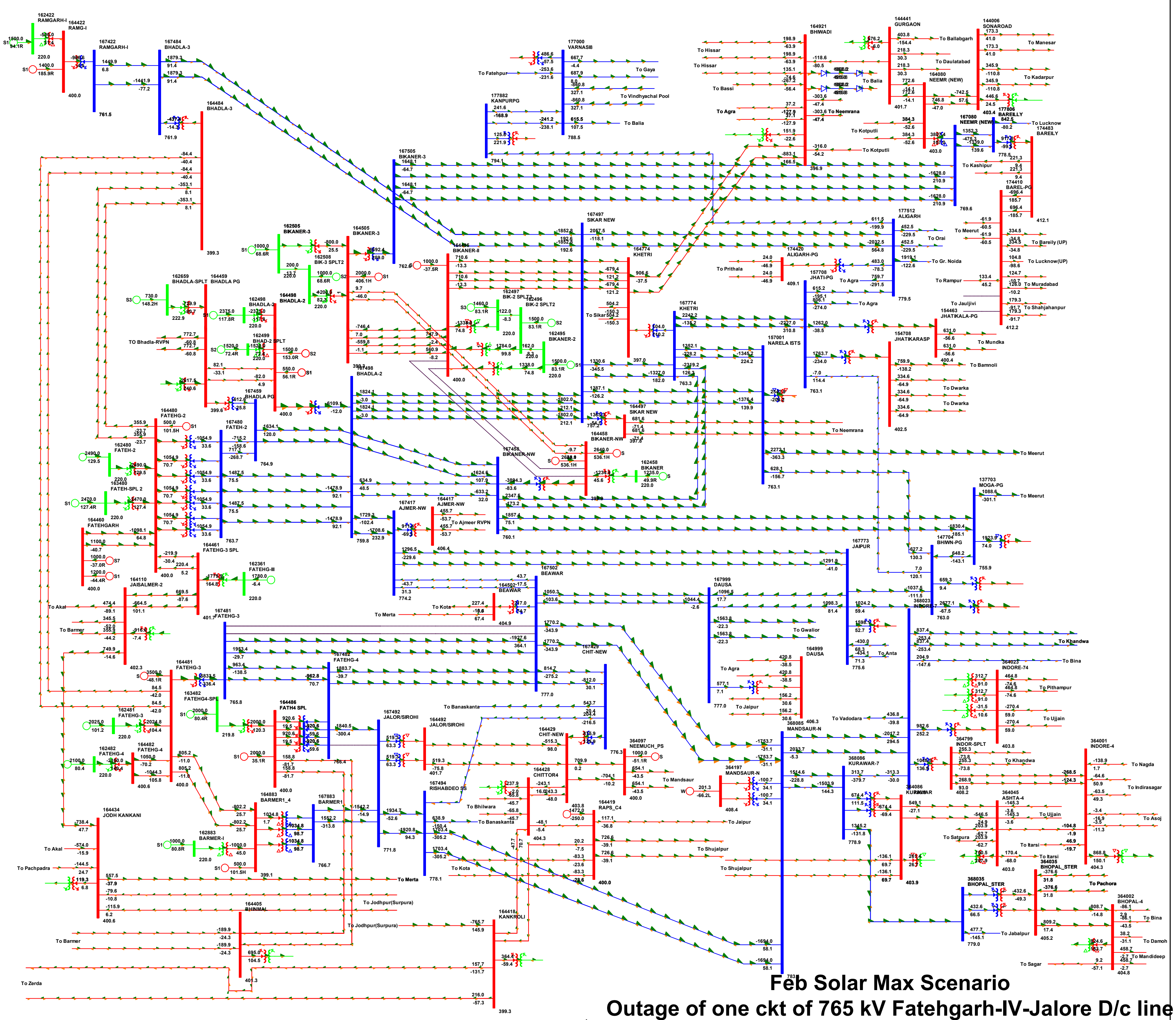


Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



Feb Solar Max Scenario
Base Case

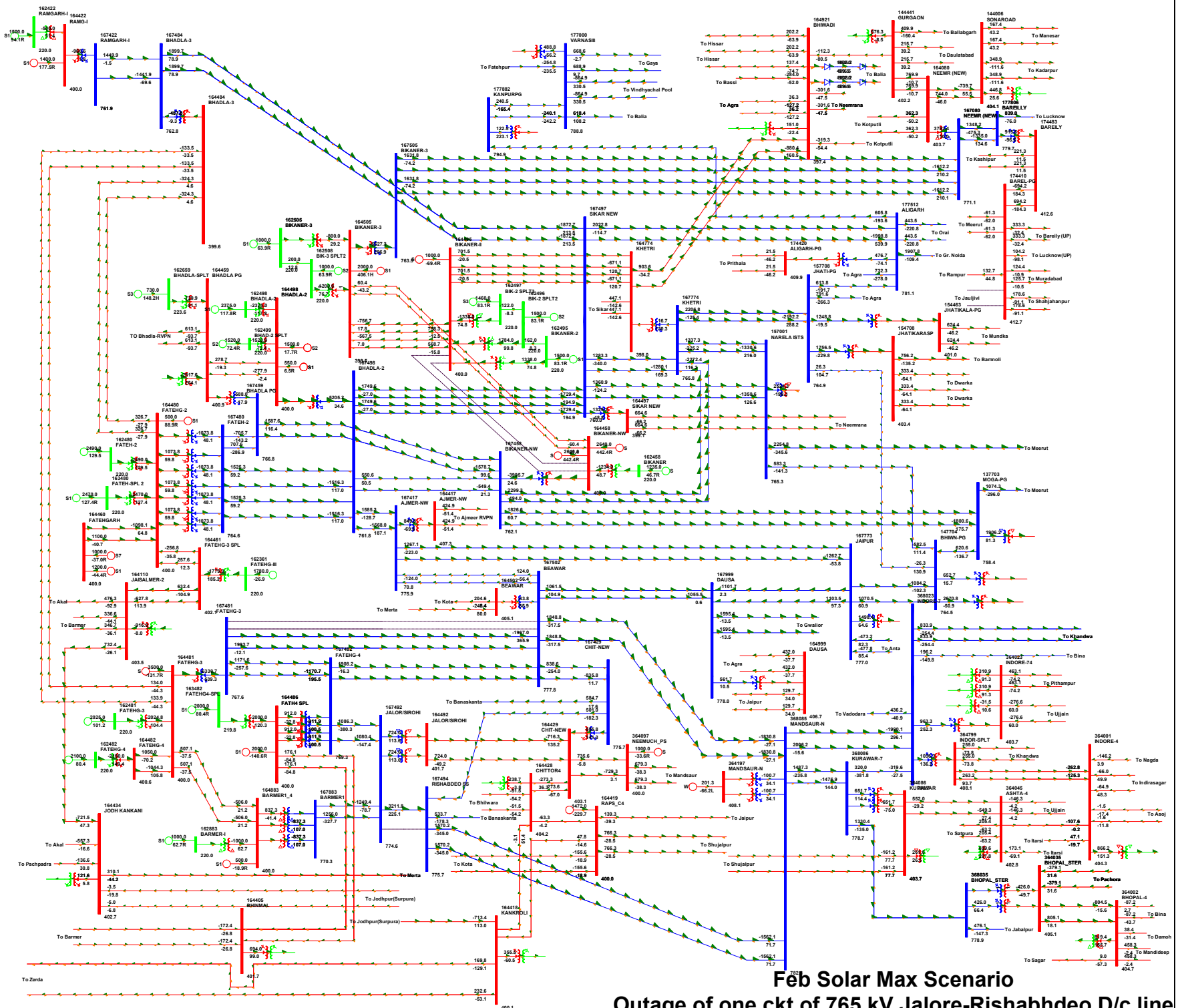
Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



Feb Solar Max Scenario

Outage of one ckt of 765 kV Fatehgarh-IV-Jalore D/c line

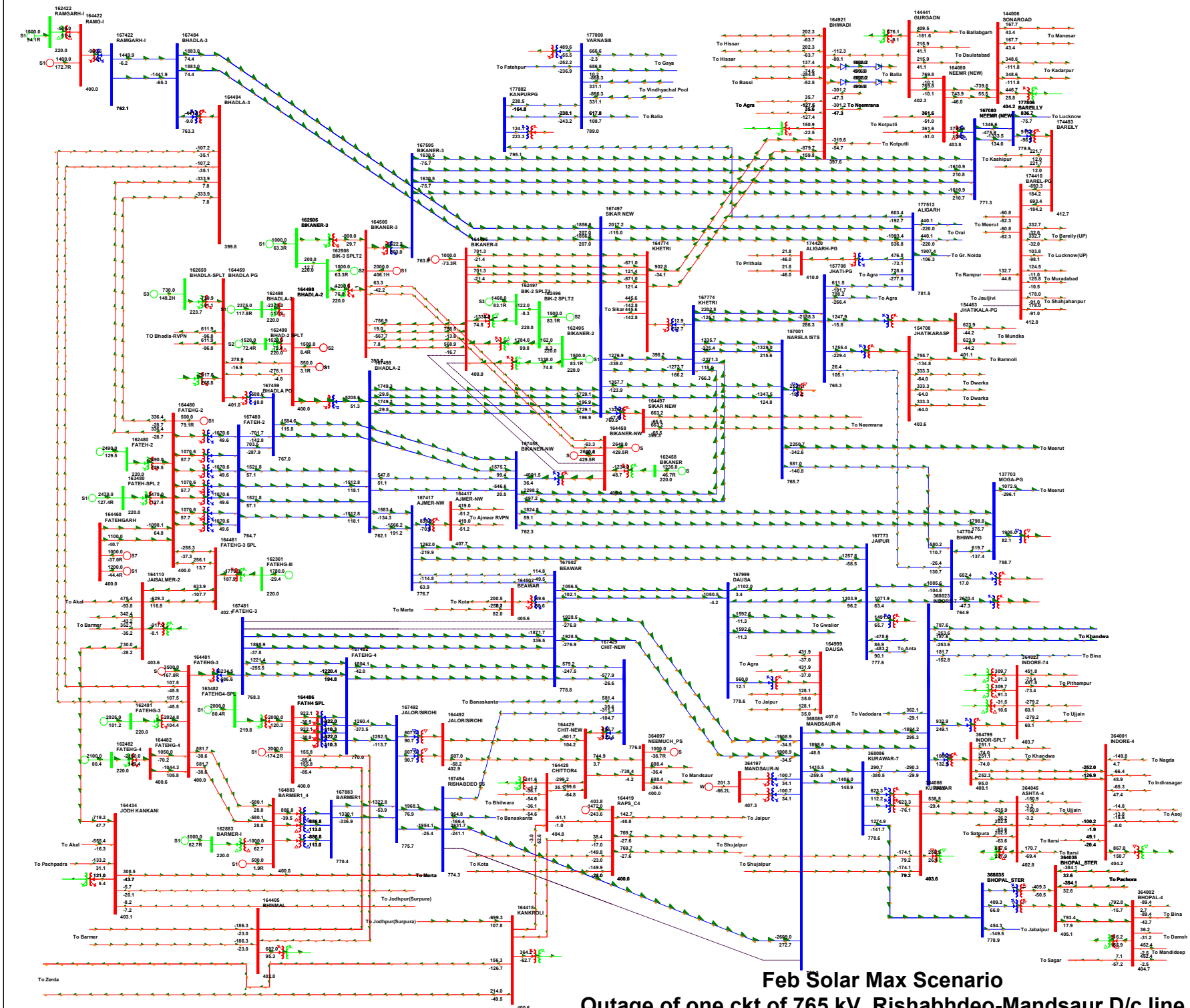
Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



Feb Solar Max Scenario

Outage of one ckt of 765 kV Jalore-Rishabhdeo D/c line

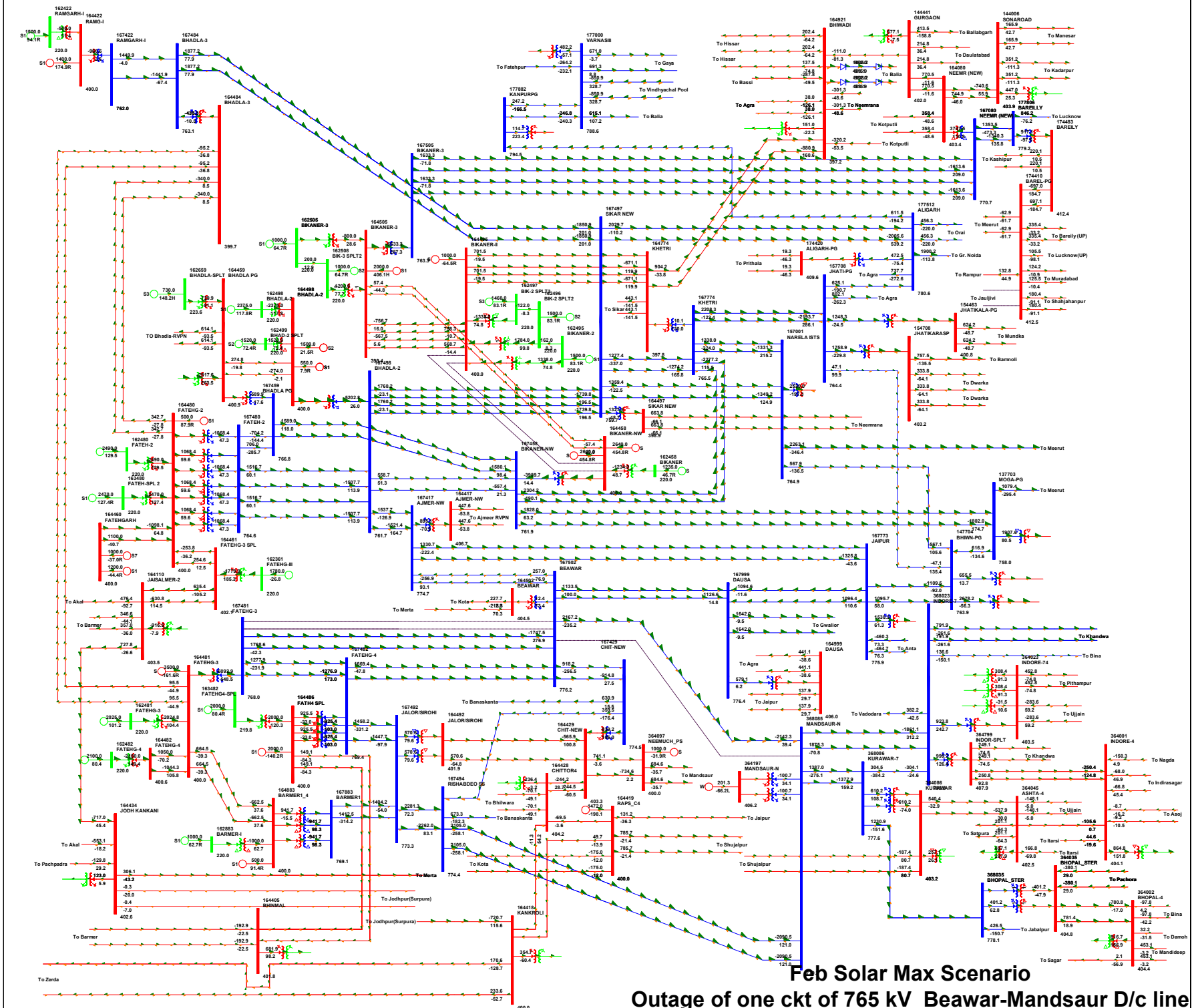
Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



Feb Solar Max Scenario

Outage of one ckt of 765 kV Rishabhdeo-Mandsaur D/c line

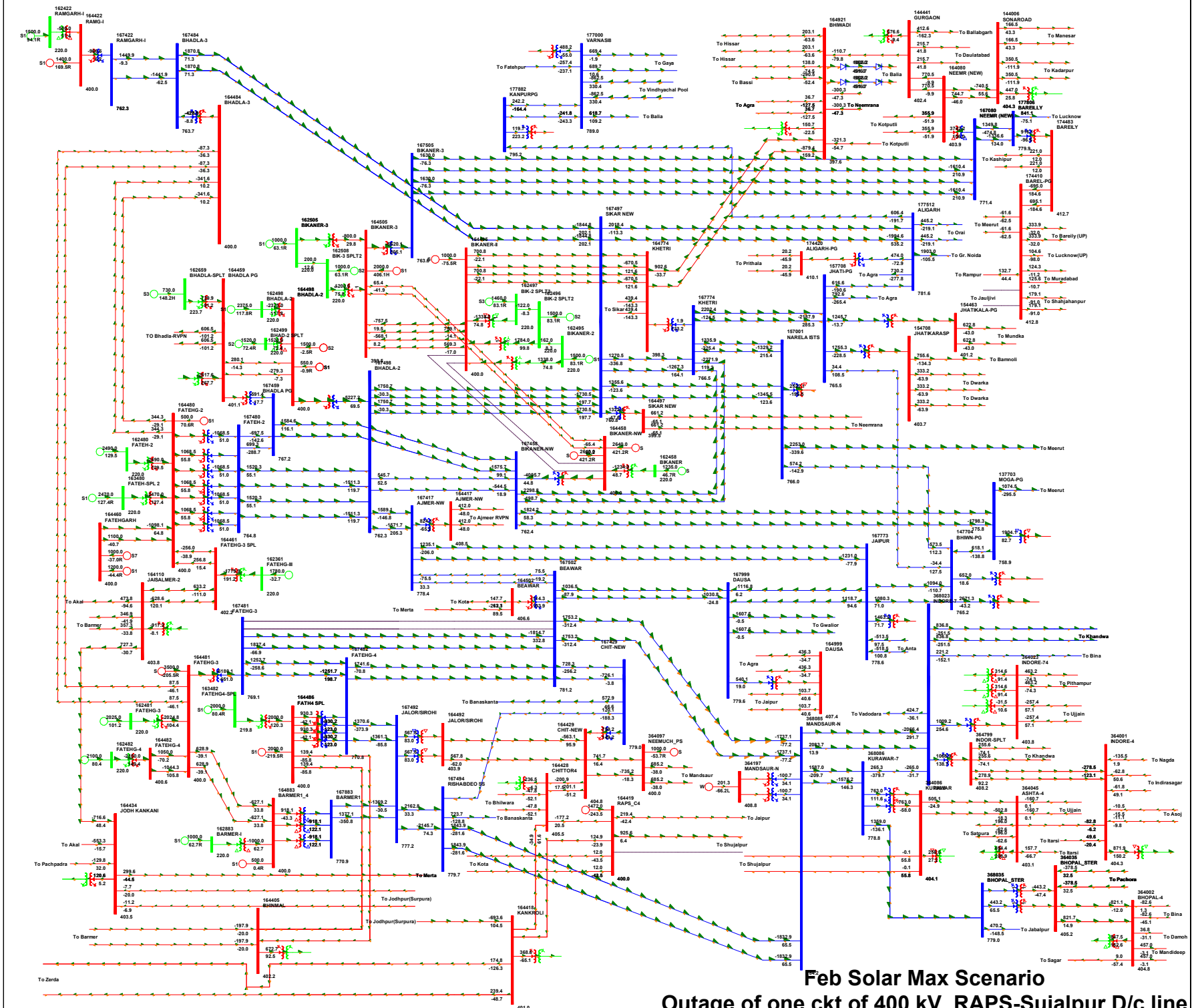
Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



Feb Solar Max Scenario

Outage of one ckt of 765 kV Beawar-Mandsaur D/c line

Transmission System for Rajasthan REZ Phase-IV (Part-2: 5.5 GW) (Jaisalmer/Barmer Complex)



Feb Solar Max Scenario

Outage of one ckt of 400 kV RAPS-Sujalpur D/c line

Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-2 :5.5GW) (Jaisalmer/Barmer Complex)

Fatehgarh-IV (Section-2) : 4GW and Barmer-I PS: 1.5 GW

A. Fatehgarh-IV: 4 GW (Considering 2GW at 400kV and 2GW at 220kV)

- Establishment of 4x1500 MVA, 765/400 kV & 5x500 MVA^, 400/220 kV Fatehgarh- IV (Section-2) Pooling Station along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor*
- Fatehgarh-IV (Section-2) PS – Bhinmal (PG) 400 kV D/c line (Twin HTLS) along with 50 MVAr switchable line reactor on each ckt at each end (~200 km)
- LILO of both ckts of 765 kV Fatehgarh-III- Beawar D/c line(2nd) at Fatehgarh-IV (Section-2) PS along with 330 MVAr switchable line reactors at Fatehgarh-IV PS end of each ckt of 765 kV Fatehgarh-IV- Beawar D/c line** (formed after LILO) (~15 km)
- Beawar- Mandsaur PS 765 kV D/c line along with 240 MVAr switchable line reactor on each circuit at each end (~260 km)
- Augmentation by 1x1500 MVA, 765/400 kV ICT at Fatehgarh-II PS (7th)
- 6 nos. of 220 kV line bays at Fatehgarh-IV PS (for RE connectivity)
- 220kV Sectionalization bay (1 set) along with BC (2 nos.) and TBC (2 nos.) at Fatehgarh- IV (Section-2) Pooling Station
- 1 set 400kV Sectionalization bay at Fatehgarh- IV (Section-2) Pooling Station

Future provisions at Fatehgarh-IV PS is already approved in 8th NCT meeting dated 25.03.22
^incl 1x500MVA ICT to fulfill 'N-1' requirement
****Incl. spare one ICT unit (500MVA) and spare one reactor unit (80MVAr) at Fatehgarh-IV PS***
*****Incl spare one reactor unit (110MVAr) at Fatehgarh-IV PS***

B. Barmer-I : 1.5 GW (Considering 0.5GW at 400kV and 1 GW at 220kV)

- Establishment of 3x1500 MVA, 765/400 kV & 2x500 MVA, 400/220 kV Barmer-I Pooling Station along with 2x240 MVAr (765 kV) Bus Reactor & 2x125 MVAr (400 kV) Bus Reactor*

Future provisions at Barmer-I S/s:

Space for

- 765/400kV ICT along with bays- 3 no.
- 765 kV line bays along with switchable line reactors – 4 nos.
- 765kV Bus Reactor along with bay: 1 no.
- 400 kV line bays –4
- 400 kV line bays along with switchable line reactor –4 nos.
- 400/220kV ICT along with bays -8 nos.
- 400 kV Bus Reactor along with bay: 1 no.
- 400kV Sectionalization bays: 2 sets
- 220 kV line bays for connectivity of RE Applications -10 nos.
- 220kV Sectionalization bay: 3 sets
- BC (4 nos.) & TBC (4 nos.)
- STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr)

- Fatehgarh-III (Section-2) PS – Barmer-I PS 400 kV D/c line (Quad)(~50 km)
- 4 nos. of 220 kV line bays at Barmer-I PS (for RE connectivity)

****Incl. spare one ICT unit (500MVA) and spare one reactor unit (80MVAr) at Barmer-I PS***

C. Common Transmission System for Fatehgarh-IV and Barmer-I in NR

- Establishment of 2x1500 MVA, 765/400 kV Substation at suitable location near Sirohi along with 2x240 MVAr (765 kV) & 2x125 MVAr (400 kV) Bus Reactor *

  Future provisions at Sirohi S/s:

  Space for

  - 765/400kV ICT along with bays- 4 no.
  - 765 kV line bays along with switchable line reactors – 4 no.
  - 765kV Bus Reactor along with bay: 1 no.
  - 400 kV line bays along with switchable line reactor –4 no.
  - 400 kV line bays –4 no.
  - 400 kV Bus Reactor along with bay: 1 no.
  - 400kV Sectionalization bay: 2 sets
  - 400/220kV ICT along with bay - 6 no.
  - 220kV line bays -10 no.
  - 220kV Sectionalization bay: 2 sets
  - BC (3 nos.) & TBC (3 nos.)
  - STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr)

  Incl. spare one ICT unit (500MVA) and spare one reactor unit (80MVAr & 110MVAr) at Sirohi PS

- Establishment of, 765 kV Substation at suitable location near Rishabdeo/Salumbar (Distt. Udaipur) along with 2x240 MVAr (765 kV) Bus Reactor *

  Future provisions at Rishabdeo/Salumbar S/s:

  Space for

  - 765/400kV ICT along with bays- 5 no. along with spare unit
  - 765 kV line bays along with switchable line reactors – 4 no.
  - 765kV Bus Reactor along with bay: 1 no.
  - 400 kV line bays along with switchable line reactor –4 no.
  - 400 kV line bays –4 no.
  - 400 kV Bus Reactor along with bay: 3 no.
  - 400kV Sectionalization bay: 2 sets
  - 400/220kV ICT along with bay - 6 no.
  - 220kV line bays -10 no.
  - 220kV Sectionalization bay: 2 sets
  - BC (3 nos.) & TBC (3 nos.)
  - STATCOM (2x±300MVAr) along with MSC (4x125 MVAr) & MSR (2x125 MVAr)

  Incl. spare one reactor unit (80MVAr)

- Fatehgarh-IV (Section-2) PS – Sirohi PS 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end (~240 km)
- Barmer-I PS– Sirohi PS 765 kV D/c line along with 240 MVAr switchable line reactor for each circuit at each end (~200 km)
- Sirohi PS-Chittorgarh (PG) 400 kV D/c line along with 80 MVAr switchable line reactor for each circuit at Sirohi PS end (Quad) (~160 km)
- Sirohi PS- Rishabdeo/Salumbar 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at Sirohi end (~170 km)
- Rishabdeo/Salumbar - Mandsaur PS 765 kV D/c line along with 330 MVAr switchable line reactor for each circuit at Rishabdeo/Salumbar end (~160 km)

- LILO of one circuit of 765 kV Chittorgarh-Banaskanta D/c line at Rishabdeo/Salumbar S/s (20 km)

In addition to the above, following transmission scheme is also required in Western region for further dispersal of power for above RE complexes (Fatehgarh-IV and Barmer-I).

D. Common Transmission System for Fatehgarh-IV (4GW) and Barmer-I (3.5GW) in Western Region

- Establishment of 765kV Mandsaur Pooling Station along with 2x330MVAr (765kV) Bus Reactors (with 1x110MVAr & 1x80MVAr, 765kV spare single phase reactor unit for line/bus reactor)

Future Scope:
Space for

- 765/400kV ICT along with bays- 6 no.
- 765 kV line bays along with switchable line reactors – 6 nos.
- 765kV Bus Reactor along with bay: 2 no.
- 765kV Sectionaliser bay: 1 -set
- 400 kV line bays along with switchable line reactor – 12 nos.
- 400/220kV ICT along with bays -8 nos.
- 400 kV Bus Reactor along with bay: 2 no.
- 400kV Sectionalization bay: 1- set
- 220 kV line bays: 16 nos.
- 220kV Sectionalization bay: 2 sets
- 220kV BC and TBC: 3 nos.
- STATCOM (±300MVAr) along with MSC (2x125 MVAr) & MSR (1x125 MVAr): 1 no.

- Mandsaur PS – Indore(PG) 765 kV D/c Line (200km) along with 1x330MVAr switchable line reactor (SLR) on each ckt at Mandsaur end
- Establishment of 765/400 (2x1500MVA) 400/220 (2x500MVA) & 220/132kV (3x200MVA) Kurawar S/s (with 1x500MVA spare single phase transformer unit) with 2x330MVAr 765kV bus reactor and 1x125MVAr 420kV bus reactor (with 1x110MVAr & 1x80MVAr, 765kV spare single phase reactor unit for line/bus reactor)

Future Scope:
Space for

- 765/400kV ICT along with bays- 4 no.
- 765 kV line bays along with switchable line reactors – 8 nos.
- 765kV Bus Reactor along with bay: 2 no.
- 765kV Sectionaliser bay: 1 -set
- 400 kV line bays along with switchable line reactor – 10 nos.
- 400/220kV ICT along with bays -6 nos.
- 400 kV Bus Reactor along with bay: 2 no.
- 400kV Sectionalization bay: 1- set
- 220 kV line bays: 12 nos.
- 220kV Sectionalization bay: 2 sets
- 220kV BC and TBC: 3 nos.
- 220/132kV ICT along with bays: 3 nos.
- 132kV line bays: 8

  - 132kV Sectionalization bay: 1 set
  - STATCOM (±300MVAr) along with MSC (2x125 MVAr) & MSR (1x125 MVAr): 1 no.
- Mandsaur – Kurawar 765kV D/c line (~235km.) with 240MVAr switchable line reactors at both ends
- LILO of Indore – Bhopal 765kV 765kV S/c line at Kurawar (LILO route length ~15km.)
- Kurawar – Ashtha 400kV D/c (Quad ACSR/AAAC/AL59 moose equivalent) line (~65km)
- LILO of one circuit of Indore – Itarsi 400kV D/c line at Astha (LILO route length ~ 30km.)
- Shujalpur – Kurawar 400kV D/c (Quad ACSR/AAAC/AL59 moose equivalent) line (~40km)

Estimated Cost : Rs 14556 Cr (NR portion)
: Rs 5967Cr (WR portion)