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 (54वीं)/2022/3978-4025 दिनाँक: 26 मई, 2022

सेवा में / To,

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

विषय: उत्तर क्षेत्रीय विद्युत समिति की 54वीं बैठक की दिनांक एवं कार्यसूची ।
Subject: 54th meeting of Northern Regional Power Committee-Date and Agenda

महोदय / Sir,

उत्तर क्षेत्रीय विद्युत समिति की 54वीं बैठक दिनांक **31 मई, 2022** को **1100** बजे विडियो कोंफ्रेंसिंग के माध्यम से आयोजित की जाएगी । बैठक की कार्यसूची संलग्न है। बैठक का लिंक एंव पासवर्ड नियत समय पर ईमेल द्वारा उपलब्ध करा दिया जायेगा ।

The 54th meeting of Northern Regional Power Committee (NRPC) will be held at **1100 Hrs** on **31st May, 2022** via video conferencing. Agenda for the same is attached. The link and password for joining the meeting shall be sent in due course of time to the respective email-IDs.

भवदीय
Yours faithfully,

-sd-

(नरेश भंडारी)
(Naresh Bhandari)
सदस्य सचिव
Member Secretary

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List of NRPC Members

1. Chairperson, NRPC & CMD, Delhi Transco Limited (DTL), Shakti Sadan, Kotla Marg, New Delhi-110002
2. MD, PTCUL, Dehradun-248001, (Fax- 0135-2764496)
3. MD, UPPTCL, Lucknow-226001, (Fax-0522-2287792)
4. CMD, RRVPNL, Jaipur-302005, (Fax -01412740168)
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18. Managing Director, HPPTC Ltd, Himfed Bhawan, Shimla-171005, (Fax-0177-2832384)
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20. Managing Director, J&K State Power Dev. Corp., Srinagar, J&K, (Fax-0194-2500145)
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26. Managing Director, UPRVUNL, Lucknow-226001, (Fax-0522-2288410)
27. Representative of MVVNL (UP Discom)
28. Managing Director, SLDC, PTCUL, Rishikesh, (Fax-0135-2451160)
29. Managing Director, UJVNL, Dehradun-248001, (Fax-0135-2763507)
30. Managing Director, UPCL, Dehradun-248001, (Fax-0135-2768867/2768895)
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32. Director (Finance), NPCIL, Mumbai-400094, (Fax-022-25563350)
33. Director (Commercial), NTPC, New Delhi-110003, (Fax-011-24368417)
34. Representative of CTUIL, Gurgaon-122001
35. CMD, SJVNL, New Delhi, (Fax-011-41659218/0177-2660011)
36. Director (Technical), THDC, Rishikesh-249201, (Fax-0135-2431519)
37. Director (Commercial), POSOCO, New Delhi-110016, (Fax-011-26560190)
38. ED, NRLDC, New Delhi-110016, (Fax-011-26853082)
39. CEO, Aravali Power Company Pvt. Ltd., NOIDA, (Fax-0120-2591936)
40. CEO, Jhajjar Power Ltd., Haryana, (Fax-01251-270105)
41. Representative of Lanco Anpara Power Ltd., (Fax-124-4741024)
42. Station Director, Rosa Power Supply Company Ltd., (Fax-05842-300003)
43. Director and head regulatory and POWER Sale, JSW Energy Ltd., New Delhi (Fax- 48178740)
44. COO, Adani Power Rajasthan Ltd., Ahmedabad-380006 (Fax No- 07925557176)
45. COO, Talwandi Sabo Power Ltd. Distt: Mansa, Punjab-151302(Fax: 01659248083)
46. MD, Lalitpur Power Generation Company Ltd., Noida-201301(Fax: 01204045100/555, 2543939/40)
47. Director (Commercial & Operations), PTC India Ltd., New Delhi (Fax- 01141659144,41659145)
48. CEO, Nabha Power Limited, (Fax: 01762277251 / 01724646802)
49. Representative of Prayagraj Power Generation Co. Ltd.
50. Representative of Greenko Budhil Hydro Power Private Limited (Member IPP<1000 MW)
51. Representative of TPDDL (Delhi Private Discom)

Special Invitee:

i. Member Secretary, WRPC, Mumbai-400 093.
ii. Member Secretary, SRPC, Bangalore-560 009
iii. Member Secretary, ERPC, Kolkata-700 033.
iv. Member Secretary, NERPC, Shillong-793 003.

Contents

उत्तरी क्षेत्रीय विद्युत समिति की 54वीं बैठक
54th MEETING OF NORTHERN REGIONAL POWER COMMITTEE

Time & Date of NRPC meeting: 11:00 HRS; 31st May 2022

Venue: Video Conferencing

AGENDA

A.1 Approval of MoM of 53rd NRPC meeting

A.1.1 Minutes of 53rd NRPC meeting has been issued on 26.05.2022. No comment has been received till the date.

A.2 Non-inclusion of LTA quantum for calculation of transmission charges for UPPCL share in UCH Stage-II (132 MW), UCH Stage-III (66 MW) & ROSA Stage-II (300 MW) (Agenda by UPPCL)

A.2.1 The issue was discussed in 52nd NRPC meeting held on 31.03.2022, wherein, it was decided that matter may be discussed at NRPC Secretariat firstly and then may be taken in upcoming NRPC meeting.

A.2.2 UP has submitted vide letter dt. 30.04.2022 (**Annexure-I**) that 27th meeting of the Standing Committee on Transmission System Planning of Northern Region held on 29th/30th May, 2009 at Nainital, Uttrakhand may be referred. The Minutes of subject meeting were issued vide CEA letter no. 1/9/06-SP&PA dated 11.06.2009. Para no. 06 and para pertaining to conclusion made on the subject matter mentioned on page no. 30 & 31 of MoM, is iterated below:

"6. Long Term Open Access to Rosa Power Supply Company Limited for transfer of 600 MW from their Rosa Thermal Power Project (Stage II) located at Shahjahanpur, Uttar Pradesh.

Concluding the discussions following was agreed:

Long-term Open Access can be granted for 25 years subject to following:

- ***Long Term Open Access to Rosa Power Company shall be granted after the commissioning of following strengthening scheme:***
  - ***One ckt of Lucknow – Bareilly 765 kV line.***
  - ***Bareilly – Meerut 765 kV S/c***
  - ***Bareilly-Kashipur-Roorkee-Saharanpur 400 kV D/c (Quad conductor)***
- ***For connectivity of Rosa Power Plant with the grid the following was agreed:***
  - ***Rosa – Shahjahanpur 400 kV D/c***
- ***For supply of power to Uttar Pradesh, Rosa Power Company shall provide 400/220 kV ICTs of adequate capacity at Rosa switchyard, therefore ISTS charges for supply of power to Uttar Pradesh would not be applicable.***

- ***M/s Rosa Company would sign the requisite BPTA for Northern regional Transmission system charges for 300 MW (150 MW for Delhi & 150 MW for Haryana)."***

A.2.3 It is clear from above that ***no ISTS charges were applicable for supply of power from Rosa Power Company (Stage-II) to Uttar Pradesh***.

A.2.4 Further, M/s Rosa Power Company would sign the requisite BPTA for ***Northern regional Transmission system charges for 300 MW (150 MW for Delhi & 150 MW for Haryana).*** However, later on Delhi and Haryana backed out to share 300 MW generation of power of Rosa Power Company. So, LTA charges on this account must either by borne by Delhi / Haryana or Rosa Power Company instead of being charged from UPPCL.

A.2.5 UP has requested that LTA of Rosa Power Company (Stage-II) for 300 MW must be excluded with immediate effect by CTU while submitting the Transmission charges bill to UPPCL. Case of Unchchar-II & Unchchar-III, also may be taken up.

Members may kindly deliberate.

A.3 Default in release of outstanding dues by THDCIL's Beneficiary (agenda by THDCIL)

A.3.1 The issue was discussed in 51st and 53rd NRPC meeting also, wherein JKPCL stated that matter is taken up with government of J&K.

A.3.2 THDC vide mail dt. 19.05.2022 has mentioned that as on 18.05.2022, an overdue amount including LPS of approx. Rs.341.04 Cr. is due for payment. THDC India Ltd has been vigorously pursuing with JKPCL (J&K DISCOM) for expeditious payment. Despite vigorous follow up, JKPCL (J&K DISCOM) has still to liquidate its old outstanding due. The details of the overdue amount on JKPCL (J&K DISCOM), as on 18.05.2022, is as under:

DISCOMs	Principal Outstanding (Rs. in Cr.)	Late Payment Surcharge (Rs. in Cr.)	Overdue amount including LPS (Rs. in Cr.)
1	**2**	**3**	**4=2+3**
PDD & JKPCL, J&K	329.69	11.35	341.04

A.3.3 Long pending dues are to be liquidated by the JKPCL (J&K DISCOM). The amount is quite substantial and crucial. Due to scarce availability of funds with us, we are compelled to avail borrowings to meet our day-to-day requirements. Thus, immediate payment is very much crucial for sustenance of THDCIL.

A.3.4 JKPCL (J&K DISCOM) is requested to liquidate its above overdue amount immediately.

Members may kindly deliberate.

A.4 Request for opening of Letter of Credit (agenda by THDCIL)

A.4.1 The issue was discussed in 51st and 53rd NRPC meeting also, wherein JKPCL stated that matter is taken up with government of J&K.

A.4.2 THDC vide mail dt. 19.05.2022 has mentioned that despite repeated request and reminders, J&K has not opened the Letter of Credit (LC) amounting to Rs.14.45 Cr for Financial Year 2022-23.

A.4.3 It is requested to J&K to open the LC of requisite amount immediately.

Members may kindly deliberate.

A.5 Transmission System for evacuation of power from Kaza Solar Power project (880 MW) (agenda by CTU)

A.5.1 In the 50th NRPC meeting held on 28.01.22, Transmission System for evacuation of power from Kaza Solar Power project (880 MW) was approved with an estimated cost of about Rs 2134 Cr.

A.5.2 During the 8th NCT meeting held on 25.03.22, above transmission scheme was also discussed & recommended the scheme to MOP for implementation through TBCB route. In the NCT meeting, CTU explained that based on availability of cost estimate on March 2020 PL (Price Level) as well as envisaged generation schedule of Mar'24 (24 months), cost of above scheme was estimated to be about Rs 2135 Cr which was put up to NRPC.

A.5.3 However, M/s SJVN vide letter dated 21.02.22 revised/postponed the generation schedule to Mar'25 from earlier Mar'24. Therefore, considering revised schedule (36 months) as well as latest available cost estimate (Sep'21 PL), the cost estimate for Kaza transmission scheme was revised to Rs 3251 Crore based on September, 2021 PL unit cost estimate. (Item 4.8 pg 30 of Minutes of 8th NCT is enclosed as **Annexure-II**). NCT also decided that CTU shall intimate NRPC regarding increase in estimated cost for Kaza transmission scheme.

A.5.4 Further, based on NRPC comments on higher transmission cost for proposed scheme and to take up proposal with NCT for Govt. budgetary support/grant for the transmission scheme so as to rationalize transmission charges on the consumers, same was put up to NCT. In the meeting, NCT requested MoP/MNRE to consider the case for Govt. budgetary support/grant as has been done in case of Transmission system for evacuation of RE power from renewable energy parks in Leh.

Members may kindly note.

A.6 Scheduling and settlement of URS power (agenda by TPDDL)

A.6.1 The issue has already been discussed in 51st NRPC meeting, wherein, TPDDL was advised to raise the issue in next Commercial Sub-committee meeting.

A.6.2 Since then, no Commercial Sub-Committee meeting has been held. Therefore, TPDDL vide letter dated 13/05/2022 (**Annexure-III**) has again raised the same issue.

A.6.3 TPDDL has submitted that scheduling of URS power is a regular practice in day-to-day power scheduling and dispatch, however, financial settlement of the same is not being done in a time bound manner. As per the information available in the public domain, it is given to understand that details of state wise URS power is provided in the final Regional Energy Account and subsequently the credit is passed on to the beneficiaries. In case the final REA is issued by RPC with a delay then URS power settlement is also delayed. To overcome the above deficiency, it

is proposed that time lines of issuance of Final REA by RPC's should be revisited and strict timelines should be defined/followed for the same, failing which provision of carrying cost/interest should be incorporated to offset the financial losses suffered by the beneficiary on account of delay in receipt of URS credit. It is also suggested that details of power scheduled under URS be incorporated in provisional REA, if possible, to expedite the settlement process. Also, procedure/timelines should be issued for issuance of URS credit/debit within the state boundary and to be followed by state load dispatch centers so as to ensure that URS settlement within intra-state entities is done in a time bound manner.

Members may kindly deliberate.

A.7 Status of remedial measures to mitigate the transmission constraints in power system (agenda by NRLDC)

A.7.1 Transmission constraints and associated issues at both inter-state and intra-state level is being compiled & reported by NRLDC and shared to all stakeholders in regular OCC / NRPC meetings. All such transmission/ICT/generation constraints are being shared by POSOCO in quarterly operation feedback to CEA. These constraints are discussed in the regional power committee meetings and CEA/ CTU consider the operational feedback from POSOCO as an input in the future transmission planning. Several projects/schemes have been made by STU/CTU to address these constraints with time bound implementation. Few of the projects got delayed due to various reason viz. RoW issue, land acquisition etc.

A.7.2 In reference to this, a virtual meeting was taken by Joint Secretary (OM & RR), Ministry of Power on 12th Jan 2021 to review the transmission constraints in power system network and approved scheme as remedial measures in various standing committee meetings (SCM/now RPCTPs) and states forums (Attended by Officials from RPCs, POSOCO, CTU, POWERGRID, SLDCs and STUs). List of updated status of transmission constraints is attached at **Annexure-IV.**

Concerned STUs/ISTS licensees and SLDCs are requested to provide update on the status.

A.8 TTC/ATC of state control areas for summer 2022 (agenda by NRLDC)

A.8.1 From last several OCC meetings, it has been discussed that most of the NR states except J&K, Ladakh and Chandigarh UT are sharing basecase and ATC/TTC assessment report with NRLDC. It is observed that some states are still not regularly declaring/assessing the TTC/ATC for the import and export capability of power from its state periphery. OCC has advised all states to timely declare TTC/ATC for prospective months and revise the figures as per requirement.

A.8.2 In 195th OCC, SLDCs were requested to go through the tentative ATC/TTC limits for June 2022 as assessed by NRLDC and provide comments. Based on comments received till date, following is ATC/TTC of different state control areas for Summer/Monsoon 2022:

State	Total Transfer Capability (TTC) (MW)	Reliability Margin (MW)	Available Transfer

			Capability (ATC) (MW)
Punjab*	8200	500	7700
UP	15100	600	14500
Rajasthan	6200	300	5900
Haryana	9100	600	8500
Delhi	6800	300	6500
HP	1400	100	1300
Uttarakhand	1600	100	1500
J&K	2100	100	2000

* ATC/TTC would be enhanced by 800MW further if 400/220kV 500MVA ICT-3 at Rajpura and reconductoring of 220kV Jalandhar-Kartarpur is completed before paddy 2022.

Comments/feedback has been received from Punjab, Haryana, HP, Uttarakhand and Uttar Pradesh.

In addition, as per latest LGB issued by NRPC on 29.04.2022 attached as **Annexure-V**, several states have given anticipated shortage figures. Thus, it is requested to review and proper plan may be furnished by all states to meet their Load-Generation balance safely during summer 2022.

Moreover, state wise issues have been highlighted below:

Punjab

- Plan to meet anticipated maximum demand of 15500MW during paddy 2022
- Low generation at Pong
- Low peaking support from RSD despite higher reservoir level (4m) compared to last years due to construction of Shahpur Kandi Power station
- No generation at Mukerian HEP due to canal maintenance.
- One unit of GVK out of two units on coal shortage
- Availability of power from WR plants to Haryana/ Punjab due to commercial issues.
- Punjab SLDC is requested to provide update on the commissioning of these elements. In first week of June 2022, Punjab and NRLDC would assess the ATC/TTC limits as per the commissioning of above transmission elements and would be enhanced to 8500/9000MW if all the said transmission elements are commissioned.

Rajasthan

- Status of SPS implementation at 400/220kV Ajmer, Merta and Chittorgarh
- Plan to ensure loadings at these 400/220kV ICTs below their N-1 contingency limits
- Numerous forced outages of state control area thermal generating stations especially at Suratgarh TPS (forced outage on 19.05 = 2500MW)
- Dholpur Gas (330MW) out due to unavailability of gas

Delhi

- Sharing ATC/TTC assessment with NRLDC/ NRPC and uploading of ATC/TTC on website is yet to done
- Loading of 400/220kV Harshvihar and Mundka ICTs close to their N-1

contingency limits

Haryana

- Plan to meet anticipated maximum demand, maximum energy consumption
- Updated list of radial feeders for physical regulation
- Expedite commissioning of SPS at Kurukshetra (PG)

Uttarakhand

- Plan to meet anticipated maximum demand, maximum energy consumption
- Updated list of radial feeders for physical regulation
- In upcoming season, challenge of outage of hydro units on silt

UP

- Plan to meet anticipated maximum demand, maximum energy consumption during summer/monsoon 2022.
- Expedite revival of Meja unit-2 under long outage

HP

- Plan to meet anticipated maximum demand, maximum energy consumption
- In upcoming season, challenge of outage of hydro units on silt

J&K

- J&K and Ladakh U/Ts are once again requested to advise the concerned officers to evaluate their ATC/TTC limits in coordination with NRLDC and share latest assessment with NRLDC and NRPC after procurement of PSSe software.

  It is again requested that SLDCs may ensure that loading of ICTs and lines are below their N-1 contingency limits. While requisitioning power from various sources, states should take care to limit their scheduled drawl as well as actual drawl in real time within the Available Transfer Capability (ATC) limits assessed by SLDC and NRLDC.

Members may kindly deliberate.

A.9 RE related issues in Northern region grid operation (agenda by NRLDC)

A.9.1 Renewable energy is connecting at Inter State Transmission state (ISTS) with a very fast pace in view of Government of India (GoI) vision of 200 GW by 2030. At present, there are 3 major ISTS pooling station in Rajasthan from where bulk of RE energy (majority is solar generation) is being evacuated. List of all the REs at respective pooling station is enclosed in **Annexure-VIa.**

A.9.2 For registration and first-time charging (FTC) for REs at respective RLDC, POSOCO has formulated a procedure based on various regulations, procedure and guideline of CEA, CERC, MoP etc. and same is available on RLDC website. Based on this procedure, each RE has to ensure the compliances regarding protections, voltage, frequency limits, reactive power capabilities, power quality/harmonics etc. at point of interconnection (PoI). Various data, certificates and undertakings are being submitted by RE developers in order to meet the CEA

and other necessary compliances. NRLDC is facilitating smooth integration of RE assuming all the data submitted by RE developers is correct as on field. In absence of field testing, tools for data/model validation, standards for protections & other related setting of inverter, standards of data retention by REs, limited check are available to verification of data/model submitted by REs.

A.9.3 Recently in Jan-Feb'22, various trippings were experienced at 765/400/200 kV Fatehgarh-II pooling station. Majority of tripping and generation loss were observed during switching of Line reactor (LR)/Bus reactor (BR) at 765/400/220 kV Fatehgarh-II. Switching of BR and LR is usual action for voltage management at pooling and nearby station. Number of trippings and detailed report of one of the event during Jan-Feb'22 (Based on the data available at NRLDC and data provided by other stakeholder) is enclosed in **Annexure-VIb.**

Based on data and observation, NRLDC communicated vide letter reference NRLDC\ RES\TS-108 dated 15th Feb 2022to all RE at Fatehgarh-II regarding non-operation of HVRT at their stations during tripping in Jan-Feb'22. Copies of letters and reply received are enclosed in **Annexure-III**. Actions taken by some SPD and pending actions by other SPD as per direction of NRLDC is enclosed in **Annexure IIIII.**

Following are the observations:

1. Observation of Non - compliance of RE Generation w.r.t. CEA technical standards

a. High Voltage Ride Through (HVRT) non-compliance by RE Generators at interconnection point:

As per the CEA Regulation. "The generating station (Invertor based) connected to the grid, shall remain connected to the grid when the voltage at the interconnection point, on any or all phases (symmetrical or asymmetrical overvoltage condition) rises above the specified values given below for specified time."

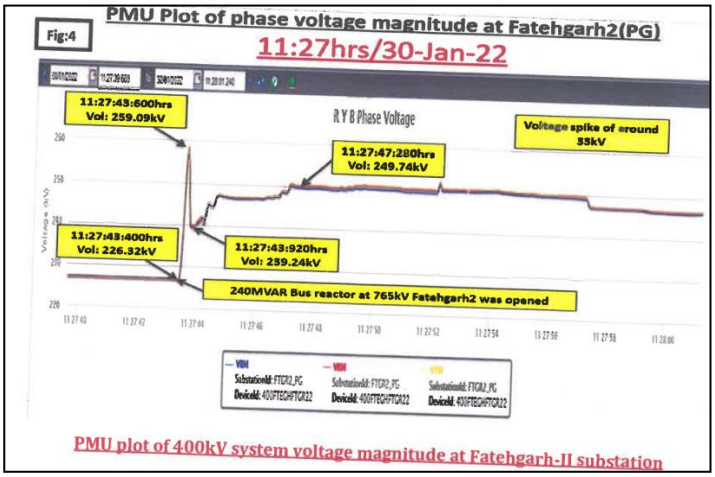
High Voltage Ride Through (HVRT)

Over voltage (p.u.)	Minimum time to remain connected (Seconds)
1.30 < V	0 Sec (Instantaneous trip)
1.30 ≥ V > 1.20	0.2 Sec
1.20 ≥ V >1.10	2 Sec
V ≤ 1.10	Continuous

In recent tripping of Jan & Feb 2022, it has been experienced that voltage at interconnection point was less than 1.1.p.u. (as per PMU data) and as per the HVRT compliance, there should not be any disconnection of solar generation. However, in all the events, partial or large number of solar generation loss occurred due to non-compliance of HVRT as one of the main reasons. For example, in one of the event (data & time), during opening/switching of 765kV, 240 MVAr Bus reactor at Fatehgarh-II PS (to manage voltage during peak solar in day time), a sudden voltage spike of about 33kV was observed from PMU data. Connectivity

diagram for 765/400/220kV Fatehgarh-II is enclosed in **Annexure-IX**. As per the data available at NRLDC and data shared by respective stations during this event, following are interpreted:

- As per CEA regulation, the solar generating station must remain connected to the grid upto 1.1 pu voltage level i.e. 242 kV in case of 220kV voltage bus. As per the disturbance records (DR) of Fatehgarh-II PS and other data, it seems that the solar/wind generators are not riding through the high voltage condition i.e. non – complaint to HVRT guidelines.
- In addition, at some of the stations, solar generators were disconnected from the system due to pessimistic low overvoltage settings at their end in 220 kV lines connecting the generators to ISTS (POWERGRID).
- Due to such 220kV line tripping and then consequent tripping of 220/33kV Transformers further aggravate the high voltage resulted in solar generation loss.
- During the incident, due to voltage rise, overvoltage protection operated in 765 kV Fatehgarh-II – Bhadla-II ckt-I and 400 kV Fatehgarh-II Fatehgarh-I (Adani) Ckt-I
- 765 kV Fatehgarh-II – Bhadla-II ckt-I: Voltage rise upto 825kV (Tripped on OV from Fatehgarh-2 (PG) end.
- 400kV Fatehgarh-II – Fatehgarh-I(Adani) Ckt-I: Voltage rise upto 432kV (Tripped on OV from Fatehgarh-I(Adani) end and DT received at Fatehgarh-II(PG) end



PMU plot of 400kV system voltage magnitude at Fatehgarh-II substation

*Based on the event analysis, RE generators are advised to review their protection settings so as to comply with HVRT requirement. NRLDC has communicated through email/letter (Annexure VII) to all RE for detail analysis and data sharing at Inverter and PPC end. Some of the RE generators shared the preliminary observations and analysis however, inverter level data has not been shared by any RE (Input given by RE is enclosed in **Annexure X**).*

The modelling data submitted by REs at point of registration and first time charging, is showing the HVRT & LVRT compliances which is in contradiction with real time events. In view of the above, off-line models also need to retune/corrected as per actual field data.

In this regard, Working Group consisting of CEA, CTU, POSOCO, SECI recommended the following:

The RE developer shall submit the final validated plant model of the implemented RE generating Station within 03 months of commissioning of all such additional equipment/parameter tuning/setting changes.

For active power/frequency control & reactive power/voltage control, reactive power capability, and power quality this model shall be validated through field measurements/on-site testing. Further, for LVRT and HVRT, the model shall be validated preferably against field test results. In case the same is not possible within prescribed time-frame, the plant model shall be validated against grid event, if any, after complete plant commissioning and same shall be included in the validation reports.

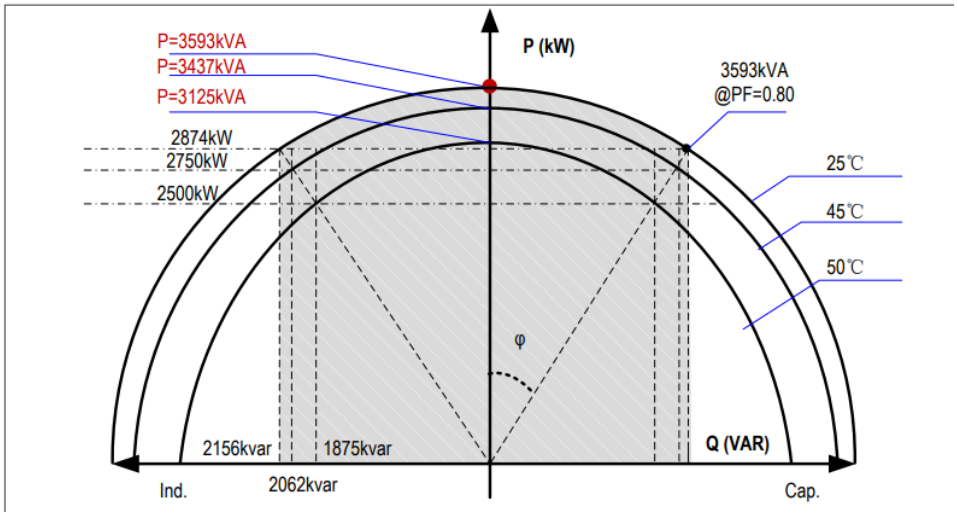
b. Dynamic varying Reactive power support in power factor range of +/- 0.95 lag and lead

RE generators are required to meet CEA (Technical standard for connectivity to the grid) regulation for supplying dynamically varying reactive power support so as to maintain power factor within limits of 0.95 lagging to 0.95 leading. Working Group consisting of CEA, CTU, POSOCO, SECI has also clarified that the RE generator should be able to demonstrate reactive power capability to operate at least up to 'V-curve' boundaries (0.95lag/lead level at the POI/PCC).

RE power is injected at unity power factor and **no reactive power support is available from solar generator bus at PCC/ISTS point**. Plot of voltage at all pooling station for Jan-Mar'22 is enclosed in **Annexure XI**.

At the time of registration and FTC, RE generators are submitting the reactive power capability of inverter at different design temperatures. Typical graph of capability curve of one of the invertors of 3.125 MVA @50^{o}C is shown below. The shaded area in the figure below shows the inverter's P-Q capability. So, RE plant are registering the installed capacity as 3.125 MW (considering unity power factor in design itself at invertor terminal). For example, 300 MW plant comprising of this invertor model would have 96 invertor.

Thus, if plant is generating at its peak i.e. at rated installed capacity of 300 MW, solar generator are operating at unity power factor and the station is operating at leading MVAr i.e. drawing MVAr from the grid during peak generation scenario. The reactive power requirement from the invertor terminal to Invertor duty transformer (600V to 33kV), 33kV cables, 33/220kV ICTs, 220kV lines to pooling station would be drawn by grid only.



Qmax : +2156Kvar, when the power factor is +0.8, at 25°C;
Qmin : -2156Kvar, when the power factor is -0.8, at 25°C;

As per CEA guideline, this generator of 300 MW should be capable of providing reactive power in the range of 33% (based on 0.95 power factor) of active power in both lag & lead at rated installed capacity i.e. ~ 90 MVAr (0.9373 MVAr per invertor) at PoI not at invertor terminal irrespective of temperature.

Following are the major operational issues:

i. Except winter, temperature in Rajasthan used to be greater than 40°C during day time. Thus, in design itself, RE invertor /generator don't have reactive capability at higher temperature at rated peak generation.

ii. As the temperature in Rajasthan area has already above 45°C, it is understood that reactive support margin (as required in line with CEA regulation) would reduce considerably. In such scenario, RE solar would mostly dependent on grid which would further aggravate the situation as there is no reactive margin left under any N-1 non-compliance at EHV pooling stations.

iii. During rated or maximum power generation only, reactive power drawn from the grid increases. All RE generators are advised to operate in voltage control mode however, most of the time invertor operating at unity power factor and plant as leading mode. After continuous follow up by NRLDC for voltage control mode, it has been observed that adequate reactive support is not available at hour of need.

iv. All RE solar used to draw reactive power during peak solar generation causing the low voltage at pooling station and any switching/tripping during such scenario are leading to inadvertent tripping/voltage fluctuations.

v. In Jan/Feb'22, there were numbers of tripping and solar generation loss in Rajasthan RE ISTS pooling stations, and it has been observed from the submitted data that inadequate reactive support attributes to such events.

In view of above, it is evident that adequate reactive support is required for normal operation as well as for stability under any switching/contingency.

Insufficient reactive support/margin during design itself are imposing a daily operational challenge. As such inverters would scale up in upcoming times, present experiences necessitates timely action of reactive planning (design temperature, LVRT/HVRT compliance, dynamic varying reactive power capability at 0.95 p.f at all points) for upcoming inverter (Inverters should have high capabilities for reactive support) integrating into the grid.

c. Injection of harmonics by wind/solar generators at injection point (Agenda by Power grid)

CEA Grid Standards stipulates a limit of current harmonic injections from RE plants as per IEEE 519 which is THD (Total Harmonic Distortion) of 1.5% and between 0.025% to 1% for individual harmonics.

Table 4—Current distortion limits for systems rated > 161 kV

Maximum harmonic current distortion in percent of I_L						
Individual harmonic order (odd harmonics)[a, b]						
I_{sc}/I_L	$3 \le h < 11$	$11 \le h < 17$	$17 \le h < 23$	$23 \le h < 35$	$35 \le h \le 50$	TDD
< 25[c]	1.0	0.5	0.38	0.15	0.1	1.5
$25 < 50$	2.0	1.0	0.75	0.3	0.15	2.5
≥ 50	3.0	1.5	1.15	0.45	0.22	3.75

[a]Even harmonics are limited to 25% of the odd harmonic limits above.

[b]Current distortions that result in a dc offset, e.g., half-wave converters, are not allowed.

[c]All power generation equipment is limited to these values of current distortion, regardless of actual I_{sc}/I_L.

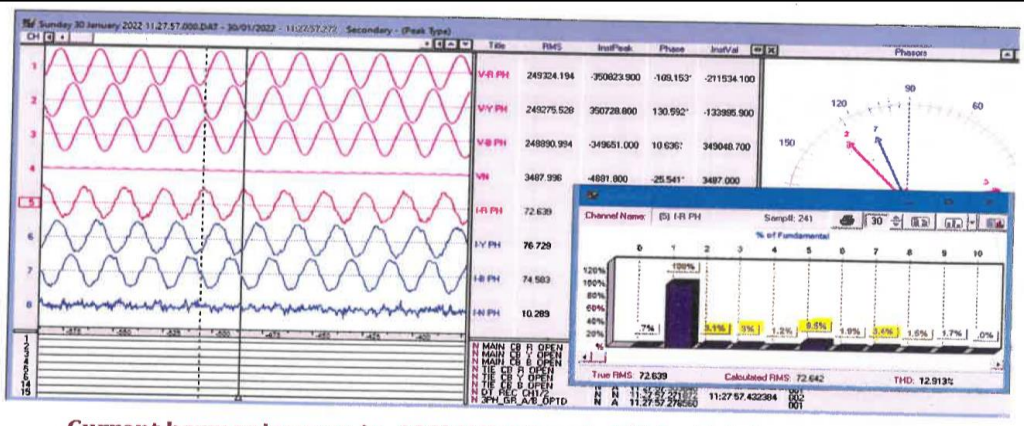
where

I_{sc} = maximum short-circuit current at PCC

I_L = maximum demand load current (fundamental frequency component) at the PCC under normal load operating conditions

The voltage generated by the wind and solar power sources contain harmonic content, which gets injected in the grid.

On analysis of the voltage and current data of Fatehgarh 1- Adani line, POWERGRID has observed that the individual harmonics are ranging in 3% to 9% as against the limit of 0.025% to 1% mentioned in the Standard. THD is around 7-13% as against the limit of 1.5%.



Current harmonics seen in 400kV Fatehgarh-1(Adani) Solar Generator

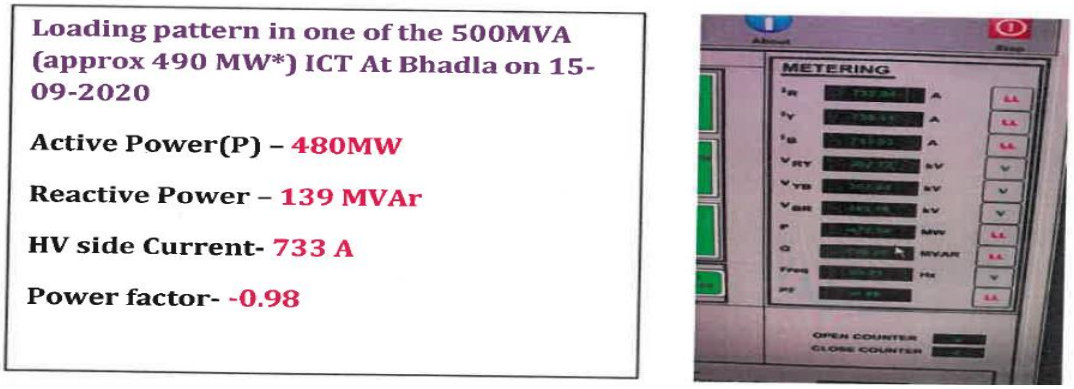
As per CEA technical Standards for connectivity to the Grid-2007 as amended, measurement of harmonic content, DC injection and flicker shall be done at least once in a year in presence of the parties concerned. However, no RE Generator has provided any such measurement report to CTU. Standard methodology may be taken into consideration for the measurement.

*NRDLC has also requested to all RE to submit the CEA compliances regarding harmonic vide letter dated 13.04.2022 (enclosed as **Annexure IIIII**)*

At 12:31 Hrs on Dated 20th-May-2022, 765kV Bhadla-Bikaner(PG) ckt-1 tripped on B-N phase to earth fault. At the same time, drop in solar generation of approx. 3014MW (Fatehgarh2 1578MW, Bhadla PG 1136 MW, Bhadla2 30 MW,Bikaner 270 MW) observed as per SCADA. After approx. 5 sec, 765kV Bhadla2-Fatehgarh2 ckt-1 tripped on over voltage. Further after approx. 5 sec, 765kV fatehgarh2-Bhadla ckt-1 also tripped on over voltage.

2. Review of Transmission Planning criteria for RE (N-0) to N-1 (agenda by NRLDC)

Continuous overloading of 400/220 kV Transformers at Bhadla in early stage of substation: The ICT in Bhadla substation generally run under full load condition. In the initial period after commissioning (2019) the 03 ICTs (approx. 1470 MW) were running in overloaded condition. Sometimes, the loading went upto 110% loading with all fans & pumps operational. A sample datapoint for loading is exhibited below.



On 22/11/2020 the 3 Nos ICTs were carrying approximately 1200 MW, incidentally ICT-II tripped and remaining ICTs carried load of about 600 MW each (more than 120% overload) for more than 02 hours.

After this incident rise in fault gasses were observed in ICT-I and ICT-III.

Dissolved gas analysis data of affected ICT-I and ICT-III is mentioned below:

Date	ICT	Gas Content									NEI (kJ/kL)	
		H2	CH4	C2H2	C2H4	C2H6	CO	CO2	CO2/CO	O2/N2	Oil	Paper
02/12/20	ICT-I	131	165	4.3	289	45	320	1118	3.49	0.16	2.16	2.96
16/11/20		68	06	0.9	146	27	332	1210	3.64	0.17	1.14	3.13
23/11/20	ICT-III	133	16	0	8	4	266	1187	4.46	0.14	0.11	2.8
22/08/20		90	13	0	7	3	254	1505	5.93	0.06	0.09	3.18

In Fatehgarh-II PS also similar loading levels are observed on 5 nos. 500 MVA ICTs. The overloading of transformers, variations in their loading throughout the day and heating/cooling cycle do affect the life of the transformer in the long run.

Therefore, it is proposed that high RE capacity Substations must have N-1 compliance at 400/220 kV level i.e. Fatehgarh-II (both sections)/Fatehgarh-III PS, Bhadla-II PS etc.for which revised transmission planning criteria must have suitable provisions.

POSOCO has always advocating the N-1 compliance of ICTs, lines for evacuation of bulk RE power reliably and safely.

In addition, bus sectionalization at pooling station should have arrangements such that sharing on ICTs loading on each bus remain commensurate with underlying RE connected generation and ICTs on each bus should be N-1 compliant. Recently, in NR, it has been observed that at 765/400/220kV Bhadla, bus sectionalization couldn't be utilized because of unequal sharing of load amongst ICTs. NRLDC has highlighted this issue vide NRLDC letter dated 26th April 2022 to CTU/CEA/PGCIL/NRPC, enclosed as ***Annexure-IVIII.***

Members may kindly deliberate.

*****

Annexure-I

Office of Chief Engineer
Power Purchase Agreement Directorate,
14th Floor, Shakti BhawanExtn.,
14-Ashok Marg, Lucknow –226 001
TeleFax:0522-2218812,
Email:ppare@uppcl.org

Letter No. 530./CE/PPA **Dated: - 30.04.2022**

To
The Member Secretary,
Northern Regional Power Committee,
New Delhi

Sub: UPPCL - CERC (Sharing of Inter State Transmission Charges and Losses) Regulations, 2020 Sharing of transmission charges in proportion to LTA — Wrongful inclusion of LTA for the assets owned by UPPTCL/UPPCL — reduction of LTA .

Sir,

Kindly refer to 52nd Meeting of Northern Regional Power Committee wherein matter related to exclusion of LTA quantum by CTU for calculation of transmission charges for UPPCL share of UCH stage-II (132 MW), UCH stage-III (66MW) & ROSA stage-II (300 MW) was raised by UPPCL. After deliberations following were decided in the meeting and same was recorded in MoM which was issued vide NRPC letter no उक्षेविस/वाणिज्यिक/209/आर पी सी (52वीं)/2022/2929–2976 दिनांक 21 अप्रैल, 2022 (Annexure-1) as follows:-

"A.4.13.. CTU clarified that at the time of planning, nowhere, it has been mentioned that no charges will be levied on UP. UP may approach CERC, if required.

A.4.13.. MS, NRPC stated that CTU may visit NRPC Sectt. along with all relevant documents on the matter for discussion. Accordingly, the agenda may be taken in upcoming NRPC meetings."

It was expected that the above matter would be taken up in the next 53rd NRPC meeting to be held in the month of April 2022. However as the Agenda circulated by NRPC of 53rd meeting on 21.04.2022, the same was not included. Hence, it is requested that the matter of exclusion of LTA quantum for calculation of transmission charges by CTU for UPPCL share in case of UCH stage-II (132 MW), UCH stage-III (66MW) & ROSA stage-II (300 MW) raised by UPPCL must be taken on priority.

Further, in order to substantiate UPPCL claim regarding exclusion of LTA quantum from Transmission charges charged by CTU in case of Rosa Stage-II, kindly refer to 27th meeting of the Standing Committee on Transmission System Planning of Northern Region held on 29th/30th May, 2009 at Nainital, Uttrakhand. The Minutes of subject meeting were issued vide Central Electricity Authority, Government of India letter no. 1/9/06-SP&PA dated 11.06.2009 (Annexure-2). In this regard kindly refer para no. 06 and para pertaining to conclusion made on the subject matter mentioned on page no. 30 & 31 of MoM, which is iterated below for your kind reference :-

"6. Long Term Open Access to Rosa Power Supply Company Limited for transfer of 600 MW from their Rosa Thermal Power Project (Stage II) located at Shahjahanpur, Uttar Pradesh.

Concluding the discussions following was agreed:

Long-term Open Access can be granted for 25 years subject to following:

- ***Long Term Open Access to Rosa Power Company shall be granted after the commissioning of following strengthening scheme:***
  - ***One ckt of Lucknow – Bareilly 765 kV line.***
  - ***Bareilly – Meerut 765 kV S/c***
  - ***Bareilly-Kashipur-Roorkee-Saharanpur 400 kV D/c (Quad conductor)***
- ***For connectivity of Rosa Power Plant with the grid the following was agreed :***
  - ***Rosa – Shahjahanpur 400 kV D/c***
- ***For supply of power to Uttar Pradesh, Rosa Power Company shall provide 400/220 kV ICTs of adequate capacity at Rosa switchyard, therefore ISTS charges for supply of power to Uttar Pradesh would not be applicable.***
- ***M/s Rosa Company would sign the requisite BPTA for Northern regional Transmission system charges for 300 MW (150 MW for Delhi & 150 MW for Haryana)."***

As clear from above that in the 27th meeting of the Standing Committee during Transmission System Planning of Rosa Power Supply Company Project (Stage-II), it was decided ***that no ISTS charges were applicable for supply of power from Rosa Power Company (Stage-II) to Uttar Pradesh***. Further, ***M/s Rosa Power Company would sign the requisite BPTA for Northern regional Transmission system charges for 300 MW (150 MW for Delhi & 150 MW for Haryana).*** However, as you are aware that later on Delhi and Haryana backed out to share 300 MW Generation of Power of Rosa Power Company. So LTA charges on this account must either by borne by Delhi/ Haryana or Rosa Power Company instead of being charged from UPPCL.

In view of above it is again requested that LTA of Rosa Power Company (Stage-II) for 300 MW must be excluded with immediate effect by CTU while submitting the Transmission charges bill to UPPCL. Further, in case of Uchchar-II & Uchchar-III, the matter must be taken up on priority in next NRPC meeting to avoid any financial loss to UPPCL.

Encl:- As above

Yours Faithfully,

(Deepak Raizada)
Chief Engineer (PPA)

No. /EIE & PC/ Dated: 2022

Copy forwarded to following for information necessary action:-

1. Secretary, Central Electricity Regulatory Commission, 4th Floor, Chanderlok Building, 36, Janpath, New Delhi- 110001.
2. Managing Director, U.P. Power Corporation Ltd., 7th Floor, Shakti Bhawan, Lucknow
3. Director (Market Operation), POSOCO, B-9 (1st Floor), Qutab Institutional Area, Katwaria Sarai, New Delhi -110016.
4. Director (Corporate Planning), U.P. Power Corporation Ltd., 7th Floor, Shakti Bhawan, Lucknow
5. Director (Commercial), U.P.Power Transmission Corp Ltd., 5th Floor, Shakti Bhawan, Lucknow
6. General Manager/ Commercial, Powergrid Corporation of India Ltd., "Saudamini" Plot No.2, Sector-29, Gurgaon-122 001.
7. Chief Engineer (E&RS), UPSLDC, Vibhuti Khand, Gomti Nagar, Lucknow.

Yours Faithfully,

(Deepak Raizada)
Chief Engineer (PPA)

Annexure-I

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 (52वीं)/2022/ 2929-2976 दिनाँक : 21 अप्रैल, 2022

सेवा में / To,

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

विषय: उत्तर क्षेत्रीय विद्युत समिति की 52वीं बैठक का कार्यवृत ।
Subject: 52nd meeting of Northern Regional Power Committee – MoM

महोदय / Sir,

उत्तर क्षेत्रीय विद्युत समिति की 52वीं बैठक दिनांक **31 मार्च, 2022** को **1200** बजे विडियो कोंफ्रेंसिंग के माध्यम से 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 52nd meeting of Northern Regional Power Committee (NRPC) was held at **1200 Hrs** on **31st March, 2022** via video conferencing. MoM of the same is attached herewith. The same is also available on NRPC Sectt. website (http://164.100.60.165/).

डायरी सं. 2523 दि. 27/4/22

भवदीय
Yours faithfully,

Naresh 21/4/22
(नरेश भंडारी)
(Naresh Bhandari)
सदस्य सचिव
Member Secretary

Er. R.N. Kushwaha EE
AM
27/04/22

18-ए, शहीद जीत सिंह मार्ग, कटवारिया सराय, नई दिल्ली- 110016 फोन:011-26513265 ई-मेल: ms -nrpc@nic.in वेबसाईट: www.nrpc.gov.in
18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110016 Phone: 011-26513265 e- mail: ms-nrpc@nic.in Website: www.nrpc.gov.in

Contents

states.

A.3.42 In 193rd OCC meeting held on 22.03.2022, forum decided that agenda may be taken up in next NRPC meeting for payment to CPRI.

A.3.43 Forum was requested to approve the payment of Rs. 14 Lakh excluding GST to CPRI (as per deliberations in 48th NRPC meeting).

A.3.44 Forum approved the proposal for payment of Rs. 14 Lakh (excluding GST) to CPRI.

A.4 Non-inclusion of LTA quantum for calculation of transmission charges for UPPCL share in UCH Stage-II (132 MW), UCH Stage-III (66 MW) & ROSA Stage-II (300 MW) (Agenda by UPPCL)

A.4.1 Forum was apprised that UPPCL vide letter dt. 11.03.2022 has informed that the issued was raised regarding wrongful charging of transmission charges against LTA of certain generators being done by CTU to UPPCL for Unchahar Stage-I, Unchahar Stage-II, Unchahar Stage-III, NAPP, TANDA Stage-II, and ROSA Stage-II.

A.4.2 CTU vide letter dt. 08.02.2022 acknowledged the issue raised by UPPCL and partially accepted the claim of UPPCL. CTU has intimated that NLDC may exempt deemed LTA quantum of UP from the computation of monthly transmission charges w.e.f. 01.11.2020 for UP quantum of share from Unchahar Stage-I, NAPP, and TANDA Stage-II as evacuation of UP's share powe projects was on Intra State Transmission System (UPPTCL).

A.4.3 However, the issue regarding Unchahar Stage-II, Unchahar Stage-III and ROSA Stage-II still remains un-resolved. Matter was discussed in 44th Commercial Sub-committee meeting, wherein CTU intimated that a letter shall be sent to UPPCL on the issue.

A.4.4 CTU vide letter dt. 07.02.2022 has refused the claims of UPPCL in respect of Unchahar Stage-II, Unchahar Stage-III and ROSA Stage-II as these generation projects were planned along with ISTS system.

A.4.5 UPPCL has highlighted that under previous CERC (sharing of Inter State Transmission Charges & Losses) Regulations 2010 regime, transmission charges were allocated based on usage of the transmission assets by the entities to draw their allocated power and were independent of LTA quantum. In the contrary the new sharing Regulation 2020, allocates the charges based on (LTA+MTOA) quantum irrespective of usage of ISTS assets. So, provisioning of LTA quantum with various DISCOM(s) needs a relook under new Regulations as any additional/ unwarranted inclusion of LTA quantum has undesirable effect on the concerned DISCOM.

A.4.6 Regulation 13(11) of Chapter 3 (SPECIFIC CASES) of CERC (Sharing of Intra State Transmission Charges & Losses) Regulation, 2020 may kindly be referred to:

'Where a generating station is connected to both ISTS and intra-state transmission system, only ISTS charges and losses shall be applicable on the quantum of Long-

term access and medium-term Open Access corresponding to capacity connected to ISTS'.

In this regard, it is to note that above clause mentions only ISTS charges & losses shall be applicable on the quantum of long-term access corresponding to capacity connected to ISTS. In above clause the word corresponding to capacity connected to ISTS is hereby being emphasized by UPPCL to lodge their claim.

A.4.7 It is to note that UCH-II, UCH-III and ROSA Stage-II are connected to both ISTS and Intra State Transmission system, but for evacuation of UPPCL share of generation in these 03 power stations no corresponding evacuation through ISTS lines is desired as Intra state transmission lines is sufficient for evacuation of UPPCL LTA share of these generators. It is to submit that the present ISTS lines of these generators is available for evacuation of power for other Inter-state shareholders of these generators. In such case UPPCL must not be billed & charged for transmission charges of such ISTS lines which are for evacuation of power for other state DISCOM(s).

A.4.8 Judgement order of CERC on petition no. 20 MP/2017 in matter of M/s Kanti Bijlee Utpadan Nigam Limited, New Delhi Vs CTU may be referred. In this the petitioner M/s Kanti Bijlee Utpadan Nigam Limited, New Delhi was seeking directions with regard to signing of the LTA agreement by the beneficiaries of the generating station of MGTS stage-II with the CTU along with issue of jurisdiction for schedule of the power from the generating station, non-applicability of PoC charges for the power scheduled to Bihar. In the subject r following:

"55. Considering the suggestions of ERPC, we are of the view that while computing schedules of Bihar from MTPS Stage-II, ISTS Charge and losses shall not be applicable on schedules of Bihar."

A.4.9 In view of above, UPPCL has requested that necessary instruction may kindly be issued for non-inclusion of LTA quantum for calculation of transmission charges for UPPCL share in case of UCH stage-II (132 MW), UCH stage-III (66MW) & ROSA stage-II (300 MW).

A.4.10 In the meeting, CTU representative stated that the request of UPPCL was considered as per methodology finalized in SR (Southern Region) Sub-Committee and reply letters were issued accordingly.

A.4.11 UP representative stressed that this is a case of change of law. Under previous CERC (sharing of Inter State Transmission Charges & Losses) Regulations 2010 regime, transmission charges were allocated based on usage of the transmission assets by the entities to draw their allocated power and were independent of LTA quantum. In contrary, the new Sharing Regulations 2020 allocates the charges based on (LTA+MTOA) quantum irrespective of usage of ISTS assets.

A.4.12 UP highlighted that intra state transmission lines are sufficient for evacuation of UPPCL LTA share. Moreover, in case of ROSA, the full share of power is being drawn by UPPCL and the ISTS system was initially developed for evacuation of power to Haryana DISCOM which later backed out to sign PPA/TSA with ROSA.

A.4.13 CTU clarified that at the time of planning, nowhere, it has been mentioned that no charges will be levied on UP. UP may approach CERC, if required.

A.4.14 MS, NRPC stated that CTU may visit NRPC Sectt. along with all relevant documents on the matter for discussion. Accordingly, the agenda may be taken in upcoming NRPC meetings.

A.5 OPGW installation on two nos. of existing lines which are to be LILOed at new Dausa substations under TBCB project (Agenda by CTUIL)

A.5.1. Forum was apprised that New Dausa substation is proposed to be established under TBCB project under the bid d *Transmission system for evacuation of power from REZ in Rajasthan (20GW) under phase-III – Part-H'* by LILOing the following two existing lines:

a. 765kV D/c (2xS/c) Jaipur (Phagi) (RVPNL) – Gwalior line (312 kms.)

b. 400kV D/c Agra – Jaipur (South)(PG) line (254 kms.)

A.5.2. As OPGW is not available on the both of the above two nos. existing lines, CTUIL has proposed a scheme for OPGW installation by replacing one no. of earth wire on the following lines along with terminal equipment to provide data & voice connectivity of New Dausa S/s:

a. 765kV S/c Jaipur (Phagi) (RVPNL) – Gwalior line (312 kms.) (Ckt-1 is proposed)

b. 400kV D/c Agra – Jaipur (South)(PG) line (254 kms.)

A.5.3. In line with MoP office order no. 15/03/2017-Trans-Pt(1) dated 09.03.2022 regarding "Planning of Communication System for Inter-State Transmission System - for Category (B) a Communication clause 5 for Schemes/Packages proposed by CTUIL for upgradation /modification of existing ISTS Communication System shall be put up to RPCs for their views. RPCs to provide their views on the Scheme/Packages proposed by CTUIL within 45 days of receipt of the proposal from CTUIL.

A.5.4. Clause 5 of the Category (B) is stipulated below:

"Communication Schemes/Packages proposed modification of existing ISTS Communication System, standalone projects, adoption of new technologies shall be put up to RPC for their views. RPC to provide their views on the Scheme / Packages proposed by CTUIL within 45 days of receipt of the proposal from CTUIL."

A.5.5. In consideration of above, views of NRPC forum was solicited so that the scheme may be taken up for consideration in the NCT meeting along with the views of NRPC.

A.5.6. In the meeting, CTU representative stated that OPGW may be installed for both sides of LILO portion. Timeline will also match with TBCB project.

A.5.7. NRLDC representative stated that TeST committee has already decided that OPGW from Phagi to Dausa and Dausa to Jaipur (South) would suffice the purpose as Dausa will get connection to Jaipur (Phagi), Jaipur (South) and Beawar.

Annexure-2

Central Electricity Authority
Government of India
System Planning & Project Appraisal Division
Sewa Bhawan R K Puram,
New Delhi -110066

No.1/9/06-SP&PA/ Dated: 11.06.2009

-As per List enclosed-

Sub: Minutes of the 27th meeting of the Standing Committee on Transmission System Planning of Northern Region held on 30th May, 2009 at 1000 Hrs. in Nainital, Uttarakhand.

Sir,

Please find enclosed the minutes of the 27th meeting of the Standing Committee on Transmission System Planning of Northern Region held on 30th May, 2009 at 1000 Hrs in Nainital, Uttarakhand. This is for your kind information and further necessary action at your end please. **The minutes is also be available on CEA website under PS wing/standing committee meeting/NR.**

Yours faithfully

(Naresh Bhandari)
Director (SP&PA)

- Bareilly-Kashipur–Roorkee–Saharanpur 400 kV D/c (Quad conductor)

– Lanco Hydro Energies Private Limited would coordinate with PTCUL for implementation of transmission system within the state of Uttarakhand.

6. Long Term Open Access to Rosa Power Supply Company Limited for transfer of 600 MW from their Rosa Thermal Power Project (Stage II) located at Shahjahanpur, Uttar Pradesh

Powergrid stated that an application dated 26/08/2008 has been received from M/s Rosa Power Supply Company Limited seeking Long-term Open Access for transfer of 300 MW power from Stage-II (2x300 MW) of Rosa Power Project located at Shahjahanpur, U.P. Out of 600 MW power, 300 MW power is allocated to Uttar Pradesh and balance 300 MW is to be distributed between Delhi(150 MW) and Haryana(150 MW). The Long Term Open Access has been sought for the power which is to be transmitted outside the state for 25 years.

Member (PS) enquired about the commissioning schedule of the Rosa generation project. Representative from Rosa Power Company informed that Unit-1 of Rosa stage-II is scheduled to be commissioned by December 2011 and Unit-2 by March 2012.

Powergrid informed that the margins available in Lucknow – Shajahanpur – Bareilly – Mandaula 400 kV (Quad) corridor and Lucknow – Bareilly – Meerut 765 kV transmission corridor would be adequate for transfer of additional 300 MW power.

RRVPN submitted that the LTOA of Tapovan Vishnugadh, Rambara, Phatabyung and Rosa all are being linked to this strengthening and 765 kV system of North Karanpura and wanted to reconfirm about the requirement of strengthening scheme. Powergrid explained that the total power transfer due to LTOA would be about 800-900 MW and margins available in Lucknow– Shajahanpur – Bareilly – Mandaula 400 kV (Quad) corridor and Lucknow – Bareilly – Meerut 765 kV transmission line shall be adequate for transfer of this power.

Member (PS) enquired about the time frame of Shahjahanpur 400 kV substation of Powergrid. Powergrid informed that land for the substation has already been identified the fesibility report is under preparation. Member (PS) stated that Powergrid should expedite the works to complete the Sahajahanpur substation by the time frame of the generation.

Concluding the discussions following was agreed:

Long-term Open Access can be granted for 25 years subject to following:

- Long Term Open Access to Rosa Power Company shall be granted after the commissioning of following strengthening scheme:
  - One ckt of Lucknow – Bareilly 765 kV line
  - Bareilly – Meerut 765 kV S/c
  - Bareilly-Kashipur–Roorkee–Saharanpur 400 kV D/c (Quad conductor)

- For connectivity of Rosa Power Plant with the grid the following was agreed :
  - Rosa- Shahjahanpur 400 kV D/c

- For supply of power to Uttar Pradesh, Rosa Power Company shall provide 400/220 kV ICTs of adequate capacity at Rosa switchyard, therefore ISTS charges for supply of power to Uttar Pradesh would not be applicable.

- M/s Rosa Power Company would sign the requisite BPTA for Northern regional Transmission system charges for 300 MW (150 MW for Delhi & 150 MW for Haryana).

7. Long-Term Open Access to Shri Bajrang Power & Ispat Ltd. for transfer of 22.5 MW power from Rupin HEP (45 MW) located in Himachal Pradesh

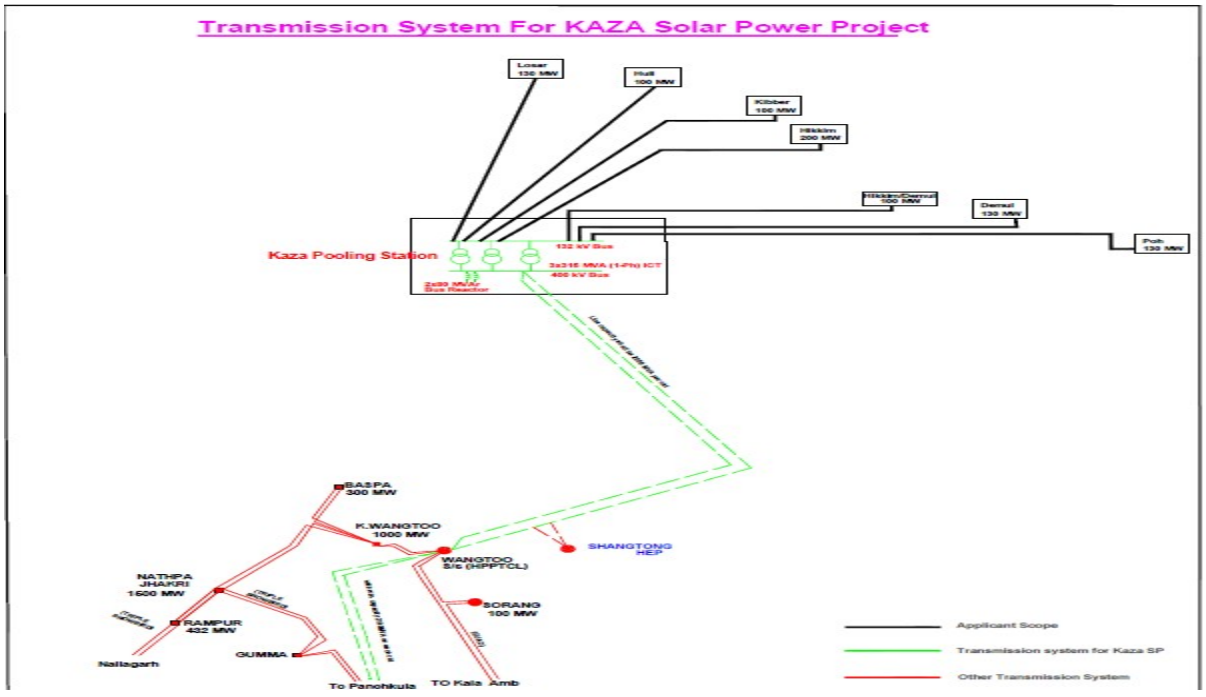
Powergrid informed that Shri Bajrang Power & Ispat Ltd. vide letter dated 18.12.2008 has applied for long term Open Access in inter-state transmission system for transfer 22.5 MW of power from the proposed Rupin hydro power plant to be set up in Himachal

4.8. Transmission system for evacuation of power from Kaza Solar Power Project (880 MW)

4.8.1. SJVN is developing a Solar power park (880 MW) in Lahul & Spiti (Kaza) in Himachal Pradesh. SJVN is also granted Stage-I connectivity in this regard. In the 4thNRPC (TP) meeting held on 05.10.21, Transmission system to provide connectivity to Kaza Solar Power Project was discussed & agreed. It was also decided that for transfer of power beyond Wangtoo S/s (HPPTCL), a high-capacity corridor would be planned.

4.8.2. In the 6th NCT meeting held on 29.10. 2021, the scheme was recommended to MoP for implementation through TBCB route. However, the scheme was not sent MoP as CTU vide its e-mail dated 9.12.2021 has suggested some modification in the scope as well as has suggested additional line for further evacuation of power beyond 400kV Wangtoo S/s. A Joint Study Meeting was held on 24.12.2021 with CEA, POSOCO, HVPN, PTCUL, HPPTCL, UPPTCL and other STUs of Northern Region by CTU to finalize the transmission system for evacuation of power from Kaza Solar Power Project (880MW) beyond Wangtoo. In the above Joint study meeting, various transmission alternatives were deliberated and 400kV Wangtoo-Panchkula D/c line (Twin HTLS) was selected as preferred transmission alternative for evacuation of power beyond Wangtoo S/s. Connectivity of existing 400/220kV Wangtoo (HPPTCL) S/s includes 400kV D/c interconnection with Kala Amb (PG). 400kV Wangtoo S/s is also interconnected to Karcham Wangtoo S/s through 400kV D/c line.

4.8.3. The revised scheme has been discussed in the 2nd Consultation Meeting for Evolving Transmission Schemes in Northern Region (CMETS-NR) held on 29/12/2021 as well as 50th NRPC held on 28.01.2022, wherein transmission scheme comprising connectivity and evacuation system for Kaza Solar-park was agreed.NRPC has opined that in view of higher transmission cost of about Rs 2.5 Cr/MW for proposed scheme, CTU may take up with NCT for Govt. budgetary support/grant for the transmission scheme so as to rationalize transmission charges on the consumers. Transmission scheme for evacuation of 880 MW power from Kaza Solar Park is as shown below:



4.8.4. Director, MoP enquired whether any Battery Energy Storage System has been considered while planning evacuation of power from Kaza Solar park to optimise the transmission requirement. CTU clarified that the system being proposed is the minimum system required for evacuation of power and incorporation of BESS in the present case would not result in any further optimisation.

4.8.5. CEA informed that while the estimated cost of the scheme submitted along with the proposal by CTU was Rs 2135 Crore (March 2020 PL), however, CTU vide its email dated 22.03.2022 has conveyed the revised cost of Rs 3152 Crore based on September, 2021 PL. Also, NRPC while approving the scheme in its 50thmeeting held on 28.01.2022 has opined that in view of higher transmission cost of about Rs 2.5 Cr/MW (2135 crores for evacuation of 880 MW power) for proposed scheme, CTU may take up with NCT for Govt. budgetary support/grant for the transmission scheme so as to rationalize transmission charges on the consumers. With the revised cost of Rs. 3152 crores intimated by CTU, transmission cost would be about 3.6 Cr/MW and the same needs to be apprised again to NRPC.

4.8.6. NCT requested MoP/MNRE to consider the case for Govt. budgetary support/grant as has been done in case of Transmission system for evacuation of RE power from renewable energy parks in Leh.

4.8.7. Regarding the increase in cost CTU clarified that change in the estimated cost of the scheme is on account of increase in the base cost of per km transmission line and equipments (appx 50 %) on account of change in Price Level . The basis of the equipment and per km cost is the Cost Matrix of PGCIL which is made available to the Cost Committee by PGCIL.

4.8.8. NCT members agreed that technically the scheme can be recommended for approval to MoP, As the estimated cost of the scheme is beyond 500 crores, NCT recommended the scheme to MoP for implementation through TBCB route.

S.no	Name of the scheme/est. cost	Decision of NCT	Purpose /Justification
1	Transmission system for evacuation of power from Kaza Solar Power Project (880 MW) Est Cost: Rs 3251 Crore **Implementation Timeframe**: Matching with Kaza Solar Park i.e. Mar' 2024	• Recommended to MoP • Implementation through **TBCB** mode • CTU to intimate NRPC regarding increase in the estimated cost of the scheme.	To provide connectivity to Kaza Solar Power Project (880 MW) being developed by SJVNL along with further transfer of power beyond Wangtoo S/s (HPPTCL)

Detailed scope of the scheme is as given below:

Transmission system for evacuation of power from Kaza Solar Power Project (880 MW)

Sl.	*Scope of the Transmission Scheme*	*Capacity /km*
1.	Establishment of 3x315 MVA (10x105 MVA single phase units including one spare) [$] 400/132kV Kaza PS (GIS) alongwith 2x80 MVAr (420kV) Bus Reactors at Kaza PS Future Scope at Kaza Pooling Station: Space provision for: i. 5 nos. of 132 kV line bays for future projects[#] ii. 2 nos. of 400/132 kV Transformers	315MVA, 400/220kV ICT: 3 nos. (10x105 MVA including 1 spare ICT) 400kV ICT bays: 2 nos. 132kV ICT bays: 2 nos. 400 kV GIS Line Bays: 2 nos. 420 kV, 80 MVAr Bus Reactor- 2 420 kV Bus Reactor bay- 2 no.
2.	Kaza-Wangtoo (HPPTCL) 400 kV D/c (Quad) line^	197 km
3.	2 no. of 400kV line bays at Wangtoo S/s (HPPTCL)for termination of Kaza-Wangtoo (HPPTCL) 400 kV D/c (Quad) line	400 kV Line Bays- 2 nos.
4.	1x80 MVAR switchable line reactor on each circuit at Kaza end of Kaza- Wangtoo 400 kV D/c line	420 kV, 80 MVAr SLR- 2 Line Reactor bay – 2 nos.
5.	Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c (Twin HTLS*) Line along with 80 MVAr switchable line reactor at Panchkula end at each circuit-210 Km	210 km 400 kV Line bays- 4 nos. (2 at Wangtoo and 2 at Panchkula) 420 kV, 80 MVAr SLR- 2 Line Reactor bay – 2 nos.

^Line capacity shall be 2500 MVA per circuit at nominal voltage

[$] *In case of transportation constraints, 5x200 MVA ICTs (16x66.67 MVA, 1-phase unit including one spare unit) shall be considered*

[#] *132 kV line bays (9 Nos.) at Kaza PS for termination of lines from 7 pockets of solar projects of SJVNL shall be under applicant scope for implementation. Space provision to kept additionally for above 9 nos. bays.*

** with minimum capacity of 2100 MVA on each circuit at nominal voltage*

Note:

(i) HPPTCL to provide space for 400 kV line bays at Wangtoo S/stn for termination of Kaza-Wangtoo (HPPTCL) 400 kV D/c (Quad) line and Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c

(ii) PGCIL to provide space for 400 kV line bays at Panchkula S/s alongwith SLR for termination of Wangtoo (HPPTCL) - Panchkula (PG) 400 kV D/c

(iii) The line lengths mentioned above are approximate as the exact length shall be obtained after the detailed survey

(iv) The schedule of implementation would be matching with Kaza Solar park.

5. Space allocated at ISTS substations in ER to STUs for new intra-state lines.

5.1.1. CTU informed that space has been allocated to State Transmission Utility for line bays at ISTS substations in Easter Region for termination of new transmission lines by STU under intra-state scheme. The same has been deliberated in the 1st Consultation Meeting for Evolving Transmission Schemes in Eastern Region held on 25-11-2021 and the details are given below:

(a) Angul 765/400kV (POWERGRID) S/s: Space for 2 no. of new 765kV lines bays has been allocated to OPTCL (Odisha) for implementation of Angul (POWERGRID) – Paradeep (OPTCL) 765kV D/c intra-state line (including suitable switchable line reactors).

(b) Rourkela 400/220kV (POWERGRID) S/s: Space for 2 no. of new 220kV lines bays has been allocated to OPTCL (Odisha) for implementation of 2nd Rourkela (POWERGRID) – Tarkera (OPTCL) 220kV D/c intra-state line.

(c) Keonjhar 400/220kV (POWERGRID) S/s: Space for 2 no. of new 220kV lines bays has been allocated to OPTCL (Odisha) for implementation of Keonjhar (POWERGRID) – Tikarpada (OPTCL) 220kV D/c intra-state line.

NCT noted the same.

6. ISTS Network Expansion scheme in Western Region & Southern Region for export of surplus power during high RE scenario in Southern Region: The scheme has been proposed by CTU to cater to export requirement from SR under high RE scenario as well as to mitigate operational constraints being faced on Kolhapur – Kolhapur(MSETCL) 400kV D/c line under real-time as elaborated below:

(i) NLDC as part of operational feedbacks has highlighted the high loadings on transmission lines beyond Kolhapur (i.e. Kolhapur (PG)-Kolhapur(MH) 400kV D/c line, Kolhapur(MH)-Karad 400kV D/c line) which is attributable to multiple factors viz. high generation at Kudgi TPS, low generation at plants in southern Maharashtra, high load around Kolhapur area, high renewable generation in Southern Region etc. In addition, number of large RE based generation projects are envisaged in Southern Region especially in the prioritized REZs of Koppal, Gadag, Karur and Tuticorin areas. Stage-II Connectivity and LTA have already been granted to number of generation projects in these areas.

(ii) Transmission system for integration and immediate evacuation of power from these REZs has already been planned and is under different phases of implementation. However, constraints are observed for export of surplus power from REZs in Southern Region to Western Region under high RE scenario in SR.

Annexure-III

TATA POWER-DDL

TPDDL/NRPC/13052022 Date: - 13/05/2022

To,

Member Secretary,
Northern Regional Power Committee
18-A, Qutab Institutional Area,
Shaheed Jeet Singh Marg,
Katwaria Sarai, New Delhi-110 016

Kind Attn: Mr. Naresh Bhandari

Subject: Scheduling and settlement of URS power (agenda by TPDDL)

Reference: Supplementary Agenda for 51st meeting of Northern Regional Power Committee dated 23.02.2022

Dear Sir,

We write in reference to the above mentioned agenda of 51st meeting of Northern Regional Power Committee (NRPC) wherein TPDDL has raised the issue of requirement of timely URS settlement which is done after issuance of final REA by NRPC.

The issue raised by TPDDL in 51st meeting of NRPC is again reproduced herein for reference:-

"AA.2 Scheduling and settlement of URS power (agenda by TPDDL)

AA.2.1 Scheduling of URS power is a regular practice in day-to-day power scheduling and dispatch; however, financial settlement of the same is not being done in a time bound manner. As per the information available in the public domain, it is given to understand that details of state wise URS power is provided in the final Regional Energy Account and subsequently the credit is passed on to the beneficiaries. In case the final REA is issued by RPC with a delay, then URS power settlement is also delayed.

AA.2.2 To overcome the above deficiency, it is proposed that timelines of issuance of Final REA by RPC's should be revisited and strict timelines should be defined/followed for the same, failing which provision of carrying cost/interest should be incorporated to offset the financial losses suffered by the beneficiary on account of delay in receipt of URS credit. It is also suggested that details of power scheduled under URS be incorporated in provisional REA, if possible, to expedite the settlement process.

AA.2.3 Procedure/timelines should be issued for issuance of URS credit/debit within the state boundary and to be followed by state load dispatch centres so as to ensure that URS settlement within intra-state entities is done in a time bound manner. "

During the 51st NRPC meeting, TPDDL was advised to raise the issue in next NRPC Commercial Sub-committee meeting. It may however be noted that there is no notice issued for the next Commercial Sub-Committee meeting.

We would take this opportunity to indicate that a *"Procedure for finalization of Regulatory Accounts"* was deliberated in 33rd Committee Sub Committee meeting held on 28th July'2017 and the same was approved in 40th NRPC meeting held on 28th October'2017. Please find enclosed the minutes of meeting of the 40th meeting of Northern Regional Power Committee dated 11th Jan'2018 which indicate that the final REA has to be issued by (D+15+7+7)th day, D being the date of issuance of the Provisional REA. Hence, the timelines for the issuance of REAs in question will be as below:

Month	Date of Issuance of Provisional REA (D)	Date of Issuance of Final REA as per NRPC guidelines (D+29)	Status of Issuance of Final REA
Nov-21	02-Dec-21	31-Dec-21	Not issued Till date
Dec-21	03-Jan-22	01-Feb-22	Not issued Till date
Jan-22	04-Feb-22	05-Mar-22	Not issued Till date

In our view, Tata Power-DDL is within its rights to claim interest charges @ 1.5% per month (in line with CERC Tariff Regulations'2019) from the (D+29) date as above till the actual date of payment from the beneficiaries which utilized the energy paid for by Tata Power- DDL as per the Provisional REAs dated 2nd Dec'21,3rd Jan'22 & 4th Feb'22 issued by NRPC. Please include such direction from NRPC to these beneficiaries to pay such interest charges.

On this basis, we request you to consider the issue of URS power settlement in the next NRPC meeting scheduled on 30th/31st May'2022 in the event commercial subcommittee meeting is not taking place before 30th/31st May'2022.

Thanking You,
For **Tata Power Delhi Distribution Ltd.**

Peyush Tandon
Chief (Regulatory, Legal & Power Management)

Enclosures:-

1. Relevant extracts of minutes of meeting of the 40th meeting of Northern Regional Power Committee dated 11th Jan'2018.

Annexure-IV

Statewise transmission adequacy

Sl.NO.	Name of the state	Antecedent condition	Likely constraints	Future element to relieve constraints		Executing agency	Details of SCM/plan/forum	Date of approval	Expected date of commissioning	if delayed from SCOD, Reason	Revised expected date of commissioning	Other reason
1	Punjab	Demand >13500MW; Import >8000MW	N-1 non-compliance of 400/220kV ICTs at Rajpura, Nakodar, Ludhiana. High loading of 220kV lines such as 220kV Amritsar-Verpal D/C, 220kV Dhuri-Sunam D/C, 220kV Rajpura-Gobindgarh D/C, 220kV Ludhiana-Laltokalan and 220 kV Jalandhar-Kartarpur	ISTS	PGCIL has conveyed that augmentation of 1 No. 315 MVA ICT with 500 MVA ICT will be completed before May-2022 by shifting of 500 MVA ICT lying spare at Malerkotla to Ludhiana.	POWERGRID	On request basis		Commissioned	NA	NA	
				Intra State	500MVA ICT at Rajpura	PSTCL	3 NRSCT held on 24.05.2019		28.05.2022	NA	NA	
					Augmentation at Nakodar from 2*315MVA to 2*500MVA. Tenders for augmentation of 2 No. 315 MVA ICTs with 500 MVA ICTs have been received and the same are under evaluation.	PSTCL	Nakodar- 3 NRPCTP held on 19.02.2021		May-23	NA	NA	Presently, to make 2 No. 315 MVA ICTs N-1 complaint, the loading of these ICTs will be controlled by shifting of Kartarpur load to Jalandhar PGCIL(presently running from Nakodar ICTs) after augmentation of Kartarpur-Jalandhar PGCIL line with HTLS conductor. Note: The tendering process for HTLS work is completed. DPR with respect to proposal No. 285 stands submitted to NLDC(POSOCO) for PSDF
					220kV Rajpura-Gobindgarh D/C. DPR with respect to proposal No. 301 already submitted to NLDC(POSOCO) for augmentation of these transmission lines with HTLS. Enquiry raised by TESG (Techno Economic Sub Group) has been replied. Work will be done after sanction of PSDF.	PSTCL	NA	NA	NA	NA	NA	220 KV Amritsar - Verpal D/C. To reduce the loading of Amritsar - Verpal D/C, shifting of load of 220 KV Patti Substation (presently being fed from Verpal) to PGCIL Amritsar directly has been planned. 1 No. 220 KV spare bay at Amritsar (PGCIL) is available for terminating 1 No. circuit. For termination of 2nd circuit, the new bay will be constructed by PGCIL as discussed in 4th meeting of NRPC(TP).
					220 KV Jalandhar - Kartarpur. DPR with respect to proposal No. 285 stands submitted to NLDC(POSOCO). Funding to be expedited.	PSTCL	NA	NA	Jun-22	NA	NA	
2	Haryana	Demand >11000MW; Import >8000MW	N-1 non-compliance at 400/220kV Deepalpur, Kurukshetra and Panipat ICTs. High loading of 220kV Hisar-HisarIA	ISTS	500MVA ICT at Kurukshetra. (Awarded to POWERGRID under RTM) HVPN & POWERGRID to plan & implement SPS at Kurukshetra(PG) till commissioning of additional ICT.	PGCIL	4 NRPCTP held on 05.10.2021		Feb-23	NA	NA	
				Intra State	500MVA ICT at Deepalpur. HVPN to plan & implement SPS at Deepalpur till commissioning of additional ICT.	HVPNL	4 NRPCTP held on 05.10.2021		NA	NA	NA	SPS implemented at 400/220kV Deepalpur
3	UP	Demand>24000MW; Import >13000MW	N-1 non-compliance at 400/220kV Sohawal(PG), Tanda, Lucknow(PG), Sarnath, Azamgarh, Gorakhpur(UP) ICTs .	ISTS	500MVA ICT at Sohawal. POWERGRID to expedite commissioning of ICT. UPPTCL and POWERGRID to expedite installation of SPS at Sohawal(PG) and Lucknow(PG).	PGCIL	3 NRPCTP held on 19.02.2021		Mar-23	NA	NA	
				Intra State	Capacity augmentation at Gorakhpur(UP) from 1055MVA to 1315MVA	UPPTCL	Meeting between CEA, CTU, POSOCO held on 31.12.2021 (Gorakhpur		NA	NA	NA	
				Intra State	400/220kV S/s at Machhalishahr (Jaunpur)	UPPTCL	4 NRSCM held on 25.07.2019		Jun-22	NA	NA	
				Intra State	. 400/220kV Basti substation likely to ease constraints at Sohawal & Tanda (400kV commissioned, 220kV expected to be commissioned in Jan'2022)	UPPTCL	40 NRSCM held on 20.06.2018		Commissioned	NA	NA	
		Generation evacuation from Bara TPS	Bara TPS (1980MW) evacuation only through 765kV Bara-Mainpuri ckt2 and one 765/400kV Bara ICT. N-1 non-compliant under outage of 765kV Bara-Mainpuri ckt2.	Intra State	Commissioing of 765kV Bara-Mainpuri ckt1 and 2nd 765/400kV Bara ICT	UPPTCL	26 NRSCM held on 13.10.2008		Jun-17	Executing Company under insolvency process	NA	SPS is implemented at Bara TPS which trips one unit at Bara TPS under N-1 contingency of 765kV Bara-Mainpuri ckt2 to avoid complete generation loss
4	Rajasthan	Demand>13000MW; Import >6000MW	N-1 non-compliance at 400/220kV Ajmer, Bikaner, Bhinmal, Merta, Jodhpur, Chittorgarh ICTs. Severe low voltages at Hindaun & Alwar (340-350kV). High loading of 400kV Anta-Kota. High loading of 220kV Bassi-Dausa, 220kV Sikar-Sikar, 220kV Kankroli-Kankroli	ISTS	Rajasthan STU has submitted proposal to CEA/ NRPC for LILO of 400kV Agra-Sikar at 400/200kV Alwar substation.	RRVPNL	In 3 NR-CMTES held on 28.01.2022, CTU requested RVPN to revert back on their management decision for implementation of above scheme as Intra state along with the implementation schedule as well as arrangement for communication redundancy. RVPN agreed for the same					NA	
				Intra State	Feedback related to transmission issues shared by POSOCO with CEA/CTU through operational feedbacks & regularly discussed in OCC meetings. Rajasthan STU to expedite planning of ICT capacity augmentation at these stations with CTU/CEA and implement SPS till commissioning of additional ICTs	NA	Telephonically informed by Rajasthan STU that additional ICT capacity has been approved at Bikaner, Ajmer, Merta and Jodhpur.				NA	

5	Delhi	Demand >7000MW; Import >6000MW	N-1 non-compliance of 400/220kV ICTs at Mundka and Bamnauli	ISTS	400/220kV S/s Dwarka by LILO of 400kV Bamnauli-Jhatikara S/C	PGCIL	34 NRSCT held on 08.08.2014		Commissioned			Load loss and interruption of DMRC supply observed in few instances in 2021 Delhi to implement SPS at constrained ICTs such as Mundka before summer 2022. Loading of 400/220kV Bamnauli expected to reduce with commissioning of 400/220kV Dwarka and underlying network. 400/220kV ICTs and underlying network at Dwarka & Gopalpur would also create margins at 400/220kV Mundka as informed by DTL representative
				Intra State	Presently, only two ICTs available at 400/220kV Mundka. Loading was above N-1 contingency limit even with three ICTs during summer 2021, leading to load loss including interruption of supply to DMRC. DTL to expedite revival of ICTs under outage. Commissioing of	DTL	One 315MVA ICT shifted from Bamnauli. SPS has also been commissioned at 400/220kV Mundka S/s.			NA	NA	
				Intra State	400/220kV Gopalpur substation under construction by LILO of under commissioing 400kV Bawana-Maharanibagh D/C.	DTL	39 NR SCM held on 29,30 May 2017		NA	NA	NA	
6	J&K and Ladakh U/Ts	Import >2000MW	400/220kV Amargarh ICTs, High loading of 220kV lines from Wagoora & Sambha	ISTS	400/220 kV, 2x315 MVA S/S at Siot	NA	3 NRPCTP held on 19.02.2021		Mar-24	NA	NA	
				ISTS	Addition of new 1x315 MVA(or 1x500 MVA if possible), 400/220kV ICT at Amargarh. CTU & POSOCO to discuss early commissioining of ICT with JKPDD	STERLITE	3 NRPCTP held on 19.02.2021		Apr-26	NA	NA	Underlying 220kV network at New Wanpoh (D/C lines to Alusteng, Mattan New) needs to be expedited to utilise vacant bays and relieve ICT & line loadings in Kashmir valley
				Intra State	Commissioing of 220kV Wagoora-Budgam-Ziankote	JKPDD	NA	NA	Dec-19	ROW issues at various locations delaying the project	NA	
					Reconductoring of 220kV Wagoora-Ziankote D/C by HTLS.	JKPDD	Approved by administrative council in Jul'2021		NA	NA	NA	
7	HP	Import>1300MW	High loading of 400/220kV Nallagarh ICTs High loading of 220kV Nallagarh-Upernangal D/C and 220kV Hamirpur-Hamirpur D/C	ISTS	HPPTCL is carrying out studies and shall approach for augmentation at Nalagarh after detailed analysis	NA	NA	NA	NA	NA	NA	400/220kV Nallagarh also has 220kV lines to Mohali & Chandigarh, i.e. Punjab, HP and Chandigarh are all drawing power from 400/220kV Nallagarh. Presently, loading remains just below but close to N-1 contingency limit.
				Intra State		NA	NA	NA	NA	NA	NA	
		Generation evacutation from SHEP and Bajoli Holi	400kV Lahal-Chamera Pool D/C	Intra State	Line is delayed due to Covid & forest clearance issues as informed telephonically.	HPPTCL	29th NR SCM held on 29.12.2010		Oct-18	NA	Jun-22	STU to expedite commissioning of transmission system for utilization of already existing of 6 no. 220kV bays at 400/220kV Kala Amb substation
8	Uttarakhand	Import >1500MW	High loading of 400/220kV Kashipur ICTs. High loading of 220kV Roorkee-Roorkee, CBGanj-Pantnagar	ISTS	STU to paln & discuss future transmission system requirements with CTU/CEA/POSOCO.	NA	NA	NA	NA	NA	NA	
				Intra State		NA	NA	NA	NA	NA	NA	

Annexure-V

State		May-22	Jun-22	Jul-22	Aug-22	Sep-22
Chandigarh	Availability	140	170	190	220	170
	Requirement	120	160	200	190	150
	Surplus/Shortfall (MU)	20	10	-10	30	20
	Surplus/Shortfall (%)	16.67%	6.25%	-5.00%	15.79%	13.33%
Delhi	Availability	2700	2750	2800	2770	2630
	Requirement	3550	4100	4000	3750	3700
	Surplus/Shortfall (MU)	-850	-1350	-1200	-980	-1070
	Surplus/Shortfall (%)	-23.94%	-32.93%	-30.00%	-26.13%	-28.92%
Haryana	Availability	5520	5580	5720	5680	5450
	Requirement	5620	6610	6660	6680	6860
	Surplus/Shortfall (MU)	-100	-1030	-940	-1000	-1410
	Surplus/Shortfall (%)	-1.78%	-15.58%	-14.11%	-14.97%	-20.55%
Himachal Pradesh	Availability	1300	1910	2230	2210	1770
	Requirement	920	1030	1180	1080	1000
	Surplus/Shortfall (MU)	380	880	1050	1130	770
	Surplus/Shortfall (%)	41.30%	85.44%	88.98%	104.63%	77.00%
Jammu & Kashmir and Ladakh	Availability	1860	2050	2140	2160	1670
	Requirement	1780	1660	1690	1330	1580
	Surplus/Shortfall (MU)	80	390	450	830	90
	Surplus/Shortfall (%)	4.49%	23.49%	26.63%	62.41%	5.70%
Punjab	Availability	5900	6280	6480	6600	6150
	Requirement	4760	7250	8590	8670	8170
	Surplus/Shortfall (MU)	1140	-970	-2110	-2070	-2020
	Surplus/Shortfall (%)	23.95%	-13.38%	-24.56%	-23.88%	-24.72%
Rajasthan	Availability	9310	9450	9290	9640	8710
	Requirement	8590	8560	8630	8820	8810
	Surplus/Shortfall (MU)	720	890	660	820	-100
	Surplus/Shortfall (%)	8.38%	10.40%	7.65%	9.30%	-1.14%
Uttar Pradesh	Availability	13320	13540	13840	14100	13230
	Requirement	14570	14700	14890	14570	14500
	Surplus/Shortfall (MU)	-1250	-1160	-1050	-470	-1270
	Surplus/Shortfall (%)	-8.58%	-7.89%	-7.05%	-3.23%	-8.76%
Uttarakhand	Availability	1130	1320	1440	1590	1360
	Requirement	1070	1250	1400	1360	1270
	Surplus/Shortfall (MU)	60	70	40	230	90
	Surplus/Shortfall (%)	5.61%	5.60%	2.86%	16.91%	7.09%
Total NR	Availability	41180	43050	44130	44970	41140
	Requirement	40980	45320	47240	46450	46040
	Surplus/Shortfall (MU)	200	-2270	-3110	-1480	-4900
	Surplus/Shortfall (%)	0.49%	-5.01%	-6.58%	-3.19%	-10.64%

Ex-Bus Peak Demand and Availability for 2022-23 (in MW)

State		May-22	Jun-22	Jul-22	Aug-22	Sep-22
Chandigarh	Availability	350	340	370	360	360
	Demand	360	380	440	360	410
	Surplus/Shortfall (MW)	-10	-40	-70	0	-50
	Surplus/Shortfall (%)	-2.80%	-10.50%	-15.90%	0.00%	-12.20%
Delhi	Availability	5840	5860	5850	5800	5770
	Demand	6900	7500	8200	7050	6900
	Surplus/Shortfall (MW)	-1060	-1640	-2350	-1250	-1130
	Surplus/Shortfall (%)	-15.40%	-21.90%	-28.70%	-17.70%	-16.40%
Haryana	Availability	11490	11650	11620	11580	11590
	Demand	9870	12030	12700	11990	12160
	Surplus/Shortfall (MW)	1620	-380	-1080	-410	-570
	Surplus/Shortfall (%)	16.40%	-3.20%	-8.50%	-3.40%	-4.70%
Himachal Pradesh	Availability	3180	3220	3250	3230	3230
	Demand	1510	1660	1680	1670	1640
	Surplus/Shortfall (MW)	1670	1560	1570	1560	1590
	Surplus/Shortfall (%)	110.60%	94.00%	93.50%	93.40%	97.00%
Jammu & Kashmir	Availability	3480	3490	3510	3480	3460
	Demand	2880	2810	2610	2400	2660
	Surplus/Shortfall (MW)	600	680	900	1080	800
	Surplus/Shortfall (%)	20.80%	24.20%	34.50%	45.00%	30.10%
Punjab	Availability	11890	12080	12080	12040	12050
	Demand	8930	15500	15320	14700	14340
	Surplus/Shortfall (MW)	2960	-3420	-3240	-2660	-2290
	Surplus/Shortfall (%)	33.10%	-22.10%	-21.10%	-18.10%	-16.00%
Rajasthan	Availability	18830	18870	18080	18270	18680
	Demand	14000	14300	14790	15500	14650
	Surplus/Shortfall (MW)	4830	4570	3290	2770	4030
	Surplus/Shortfall (%)	34.50%	32.00%	22.20%	17.90%	27.50%
Uttar Pradesh	Availability	25560	25670	26900	26790	26690
	Demand	24500	26210	27380	26130	27090
	Surplus/Shortfall (MW)	1060	-540	-480	660	-400
	Surplus/Shortfall (%)	4.30%	-2.10%	-1.80%	2.50%	-1.50%
Uttarakhand	Availability	2910	2890	3080	3070	3060
	Demand	1800	2250	2300	2350	2100
	Surplus/Shortfall (MW)	1110	640	780	720	960
	Surplus/Shortfall (%)	61.70%	28.40%	33.90%	30.60%	45.70%
Total NR	Availability	77140	77230	76380	78410	77970
	Demand	65300	75900	77000	76100	75300
	Surplus/Shortfall (MW)	11840	1330	-620	2310	2670
	Surplus/Shortfall (%)	18.10%	1.80%	-0.80%	3.00%	3.50%

Annexure-I

Existing RE Installed capacity at 3 major Pooling stations (Bhadla(PG), Bikaner(PG), Fatehgarh-II(PG))

RE Installed Capacity at 765/400/220kV Bhadla (PG):

User Name	*Installed Capacity (MW) connected at Bhadla (PG)*
Adani Solar Enegry Jodhpur Two Limited, Rawara	50
Tata Power Renewable Energy Limited	150
Azure Maple Pvt. Ltd.	250
Clean Solar Power (Jodhpur) Pvt. Ltd.	300
RENEW SOLAR POWER Pvt. Ltd. Bhadla	50
AZURE POWER INDIA Pvt. Ltd., Bhadla	200
Azure Power Thirty Four Pvt. Ltd.	130
SB ENERGY FOUR PRIVATE LIMTED, Bhadla	200
TPREL (Chhayan)	150
Clean Solar Power (Bhadla) Pvt. Ltd	300
SB Energy Six Private Limited, Bhadla	300
Azure Power Forty One Pvt limited	300
ACME Chittorgarh Solar Energy Pvt Ltd	250
Mahindra Renewable Private Limited	250
Adani Solar Enegry Four Private Limited	50
Adani Renewable Energy (RJ) limited Rawara	200
Total installed capacity (MW)	**3130**
Total No. Of Plants	**16**

RE installed capacity, pooling at Bhadla (PG): 3130MW

RE Installed Capacity at 765/400/220kV Bikaner (PG):

User Name	*Installed Capacity (MW) connected at Bikaner (PG)*
Renew Surya Ravi Pvt. Ltd.	150
Ayaana Renewable Power Pvt. Ltd.	300
Avaada RJHN_240MW	151
Azure Power Forty Three Private Limited	600
RENEW SOLAR POWER Pvt. Ltd. Bikaner	250
SBSR Power Cleantech Eleven Private Ltd.	150
Avaada sunce energy Pvt limited	350
Avaada Sustainable RJ Pvt. Ltd.	200
Thar Surya Pvt. Ltd.	54
Total installed capacity (MW)	**2205**
Total No. Of Plants	**9**

RE installed capacity, pooling at Bikaner (PG): 2205MW

RE Installed Capacity at 765/400/220kV Fatehgarh-II (PG):

User Name	Type	Installed Capacity (MW) connected at Fatehgarh-II(PG)
Adani Hybrid Energy Jaisalmer One Ltd.	Solar	360
	Wind	34.1
	Total	394.1
Adani Hybrid Energy Jaisalmer Two Ltd.	Solar	231.4
	Wind	30
	Total	261.4
Adani Hybrid Energy Jaisalmer Three Ltd.	Solar	299.38
	Wind	25.9
	Total	325.28
ReNew Solar Urja Private Limited	Solar	300
ReNew Solar Energy (Jharkhand Three) Private Limited	Solar	300
Eden Renewable Cite Private Limited	Solar	300
Renew Sun Waves Private Limited	Solar	300
Renew Sun Bright	Solar	300
Total installed capacity (MW)		**2480.78**
Total No of Plants		**8**

***RE Installed Capacity at AREPRL (Adani Renewable energy park Rajasthan Ltd.):**

User Name	Type	Installed Capacity (MW) connected at Fatehgarh-I
Adani Hybrid Energy Jaisalmer Four Ltd.	Solar	518.88
	Wind	210.7
	Total	729.58
Nedan Solar NTPC	Solar	200
Total installed capacity (MW)		**929.58**
Total No of Plants		**2**

*RE Generation connected at AREPRL is getting pooled at 400kV Fatehgarh-I (Adani Pooling) S/s through 400kV AREPRL- Fatehgarh-I D/C line, which is further getting pooled at 765/400/220kV Fatehgarh-II(PG) S/s through 400kV Fatehgarh-I (Adani Pooling)- Fatehgarh-II(PG) D/C line.

RE installed capacity, pooling at Fatehgarh-II (PG): 3410MW

RE Installed Capacity at Bhadla-II(PG):

User Name	*Installed Capacity (MW) connected at Bhadla-II(PG)*
ACME Heeragarh powertech Pvt. Ltd	200
ABC Renewable Pvt. Ltd	150
Total installed capacity (MW)	**350**
Total No. Of Plants	**2**

Total RE Installed Capacity connected at NR ISTS:

User Name	Total RE Installed capacity of NR at ISTS (MW)
Bhadla(PG)	3130
Bhadla-II(PG)	350
Bikaner(PG)	2205
Fatehgarh-II(PG)	2480
Fatehgarh-I	930
Singrauli	15
Dadri	10
Unchahar	5
Auraiya	20
Total RE at NR ISTS (MW)	**9145**

Month	Event Name	Date & Time	Generation Loss Quantum	Event Description	Remark
January	Solar generation loss at Fatehgarh2(PG) & Bhadla(PG) on RYB three phase fault followed by tripping of 765 KV Bhadla_2 (PG)-Fatehgarh_II(PG) (PFTL) Ckt-1, 765 KV Bikaner(PG)-Khetri (PKTSL) (BKTL) Ckt-1 & Ckt-2 on over voltage.	14:16 Hrs, 23 Jan'22	1400 MW (1150MW at Fatehgarh2(PG) & 250MW at Bhadla(PG))	At 14:16 Hrs, 400 KV Jaipur South-Bassi (PG) Ckt-2 tripped on R-Y fault, fault current and fault distance was 32.525kA & 1.559km and 12.097kA & 35.54km from Bassi and Jaipur South end respectively. a kite thread was found between tower location no. 103-104 during the patrolling and same was removed. At the same time, 400 KV Jaipur South-Bassi (PG) Ckt-1 tripped on R-Y-B fault (fault distance & fault current was 0.8km and 32kA from Bassi end) and 400 KV Bassi(PG)-Heerapura(RS) (PG) Ckt-2 tripped on DT received at Bassi end. Solar generation loss of approx. 1400MW was also observed during the same time. At the same time, 765 KV Bikaner(PG)-Khetri (PKTSL) (BKTL) Ckt-1 & Ckt-2 tripped on Over voltage protection operation at Bikaner end and 765 KV Bhadla_2 (PG)-Fatehgarh_II(PG) (PFTL) Ckt-1 tripped on Over voltage protection operation at Bhadla2 end. As per PMU, R-Y-B three phase fault followed by rise in voltage is observed. As per SCADA, dip in solar generation of approx. 1400MW is observed (approx. 1150MW connected at Fatehgarh2(PG) and 250MW connected at Bhadla(PG)). As per PMU MW plot, delayed LVRT operation was observed in some of solar plants.	1. Delayed LVRT operation observed at few of RENEW & ADANI RE station. 2. EDEN solar tripped due to wrong over voltage setting in its 220kV line.
	Tripping of 400kV Bikaner-Ayana ckt	12:40 hrs, 23 Jan'22	210MW	At 12:40 Hrs, 400 KV Bikaner(PG)-AYANA1 SL_BKN_PG (ARP1PL) (ARP1PL) Ckt-1 tripped on Y-phase overcurrent from PGCIL end. At the same time, 400/33 kV 330 MVA ICT 1 at AYANA1 SL_BKN_PG (ARP1PL) also tripped. As per PMU, no fault is observed. As per SCADA, solar generation loss of approx. 210MW at AYANA Solar is observed.	Maloperation of over current protection operation. Over current protection has been disabled.
		11:45 Hrs, 25 Jan'22	180MW	At 11:45 Hrs, 400 KV Bikaner(PG)-AYANA1 SL_BKN_PG (ARP1PL) (ARP1PL) Ckt-1 tripped on R&B phase overcurrent from ARP1PL end. As per PMU, no fault is observed. As per SCADA, solar generation loss of approx. 180MW is observed. In antecedent condition, 400 KV Bikaner(PG)-AYANA1 SL_BKN_PG (ARP1PL) (ARP1PL) Ckt-1 was carrying 216MW.	
		12:05 Hrs, 26 Jan'22	210MW	At 12:05 Hrs, 400 KV Bikaner(PG)-AYANA1 SL_BKN_PG (ARP1PL) (ARP1PL) Ckt-1 tripped on R & Y phase overcurrent, Iy=12.5kA, Ir=0.35kA. Fault was at LV side of 400/33kV AYANA(ARP1PL) sub-station. As per PMU, Y-N phase to earth fault is observed. As per SCADA, solar generation loss of approx. 210MW is observed. In antecedent condition, 400 KV Bikaner(PG)-AYANA1 SL_BKN_PG (ARP1PL) (ARP1PL) Ckt-1 was carrying 216MW.	Y-N phase to earth fault
		11:36 Hrs, 29 Jan'22	208MW	400 KV Bikaner(PG)-AYANA1 SL_BKN_PG (ARP1PL) (ARP1PL) Ckt-1 tripped on Y phase overcurrent from ARP1PL end. As per PMU, no fault is observed. As per SCADA, solar generation loss of approx. 208MW is observed. In antecedent condition, 400 KV Bikaner(PG)-AYANA1 SL_BKN_PG (ARP1PL) (ARP1PL) Ckt-1 was carrying 216MW.	Maloperation of over current protection operation. Over current protection has been disabled.
	Solar generation loss at Fatehgarh2(PG) due to sudden voltage shoot up after opening of 240MVAr Bus reactor-2 at 765kV Fatehgarh2(PG)	11:27 Hrs, 30 Jan'22	2038MW	At 11:27:43:400 Hrs, 240MVAR Bus reactor-2 was opened. With the opening of bus reactor, transient voltage shoot up is observed at Fatehgarh2(PG). As per PMU at Fatehgarh2(PG), phase voltage of 400kV Fatehagrh2-Fatehgarh ckt-2 shoot up from 226kV to 259kV and came back to 239kV within 520ms. Further within 500ms, solar generation loss at Renew Sunwave and EDEN solar is observed. Further after 3sec, 220/33kV transformers at Renew Solar Urja tripped. Further within 3-4 sec Renew Sunbright and some inverters of AHEJ2L, AHEJ3L, Renew jharkhand3 and RE generation at ADANI pooling substation tripped. Total solar generation loss of around 2038MW is observed. Tripping of 765kV Fatehgarh2-Bhadla2 ckt-1 and 400kV Fatehgarh2-Fatehgarh ckt-1 also observed on over voltage protection operation at Fatehgarh2 end. In antecedent condition, as per SCADA, bus voltages at Fatehgarh2 were 816kV, 428kV & 235kV at 765kV, 400kV & 220kV bus respectively.	1. Sudden power drop at few of ADANI & RENEW RE Stations during sudden voltage spike. 2. Tripping of 220/33kV ICTs & 220kV lines at RE Stations of EDEN, RENEW & ADANI
	Solar generation loss at Fatehgarh2(PG) during R-N fault in 765 KV Bhadla_2 (PG)-Fatehgarh_II(PG) (PFTL) Ckt-2	13:15 Hrs, 04 Feb'22	1100MW	At 13:15 Hrs, 765 KV Bhadla_2 (PG)-Fatehgarh_II(PG) (PFTL) Ckt-2 tripped on R-N fault after unsuccessful A/R operation. At the same time, solar generation drop of approx. 1100MW is observed connected at Fatehgarh2. Out of 1100MW around 700MW solar generation revived till 13:22 Hrs. As per PMU. R-N fault with unsuccessful A/R operation is observed. As per SCADA, drop in solar generation of approx. 1100MW is observed.	Delayed LVRT operation observed at few of RENEW & ADANI RE station.
	Solar generation loss at Fatehgarh2(PG) due to sudden over voltage during charging of 765 KV Bhadla_2 (PG)-Fatehgarh_II(PG) (PFTL) Ckt-2	13:22 Hrs, 04 Feb'22	1882MW	At 13:22Hrs, main CB at Bhadla2 of 765kV Bahdla2-Fatehgarh2 ckt-2 was closed. At the same time, over voltage occurred which led to tripping of 220/33kV ICTs at Renew Sunwave, Renew Solar Urja & Renew Jharkhand3 and incomers & inverter blocks at AHEJ2L & Renew Jharkhand3. As per PMU, voltage spike of approx. 33kV phase voltage followed by sustained over voltage for around 5-6sec is observed. As per SCADA, drop in solar generation of approx. 1882MW is observed. Out of 1882MW around 680MW reveived within 2 minutes.Grid Event of drop in solar generation of approx. 1882MW at Fatehgarh2(PG)	1. Sudden power drop at few of ADANI & RENEW RE Stations during sudden voltage spike. 2. Tripping of 220/33kV ICTs & 220kV lines at RE Stations of EDEN, RENEW & ADANI
	Solar generation loss at Fatehgarh2(PG) due to sudden voltage shoot up after opening of 240MVAr line reactor of 765kV Fatehgarh2-Bhadla2 ckt-1	11:45 Hrs, 11 Feb'22	2286MW	At 11:45 Hrs, 240MVAr line reactor of 765kV Fatehgarh2-Bhadla2 ckt-1 at Fatehgarh2 was opened. With the opening of line reactor, sudden voltage rise of approx. 40kV in phase voltage of 765kV Fatehgarh2-Bhadla2 ckt-2 at Bhadla2 end is observed. On this sudden voltage spike, drop in generation at few of RE stations is also observed. Due to drop in generation, sustain over voltage for around 6 sec is observed. At the same time, 765 KV Bhadla_2 (PG)-Fatehgarh_II(PG) (PFTL) Ckt-1, 765 KV Ajmer-Bhadla_2 (PG) Ckt-1, 400 KV Fatehgarh_II(PG)-Fatehgarh Pooling(FBTL) (FBTL) Ckt-1, 220 KV Fatehgarh_II(PG)-Renew SunWave SL_FGRAH_PG (RSWPL) (RENEW SUN WAVE (RSWPL)) Ckt-1 and 220 KV Fatehgarh_II(PG)-EDEN SL_FGRAH_PG (ERCPL) (EDEN (ERCPL)) Ckt-1 all tripped on over voltage protection operation. As per PMU, sudden voltage spike of 40kV in phase voltage followed by sustained voltage of approx. 826kV for around 6 sec is observed. As per SCADA, solar generation loss of approx. 2286MW connected at Fatehgarh2 is observed. As per PMU, sudden drop in generation during voltage transient at Renew Sunbright, EDEN Solar, Adani Hybrid & AHEJ3L RE station is observed. In antecedent condition, bus voltages at 765kV, 400kV & 220kV bus at Fatehgarh2 were 762kV, 394kV & 216kV respectively.	1. Sudden power drop at few of ADANI & RENEW RE Stations during sudden voltage spike. 2. Tripping of 220/33kV ICTs & 220kV lines at RE Stations of EDEN, RENEW & ADANI
	Solar generation loss at Fatehgarh2(PG) due to sudden voltage shoot up during charging attempt of 765kV Fatehgarh2-Bhadla2 ckt-1	11:57 Hrs, 11 Feb'22	1600MW	At 11:57Hrs, charging attempt of 765kV Fatehgarh2-Bhadla2 ckt-1 was taken which led to sudden voltage spike. At the same time, drop in solar generation connected at Fatehgarh2 of approx. 1600MW is observed as per SCADA.	1. Sudden power drop at few of ADANI & RENEW RE Stations during sudden voltage spike. 2. Tripping of 220/33kV ICTs & 220kV lines at RE Stations of EDEN, RENEW & ADANI

February	Solar generation loss at Fatehgarh2(PG) & Bhadla(PG) due to sudden voltage shoot up during charging attempt of 765kV Bhadla2-Ajmer ckt-1	12:38 Hrs, 11 Feb'22	2807MW	At 12:38 Hrs, main CB at Bhadla2 end of 765kV Bhadla2-Ajmer ckt-1 was closed. At the same time, sustained over voltage for around 6 sec occurred. On this over voltage, 765 KV Bikaner-Bhadla_2 (PG) Ckt-1, 765 KV Bhadla_2 (PG)-Fatehgarh_II(PG) (PFTL) Ckt-1, 400 KV Fatehgarh_II(PG)-Fatehgarh Pooling(FBTL) (FBTL) Ckt-1, 400 KV Fatehgarh Pooling(FBTL)-Adani RenewPark_SL_FGARH_FBTL (AREPRL) (AREPRL) Ckt-1, 220kV lines from Fatehgarh2 to Renew Sunwave, Renew Sunbright, Renew Jharkhand3 & EDEN and 220kV feeders from Bhadla(PG) to Mahindra solar & Azure PSS 41 all tripped on over voltage protection operation. As per PMU, sustained over voltage for around 6sec is observed. As per SCADA, bus voltages at 765kV, 400kV & 220kV bus at Fatehgarh2 rose up to 811kV, 425kV & 234kV and solar generation loss of approx. 2807MW connected at Fatehgarh2(PG) & Bhadla(PG) is observed. In antecedent condition, bus voltages at 765kV, 400kV & 220kV bus at Fatehgarh2 were 736kV, 380kV & 208kV respectively. Further at 14:24 Hrs, drop in solar generation connected at Fatehgarh2 of approx. 1500MW is observed as per SCADA. As per SOE, no switching operation is observed.	1. Sudden power drop at few of ADANI & RENEW RE Stations during sudden voltage spike. 2. Tripping of 220/33kV ICTs & 220kV lines at RE Stations of EDEN, RENEW & ADANI
	Solar generation loss at Fatehgarh2(PG) due to sudden voltage shoot up during charging attempt of 765kV Fatehgarh2-Bhadla2 ckt-1	13:25 Hrs, 11 Feb'22	1500MW	Further at 13:25 Hrs, again charging attempt of 765kV Fatehgarh2-Bhadla2 ckt-1 was taken which led to voltage spike. At the same time, drop in solar generation connected at Fatehgarh2 of approx. 1500MW is observed as per SCADA.	1. Sudden power drop at few of ADANI & RENEW RE Stations during sudden voltage spike. 2. Tripping of 220/33kV ICTs & 220kV lines at RE Stations of EDEN, RENEW & ADANI
	Solar generation loss at Fatehgarh2(PG) due to sudden voltage shoot up during charging attempt of 765kV Bhadla2-Bikaner ckt-1	13:55 Hrs, 11 Feb'22	1500MW	Further at 13:55 Hrs, charging attempt of 765kV Bhadla2-Bikaner ckt-1 was taken which led to voltage spike. At the same time, drop in solar generation connected at Fatehgarh2 of approx. 1500MW is observed as per SCADA. However line was successful charged.	1. Sudden power drop at few of ADANI & RENEW RE Stations during sudden voltage spike. 2. Tripping of 220/33kV ICTs & 220kV lines at RE Stations of EDEN, RENEW & ADANI
	Solar generation loss at Fatehgarh2(PG) during R-B phase to phase fault occurred at 33kV side of AHEJ3L RE station.	14:35 Hrs, 15 Feb'22	890MW	R-B phase to phase fault occurred at 33kV side of AHEJ3L RE station which led to tripping of solar blocks at AHEJ3L. During same time, drop in solar generation observed at ADANI & RENEW RE stations connected at Fatehgarh2 & Fatehgarh1. Due to sudden power drop, rise in voltage is observed. Further after 5-6sec, 765kV Bikaner-Khetri ckt-2 tripped on over voltage protection operation at Bikaner end. As per PMU, R-B phase to phase fault followed by over voltage is observed. As per DR submitted and PMU, voltage went up to 105% only (permissible range). As per SCADA, solar generation loss of approx. 890MW is observed. In antecedent condition, 765kV bus voltage at Bikaner was 784kV and total solar generation evacuating from Fatehgarh2 was 2539MW.	1. Sudden power drop at few of ADANI & RENEW RE Stations.
	Solar generation loss at Bhadla(PG) during R-Y phase to phase fault occurred on 220 KV Bhadla - TPREL Solar Ckt–1	10:51 Hrs, 24 Feb'22	500MW	220 KV Bhadla - TPREL Solar Ckt–1 tripped on R-Y phase to phase fault on line differential protection operation from TPREL end, fault occurred due to R-phase jumper broken at Tower no. 127(1.7km from Bhadla(PG) end). At the same time, 220 KV Bhadla(PG)-Saurya Urja Solar(SU) (Saurya Urja) Ckt-1 also tripped from Saurya Urja end only on Z-1 (over reach) distance protection operation. Due to tripping of both these lines, solar generation loss of 272MW at Tata Power(TPREL) & 252MW at Saurya Urja-1 occurred. At the same time, momentarily power dip of 140MW at ACME Solar, 25MW each at Adani Bhadla1&2, 75MW at AHEJ3L, 24MW at AHEJ2L, 183MW at Renew Solar Urja & 200MW at Renew Sunwave is observed. As per PMU, R-Y phase to phase fault is observed. As per SCADA, solar generation loss of approx. 550MW is observed. In antecedent condition, TPREL, Saurya Urja-1, ACME, Adani Bhadla 1&2, AHEJ3L, AHEJ2L, Renew Solar Urja & Renew Sunwave RE stations were generating 272MW, 252MW, 209MW, 84MW, 231MW, 112MWW, 256MW & 279MW respectively.	1. 252MW solar generation loss at Saurya Urja-1 occurred due to tripping of 220 KV Bhadla(PG)-Saurya Urja Solar(SU) (Saurya Urja) Ckt-1 also tripped from Saurya Urja end only on Z-1 (over reach) distance protection operation. 2. momentarily power dip of 140MW at ACME Solar, 25MW each at Adani Bhadla1&2, 75MW at AHEJ3L, 24MW at AHEJ2L, 183MW at Renew Solar Urja & 200MW at Renew Sunwave is observed
March	Tripping of 220 KV Fatehgarh_II(PG)-AHEJ3L PSS HB_FGRAH_PG (AHEJ3L) (AHEJ3L) Ckt-1	09:26 Hrs, 27 Mar'22	290MW	220 KV Fatehgarh_II(PG)-AHEJ3L PSS HB_FGRAH_PG (AHEJ3L) (AHEJ3L) Ckt-1 tripped from AHEJL end on over current protection operation. As per PMU, no fault is observed. As per SCADA, solar generation loss of approx. 290MW is observed. In antecedent condition, 220 KV Fatehgarh_II(PG)-AHEJ3L PSS HB_FGRAH_PG (AHEJ3L) (AHEJ3L) Ckt-1 was carrying approx. 294MW.	Over current protection was found sensitive and same has been corrected.

Analysis report of Solar Generation loss at Grid Event at Fatehgarh2 (PG) at 11:27 Hrs on 30th Jan'22

Date & time of event: 11:27 Hrs on 30th Jan 2022

Grid Event category: GD-1, solar generation loss of approx. 2038MW at Fatehgarh2 (PG)

i. Stations affected : 765/400/220 kV Fatehgarh 2(PG), 400 kV Fatehgarh
ii. RE stations being pooled at Fatehgarh 2 and affected:
   a. Adani Hybrid Energy Jaisalmer Two Limited (AHEJ2L) (IC=300 MW),
   b. Adani Hybrid Energy Jaisalmer Three Limited (IC=300 MW),
   c. Adani Hybrid (IC=374MW),
   d. Renew Sunwave (IC=300 MW),
   e. Renew Jharkhand3 (IC=300 MW),
   f. Renew Solar Urja (IC=300 MW),
   g. Renew Sun bright (IC=300 MW),
   h. Eden Solar (IC=300 MW)

Description of event:

At 11:27:43.400, 240 MVAR Bus reactor-2 was opened to improve voltage at 765/400/220 kV, 3*1500 MVA Fatehgarh2 (PG) which was 754 kV, 391 kV & 216 kV respectively. Bus reactor switching resulted in transient voltage shoot up at Fatehgarh2 (PG). As per SCADA, voltage rose up to 816kV, 428kV & 235kV at 765kV, 400kV & 220kV Fatehgarh2 (PG) respectively. Due to voltage shoot up, 220 kV lines connecting the RE plants to Fatehgarh2 and 220/33kV transformers stepping up the RE generations at 220kV, tripped and resulted into solar generation loss of approx. 2038 MW.

Area Affected:

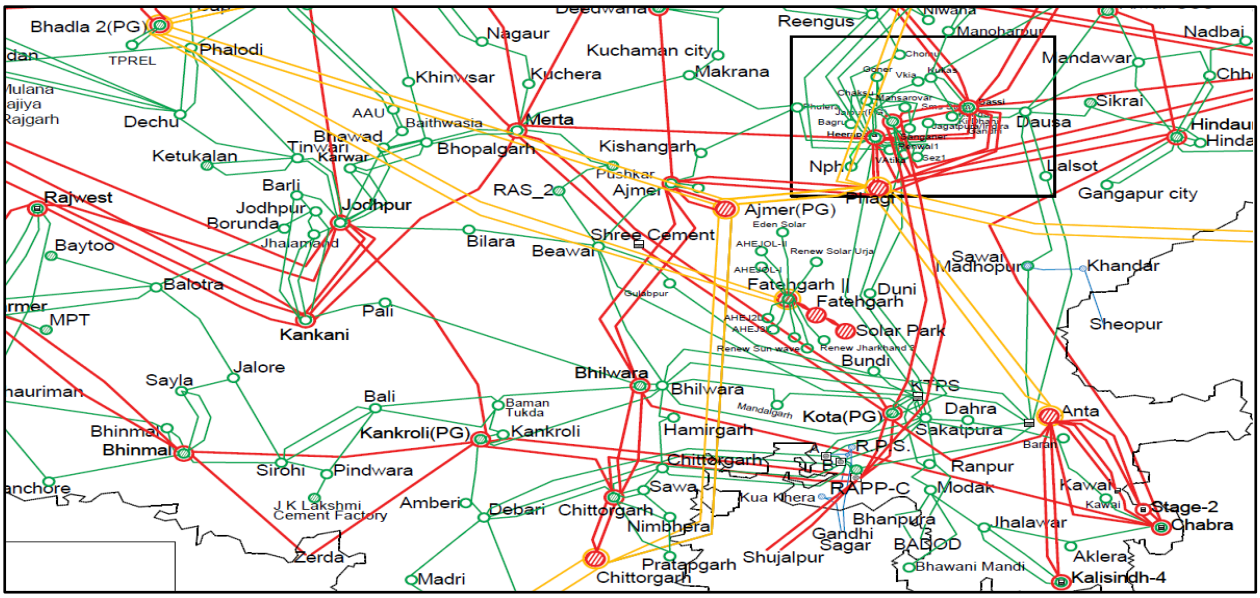


Fig 1: Affected Area during the tripping

SLD of the affected station:

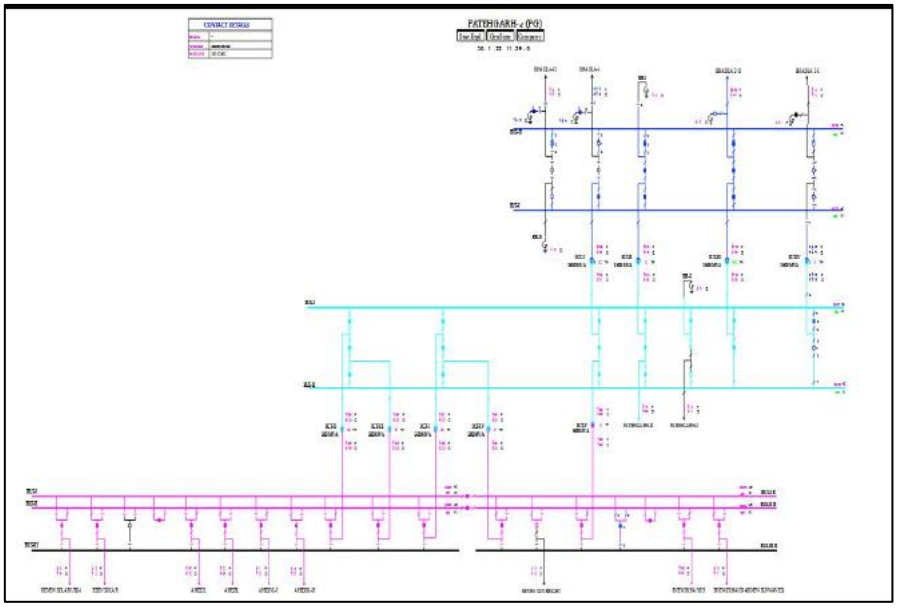


Fig 2: SLD of 765/400/220 kV Fatehgarh station

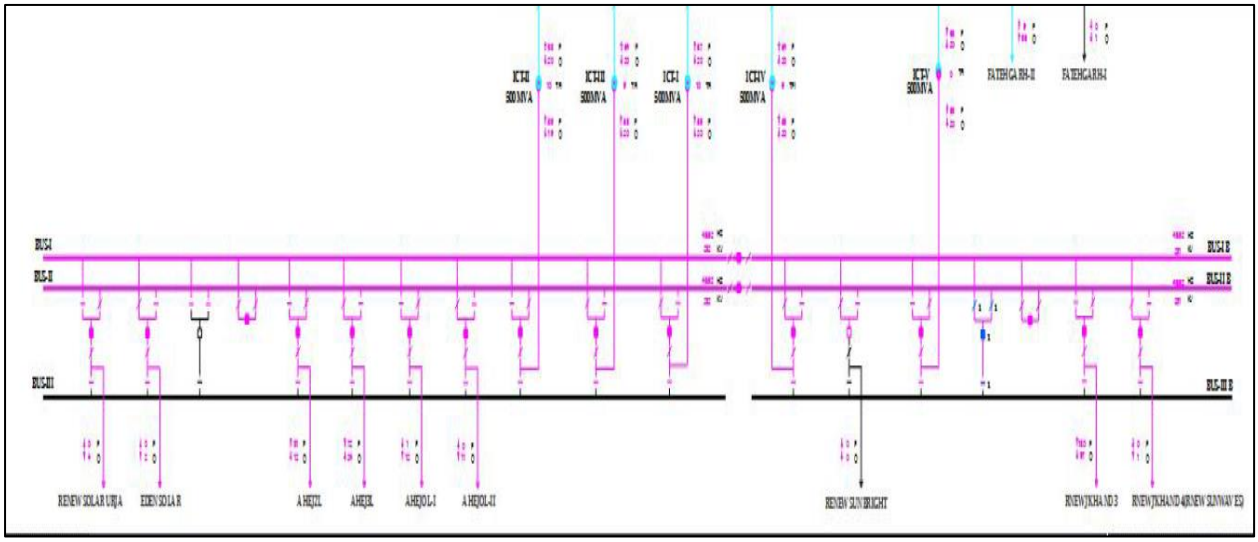


Fig 3 : 220 kV stations getting pooled at Fatehgarh

Summary of the Event :

The event was analysed using the PMU data(PMU at solar park end of 220 kV line to pooling station), Disturbance Record from site and SCADA data of NLDC/NRLDC. 765 kV Fatehgarh 2 data is not available in PMU, therefore 400 kV Fatehgarh 2 PMU data has been used. The generation getting pooled at Fatehgarh station via 400 kV line also got tripped leading to loss of approx. 150 MW generation. The summary of the event is given in Table below:

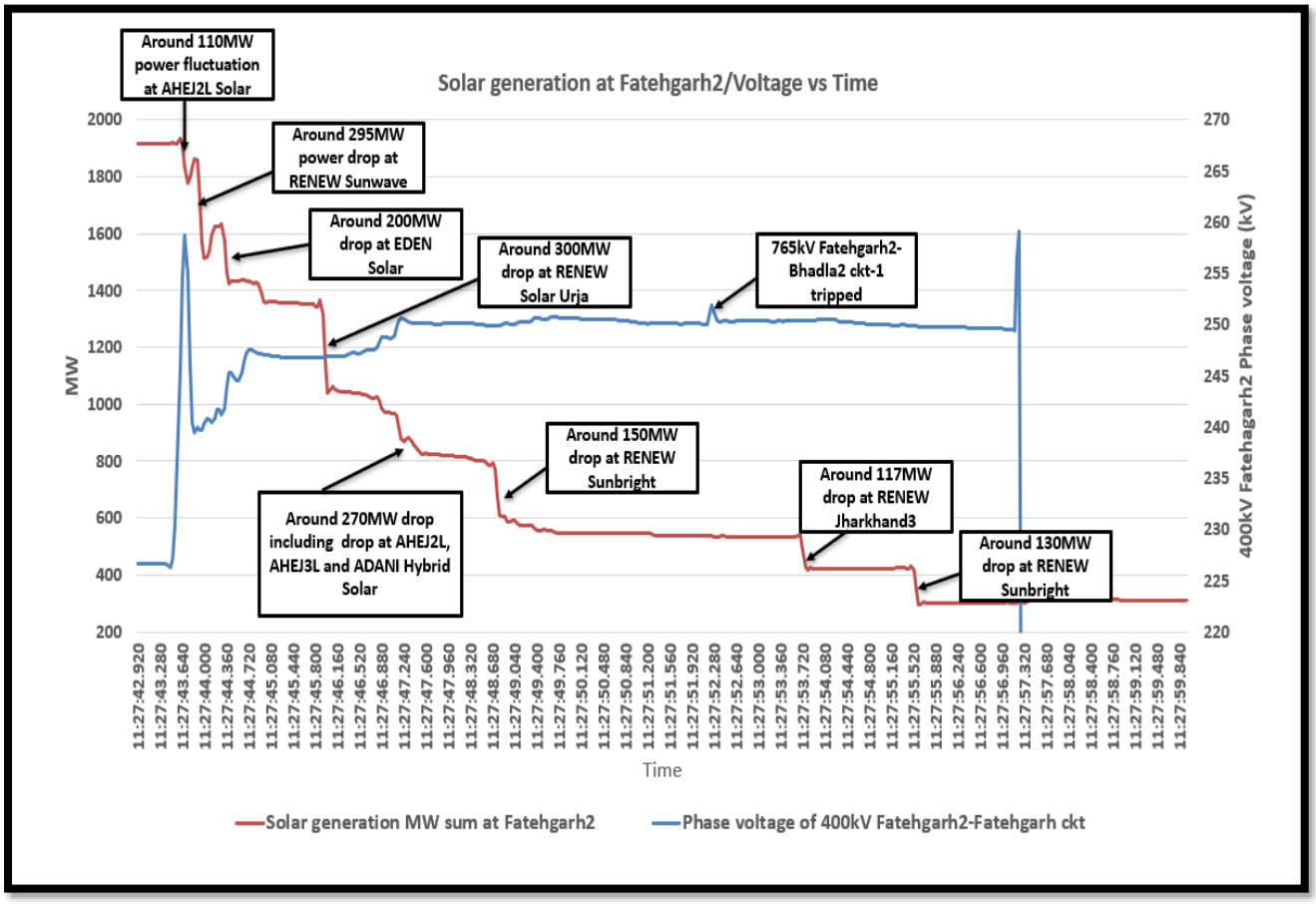
S. No	Solar Plant Name	MW/ MVAR in PMU (Pre-event)	MW (during the event)	MVAr (during the event)	Reason of solar generation loss	Remarks
1	RENEW Sunwave (IC: 300MW)	294/-79	1. 290 to 0 MW (11:27:43:880 Hrs). 2. 0 to 62 MW (Rise at 11:27:44:280 hrs) 3. 62 MW to 0 (at 11:27:44:880 Hrs)	-79 MVAr to 0 (11:27:43:880 Hrs). No MVAr support observed henceforth.	On Overvoltage stage-1, • 220/33kV ICT-2 tripped (at 11:27:46:123 Hrs as per DR) • 220/33kV ICT-1 tripped (at 11:27:49:833 Hrs as per DR.(After 3 sec)	RE Plant seems tripped momentarily for 400ms(failure to ride through HV) as both MW and MVAr dropped to zero. Then tripped on loss of evacuation.
2	RENEW Sunbright (IC: 300MW)	290/4	1. 290 to 138 MW (11:27:48:640 Hrs) 2. 138 to 0MW (11:27:55:480 Hrs)	MVAR Data not available	On Overvoltage stage-1, • 11:27:55:236 Hrs , 220/33 kV ICT-1 and 2 as well as line tripped on overvoltage. (after around 12 seconds of reactor opening)	Generation seems tripped on loss of 220 kV line. Few inverters tripped on failure of ride through.
3	RENEW Solar Urja(IC:300MW)	282/-18	282 to 0 MW (At 11:27:45:880 Hrs)	MVAR Data not available	On Overvoltage stage-1, • 220/33kV ICT-1 tripped (at 11:27:47:639 Hrs) • 220/33kV ICT-2 tripped (at 11:27:50:103 Hrs.	RE plant tripped on loss of evacuation.
4	RENEW Jharkhand3(IC:300 MW)	284/-1	1. 284 to 171 MW (At 11:27:53:680 Hrs), 2. started increasing and back to 279MW (from 11:28:44:040 Hrs) to 11:29:18:080 Hrs)	MVAR Data not available	Drop in generation of approx. 117MW is observed for around 1 minute	Reduction of generation occurred.
5	EDEN Solar(IC:300MW)	294/97	1. 294 to 305 MW (At 11:27:43:520 Hrs) 2. Dropped to 297MW (at 11:27:43:880 Hrs). 3. 297 to 96 MW (at 11:27:44:240 Hrs) 4. Gradually dropped to zero (by 11:27:50 Hrs).	1. 98 to -38MVAr (from 11:27:43:440 Hrs to 11:27:43:680 Hrs) 2. back to 62MVAr (at 11:27:43:840 Hrs) 3. Gradually to zero (by	On Overvoltage stage-1, • 220kV Eden-Fatehgarh2 ckt tripped (from EDEN end on over voltage At 11:27:59:978 Hrs),. • 220/33kV ICT-1 &2 tripped (As per SOE, LV side CB tripped at 11:28:10:562 Hrs,).	Generation reduction and finally both MW and MVAR went to zero (no clarity whether ICT tripped or invertor tripped first)

				11:27:50 Hrs).		
6	AHEJ2L Solar(IC:300MW)	112/-6	1. 112 to 0MW (from 11:27:43:600 Hrs, to 11:23:43:680 Hrs) 2. Back to 104MW (at 11:27:44:160 Hrs) 3. Instantly started ↓ and reduced to 51 MW (at 11:27:53:120 Hrs) 4. Gradually ↑ back to 104MW (at 11:29:58:520 Hrs).	1. MVAr dropped to zero (At 11:27:43:720 Hrs), 2. Gradually started absorbing to 18MVAr (at 11:27:44:200 Hrs.)	Tripping at inverter level observed. Affected blocks are being identified.	
7	AHEJ3L Solar(IC:300MW)	186/-1	1. 186 to 146MW (at 11:27:43:600 Hrs) 2. back to 185MW (at 11:27:43:880 Hrs). 3. dropped to 74MW (at 11:27:46:760 Hrs) 4. Started ↑ to 165MW (from 11:29:02:520 Hrs to 11:29:22:920 Hrs).	1. MVAr injection ↑ to 19.5MVAr (At 11:27:43:560 Hrs), 2. ↓ back to (-) 43MVAr (at 11:27:43:840 Hrs)	Tripping at inverter level observed. Affected blocks inside the park are being identified.	approx. 100MW loss of generation observed for 1.5 minutes
8	*ADANI Hybrid 1 Solar(IC:374.4 MW)	170/8	1. 170 to 71 MW (At 11:27:43:840 Hrs), revived to 131MW (at 11:27:44:320 Hrs). 2. Instantly, started decreasing and dropped to zero(0) MW (at 11:27:49:160 Hrs). 3. Started ↑ to 100 MW (from 11:29:07:080 Hrs, to 11:29:24:640 Hrs.	Increase in absorption (-)7.8MVAr to (-) 61MVAr (At 11:27:43:720 Hrs) And decreasing back to (-) 39MVAr (at 11:27:43:840 Hrs)	Tripping at inverter level is observed. Major affected inverters blocks belongs to 5,9,10,11,12,13,25,26,27 .	Generation gradually dropped from 170MW to 0MW after five (05) seconds of opening of reactor and rose back to around 98MW within around 1.5 minutes

***: Data of only one line out of two i.e. (~187 MW) available in PMU**

Sequence of event and Substation wise brief discussion of event:

The complete event using the summation of generation which are getting pooled at Fatehgarh 2 is given in Fig below. It may be noted that this plot does not cover Adani Hybrid four limited data getting pooled at Fatehgarh and one 220 kV line data from Adani hybrid one. These two comprise of around 300 MW of generation.



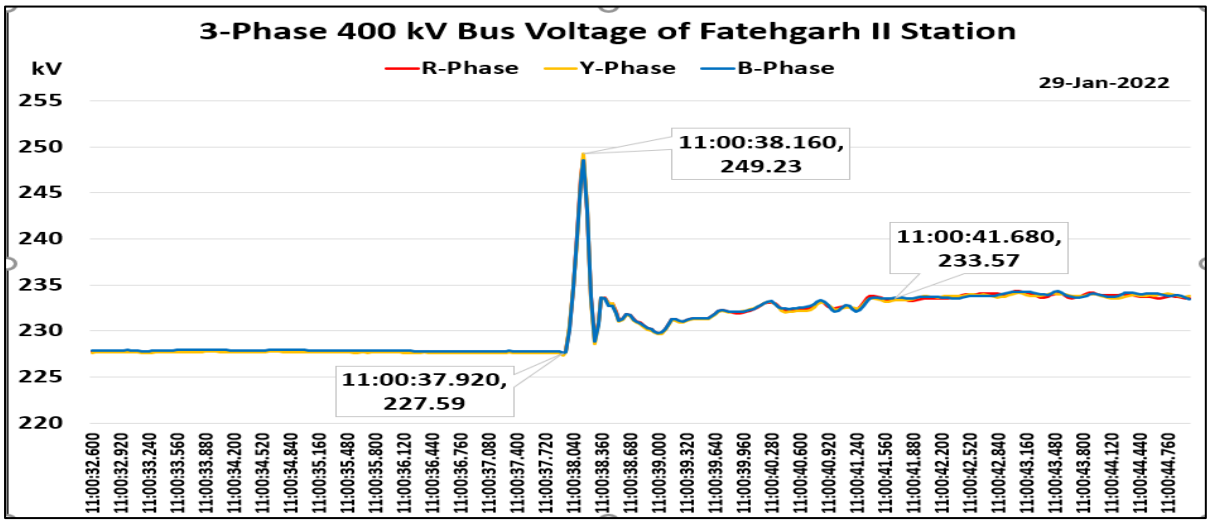
High Voltage shoot during Bus Reactor Opening:

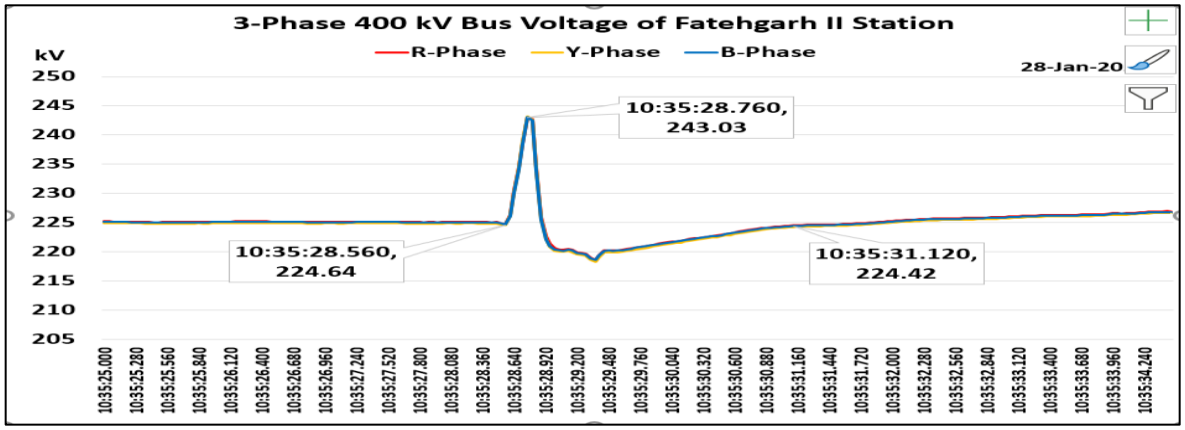
765 kV voltages are on lower side at Fatehgarh-II during peak solar hours, 765 kV Bus reactor-I & II are opened to control the low voltage. The fault level of 400 kV and 765 kV Bus at Fatehgarh-II is around 18000 MVA. The voltage rise on 765 kV and 400 kV Buses when opening next reactor (considering one reactor is out of service) is 20 kV and 12 kV respectively. However it is not the case and the voltage rise being observed at 400 kV Buses is on higher side. 765 kV Voltage data at Fatehgarh-II is not available in PMU. The more than normal voltage rise (in first shoot) has been observed for four events when Bus Reactor at 765 kV level was opened. The steady state voltage change is observed to be different during different events.

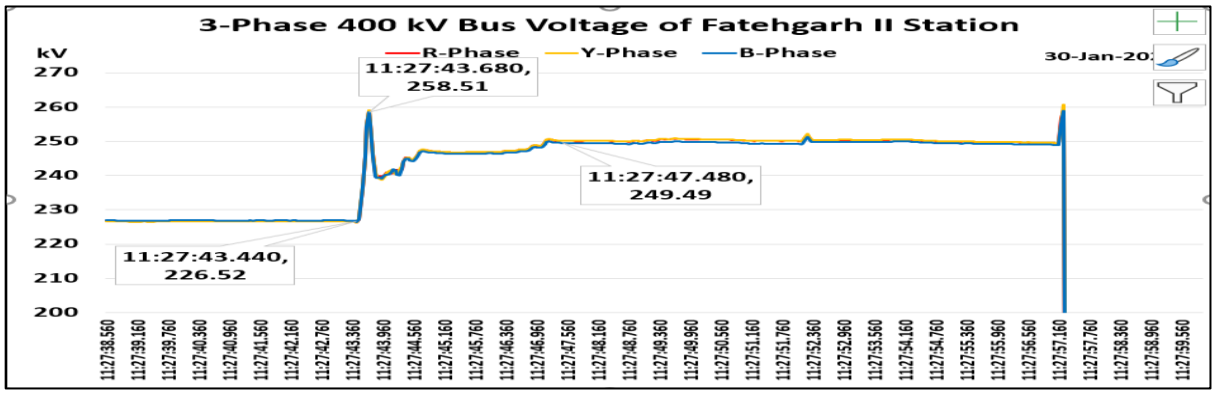
Summary of Bus Reactor Opening at Fatehgarh II station(All voltages are Phase to ground and measured from PMU)							
S.No.	**Date**	**Time**	**Element Opened**	**Fatehgarh II Voltage Prior to bus reactor opening**	**Fatehgarh II Voltage just after the bus reactor opening (first peak)**	**Rise in Fatehgarh II Voltage**	**Steady State Voltage**
1	28-Jan-22	10:35	240 MVAR Bus Reactor No 2 at 765 KV Fatehgarh_II (PG)	225	243	**18**	224
2	29-Jan-22	11:00		228	249	**22**	234
3	30-Jan-22	11:27		227	259	**32**	249
4	01-Feb-22	11:08		225	244	**19**	228
Note: In all the above cases Bus Reactor I at Fatehgarh II end is already opened. Fault MVA of Fatehgarh II is 18000 MVA as per reactive power document.							

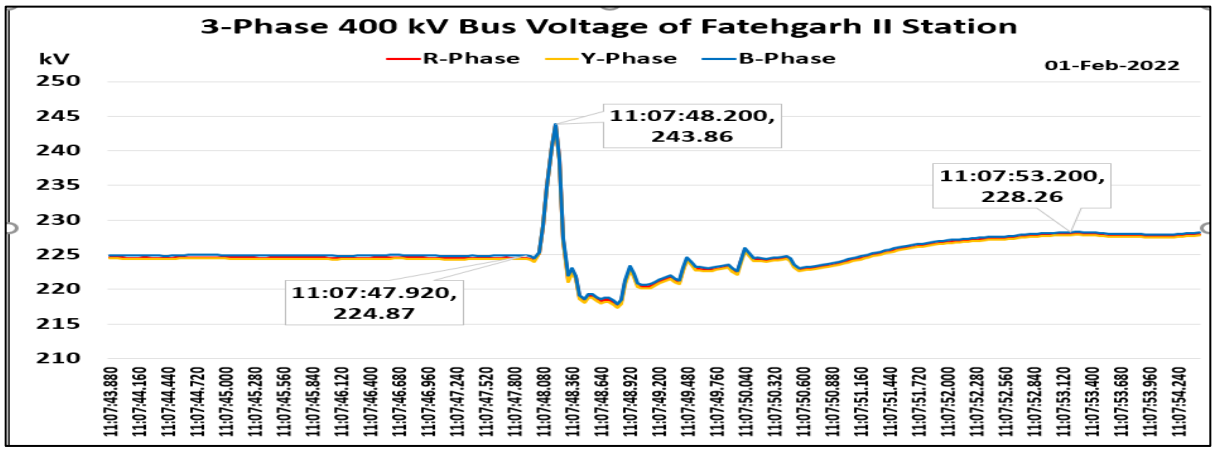
Table 1: Rise in voltage at 400 kV Bus of Fatehgarh-II on different days after opening of Bus Reactor

The behaviour of voltage on each of the days is given below:







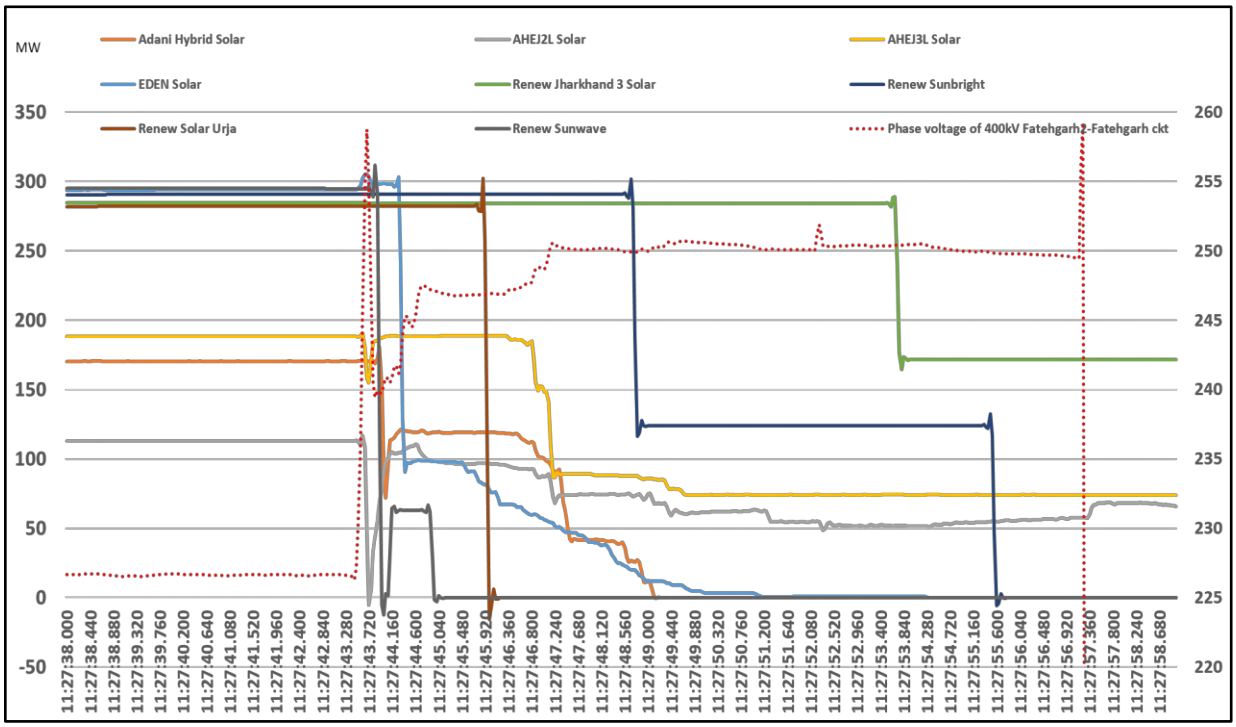


The fault level of stations involved as obtained from latest PSS/E basecase is:

- 765kV Fatehgarh-II(PG): **18033MVA (13.61kA)**
- 765kV Bhadla-II(PG): 30783MVA (23.23kA)
- 765kV Bhadla(PG): **25679MVA (19.38kA)**
- 400kV Fatehgarh-II(PG): 15111MVA (21.81kA)
- 400kV Fatehgarh-I(PG): **10675MVA (15.41kA)**
- 400kV Bhadla-II(PG): 30783MVA (23.23kA)
- 400kV Bhadla(PG): 29137MVA (42.06kA)

Simulation results shows that there is around change of 25.4kV (3.36%), 14.5kV (3.72%) and 9.1kV (4.32%) at 765kV, 400kV and 220kV voltage level respectively at Fatehgarh-II(PG) after opening of 240MVAR BR at Fatehgarh-II(PG). However, on the day of incident voltage shoot of around 32 kV was observed at 400 kV level.

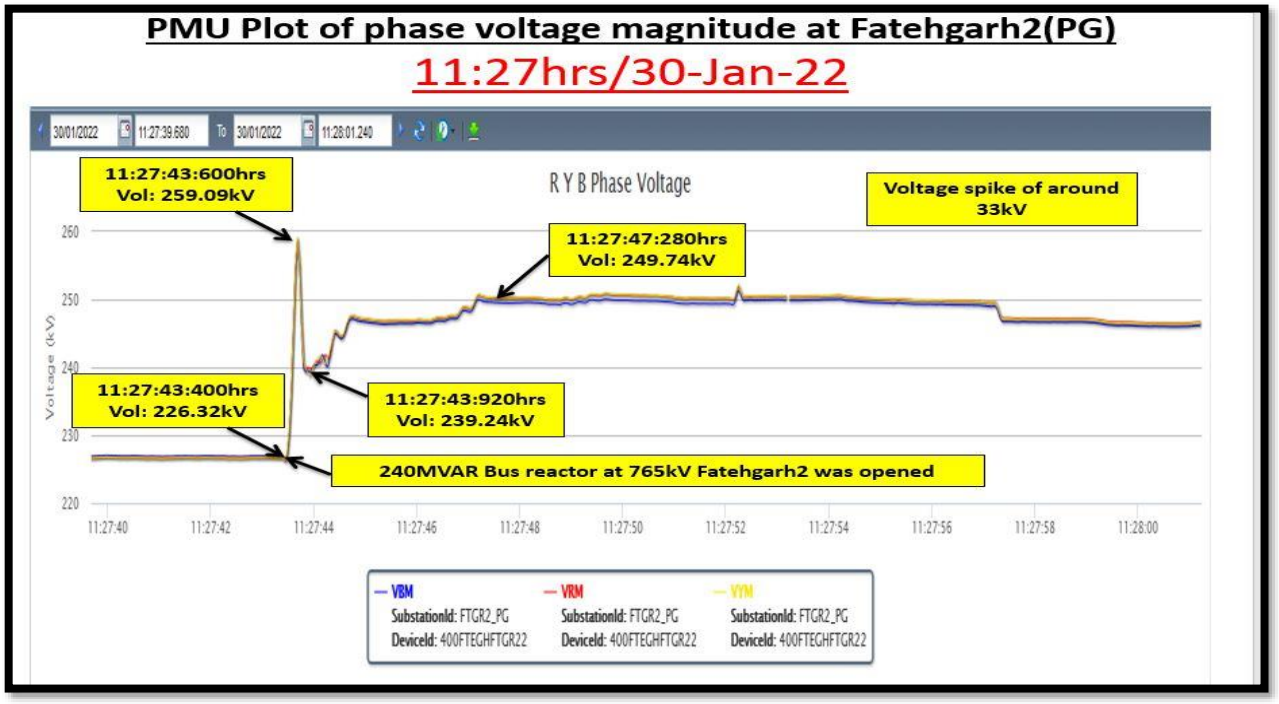
On 30th Jan 2022, at 1127 hrs the Bus Reactor was opened at 765 kV Fatehgarh II and voltage shot up from 227kV to 259 kV (Phase to Ground) in 200 msec. The voltage came down to 239 kV in 320 msec from peak. In the next 3-4 seconds, there was reduction observed in generation of solar parks connected to Fatehgarh II. The different solar parks observed reduction in generation at different instants and this caused the gradual rise in 400 kV voltage. The magnified plot is given below where red dotted line indicates 400 kV Phase to Ground voltage of Fatehgarh II and values in plot refer to secondary axis. The reduction in generation can be observed for different parks using active power values of PMU from 220 kV evacuating line. The trend in red dots indicating voltage falls to zero (shown till 225 kV in plot to manage the scaling) value after 14 seconds of switching of reactor.



The abnormal shoot of voltage indicates that inverter controls maloperated during the voltage rise and caused a very high voltage. Further, the conservative overvoltage settings at 220 kV level like 1.1 p.u with delay of 2-3 seconds in line as well as wrongly adopted settings in 220/33 kV transformers in transmission system evacuating RE park station caused loss of generation. The loss of inverter blocks at certain solar parks without any tripping of evacuation indicate non-compliance of High Voltage Ride through mandated through CEA Regulations.

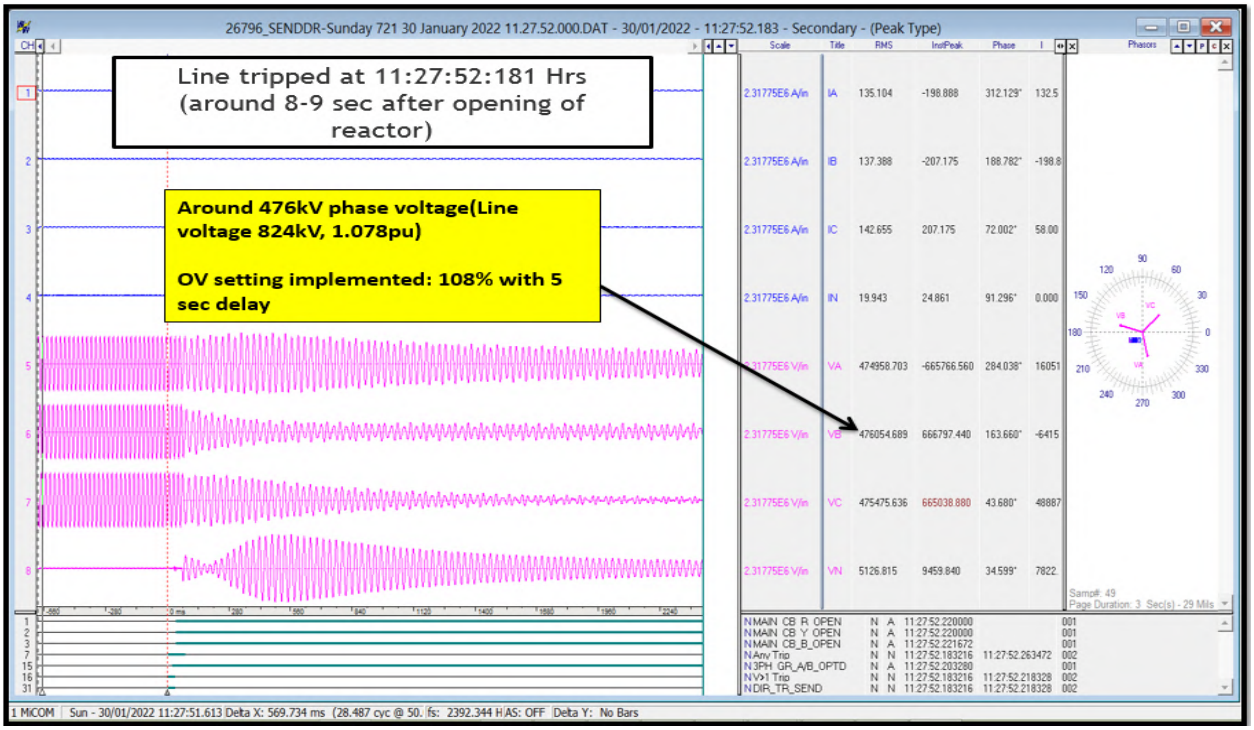
At 765/400/220kV Fatehgarh-2 POWERGRID substation:

At 11:27:43:400 Hrs, 240MVAr Bus reactor-2 at 765kV Fatehgarh2 opened. PMU & SCADA plots describing the voltage behavior during switching operations are as follows:



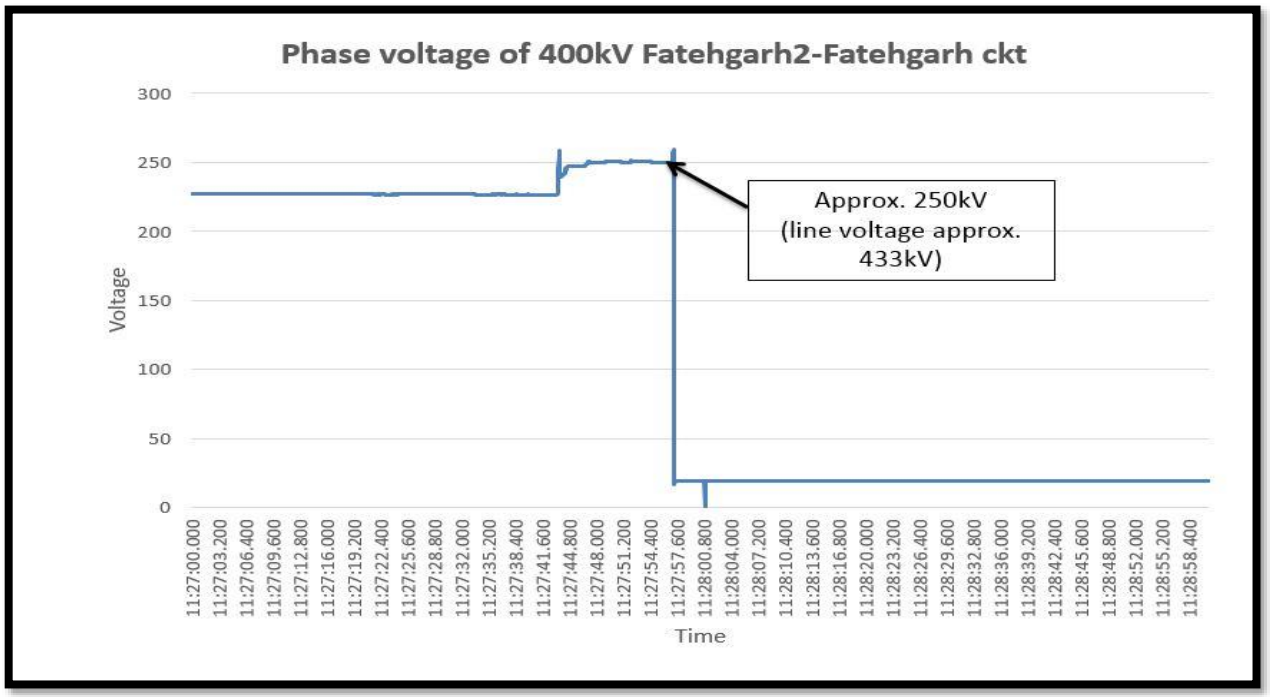
Observations:

- Just after opening of 240MVAr Bus reactor, abnormal spike in voltage of around 33kV in phase voltage is observed.
- As per PMU voltage plot of 400kV Fatehgarh2-Fatehgarh Pooling ckt-2, sudden voltage spike led to rise in phase voltage from 226kV to 259kV (approx. 33kV).
- This voltage rise led to the solar generation loss at few RE stations connected at Fatehgarh2. Due to loss in generation, voltage rose again and sustained at around 249kV phase voltage.
- High voltage of approx. 1.07pu at 765kV side led to the tripping of 765kV Fatehgarh2-Bhadla2 ckt-1. As per DR attached below, line tripped on over voltage protection (stage-1) operation after around 9 sec of reactor opening. Overvoltage setting adopted is 1.08 per unit with time delay of 5 seconds.
- The DR of the 765 kV Fatehgarh2-Bhadla2 ckt-1 at Fatehgarh end is given below.



At 400kV Fatehgarh Pooling (ADANI) substation:

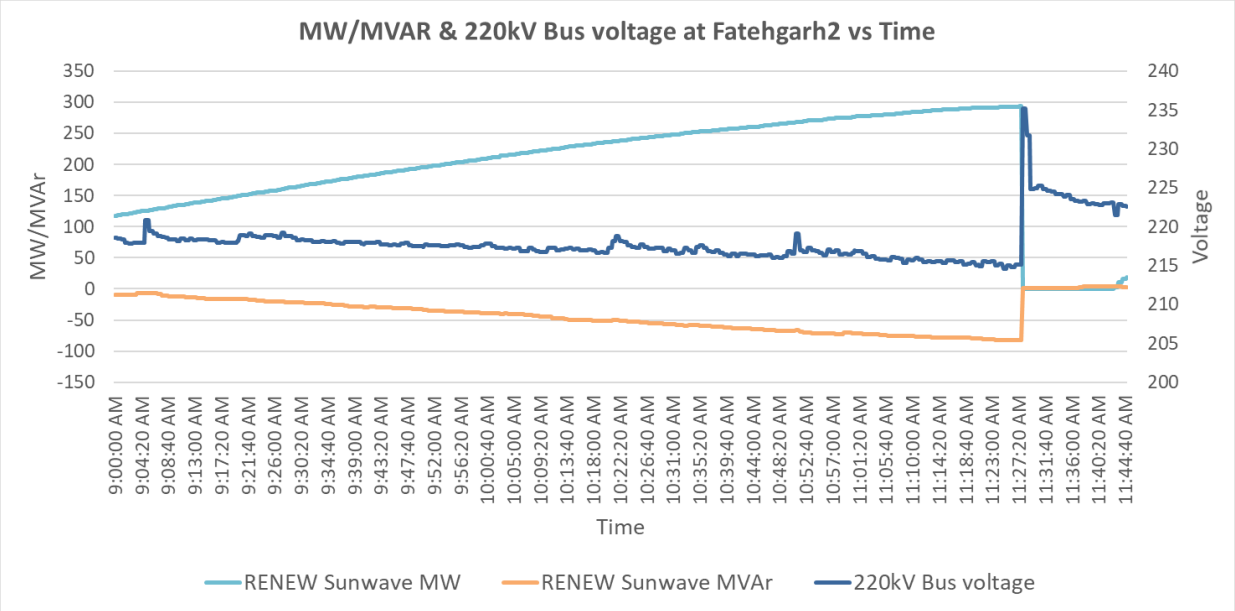
400kV Fatehgarh2-Fatehgarh Pooling ckt-1 tripped on over voltage (stage-1) protection operation. As per PMU attached below, phase voltages were in the permissible range. Line tripped after approx. 14sec of reactor opening.



**-ve MVAr showing reactive power absorption by solar plants*

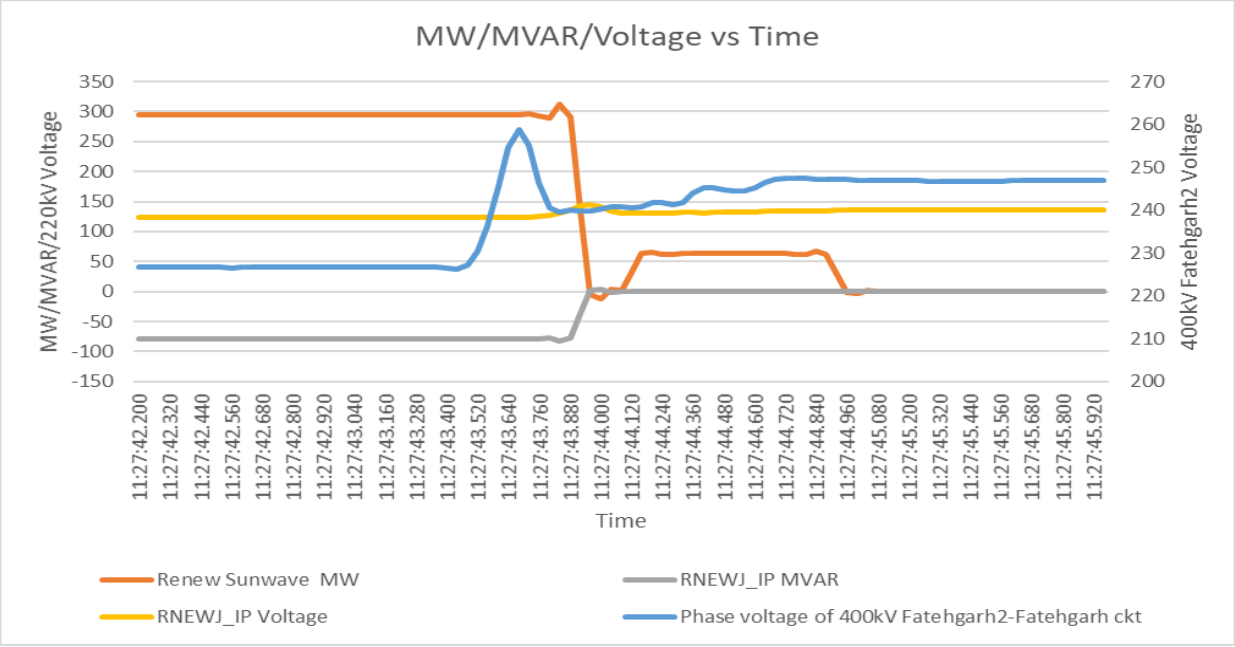
At RENEW Sunwave Solar plant:

The Reactive exchange in antecedent condition was analysed using SCADA data from 0900-1145 hours of the same day.



From above plot, it is observed that RENEW Sunwave was not supporting voltage and therefore was not in voltage control mode.

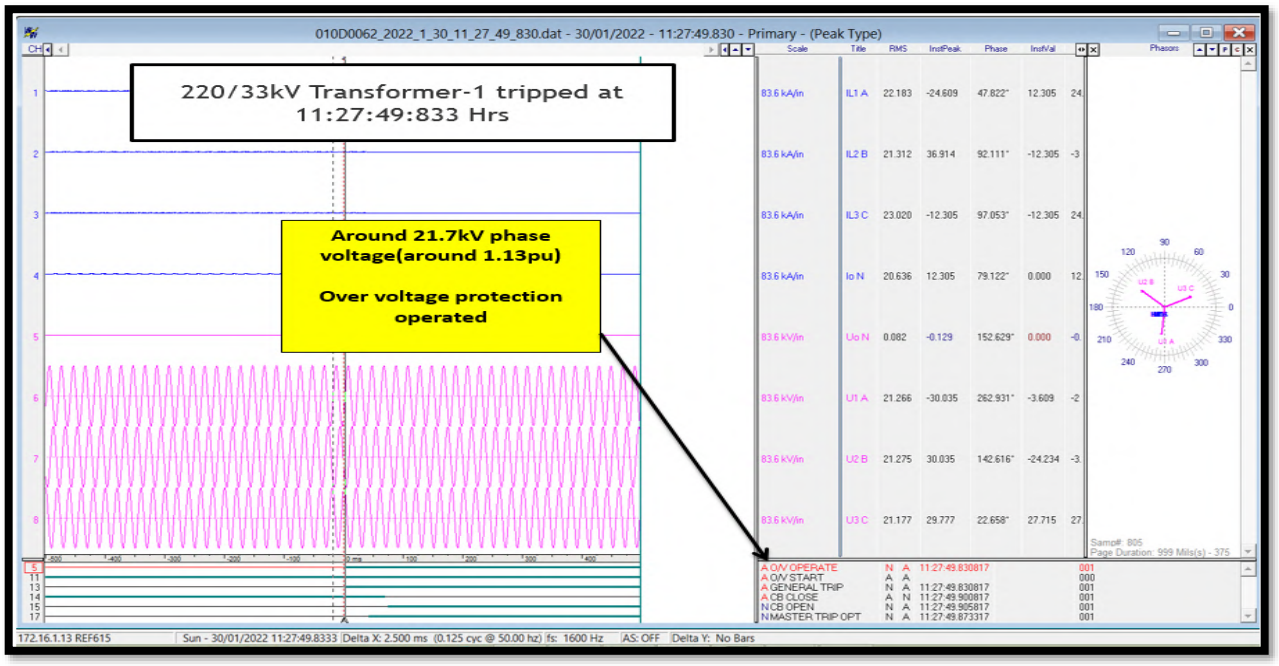
MW/MVAR & Voltage pattern during event time as per PMU data at RENEW Sunwave:

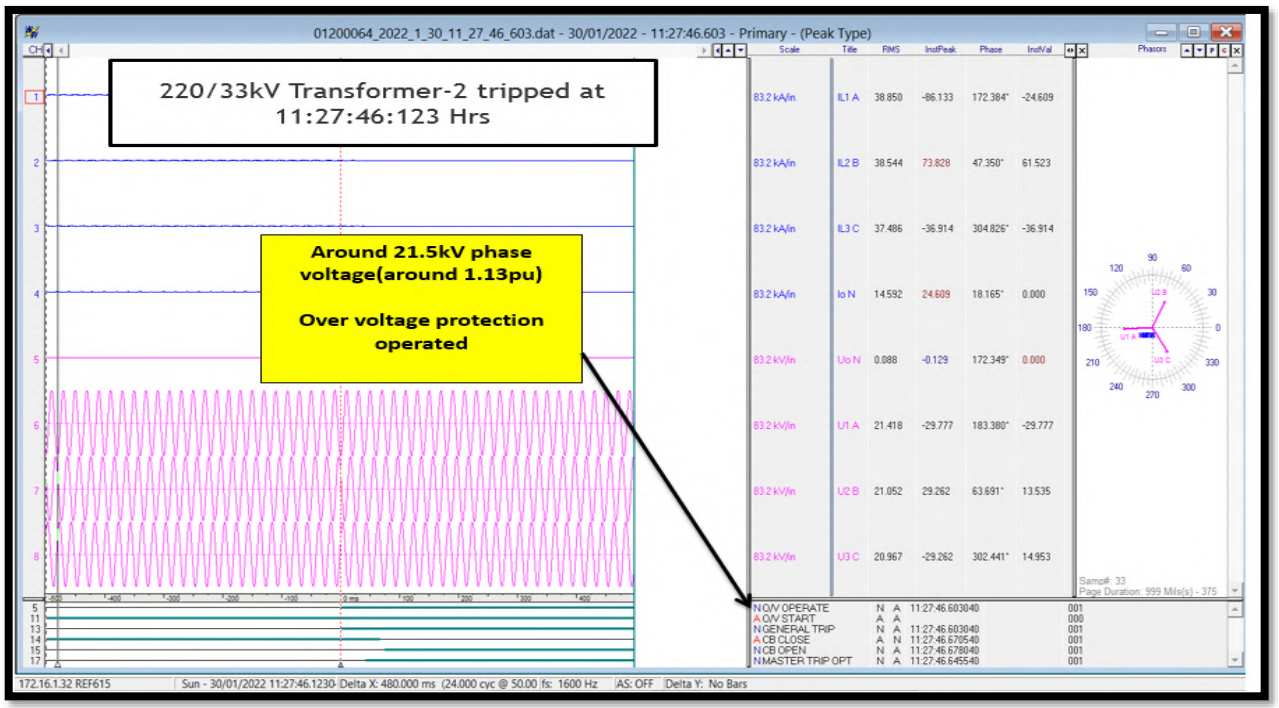


From PMU plot, it is observed that MVAr dropped to zero, generation (MW) also dropped from 295MW to zero then rose back to around 61W and again became zero after around 1 second.

As per SOE, it is observed that 220/33kV Transformers at RENEW Sunwave also tripped during the event. DRs of tripping of transformer are attached below:

DR of 220/33kV transformer-1&2 at RENEW Sunwave





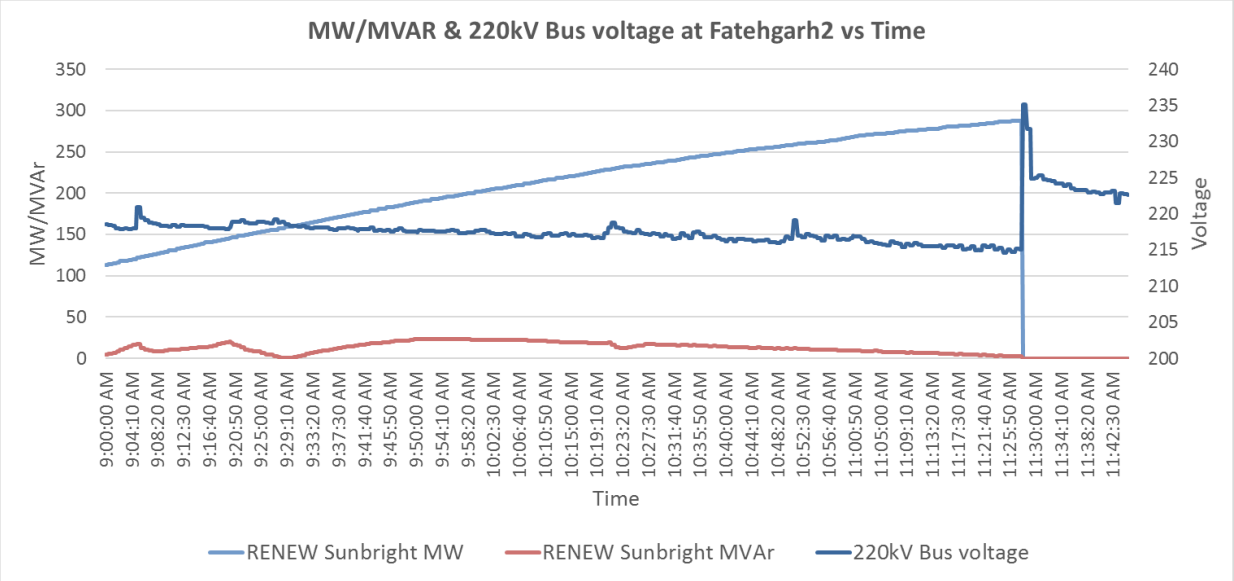
From DR of transformer, it is observed that transformer-1 tripped after around 3 seconds and transformer-2 tripped after around 6 seconds of opening of reactor on overvoltage .

Observations of tripping at RENEW Sunwave solar plant:

- **In antecedent condition, plant was not supporting the grid.**
- **During sudden rise in voltage, MW & MVAr dropped to zero. Why did MW drop to zero? In addition, why did MVAr support not observe during sudden rise in voltage?**
  Proper functioning of PPC needs to be ensured during disturbances.
- **As per protection philosophy, there should not be any over voltage protection setting in transformer, as over flux protection is already available in transformer. Therefore, RENEW Sunwave must disable the over voltage protection at 33kV level.**

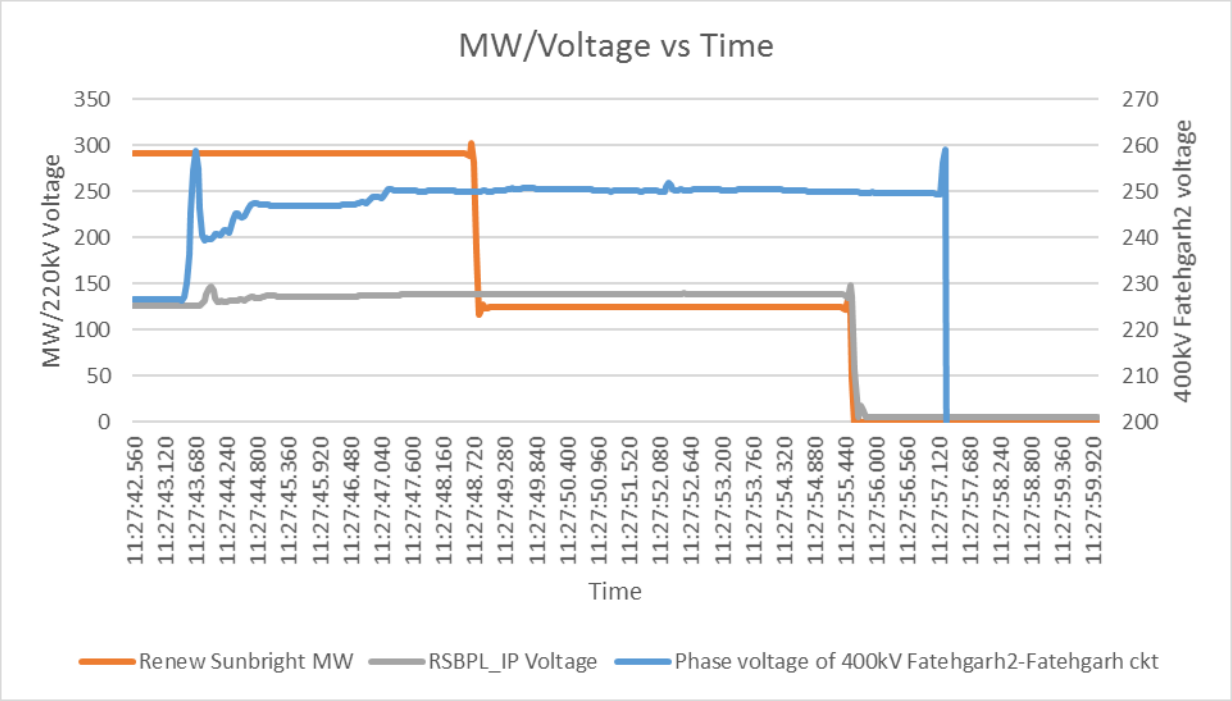
At RENEW Sunbright Solar plant:

Reactive power behavior during antecedent condition as per SCADA data:



From above plot, it is observed that RENEW Sunbright was operating in voltage control mode during antecedent condition.

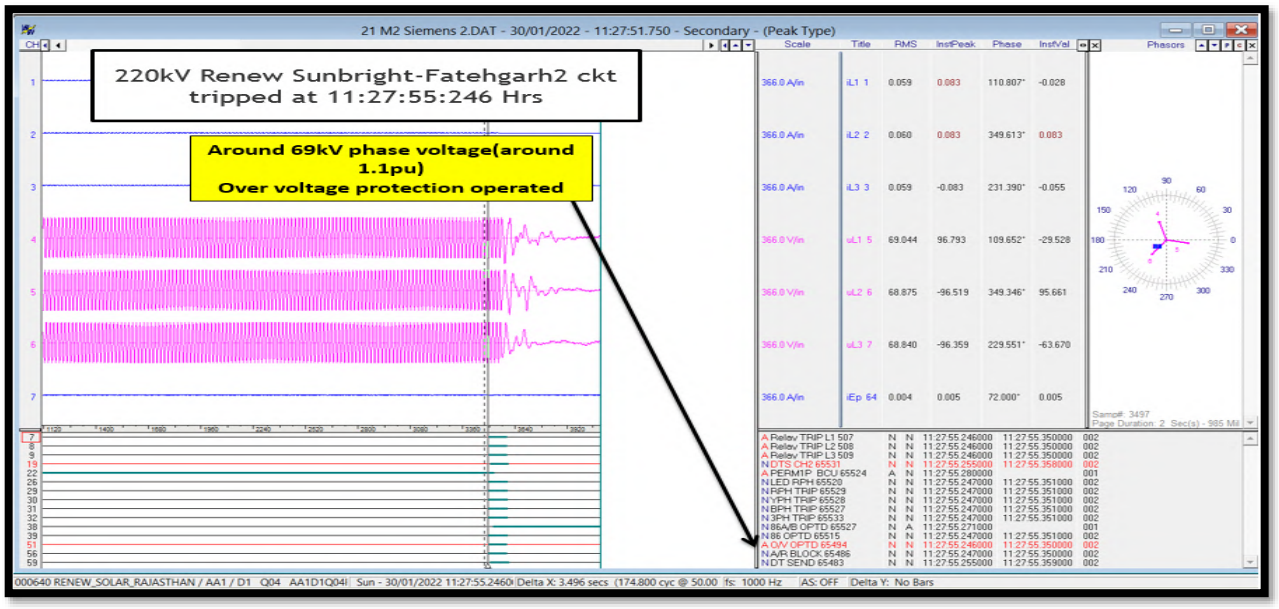
MW/Voltage pattern during event time as per PMU data at RENEW Sunbright:

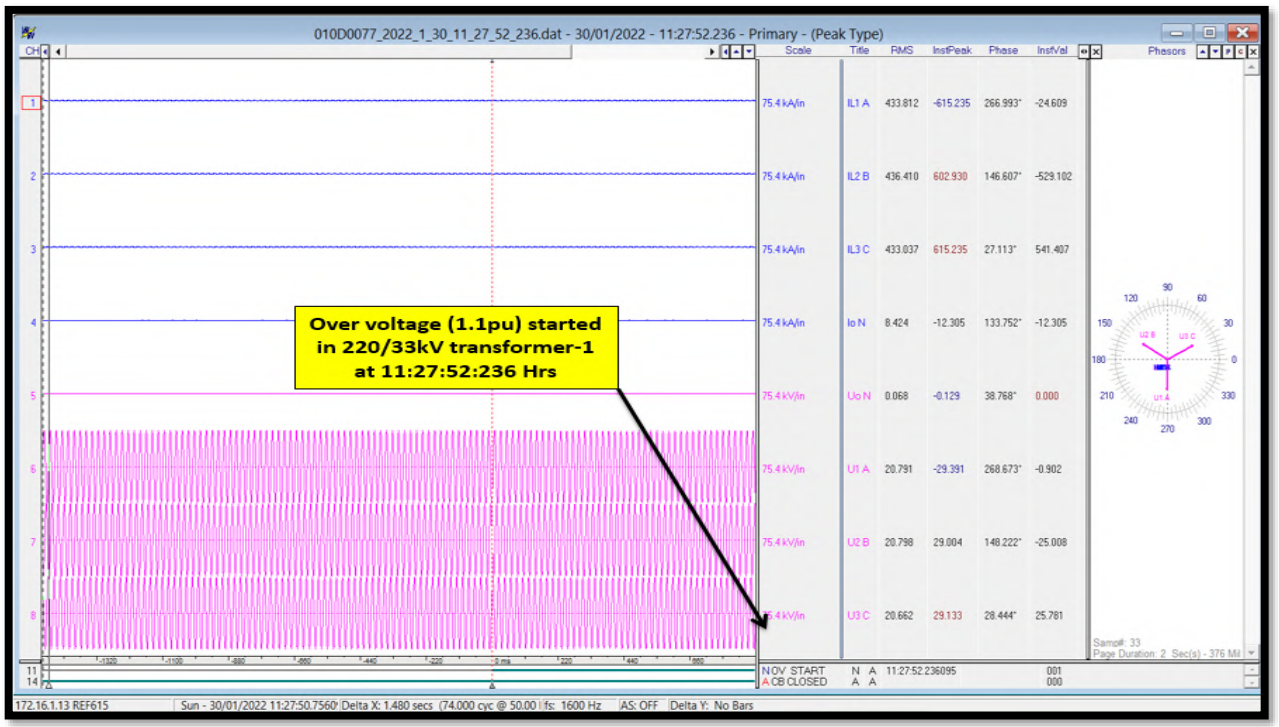


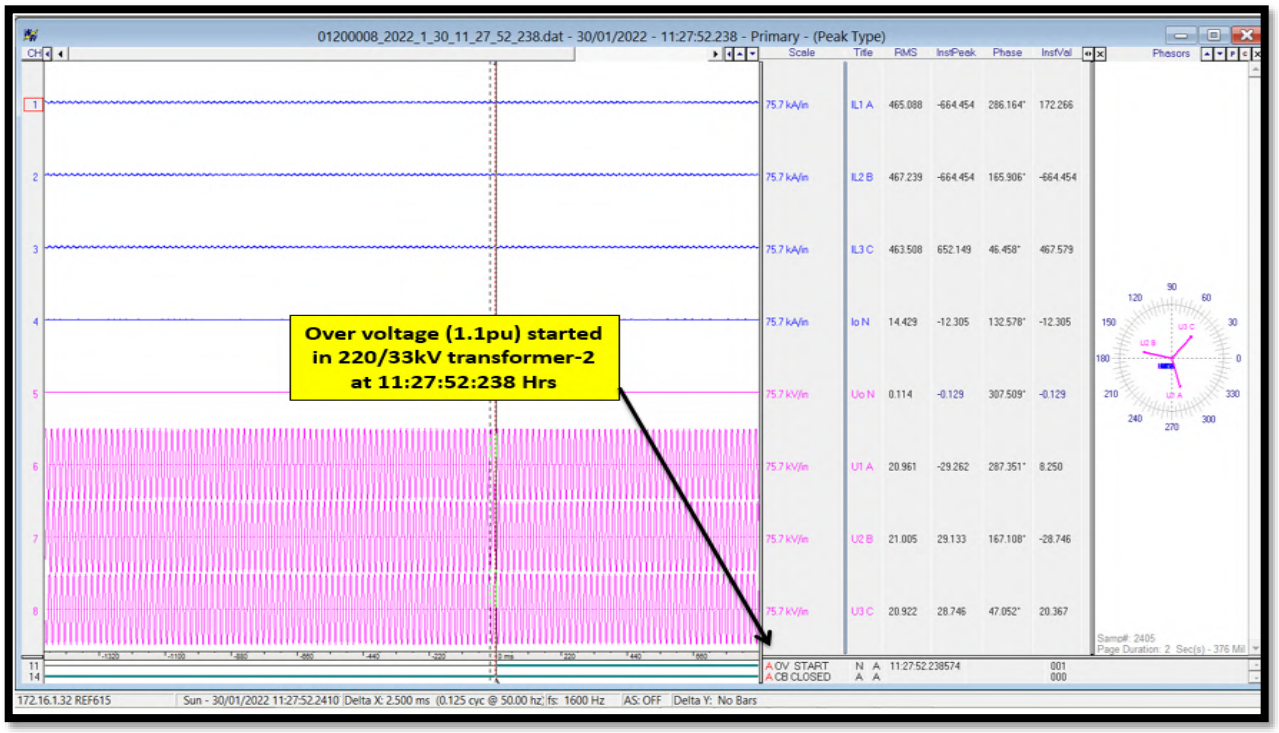
From PMU plot, it is observed that generation (MW) dropped from 290MW to 138MW at 11:27:48:640 Hrs and then dropped to zero (0MW) at 11:27:55:480 Hrs.

As per SOE, it is observed that 220/33kV Transformers and 220kV line to Fatehgarh2 all tripped at around 11:27:55:306 Hrs. DRs of tripping of transformer & 220kV line are attached below:

DR of 220/33kV transformer-1&2 at RENEW Sunbright







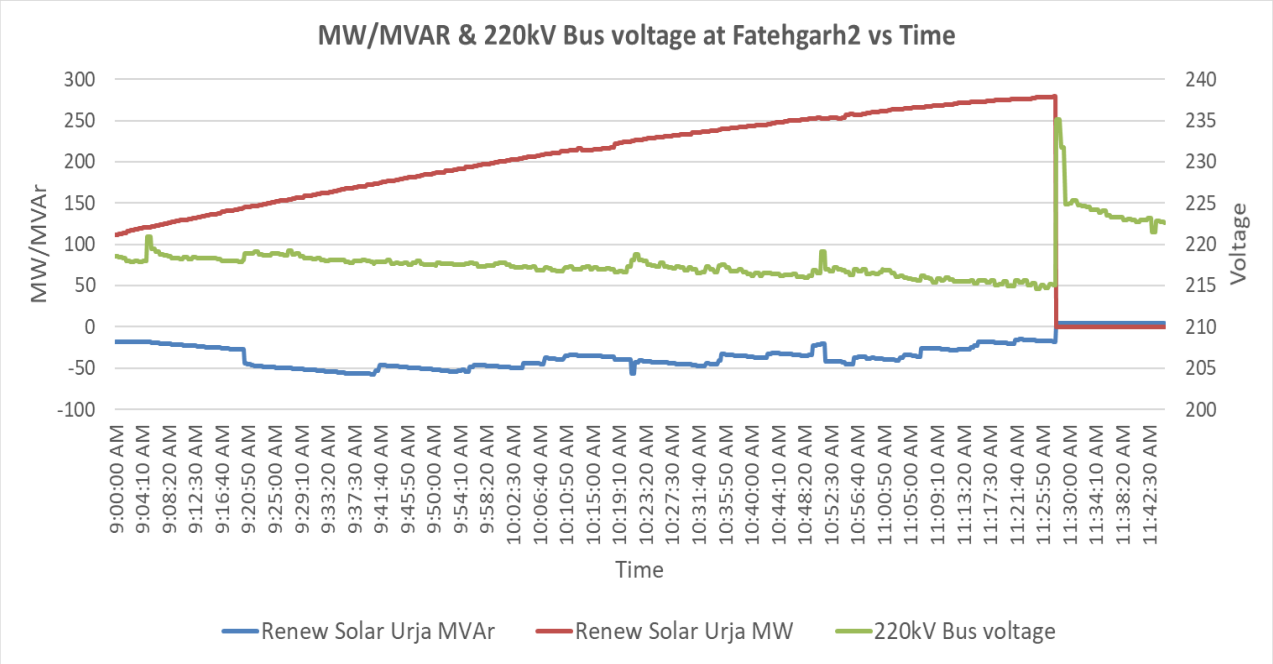
From DR of transformer and 220kV line, it is observed that all three elements tripped at around 11:27:55:236 Hrs (after around 12 seconds of reactor opening).

Observations of tripping at RENEW Sunbright solar plant:

- **Reason of generation drop from 290MW to 138MW at 11:27:48:640 Hrs.**
- **As per protection philosophy, there should not be any over voltage protection setting in transformer, as over flux protection is already available in transformer. Therefore, RENEW Sun bright must disable the over voltage protection in transformer at 33kV level.**

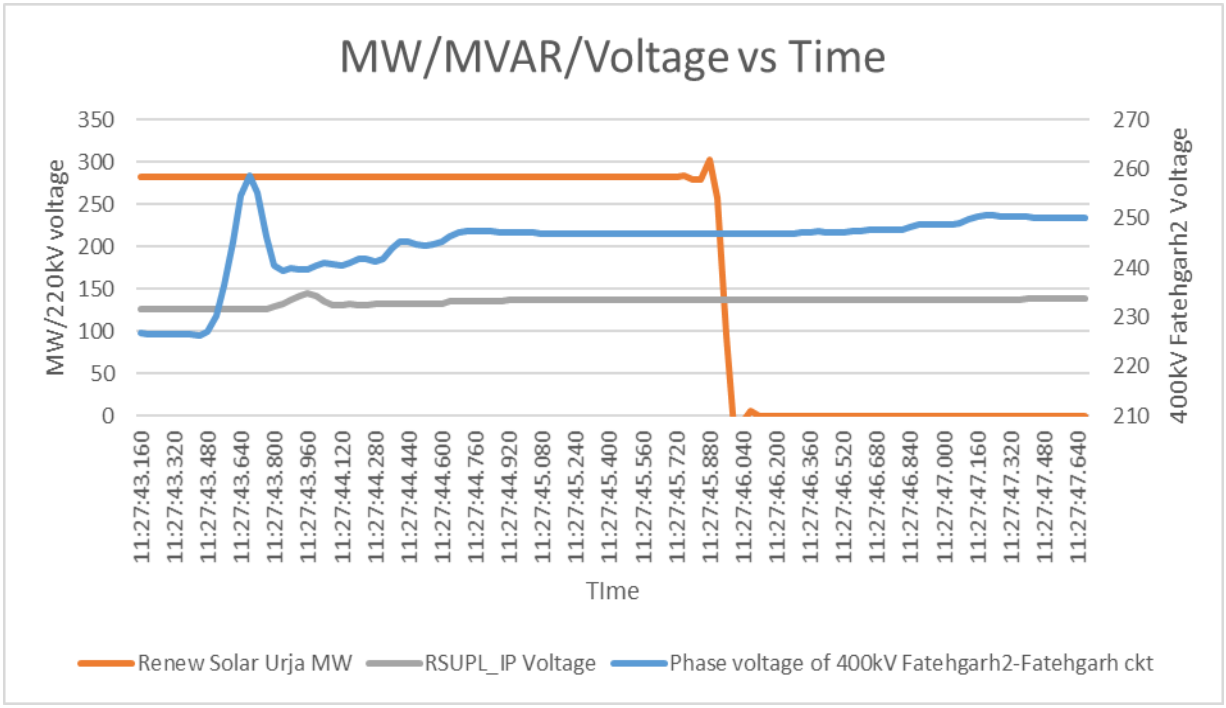
At RENEW Solar Urja Solar plant:

Reactive power behavior during antecedent condition as per SCADA data:



From above plot, it is observed that RENEW Solar Urja was not supporting the grid as it was absorbing the MVAr during antecedent condition.

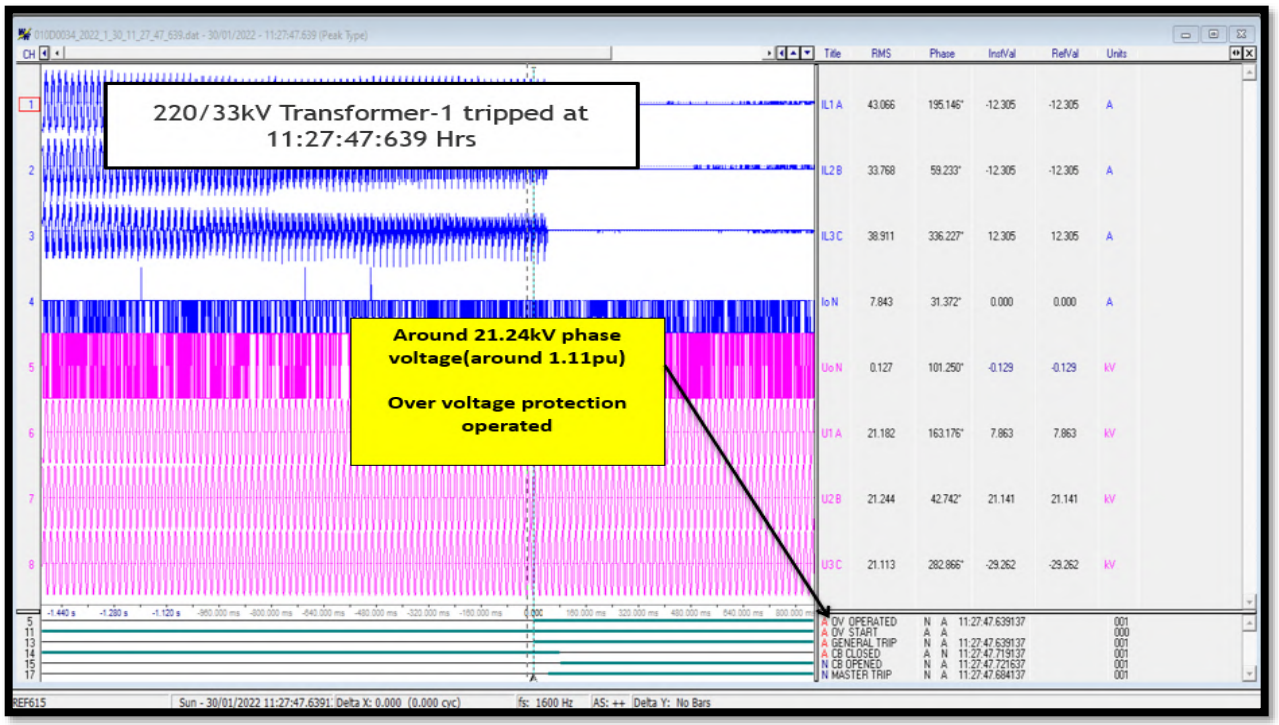
MW/Voltage pattern during event time as per PMU data at RENEW Solar Urja:

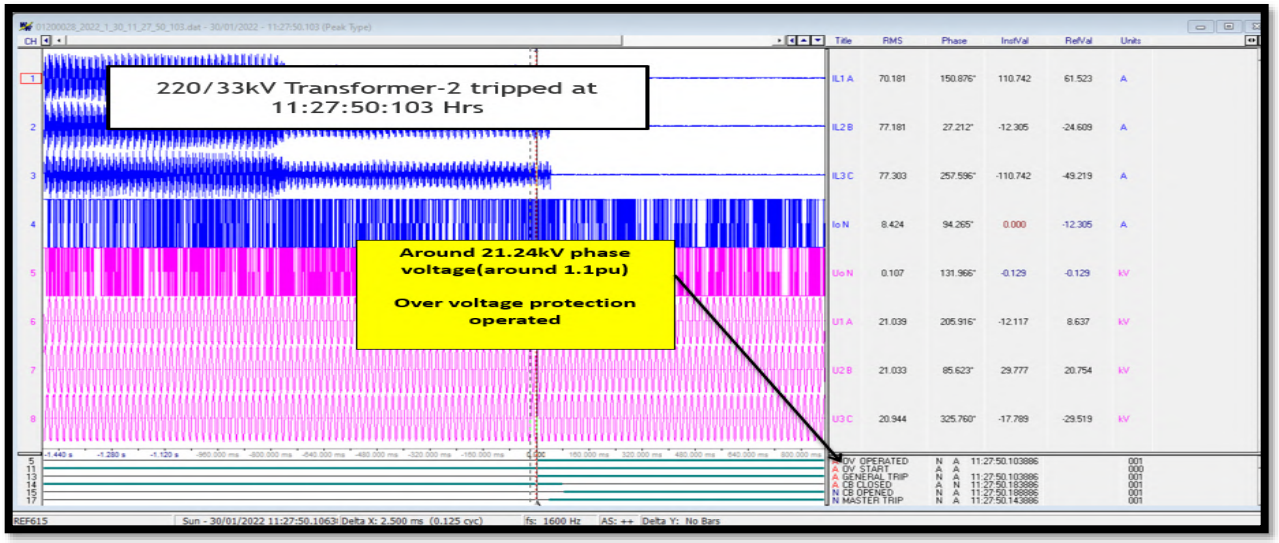


From PMU plot, it is observed that generation (MW) dropped from 283MW to 0MW at 11:27:45:880 Hrs.

As per SOE, it is observed that 220/33kV Transformers and 33kV feeders tripped at around 11:27:48 Hrs. DRs of tripping of transformer & 220kV line are attached below:

DR of 220/33kV transformer-1&2 at RENEW Solar Urja





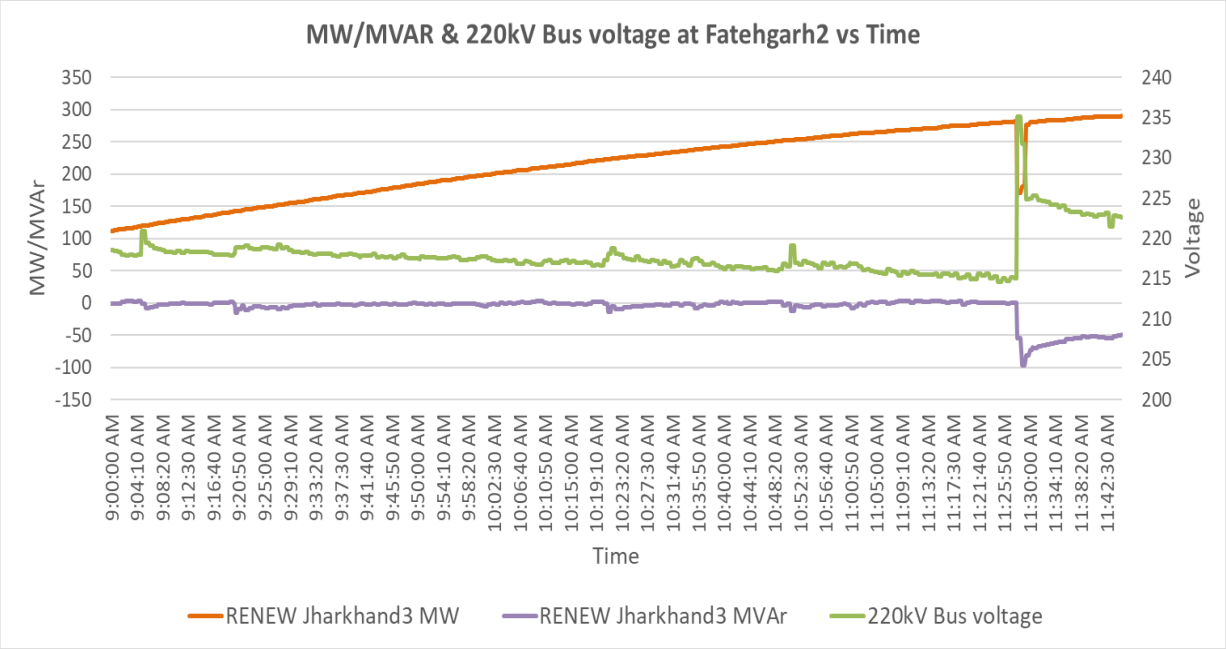
From DR of transformer, 220/33kV transformer-1 tripped at around 11:27:47:639 Hrs (after around 4 sec of reactor opening) and 220/33kV transformer-2 tripped at around 11:27:50:103 Hrs (after around 7 sec of reactor opening).

Observations of tripping at RENEW Solar Urja solar plant:

- **As per PMU generation (MW) dropped to 0MW at 11:27:45:880 Hrs, 1 second before the tripping of transformers.**
- **As per protection philosophy, there should not be any over voltage protection setting in transformer, as over flux protection is already available in transformer. Therefore, RENEW Solar Urja must disable the over voltage protection in transformer at 33kV level.**

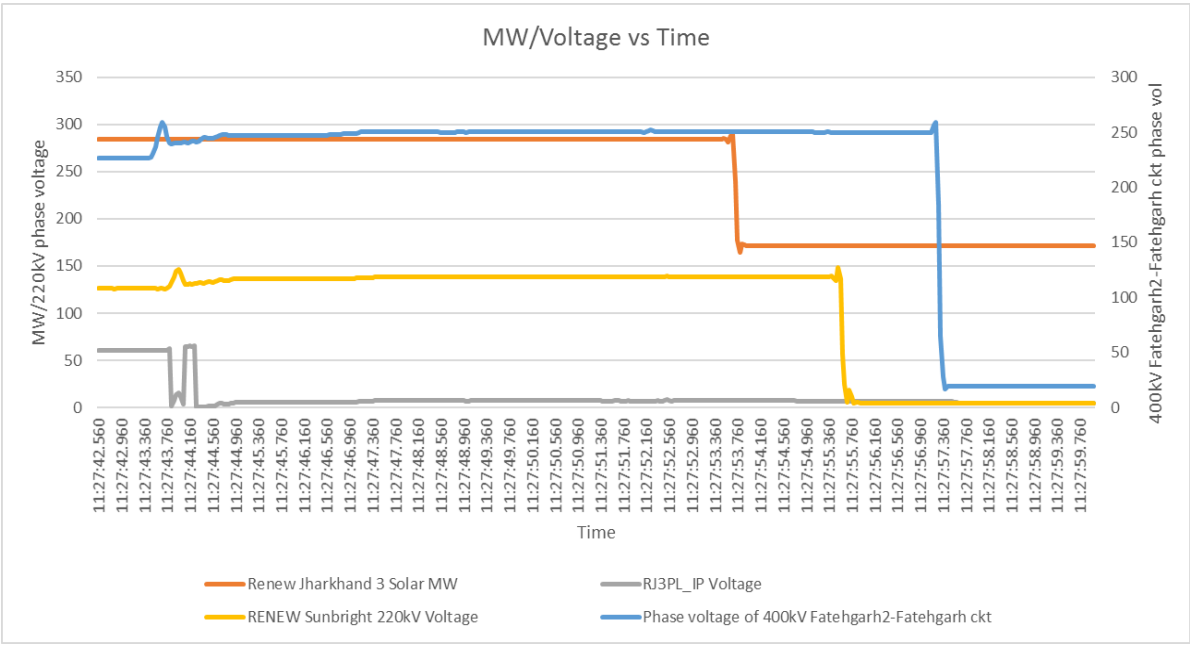
At RENEW Solar Jharkhand3 Solar plant:

Reactive power behavior during antecedent condition as per SCADA data:



From above plot, it is observed that RENEW Jharkhand3 Solar was not supporting the grid as it was absorbing the MVAr during antecedent condition. And during disturbance it supported the grid by rising MVAr absorption to 100MVAr

MW/Voltage pattern during event time as per PMU data at RENEW Jharkhand3 Solar:



From PMU plot, it is observed that generation (MW) dropped from 284MW to 167MW at around 11:27:53 Hrs after around 9 seconds of opening of bus reactor which revived after 11:28:44 Hrs in steps.

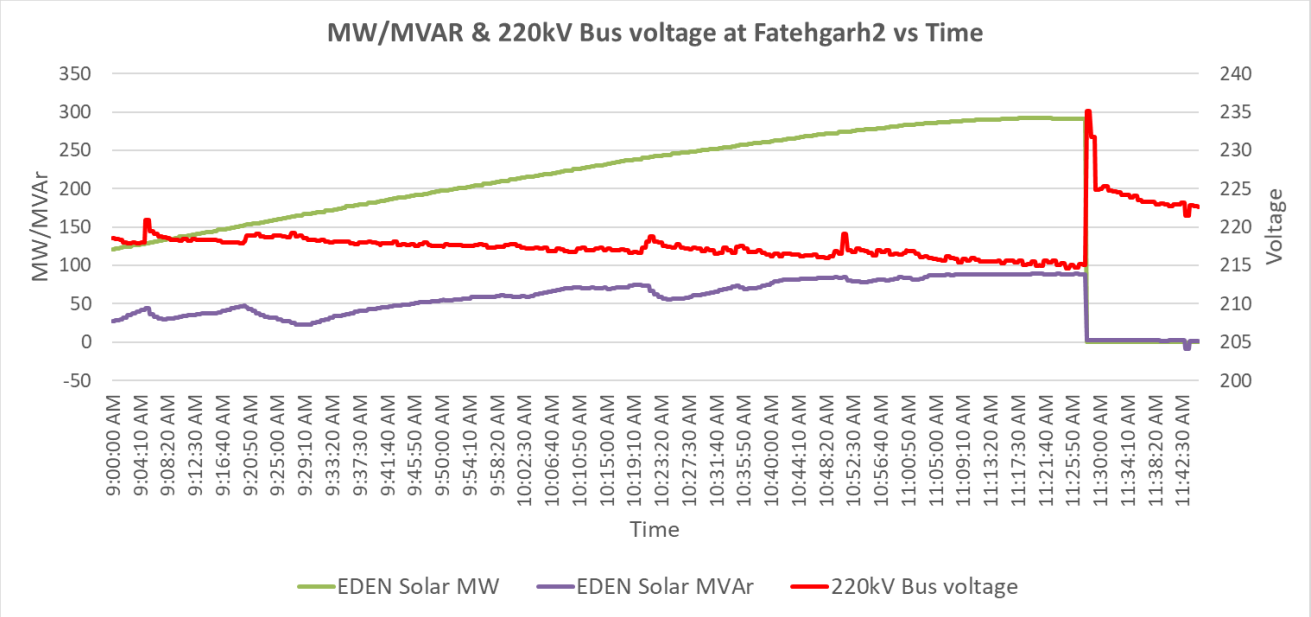
As per SOE, no element tripping is observed at RENEW Jharkhand3 Solar plant.

Observations of tripping at RENEW Jharkhand3 solar plant:

- **As per PMU, drop in generation of approx. 117MW is observed for around 1 minute. On which command this generation drop occurred and why did only 117MW generation dip occur?**

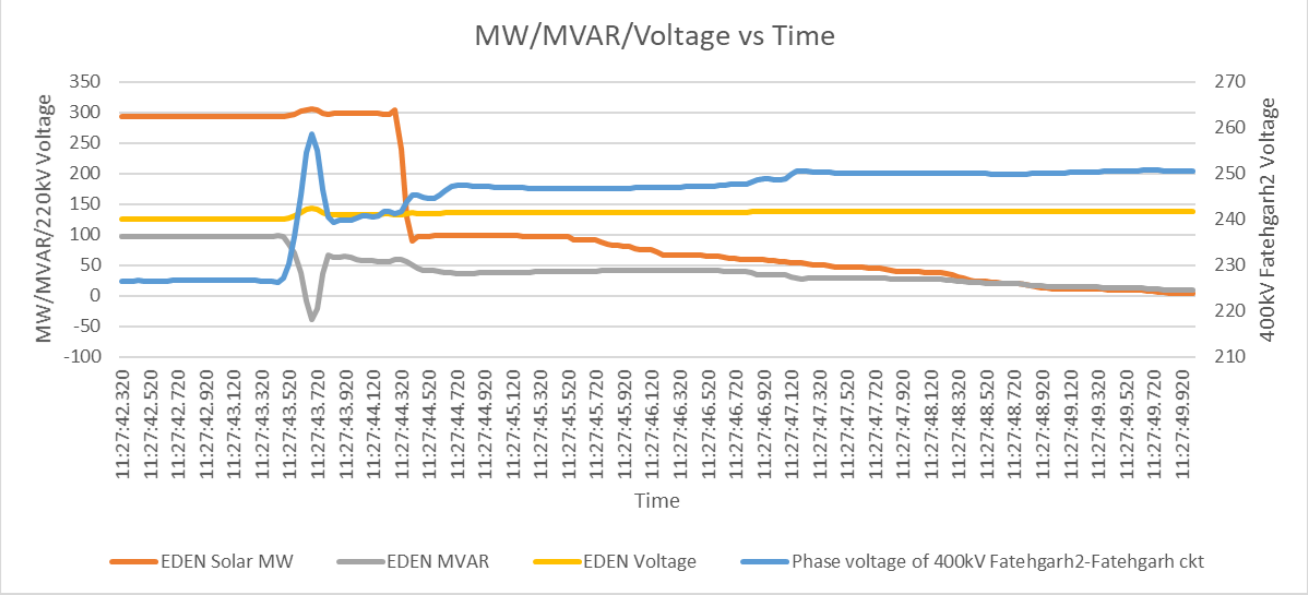
At EDEN Solar plant:

Reactive power behavior during antecedent condition as per SCADA data:



From above plot, it is observed that EDEN Solar plant was running in voltage control mode during antecedent condition.

MW/Voltage pattern during event time as per PMU data at EDEN Solar:



From PMU plot, it is observed that EDEN solar supported the grid by absorbing the MVAr and hold the generation (MW) during voltage shoot up. However, after around 300-400ms, generations dropped from 296MW to 98MW and then gradually dropped to zero (0) within five (05) seconds.

As per SOE, it is observed that 33kV feeders tripped at around 11:28:10:562 Hrs.

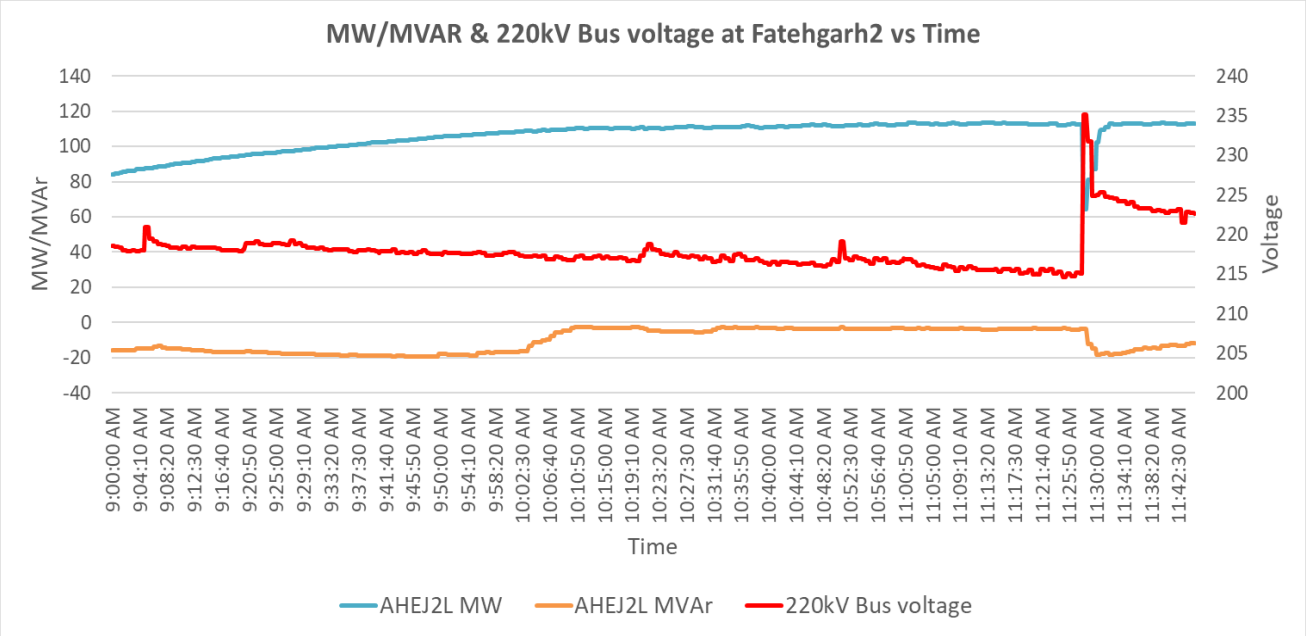
As per details received from EDEN solar, 220kV Fatehgarh2-EDEN ckt tripped from EDEN end on over voltage protection operation. (Over voltage protection setting is 1.1pu with 2 sec delay)

Observations of tripping at EDEN solar plant:

- **DR of tripped 220kV line from EDEN is yet to be received.**
- **If 220kV EDEN-Fatehgarh2 ckt tripped after**
- **As upper range of operating voltage at 220kV level is 245kV, over voltage protection setting should be kept above it and with delay not less than 5 seconds.**
- **As per SOE, tripping of 220kV line from EDEN solar is not captured. Communication of status of all the elements to NRLDC needs to be ensured.**

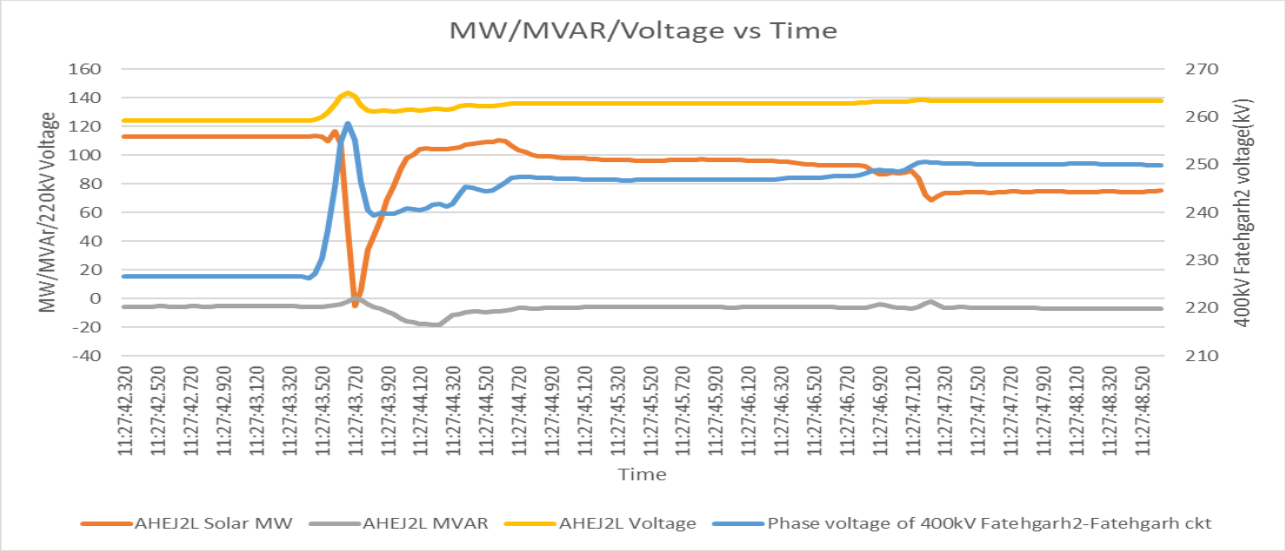
At AHEJ2L Solar plant:

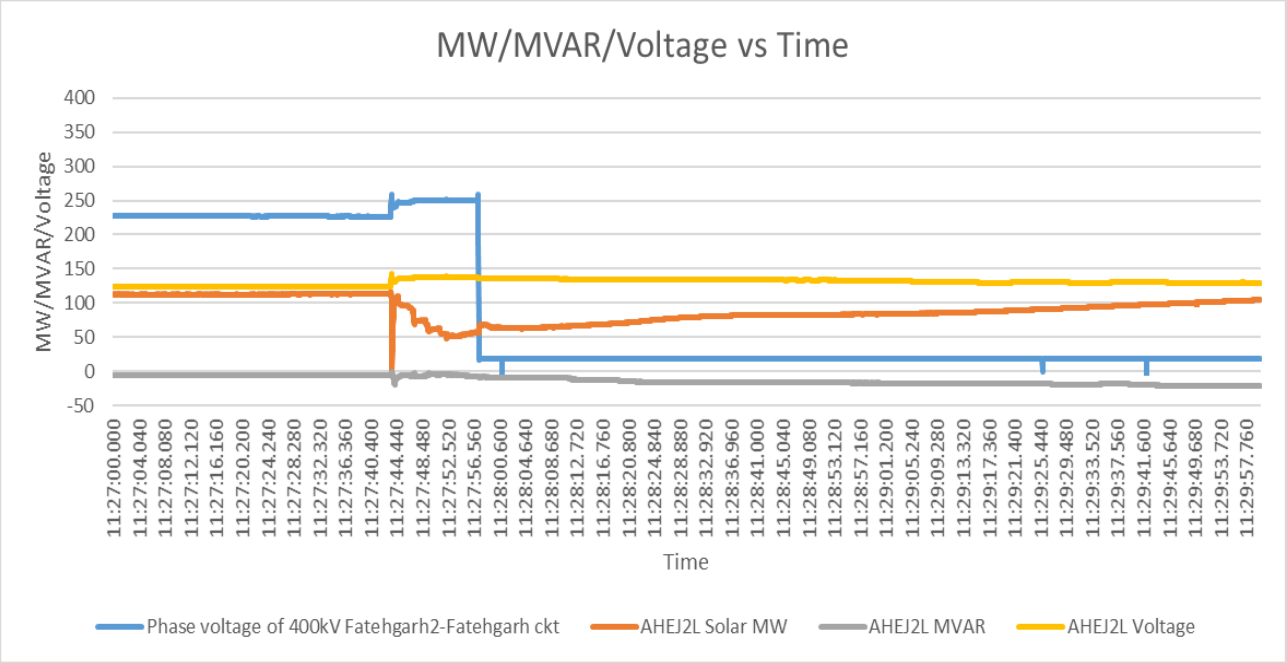
Reactive power behavior during antecedent condition as per SCADA data:



From above plot, it is observed that AHEJ2L Solar plant was absorbing the MVAr during antecedent condition and supported the grid during disturbance (sudden shoot up) by increasing MVAr absorption although magnitude of MVAr absorption is not significant.

MW/Voltage pattern during event time as per PMU data at AHEJ2L Solar:





From PMU plot, it is observed that AHEJ2L solar generation dropped from 112MW to zero and rose back to around 110MW within around 500ms. Again, generation gradually dropped to approx. 50MW within 10 seconds and rose back to 105MW within approx. two (02) minutes.

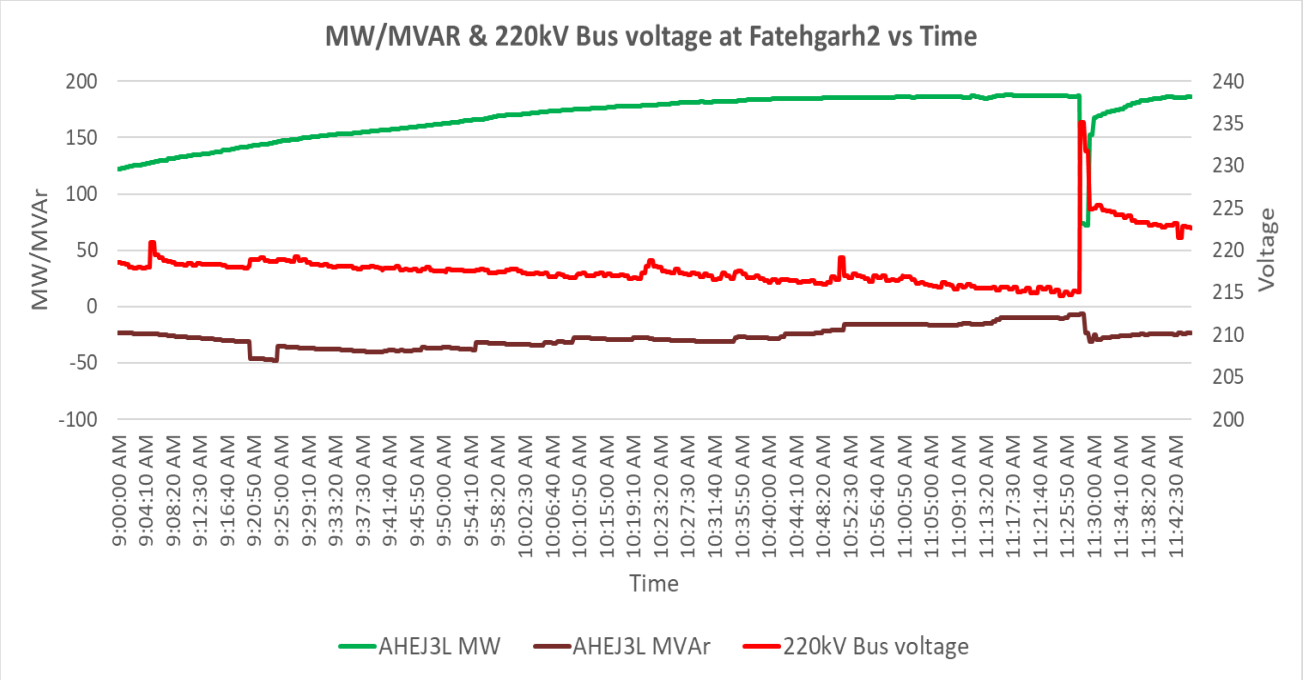
As per SOE, no elements tripping is observed at AHEJ2L Solar plant.

Observations of tripping at AHEJ2L solar plant:

- **Reason of gradual drop in generation of approx. 50MW?**
- **Whether inverters tripped at AHEJ2L Solar plant? If yes, then why did only around half of inverters trip?**

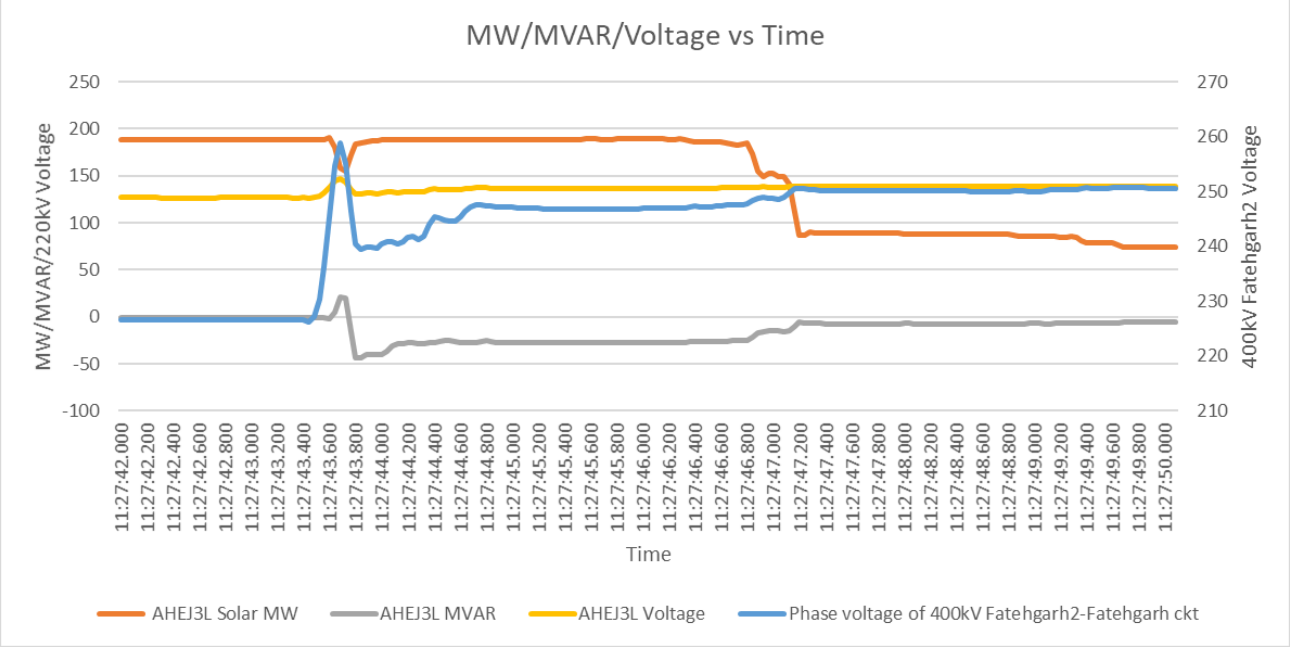
At AHEJ3L Solar plant:

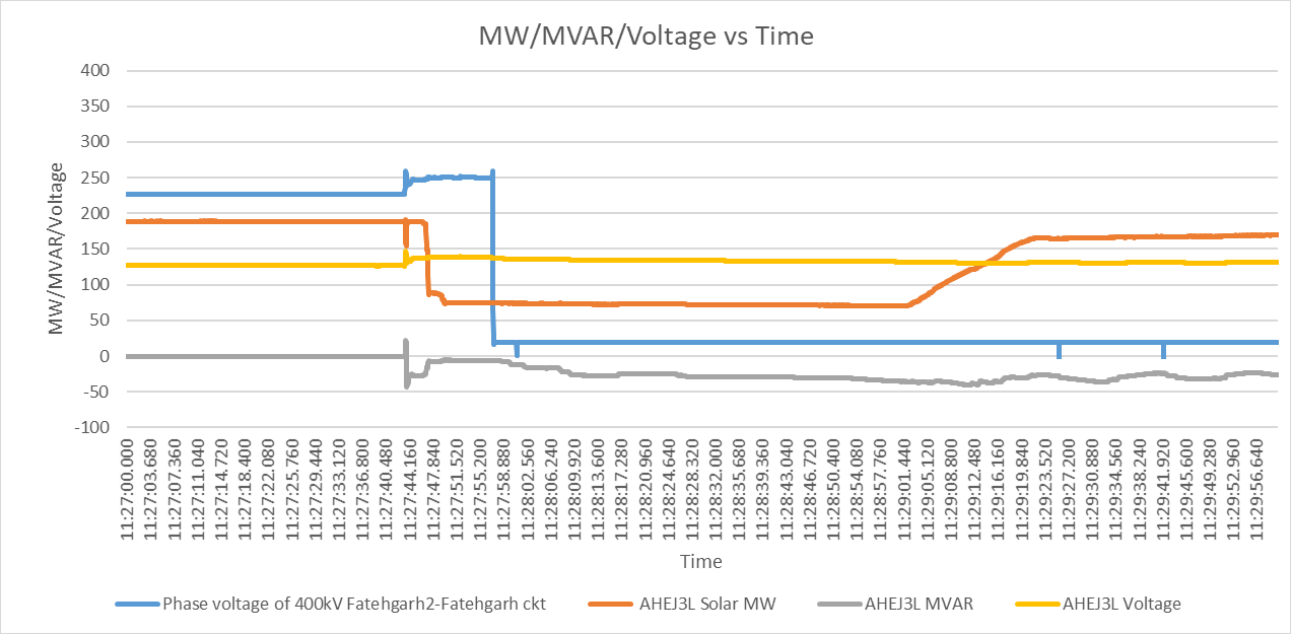
Reactive power behavior during antecedent condition as per SCADA data:



From above plot, it is observed that AHEJ3L Solar plant was absorbing the MVAr during antecedent condition and supported the grid during disturbance (sudden shoot up) by increasing MVAr absorption although magnitude of MVAr absorption is not significant.

MW/Voltage pattern during event time as per PMU data at AHEJ3L Solar:





From PMU plot, it is observed that AHEJ3L solar generation dropped from 186MW to 89MW after three (03) seconds of opening of reactor and rose back to around 170MW within around 1.5 minutes.

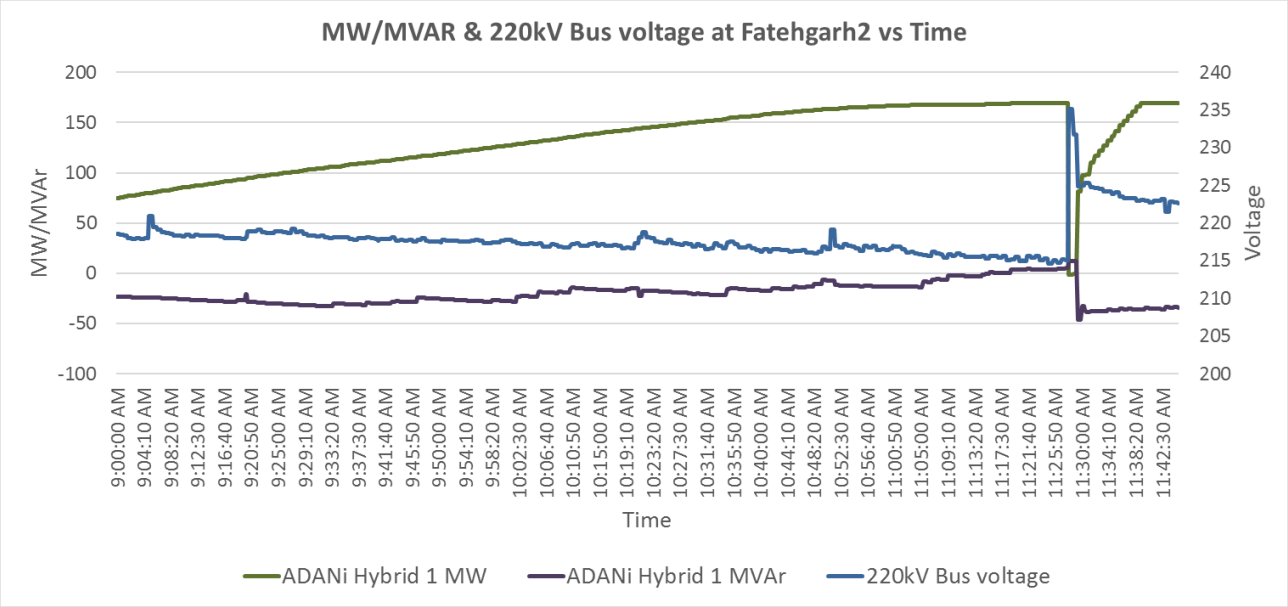
As per SOE, no elements tripping is observed at AHEJ3L Solar plant.

Observations of tripping at AHEJ3L solar plant:

- **It seems that tripping of inverters led to the solar generation loss of approx. 100MW for 1.5 minutes. On which command tripping of inverters occurred?**
- **Whether inverters tripped at AHEJ3L Solar plant? If yes, then why did only around half of inverters trip?**

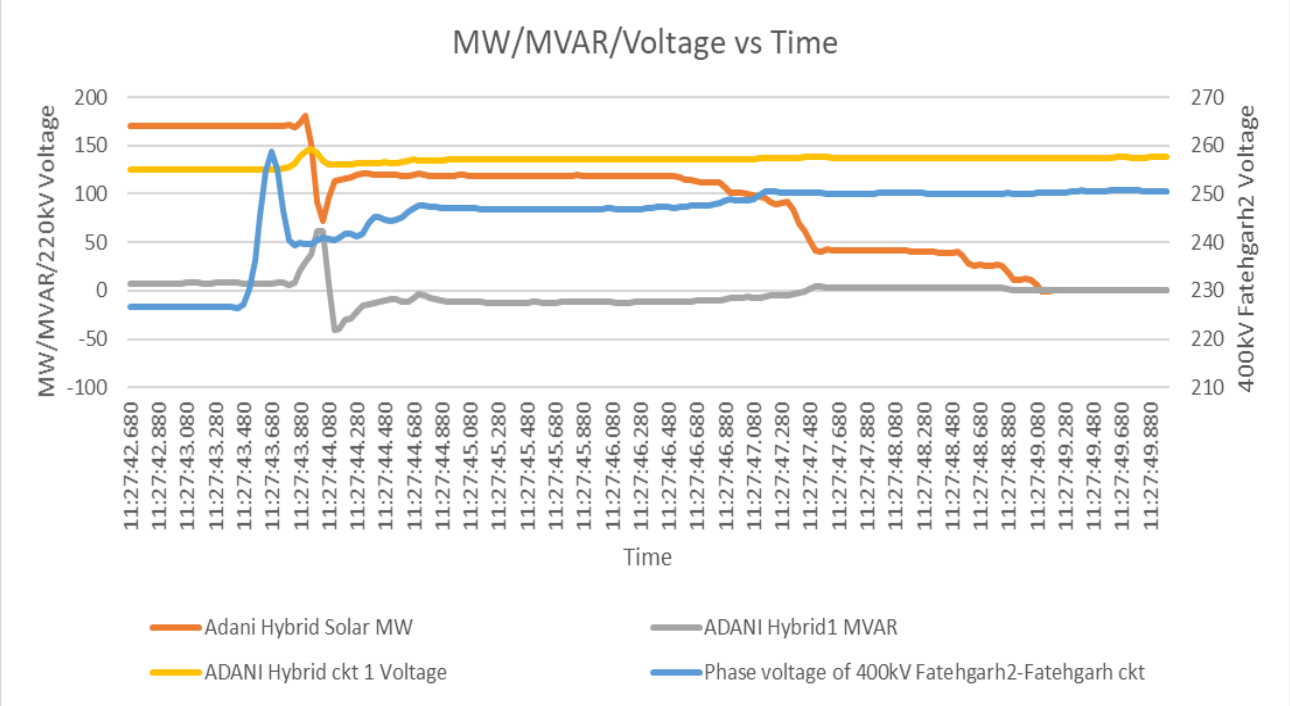
At ADANI Hybrid Solar plant:

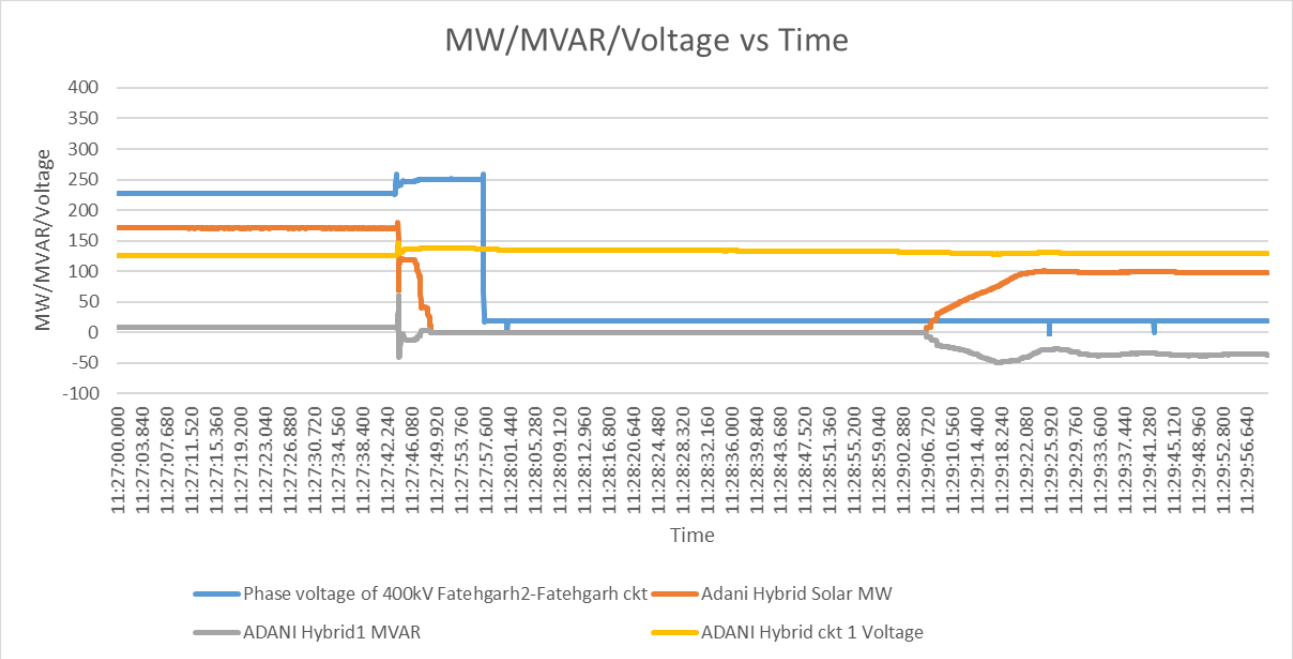
Reactive power behavior during antecedent condition as per SCADA data:



From above plot, it is observed that ADANI Hybrid 1 Solar plant was absorbing the MVAr during antecedent condition and supported the grid during disturbance (sudden shoot up) by increasing MVAr absorption.

MW/Voltage pattern during event time as per PMU data at ADANI Hybrid 1 Solar:





From PMU plot, it is observed that ADANI Hybrid 1 solar generation gradually dropped from 170MW to 0MW after five (05) seconds of opening of reactor and rose back to around 98MW within around 1.5 minutes.

As per SOE, no elements tripping is observed at ADANI Hybrid 1 Solar plant.

Observations of tripping at ADANI Hybrid solar plant:

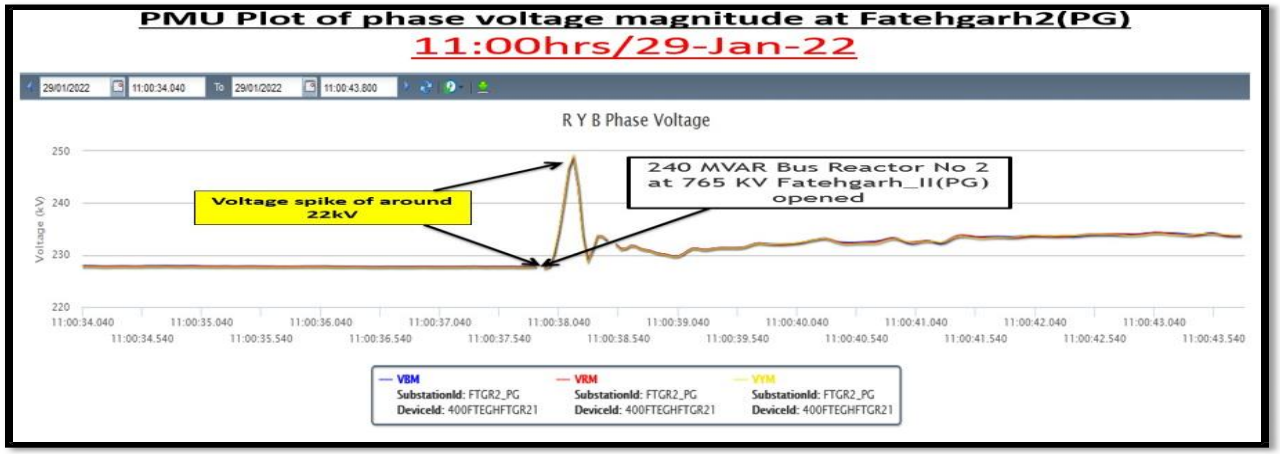
- **It seems that tripping of inverters led to the solar generation loss of approx. 170MW for 1.5 minutes. On which command tripping of inverters occurred?**

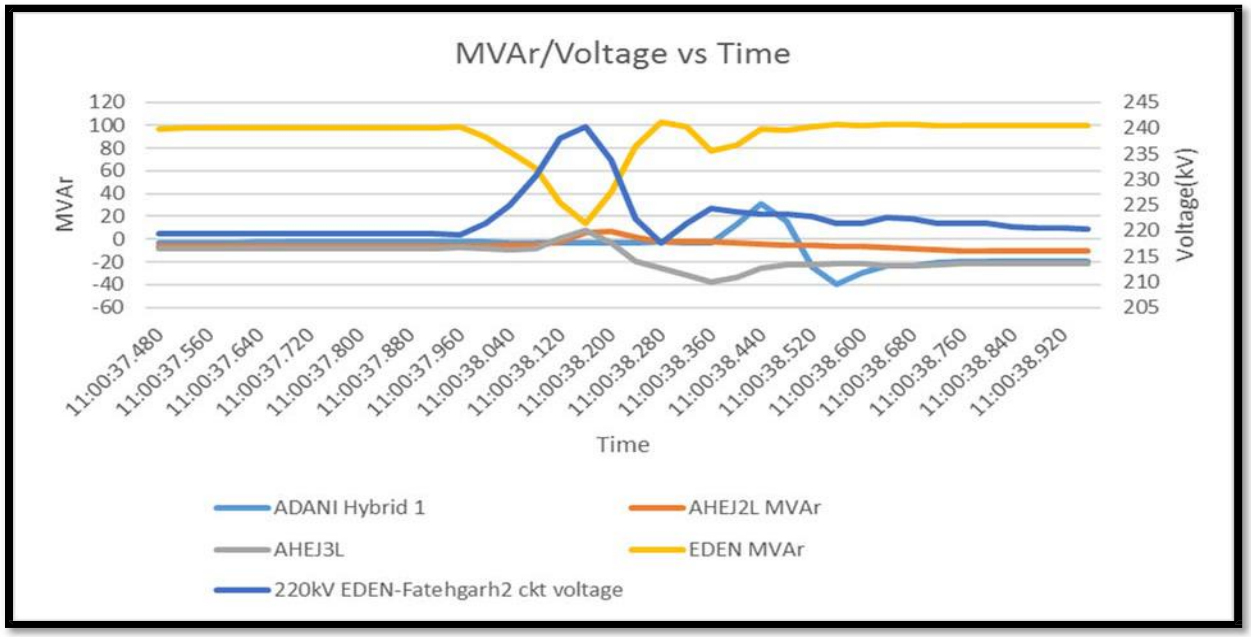
Annexure-1

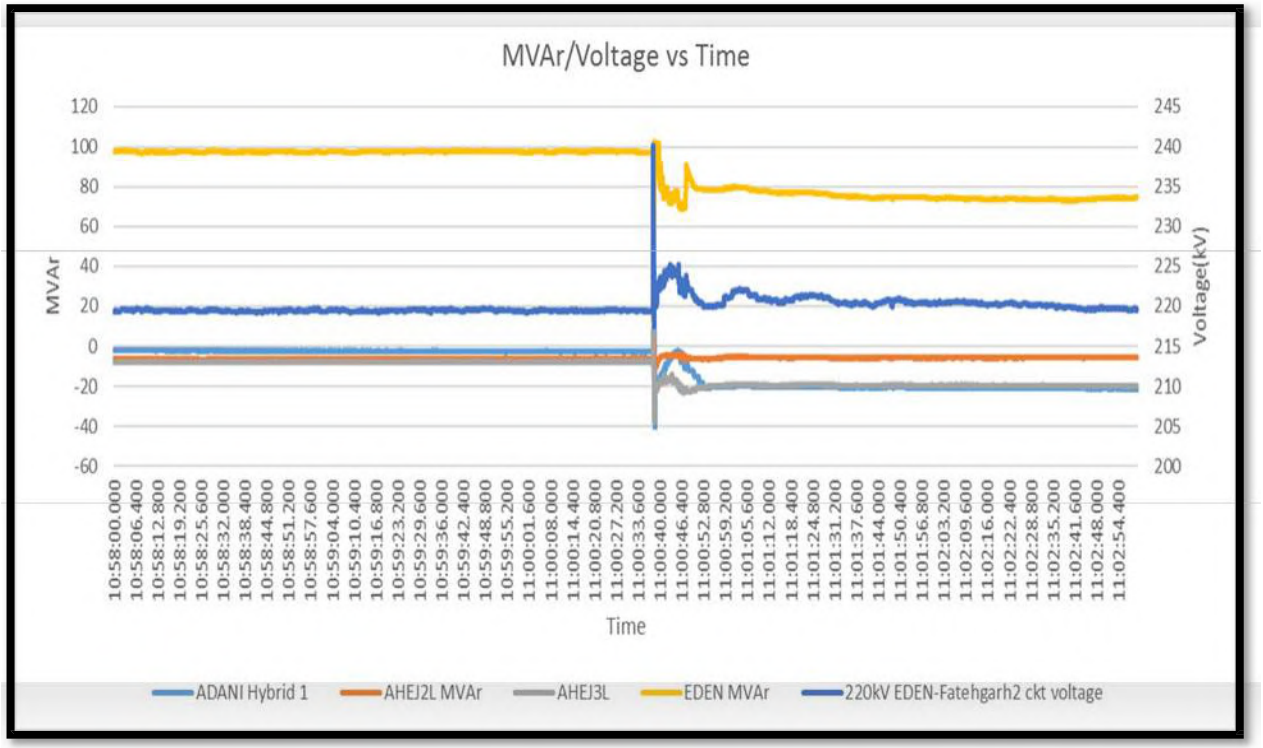
Behavior of inverters during normal reactor opening

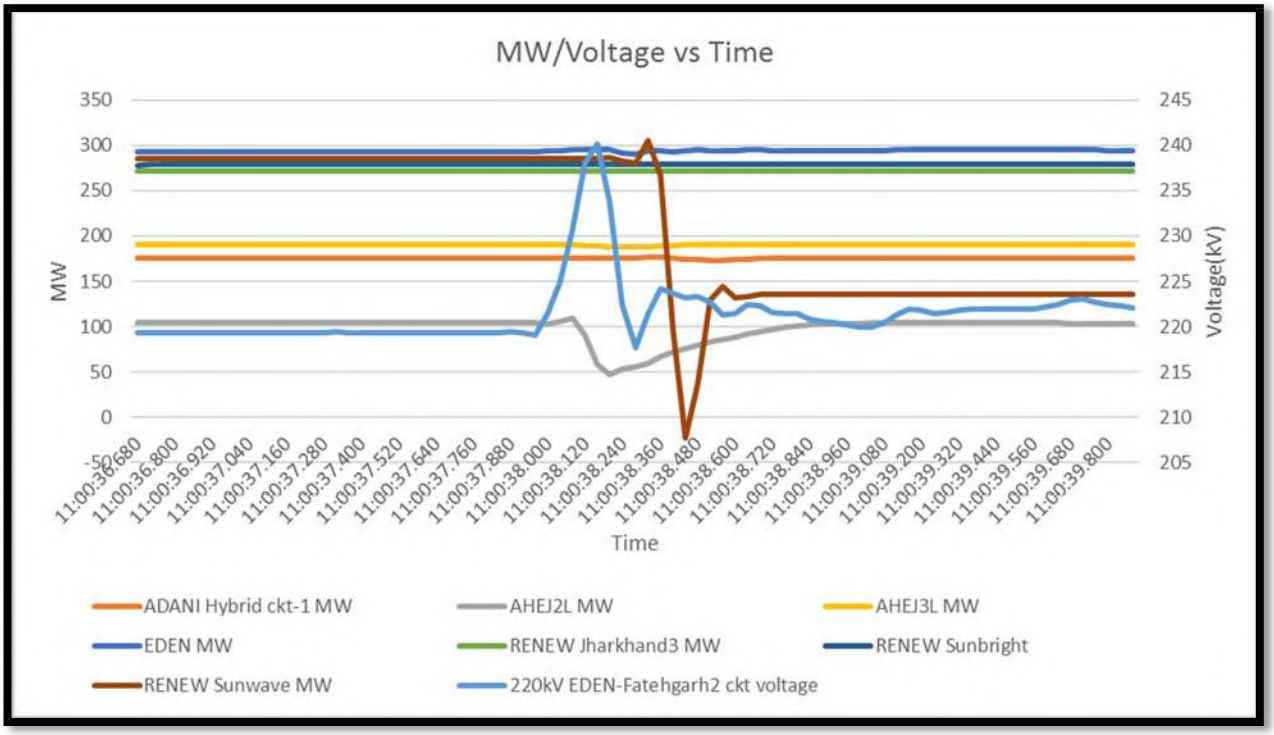
It was tried to observe the behavior of inverters for the similar event of bus reactor opening as this is a regular phenomenon. The inverter response to Bus Reactor opening at Fatehgarh-2 using PMU data has been recorded. It is observed that there are few plants which behave randomly during transient rise in voltage, this phenomenon is aggravated in certain cases and may cause the high voltage spreading over different time span.

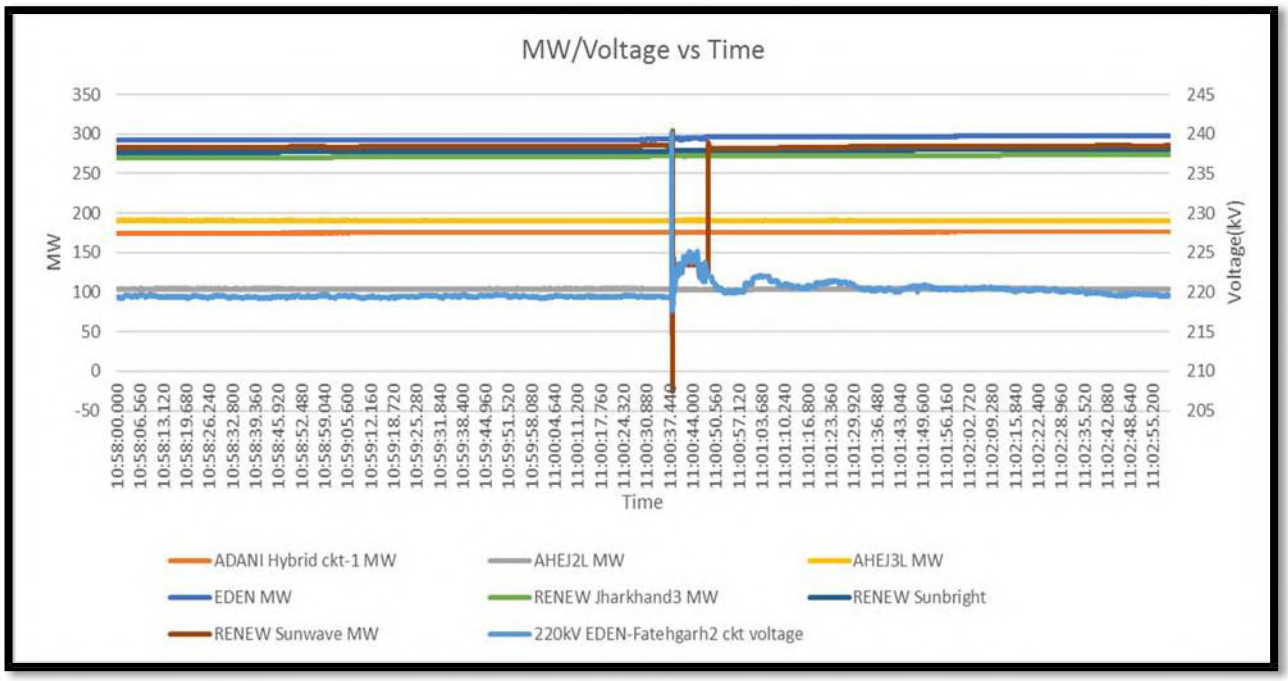
MW/MVAr behavior during 240MVAr Bus reactor opening at 765kV Fatehgarh2 (PG) at 11:00 Hrs on 29th Jan 2022:






MVAr/Voltage vs Time
MVAr
Voltage(kV)
Time
ADANI Hybrid 1
AHEJ2L MVAr
AHEJ3L
EDEN MVAr
220kV EDEN-Fatehgarh2 ckt voltage


MW/Voltage vs Time
MW
Voltage(kV)
Time
ADANI Hybrid ckt-1 MW
AHEJ2L MW
AHEJ3L MW
EDEN MW
RENEW Jharkhand3 MW
RENEW Sunbright
RENEW Sunwave MW
220kV EDEN-Fatehgarh2 ckt voltage



Observations:

- **220kV side voltage rose to 240kV from 219kV.**
- **Power fluctuation observed only at RENEW Sunwave and AHEJ2L RE station, no power fluctuation observed at other RE stations connected to Fatehgarh2.**

MVAr support observed from EDEN solar plant during transient time

पावर सिस्टम ऑपरेशन कारपोरेशन लिमिटेड
(भारत सरकार का उद्यम)
POWER SYSTEM OPERATION CORPORATION LIMITED
(A Govt. of India Enterprise)
उत्तरी क्षेत्रीय भार प्रेशण केन्द्र / NORTHERN REGIONAL LOAD DESPATCH CENTRE
कार्यालय : 18-ए, शहीद जीत सिंह सनसनवाल मार्ग, कटवारिया सराय, नई दिल्ली- 110016
OFFICE : 18-A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi- 110016
CIN : U40105DL2009GOI188682, Website : www.nrldc.org, www.nrldc.in, Tel.: 011- 26519406, 26523869, Fax : 011- 26852747

Ref no. : NRLDC\ RES\TS-108\06 Date: 15-Feb-2022

To,
Managing Director & CEO, Adani Green Energy Ltd.
Adani Corporate House
Shantigram, Near Vaishnodevi Circle, S G Highway
Ahmedabad-382421, Gujarat.

Sub: Frequent Outage of Solar/Wind generation in Northern region and suspected HVRT/LVRT failure.

Sir,

You are aware that in past 15-20 days, there have been several events of tripping of Adani Hybrid plants connected at 765/400/220kV Fatehgarh-II. Details of these events are mentioned below:

S. No.	Event	Generation loss of Adani Hybrid Plants connected at Fatehgarh-II(PG) and Fatehgarh-I (MW)	Generation loss (MW) at Fatehgarh-II(PG) pooling	Frequency dip (Hz)
1	On 30th Jan 2022 at 11:27 Hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	753	2038	0.18
2	On 04th February 2022 at 13:16 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	618	1882	0.16
3	On 11th Feb 2022 at 11:45 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	927	2316	0.20
4	On 11th Feb 2022 at 12:38 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	904	2558	0.27

In all these events, solar/wind generation reduced significantly at Adani plants. The generation at these locations picked up only after 2-3 minutes even though sustained high voltage was not observed. This large outage of solar/wind generation could be interpreted either as failure of HVRT capability of the PV inverters /WTG or tripping of lines/transformer connecting the plants to respective pooling stations leading to islanding of plant. Such behaviour during transients is neither expected nor desirable. Outage of around 1500-2000 MW generation in these events also resulted in frequency excursion of the order of 0.2-0.3 Hz.

Therefore, these events need to be analysed in detail and a report may be submitted by Adani Green Energy Ltd. (AGEL) explaining reasons for non-operation of proper HVRT functionality, improper coordination of the protection of connecting lines and transformers with HVRT withstand time of the solar inverters along with remedial action plan to avoid such issues in future.

Regards

(Surajit Banerjee)
Chief General Manager

1. Member Secretary, NRPC, 18-A SJSS Marg, Katwaria Sarai, New Delhi-110016.
2. Dy. Chief Operating Officer (CTUIL), POWERGRID, Saudamini, Plot number-2, Sector-29, IFFCO Chowk, Gurgaon-122001
3. Member (Power System), Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi–110066
4. Chairman and Managing Director (POSOCO), POSOCO, B-9, Qutub Institutional Area, New Delhi-110016
5. Executive Director (NLDC), POSOCO, B-9, Qutub Institutional Area, New Delhi-110016

पावर सिस्टम ऑपरेशन कारपोरेशन लिमिटेड
(भारत सरकार का उद्यम)
POWER SYSTEM OPERATION CORPORATION LIMITED
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Ref no. : NRLDC\ RES\TS-108\ Date: 15-Feb-2022

To,

1. DGM, Adani Hybrid Energy Jaisalmer One Limited, Village Madhipura, Tehsil-Pokharan, Dist-Jaiselmer,, Rajasthan-345026	2. DGM, Adani Hybrid Energy Jaisalmer Two Ltd, Fatehgarh-II, Village-Kajasar, Tehsil-Pokharan, Dist.:-Jaisalmer, Rajasthan-345026.
3. DGM, Adani Hybrid Energy Jaisalmer Three Ltd., Fatehgarh-II, Village-Kajasar, Tehsil-Pokharan, Dist.:-Jaisalmer, Rajasthan-345026.	

Sub: Suspected HVRT failure during recent events on 30th Jan, 4th Feb and 11th Feb 2022

Sir,

It is to bring to your notice that in several events in past 10-15 days, there have been tripping of Adani hybrid plants connected at 765/400/220kV Fatehgarh-II. Details of these events are mentioned below:

S. No.	Event	Generation loss of Adani Hybrid Plants connected at Fatehgarh-II(PG) and Fatehgarh-I (MW)	Generation loss (MW) at Fatehgarh-II(PG) pooling	Frequency dip (Hz)
1	On 30th Jan 2022 at 11:27 Hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	753	2038	0.18
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3	On 11th Feb 2022 at 11:45 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	927	2316	0.20
4	On 11th Feb 2022 at 12:38 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	904	2558	0.27

In all these events, it can be seen from the data available at NRLDC (Annexure-I) that the solar generation significantly reduced at Adani plants. The generation at these locations has picked up only after 2-3 minutes even though sustained high voltage was not observed. This large outage of solar generation could be interpreted as failure of HVRT capability of these solar plants. Such behaviour during transients is totally not expected nor desirable. Outage of around 1500-2000 MW in these events also resulted in frequency excursion of the order of 0.2-0.3 Hz.

It could be inferred from the sample plots for 30th Jan 2022 attached as Annexure-I that HVRT at Fatehgarh-II Adani hybrid plants did not function as mandated by CEA standards/ CERC orders and the affidavit of compliance submitted by the plant owners. The plots also suggest differences in the PSSe model output submitted by plants at the time of registration and their performance in real-time. Such non-operation of HVRT leads to generation drop and therefore frequency dip and is severe threat to the security of the grid.

There is also need to have standard data retention practice to understand inverter behaviour during such transient events. It is also important that inverter and POI level settings are such that the plant is able to comply with all the mandated CEA standards and undertakings given before connection to the grid.

Therefore, the event needs to be analysed in detail and a report may be submitted before 20th Feb'22 explaining reasons for non-operation of proper HVRT functionality along with remedial action plan to avoid such issues in future.

Regards

Alok Kumar

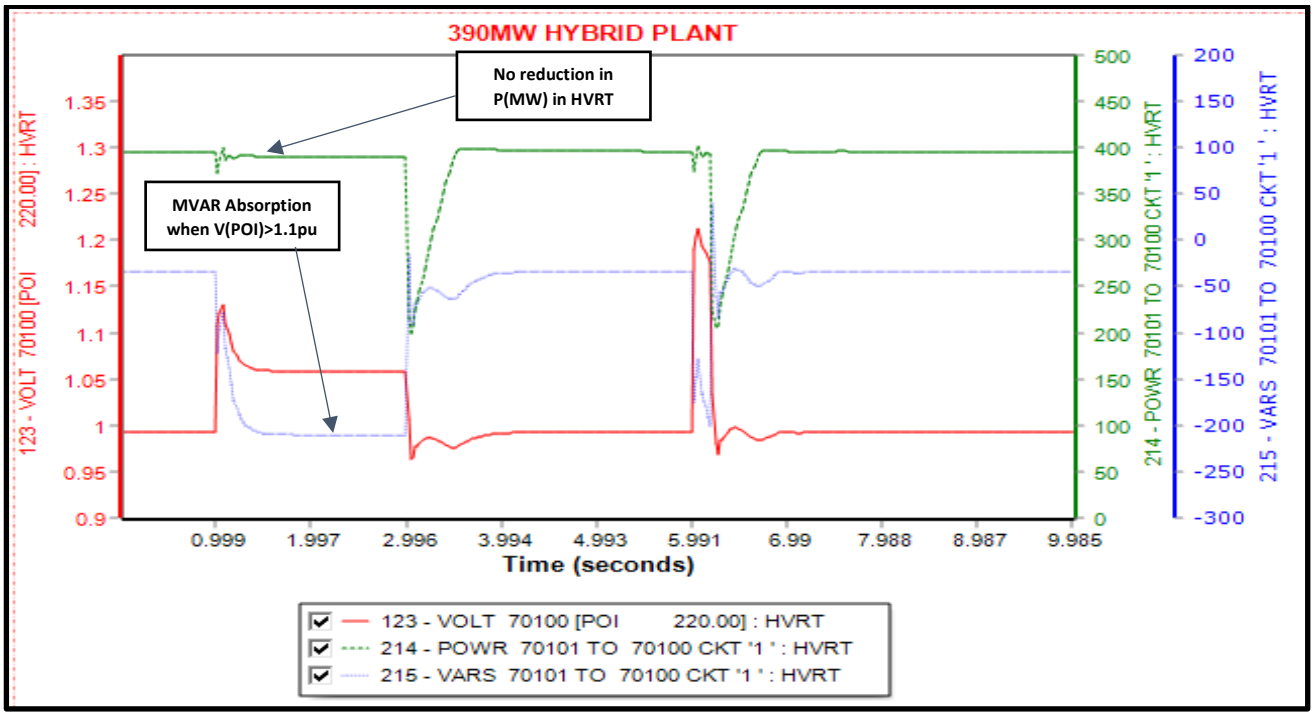
(Alok Kumar)
General Manager

1. Member Secretary, NRPC, 18-A SJSS Marg, Katwaria Sarai, New Delhi-110016.
2. Dy. Chief Operating Officer (CTUIL), POWERGRID, Saudamini, Plot number-2, Sector-29, IFFCO Chowk, Gurgaon-122001
3. Member (Power System), Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi–110066
4. Director (System Operations), POSOCO, B-9, Qutub Institutional Area, New Delhi-110016

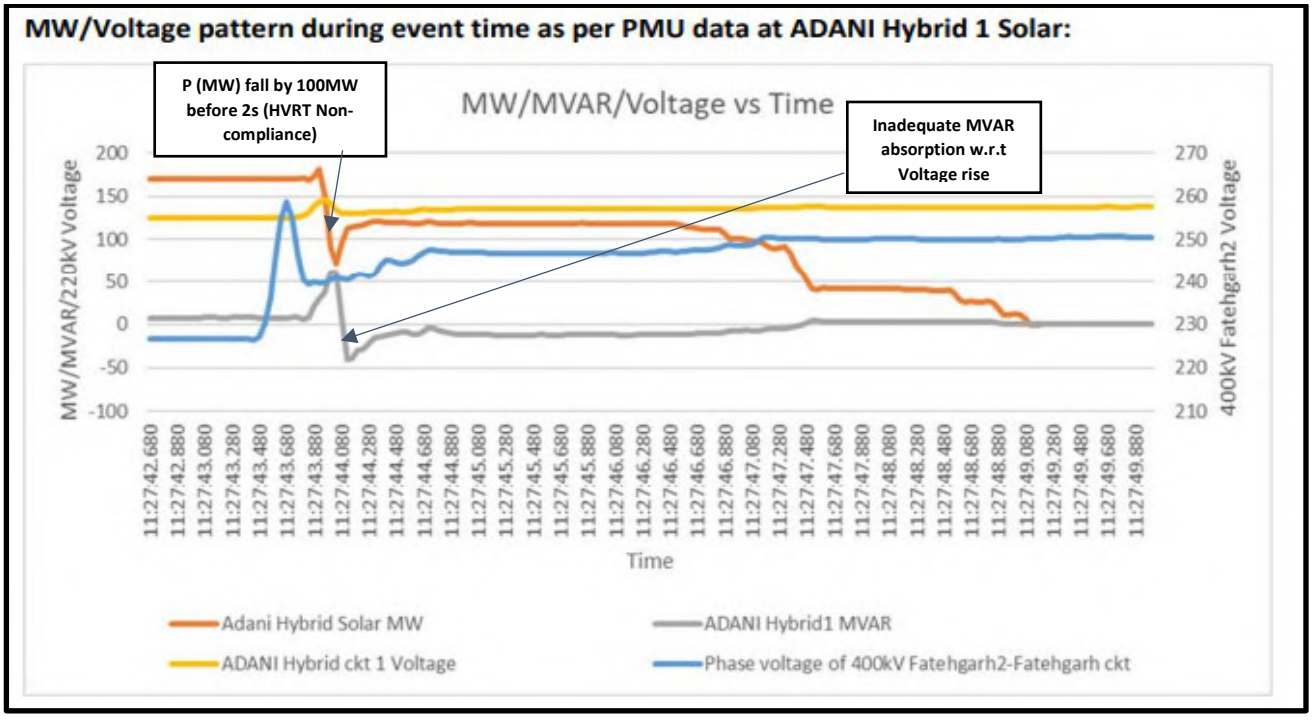
Annexure-I

Simulated response and Real-time response of AHEJOL (Adani Hybrid Energy One)

Simulated response



Actual response



- **From the simulation result of model submitted at the time of registration, it can be inferred that when voltage at POI reaches to 1.2pu, plant would remain connected to grid without any reduction in P(MW) and absorb MVAR, however in real-time Plant generation P(MW) fall down by 100MW and also MVAR absorption was not sufficient.**
- **Real time response of the plant is not matching with the validated model submitted at the time of registration and shows that plant failed to meet CEA HVRT compliance in Real time.**

Simulated response and Real-time response of AHEJ2L (Adani Hybrid Energy Two)

Simulated response

Table 9-4 300MW Hybrid 2A Plant: HVRT Case-1

Case	Description
Case-1	Rise in POC grid voltage is up to 1.2pu for 2 sec

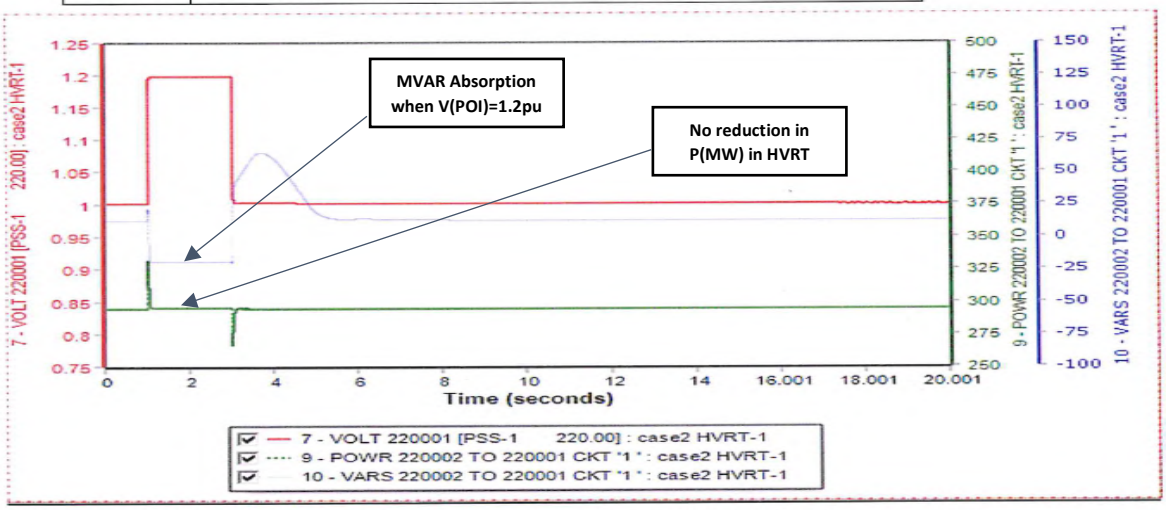
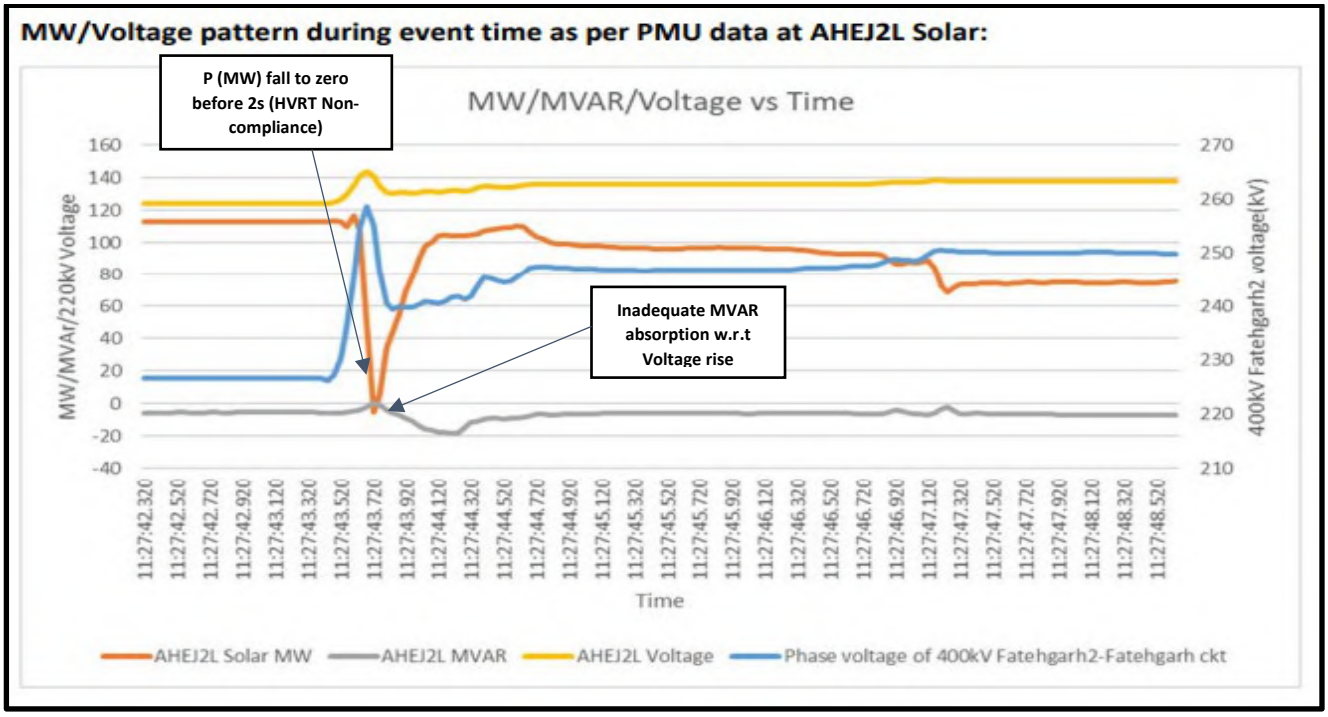


Figure 9-3 HVRT Compliance for a POC voltage of 1.2pu for 2 sec

Table 9-5 300MW Hybrid 2A Plant: HVRT Case-2

Case	Description
Case-2	Rise in POC grid voltage is up to 1.3pu for 200 msecs

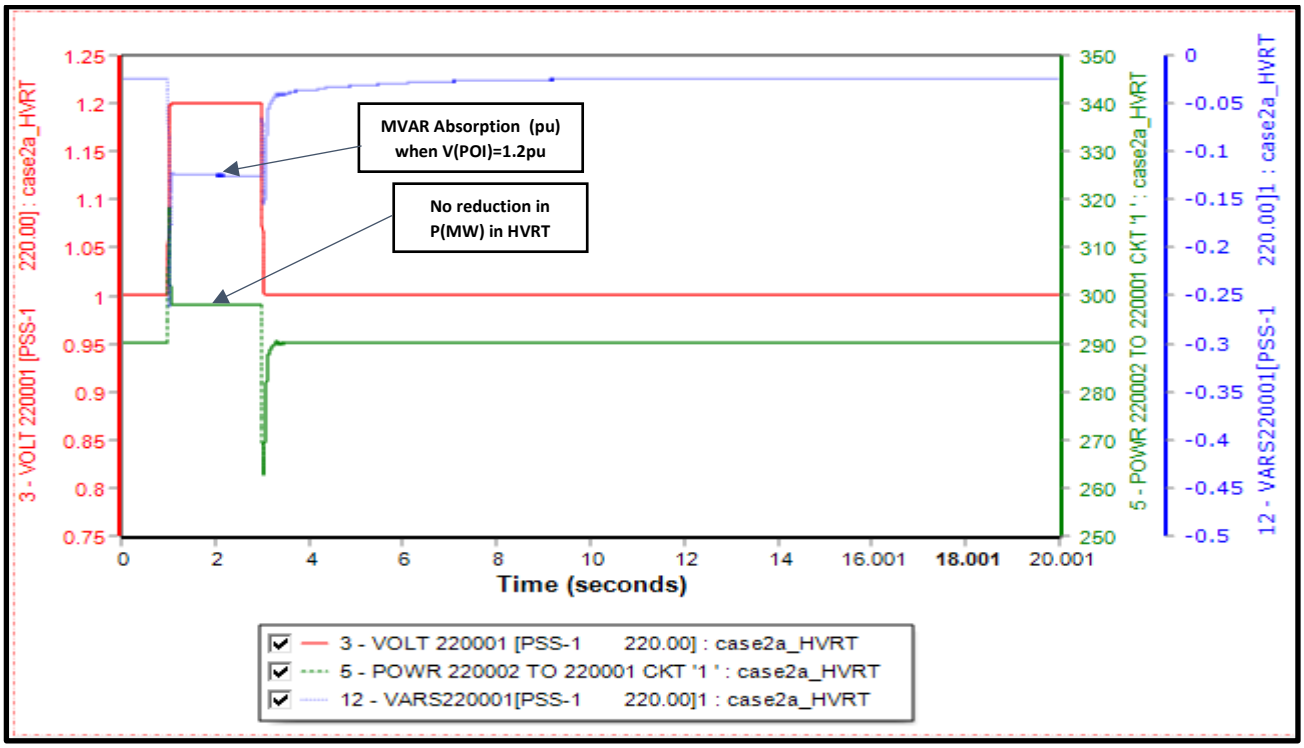
Actual response



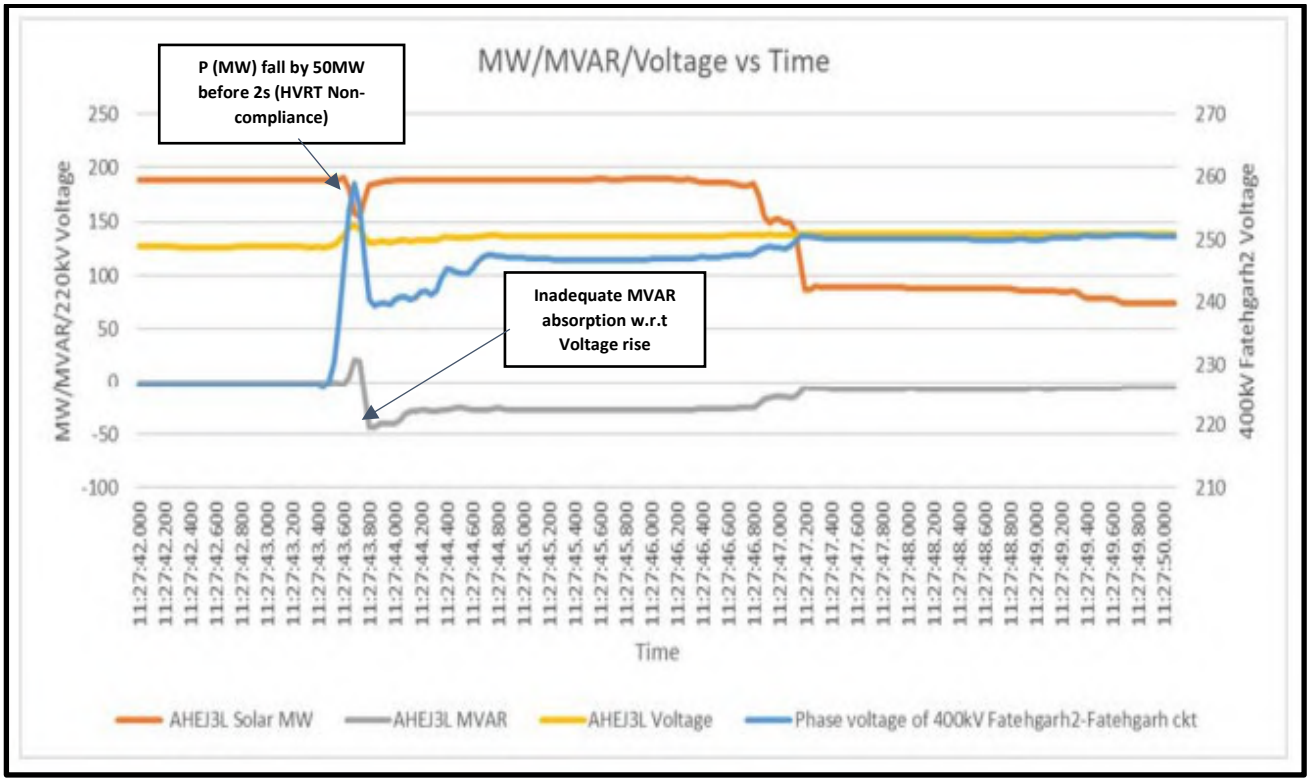
- **From the simulation result of model submitted at the time of registration, it can be inferred that when voltage at POI reaches to 1.2pu, plant would remain connected to grid without any reduction in P(MW) and absorb MVAR, however in real-time Plant generation P(MW) fall down to zero and also MVAR absorption was not sufficient.**
- **Real time response of the plant is not matching with the validated model submitted at the time of registration and shows that plant failed to meet CEA HVRT compliance in Real time.**

Simulated response and Real-time response of AHEJ3L (Adani Hybrid Energy Three)

Simulated response



Actual response



- **From the simulation result of model submitted at the time of registration, it can be inferred that when voltage at POI reaches to 1.2pu, plant would remain connected to grid without any reduction in P(MW) and absorb MVAR, however in real-time Plant generation P(MW) fall down by 50MW and also MVAR absorption was not sufficient.**
- **Real time response of the plant is not matching with the validated model submitted at the time of registration and shows that plant failed to meet CEA HVRT compliance in Real time.**

Annexure-II

Ideally there should not be any generation tripping/Backing down of generation in the incident, but tripping/baking down happened in real time its mean there might be some Over Voltage protection operated at in plant internal element or inverter responded undesirably, Over voltage setting of plant internal elements and PPC settings should be kept such that Plant would be able to meet CEA compliance at POI.

Following details is required from RE plants end for further analysis.

1. In which mode plant is being operated? (If it is in Voltage Control mode, which Reference voltage is being taken by PPC, (Is it 220kV voltage of Fatehgarh-II (PG) or 220kV Voltage at Plant end or something else?)).
2. Dead band of 220kV Voltage, i.e voltage above which or below which plant would start absorbing or injecting MVAR respectively.
3. Time delay setting after which it would start absorbing or injecting MVAR, once the voltage got changed at POI above or below dead band.
4. Following details from PPC.
    - Reference voltage for HVRT/LVRT.
    - Time delay setting for HVRT/LVRT operation.
    - HVRT/LVRT Voltage setting.
    - PPC mode of control (Voltage control/ PF control/ Q control).
    - PPC detailed communication mechanism with inverter, As per the details submitted by Plant for registration pertaining that PPC controls all the inverter, weather PPC controlling all the inverter individually or with 50MW block wise? Is there any false signal/command going to inverter to reduce its P(MW)?
5. Over voltage and overcurrent setting of 220kV line, 220/33kV power transformer, 33/0.6kV or 33/0.66kV IDT and Inverter/WTG and their time delay.
6. If there is any over voltage tripping of internal element then voltage at which it got tripped, and over voltage setting of that element.

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Renewables

22.02.2022

Shri Alok Kumar
General Manger
Northern Regional Load Despatch Centre (NRLDC)
18-A, Shaheed Jeet Singh Sansanwal Marg,
Katwaria Sarai,
New Delhi – 10016.

Sub: Overvoltage incidences during recent events on 30th Jan, 4th Feb and 11th Feb 2022.

Ref: NRLDC Letters No NRLDC/RES/TS-108 and NRLDC/RES/TS-108\06 both dated 15th Feb 2022

Plant Reference: (1) Adani Hybrid Energy Jaisalmer One Ltd (AHEJ1L)
(2) Adani Hybrid Energy Jaisalmer Two Ltd (AHEJ2L)
(3) Adani Hybrid Energy Jaisalmer Three Ltd (AHEJ3L)

Dear Sir,

This has reference to above mentioned letter dated 15th Feb 2022, regarding suspected HVRT failure of above referred Adani Hybrid plants connected at Fatehgarh-II (PG).

At the outset, we would like to bring to your kind notice that in all three hybrid plants (AHEJ1L, AHEJ2L & AHEJ3L) no trippings were observed on 220kV or 33kV feeders during recent incidences of grid overvoltage. All the three hybrid plants remained connected to the grid during overvoltage condition. All the inverters installed in the above mentioned hybrid plants are HVRT compliant and overvoltage protections are set as per the latest amendment of CEA regulation for grid connectivity, 2019. For detail kindly refer **A)** of **Annexure-1**.

Our response to each of the individual events under consideration is as follows

S.No.	Event date	Response	Action Plan
1	30.01.2022	As per the preliminary report of NRLDC for occurrence on dated 30th January 2022, It has been noticed that overvoltage was observed on 400kV & 220kV Fatehgarh-II(PG) grid on	As a preventive measure we have rechecked HVRT settings in all the inverters and found it to be in order as

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		account of possible reactor switching in Fatehgarh-II substation during peak solar generation hours. Due to this phenomenon, 220kV bus voltage at our hybrid plant had shot more than 253kV i.e.,>1.15pu. Disturbance Record snapshot is attached as **C) of Annexure-1**. Preceding this event Hybrid plants were operating in reactive power injection mode as voltages at plant bus were observed below <0.99pu and terminal voltages of inverters were maintained above >1.05pu during injection of reactive power into the grid.	per the requirement stated in CEA regulation. In addition to this, tap position of power transformer is lowered by one tap from nominal to immune plant from facing unwanted high voltages due to such grid disturbances and same is kept under observation.
2	04.02.2022	Preliminary occurrence report is awaited from NRLDC for further analysis of incident.	
3	11.02.2022 (@11:45 hrs)	Preliminary occurrence report is awaited from NRLDC for further analysis of incident.	
4	11.02.2022 (@12:38 hrs)	Preliminary occurrence report is awaited from NRLDC for further analysis of incident.	

Further, we would like to bring to your kind notice that during normal voltage conditions at Pooling Substation (PSS) of hybrid plant, it is observed that the Inverters which are distant from plant end switchyard have terminal voltage above >1.05pu. In this regard, SCADA snapshot is attached as **B)** of **Annexure-1** for reference. Thus, inverters located far from PSS are prone to sustained overvoltage conditions and are observed to have voltages beyond HVRT limits during such system disturbances and it may have led to tripping of these inverters.

The details sought in Annexure II of the NRLDC letter is enclosed as **Annexure-2**.

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In light of the above, we also seek your support and guidance on above matter as we too are facing huge generation loss and want to avoid such incidences in future.

Yours sincerely,

(Sameer Ganju)
Head Northern Region
sameer.ganju@adani.com

Copy to

Shri Surajit Banerjee
Chief General Manager
Northern Regional Load Despatch Centre (NRLDC)
18-A, Shaheed Jeet Singh Sansanwal Marg,
Katwaria Sarai,
New Delhi – 10016.

Encl.: Annexure 1 & 2

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Annexure-1

A) Inverter HVRT Settings

Sungrow

Default Value of Protection Parameters

SUNGROW

Parameter	Default
Country	India
Protection level	Fifth level
AC Under Voltage Level 1 Protection Value	680.0 V
AC Over Voltage Level 1 Protection Value	880.0 V
AC Under Frequency Level 1 Protection Value	47.5 Hz
Grid Over Frequency Level 1 Protection Value	52.00 Hz
AC Under Voltage Level 1 Protection Time	2.00 s
AC Over Voltage Level 1 Protection Time	2.00 s
AC Under Frequency Level 1 Protection Time	0.20 s
Grid Over Frequency Level 1 Protection Time	0.20 s
AC under Voltage Level 2 Protection value	400.0 V
AC Over Voltage Level 2 Protection Value	1080.0 V
AC Under Frequency Level 2 Protection Value	47.50 Hz
Grid Over Frequency Level 2 Protection Value	52.00 Hz
AC Under Voltage Level 2 Protection Time	0.10 s
AC Over Voltage Level 2 Protection Time	0.05 s
AC Under Frequency Level 2 Protection Time	0.20 s
Grid Over Frequency Level 2 Protection Time	0.20 s
Under- Voltage level-3 Protection Value of Power Grid	400.0 V
Over- Voltage level-3 Protection Value of Power Grid	1080.0 V
Under - frequency Level-3 Protection Value of Power Grid	47.50 Hz
Over - frequency Level-3 Protection Value of Power Grid	52.00 Hz
AC Under voltage level three protection time	0.10 s
AC Overvoltage level three protection time	0.05 s

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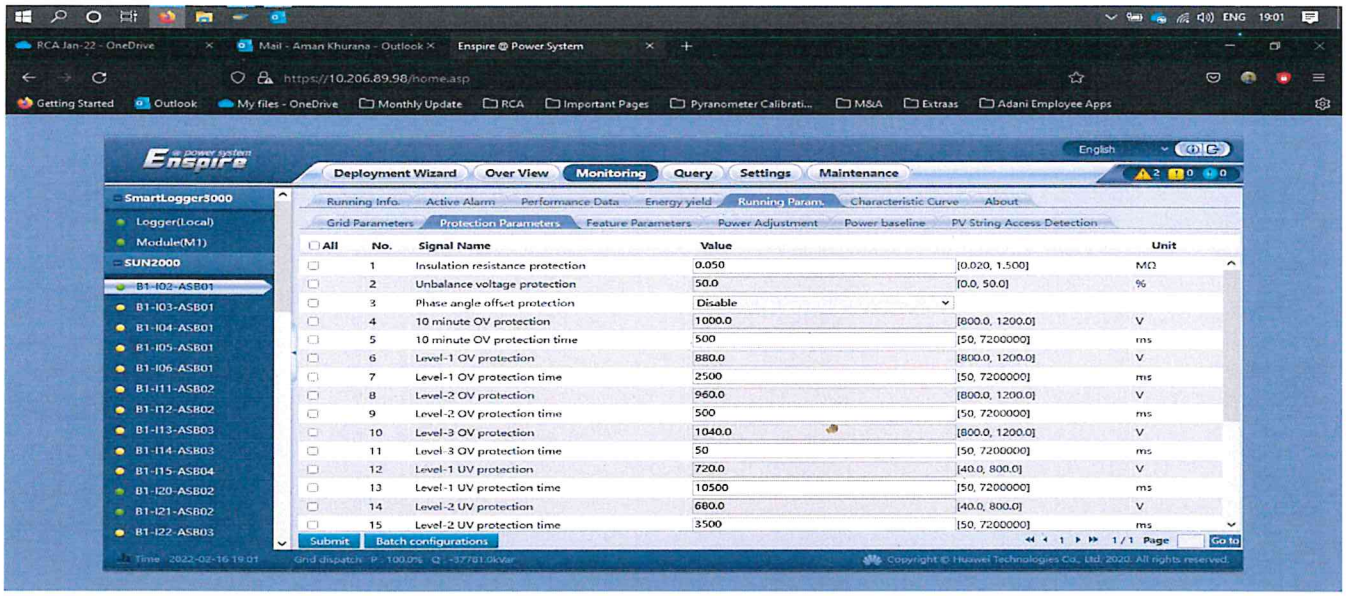
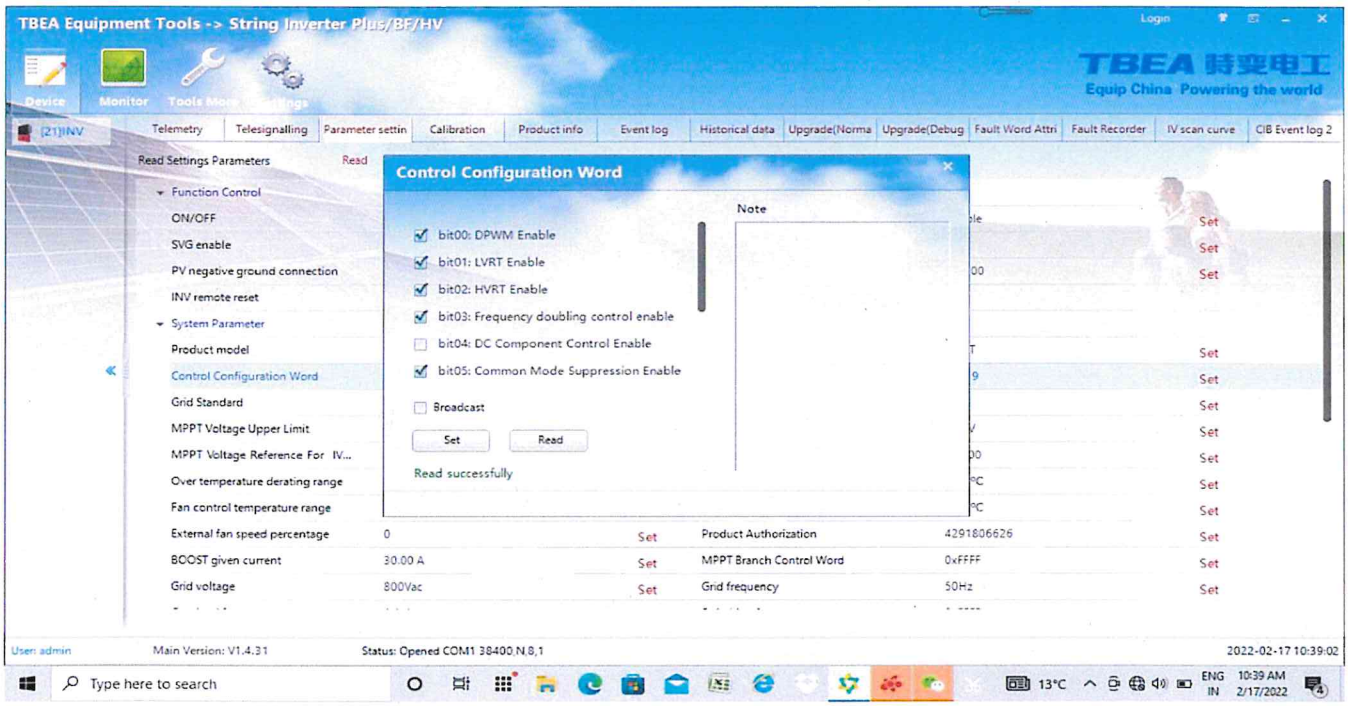
Huawei



TBEA



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220kV voltage around 1.0pu

Inverter terminal voltage > 1.08 pu

B) Terminal Voltages of distant Inverters

YYYY/MM/DD HH:MM:SS	YieldHarvest(kWh)	PV Num	MPPT1_Volt(V)	PV15_Cur(A)	PV16_Cur(A)	PV17_Cur(A)	PV18_Cur(A)	220KV voltage R/Y/B	33kv Voltage R/Y/B	OutputMode	Ua/Uab(V)	Ub/Ubc(V)	Ia(A)	Ib(A)	Q(kVar)	P(kW)	F(Hz)	RunState
2/13/2022 12:00	118946.4	18	1006	10	10	10.19	10.32	222.78/219.86/219.61		1	868.9	856.5	106	106	34.173	154.17	50.11	On-grid
2/10/2022 15:25	115524.4	18	975.9	10	10	9.46	9.6	222.53/219.94/219.71	34.28/34.05/34.2	1	870.3	861.6	99.5	99.9	38.299	144.29	49.96	On-grid
2/10/2022 15:20	115512.5	18	975.7	10	10	9.41	9.56	22.48/219/81/219.57	34.27/34.03/34.19	1	871.1	862.2	99.1	99.5	39.458	143.464	50.04	On-grid
2/10/2022 15:15	115500.6	18	985.5	10	10	9.51	9.65	222.27/219.67/219.42	34.24/34/34/16	1	871.5	862.8	99.3	99.6	40.704	143.506	49.95	On-grid
2/10/2022 15:10	115488.5	18	976.3	10	10	9.71	9.85	221.86/219.19/219.03	34.16/33.93/34.09	1	869.6	860.8	99.8	100	40.697	144.056	49.97	On-grid
2/10/2022 15:05	115476.5	18	1004	10	10	9.64	9.72	221.88/219.96/218/93	34.16/33.92/34.08	1	869.1	860.6	101	101	40.778	145.163	50.07	On-grid
2/10/2022 15:00	115464.4	18	1003	10	10	9.71	9.77	221.77/219.12/218.85	34.18/33.94/34.1	1	869.8	860.8	101	101	40.75	145.893	50.05	On-grid
2/10/2022 14:50	115439.8	18	1003	10	10	9.74	9.84	221.42/218.74/218.49	34.1/33.86/34.02	1	868.4	859.3	102	102	40.607	146.659	50.07	On-grid
2/4/2022 12:20	108155	18	1032	10	10	9.55	9.75	22.09/219.25/219.08	33.89/33.67/33.84	1	868.4	858.8	103	104	35.693	150.476	50.01	On-grid

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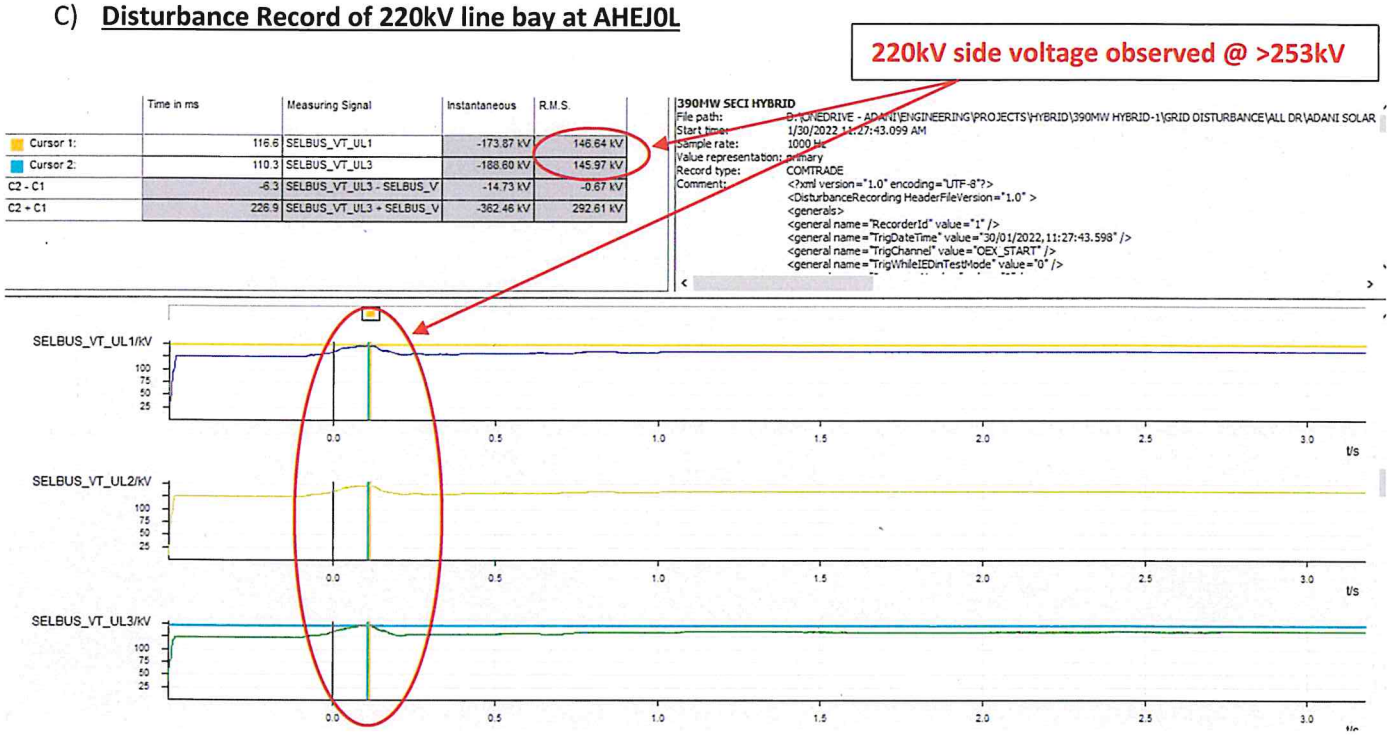
C) **Disturbance Record of 220kV line bay at AHEJ0L**



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Annexure -2

Details pertaining to Adani RE plants for further analysis.

1. In which mode plant is being operated? (If it is in Voltage Control mode, which Reference voltage is being taken by PPC, (Is it 220kV voltage of Fatehgarh-II (PG) or 220kV Voltage at Plant end or something else?)).
   Adani Reply: Plant is operated in Voltage Control mode. PPC takes reference of 220kV voltage at plant end.

2. Dead band of 220kV Voltage, i.e voltage above which or below which plant would start absorbing or injecting MVAR respectively.
   Adani Reply: Dead band is set to 1% above or below which plant would start absorbing or injecting MVAr respectively.

3. Time delay setting after which it would start absorbing or injecting MVAR, once the voltage got changed at POI above or below dead band.
   Adani Reply: PPC shall give command to inverters to start absorbing or injecting MVAr on real time basis upon occurrence of voltage change above or below dead band.

4. Following details from PPC.
   - Reference voltage for HVRT/LVRT.
     Adani Reply: Reference voltage for HVRT/LVRT is +/- 10% of Vn
   - Time delay setting for HVRT/LVRT operation.
     Adani Reply: Time delay settings for HVRT & LVRT shall be part of inverter parameter settings. It is not applicable for PPC
   - HVRT/LVRT Voltage setting.
     Adani Reply: HVRT & LVRT voltage settings is part of inverter parameter settings. It is not applicable for PPC
   - PPC mode of control (Voltage control/ PF control/ Q control).
     Adani Reply: PPC is operating in Voltage Control mode.
   - PPC detailed communication mechanism with inverter, As per the details submitted by Plant for registration pertaining that PPC controls all the inverter, weather PPC controlling all the inverter individually or with 50MW block wise? Is there any false signal/command going to inverter to reduce its P(MW)?
     Adani Reply: PPC controls all the inverters individually. There is no false signal/command going to inverter to reduce active power.

5. Over voltage and overcurrent setting of 220kV line, 220/33kV power transformer, 33/0.6kV or 33/0.66kV IDT and Inverter/WTG and their time delay.

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Adani Reply: Attached as Appendix.

6. If there is any over voltage tripping of internal element then voltage at which it got tripped, and over voltage setting of that element.

   Adani Reply: No overvoltage tripping of internal power evacuation system element was observed.

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पावर सिस्टम ऑपरेशन कारपोरेशन लिमिटेड
(भारत सरकार का उद्यम)
POWER SYSTEM OPERATION CORPORATION LIMITED
(A Govt. of India Enterprise)
उत्तरी क्षेत्रीय भार प्रेशण केन्द्र / NORTHERN REGIONAL LOAD DESPATCH CENTRE
कार्यालय : 18-ए, शहीद जीत सिंह सनसनवाल मार्ग, कटवारिया सराय, नई दिल्ली- 110016
OFFICE : 18-A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi- 110016
CIN : U40105DL2009GOI188682, Website : www.nrldc.org, www.nrldc.in, Tel.: 011- 26519406, 26523869, Fax : 011- 26852747

Ref no. : NRLDC\ RES\TS-108\146 Date: 25-Feb-2022

To

1. DGM, Adani Hybrid Energy Jaisalmer One Limited, Village Madhipura, Tehsil-Pokharan, Dist-Jaiselmer,, Rajasthan-345026	2. DGM, Adani Hybrid Energy Jaisalmer Two Ltd, Fatehgarh-II, Village-Kajasar, Tehsil-Pokharan, Dist.:-Jaisalmer, Rajasthan-345026.
3. DGM, Adani Hybrid Energy Jaisalmer Three Ltd., Fatehgarh-II, Village-Kajasar, Tehsil-Pokharan, Dist.:-Jaisalmer, Rajasthan-345026.	

Sub: Suspected HVRT failure during recent events on 30th Jan, 4th Feb and 11th Feb 2022

Ref: AGEL letter dated 23.02.2022

Sir,

With reference to AGEL letter dated 23.02.22 following points may be noted;

1. AGEL in its letter has stated that when voltage at its 220kV Plant bus was around 1pu, voltage at inverter terminal, located at a considerable distance, was around 1.05pu. However, it is reasonable that when the plant has to inject MVAR at POI to support the grid voltage after meeting its internal reactive losses as well as the reactive power consumed by the 220/33 kV transformer and the 220kV dedicated line, terminal voltage of inverter has to be at higher side. It is a basic requirement for the plant to meet the compliances as stipulated in the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2013, Part-II, clause B2, Sub-clause (1) at POI, which states that *"The generating station shall be capable of supplying dynamically varying reactive power support so as to maintain power factor within the limits of 0.95 lagging to 0.95 leading"* that's mean plant should have the capability to deliver MVAR upto 33% of its rated MW at POI, in steady state. Compliance to CEA Technical Standards of Connectivity Regulations is required at the point of interconnection (POI) irrespective of the configuration or issues in collector system.

2. As per DR/EL, 220kV Bus voltage of AHEJOL rose upto 253kV (1.15pu) during the disturbance (As mentioned in Annexure-I (C) of reference letter). Therefore, as per provision of the aforesaid CEA connectivity regulations, the plant has to Ride-through for 2sec when voltage at POI is 1.2pu. However, in real-time, AHEJOL active power generation P(MW) dipped significantly within 1 second (when POI voltage was around 1.15pu) which shows that the plant couldn't meet the HVRT compliance as specified in CEA Regulations, at POI. Further, there is no mention of reason for reduction in generation with rise in voltage. It is requested to furnish the reason for gradual reduction in generation and recovery thereafter.

3. AGEL has stated that PPC takes inputs from 220kV Plant Bus. However, the correct inputs to PPC should be the measurements at POI (i.e 220kV Fatehgarh-II(PG)).
4. As per the model submitted for Registration of AHEJOL, AHEJ2L and AHEJ3L, there is no reduction/dip in Active power generation P(MW) of Plant in case of HVRT, but in real-time significant dip in Active power generation P(MW) has been observed, please explain the reasons for reduction/dip in active power in real-time but not reflected in model.
5. Reason for no/negligible MVAR absorption support by the Plants as per HVRT requirement in case of high voltage at POI may please be clarified.

Observations on the inverter settings submitted by AGEL in reply letter dated 23.02.22 is attached as annexures as follows:
Annexure-I (For HVRT setting of Inverter)
Annexure-II (For LVRT setting of Inverter)
Annexure-III (Inverter settings submitted by AGEL)

Examination of Annexure-I&II leads us to infer that improper settings of Over Voltage and Under Voltage protection be one of the reason for not meeting CEA compliances at POI.
It appears that there is some issue with inverter controls which is causing undesired variation in generation of plants during transients.

It is therefore requested to furnish the inverter settings for TBEA TS208KTL-HV and HUAWEI SUN2000-185KTL inverters, P-Q meter data of Power plant controller and Station Event Logger for the duration of events as mentioned in letter for further analysis.

It is reiterated that all RE plants have to meet the CEA compliances at POI, and there for all the Inverters/WTG setting, including protection settings, should be such that the plant would be capable to meet all the requirements of CEA Regulations (Technical Standards for Connectivity to Grid) at POI.

To meet these compliances further actions as deemed appropriate, may be taken by the Plants for ensuring reliability and security of Grid.

Yours faithfully,

(Alok Kumar)
General Manager

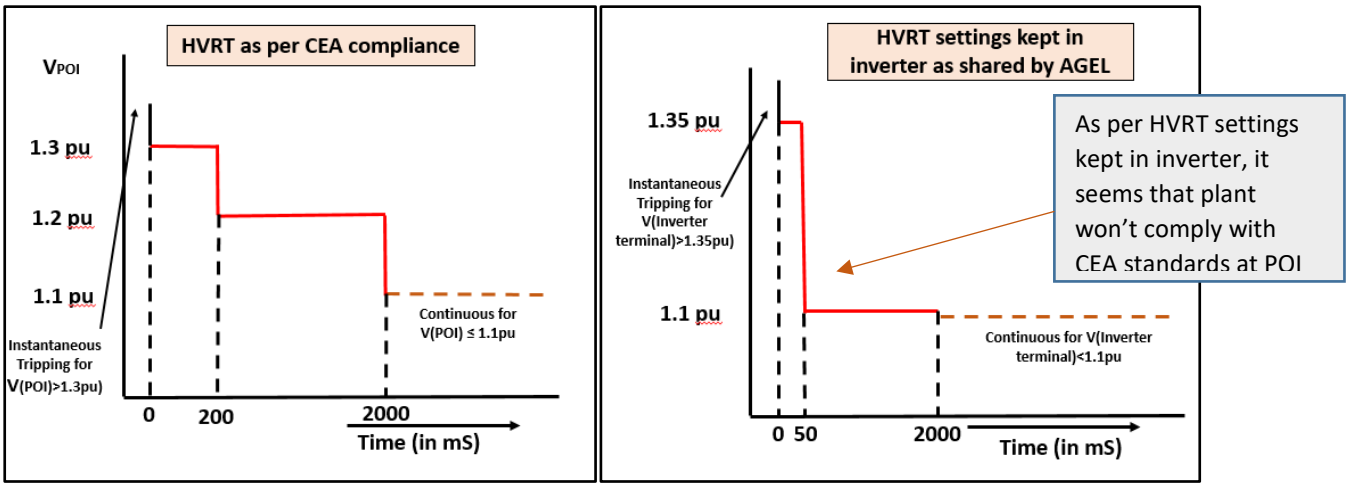
Distribution:

1. Member Secretary, NRPC, 18-A SJSS Marg, Katwaria Sarai, New Delhi-110016.
2. Dy. Chief Operating Officer (CTUIL), POWERGRID, Saudamini, Plot number-2, Sector-29, IFFCO Chowk, Gurgaon-122001
3. Member (Power System), Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066
4. Chairman and Managing Director (POSOCO), POSOCO, B-9, Qutub Institutional Area, New Delhi-110016
5. Chief General Manager (SO), NRLDC/Executive Director (NLDC), POSOCO, B-9, Qutub Institutional Area, New Delhi-110016

Annexure-I

As per the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2019, Part-II, clause B2, Sub-clause (7) The generating station connected to the grid, shall remain connected to the grid when voltage at the ***interconnection point****, on any or all phases (symmetrical or asymmetrical overvoltage conditions) rises above the specified values given below for specified time —*

Over voltage (pu)	Minimum time to remain connected (Seconds)
1.30 < V	0 Sec (Instantaneous trip)
1.30 ≥ V > 1.20	0.2 Sec
1.20 ≥ V >1.10	2 Sec
V ≤ 1.10	Continuous

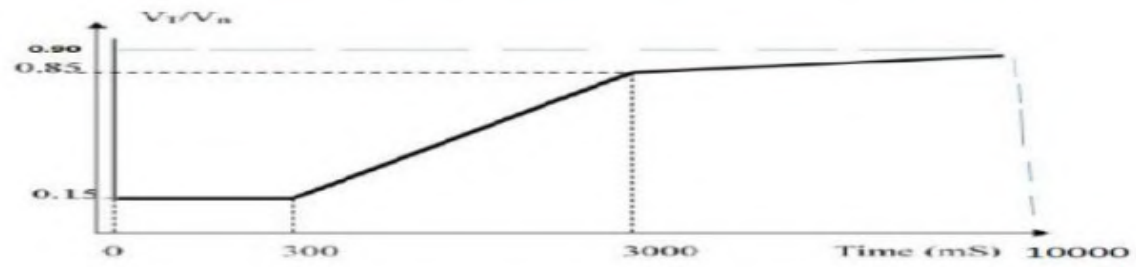


Following Over voltage settings of Inverter need to be changed

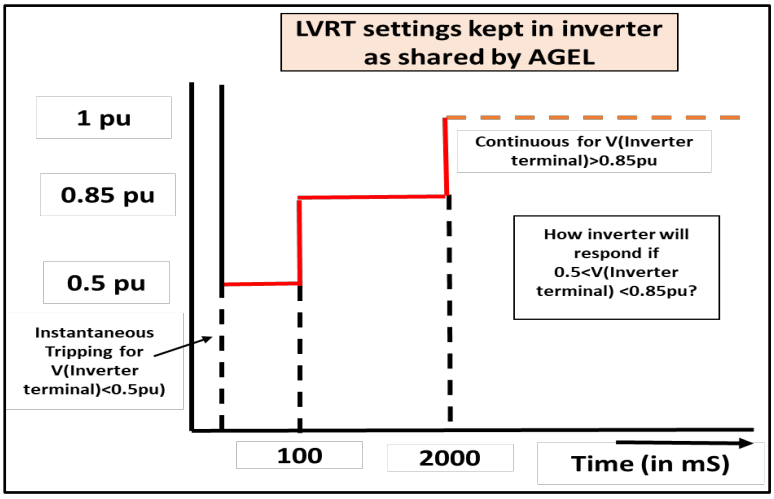
Parameters	Default values as shared by AGEL (Inverter)	Remarks
AC Overvoltage level 1 protection Value	880V	Overvoltage level 1 protection setting of Inverter should be kept in such a way that Plant would be able to Ride-through for 2sec in case of V(POI)=1.2pu. (As stated by AGEL, Inverter terminal voltage is around 1.05pu when voltage at POI is 1pu. Hence, OV setting of inverter (in pu) should be kept higher w.r.t HVRT voltage set value (in pu) at POI)
AC Overvoltage level 1 protection Time	2s	
AC Overvoltage level 2 protection Value	1080V	Overvoltage level 2 protection setting of Inverter should be kept in such a way that Plant would be able to Ride-through for 0.2sec in case of V(POI)=1.3pu. (As stated by AGEL, Inverter terminal voltage is around 1.05pu when voltage at POI is 1pu. Hence, OV setting of inverter (in pu) should be kept higher w.r.t HVRT voltage set value (in pu) at POI)
AC Overvoltage level 2 protection Time	0.05s	

Annexure-II

As per the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2019, Part-II, clause B2, Sub-clause (3) The generating station connected to the grid, shall remain connected to the grid when voltage at the interconnection point on any or all phases dips up to the level depicted by the thick lines in the following curve, namely: — VT : Actual Voltage; Vn: Nominal Voltage—



Provided that during the voltage dip, the supply of reactive power has first priority, while the supply of active power has second priority and the active power preferably be maintained during voltage drops, provided, a reduction in active power within the plant's design specifications is acceptable and active power be restored to at least 90% of the pre-fault level within 1 sec of restoration of voltage.



- As per LVRT settings kept in inverter, it seems that plant won't comply with CEA standards at POI.
- For V (Inverter terminal) =0.85pu, time delay kept 2sec (this should be 3sec for V(POI).
- For V (Inverter terminal) <0.5pu, instant tripping, however instantaneous tripping should be at voltage <0.15pu at POI.
- Above two settings shows violation of CEA compliances

Following Under voltage settings of Inverter need to be changed

Parameters	Default values as shared by AGEL (Inverter)	Remarks
AC Undervoltage level 1 protection Value	680V (0.85pu)	Undervoltage level 1 protection setting of Inverter should be kept in such a way that Plant would be able to Ride-through for 3sec in case of 0.15pu<V(POI)≤0.85pu.
AC Undervoltage level 1 protection Time	2s	
AC Undervoltage level 2 protection Value	400V (0.5pu)	Undervoltage level 2 protection setting of Inverter should be kept in such a way that Plant would be able to Ride-through for 0.3sec in case of V(POI)=0.15pu.
AC Undervoltage level 2 protection Time	0.1s	

Annexure-III

Sungrow

Default Value of Protection Parameters

SUNGROW

Parameter	Default
Country	India
Protection level	Fifth level
AC Under Voltage Level 1 Protection Value	680.0 V
AC Over Voltage Level 1 Protection Value	880.0 V
AC Under Frequency Level 1 Protection Value	47.5 Hz
Grid Over Frequency Level 1 Protection Value	52.00 Hz
AC Under Voltage Level 1 Protection Time	2.00 s
AC Over Voltage Level 1 Protection Time	2.00 s
AC Under Frequency Level 1 Protection Time	0.20 s
Grid Over Frequency Level 1 Protection Time	0.20 s
AC under Voltage Level 2 Protection value	400.0 V
AC Over Voltage Level 2 Protection Value	1080.0 V
AC Under Frequency Level 2 Protection Value	47.50 Hz
Grid Over Frequency Level 2 Protection Value	52.00 Hz
AC Under Voltage Level 2 Protection Time	0.10 s
AC Over Voltage Level 2 Protection Time	0.05 s
AC Under Frequency Level 2 Protection Time	0.20 s
Grid Over Frequency Level 2 Protection Time	0.20 s
Under- Voltage level-3 Protection Value of Power Grid	400.0 V
Over- Voltage level-3 Protection Value of Power Grid	1080.0 V
Under - frequency Level-3 Protection Value of Power Grid	47.50 Hz
Over - frequency Level-3 Protection Value of Power Grid	52.00 Hz
AC Under voltage level three protection time	0.10 s
AC Overvoltage level three protection time	0.05 s

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11/03/2022

Shri Alok Kumar
General Manager
Northern Regional Load Despatch Centre (NRLDC)
18-A, Shaheed Jeet Singh Sansanwal Marg,
Katwaria Sarai,
New Delhi – 10016.

Sub: Overvoltage incidence during recent events on 30th Jan, 4th Feb and 11th Feb 2022

Ref: 1) NRLDC Letters No NRLDC\RES\TS-108\146 dated 25th Feb 2022.
2) Old NRLDC Letters No NRLDC/RES/TS-108 and NRLDC/RES/TS-108\06 both dated 15th Feb 2022.
3) Old AGEL letter dt:22/02/2022

Plant Reference: 1) Adani Hybrid Energy Jaisalmer One Ltd (AHEJ1L)
2) Adani Hybrid Energy Jaisalmer Two Ltd (AHEJ2L)
3) Adani Hybrid Energy Jaisalmer Three Ltd (AHEJ3L)

Dear Sir,

This has reference to the above-mentioned letter dated 25th Feb 2022, regarding suspected HVRT failure of above referred Adani Hybrid plants connected at Fatehgarh-II (PG).

Our response to each point under consideration is as follows:

1. AGEL in its letter has stated that when voltage at its 220kV Plant bus was around 1pu, voltage at inverter terminal, located at a considerable distance, was around 1.05pu. However, it is reasonable that when the plant has to inject MVAR at POI to support the grid voltage after meeting its internal reactive losses as well as the reactive power consumed by the 220/33 kV transformer and the 220kV dedicated line, terminal voltage of inverter has to be at higher side. It is a basic requirement for the plant to meet the compliances as stipulated in the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2013, Part-II, clause B2, Sub-clause (1) at POI, which states that "The generating station shall be capable of supplying dynamically varying reactive power support so as to maintain power factor within the limits of 0.95 lagging to 0.95 leading" that's mean plant should have the capability to deliver MVAR up to 33% of its rated MW at POI, in steady state. Compliance to CEA Technical Standards of Connectivity Regulations is required at the point of interconnection (POI) irrespective of the configuration or issues in collector system.

   Adani reply: Noted. All plants mentioned above are complying with CEA regulation for reactive power requirement of supplying dynamically varying reactive power support so as to maintain power factor within the limits of 0.95 lagging to 0.95 leading. In this regard, it may be noted that the CEA convened a meeting on 14.07.2021 with MNRE, CTU, POSOCO and Wind Power Generating

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Companies to discuss the reactive power requirement in accordance with Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulation (MoM of the meeting enclosed for ready reference). The meeting was convened as certain RE generators had approached CEA on account of difficulty being faced w.r.t. interpretation of Clause (1) of B2 of Part-II of Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations for issuance of grant of connectivity by CTU and processing of F.T.C. (First Time Charging) by RLDCs. After deliberation, it was concluded that the provision related to reactive power requirement for generation stations provided in the CEA Grid Connectivity regulations may need to be clarified considering, amongst other issues, the following [Reference Para 38 (ii)) of the MoM]

"The RE generator should have reactive power capability to operate up to the 'Vcurve' boundaries at corresponding generation level. Accordingly, the terms "dynamically varying" and "within the limits of 0.95 lagging to 0.95 leading" need clarification."

However, the clarification on above is still awaited from CEA.

2. As per DR/EL, 220kV Bus voltage of AHEJOL rose upto 253kV (1.15pu) during the disturbance (As mentioned in Annexure-I (C) of reference letter). Therefore, as per provision of the aforesaid CEA connectivity regulations, the plant has to Ride-through for 2sec when voltage at POI is 1.2pu. However, in real-time, AHEJOL active power generation P(MW) dipped significantly within 1 second (when POI voltage was around 1.15pu) which shows that the plant couldn't meet the HVRT compliance as specified in CEA Regulations, at POI. Further, there is no mention of reason for reduction in generation with rise in voltage. It is requested to furnish the reason for gradual reduction in generation and recovery thereafter.

Adani reply:

i. **Event on dt.30/01/2022:** As per the preliminary report of NRLDC for occurrence on dated 30th January 2022, It has been noticed that overvoltage was observed on 400kV & 220kV Fatehgarh-II(PG) grid on account of possible reactor switching in Fatehgarh-II substation during peak solar generation hours. Due to this phenomenon, 220kV bus voltage at our hybrid plant had shot more than 253kV i.e.,>1.15pu. Disturbance Record snapshot is attached as **B) of Annexure-1**. Preceding this event Hybrid plants were operating in reactive power injection mode as voltages at plant bus were observed below <0.99pu and terminal voltages of inverters were maintained above >1.05pu during injection of reactive power into the grid.

ii. **Event on dt.11.02.2022 (@11:45 hrs):** We have observed voltage rise at our plant in 220Kv line feeder. From the DR the voltage rise found up to 149KV phase to neutral i.e., 1.17 pu is very much higher the 1.1 pu and also there is no rise in current in any phase which is evidence that there is some disturbance from grid side might be due to switching of element or operation of reactor. Disturbance Record snapshot is attached as C**) of Annexure-1**.

iii. **Event on dt.11.02.2022 (@12:38 hrs)**: We have observed voltage rise at our plant in 220Kv line feeder. From the DR the voltage rise found up to 148KV phase to neutral i.e 1.17 pu is very much higher the 1.1 pu and also there is no rise in current in any phase which is evidence that

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there is some disturbance from grid side might be due to switching of element or operation of reactor. Disturbance Record snapshot is attached as D**) of Annexure-1**.

It is evident that in all above events voltage rose up to 1.17pu at 220kV bus of plant end substation subsequently, voltage at inverter terminal is observed > 1.05pu during reactive power injection in to the grid. Hence, it is suspected that during these disturbances terminal voltage of some of the inverter which are distant from plant end substation has crossed above 1.2pu and tripped as per HVRT settings. Further Please note that inverter HVRT / overvoltage settings are as per CEA guideline details are attached as A**) of Annexure-1**

Action plan:

Tap position of power transformer is lowered by one tap from nominal to immune plant from facing unwanted high voltages due to such grid disturbances and same is kept under observation. As a preventive measure, we have rechecked HVRT settings in all the inverters and found to be in order as per the requirement stated in CEA regulation.

3. AGEL has stated that PPC takes inputs from 220kV Plant Bus. However, the correct inputs to PPC should be the measurements at POI i.e 220kV Fatehgarh-II(PG).

   Adani reply: PPC is installed at plant end and there is no technical feasibility to measure real time inputs from remote end. Hence, PPC takes input from plant end bus as reference for voltage control mode operation.

4. As per the model submitted for Registration of AHEJOL, AHEJ2L and AHEJ3L, there is no reduction/dip in Active power generation P(MW) of Plant in case of HVRT, but in real-time significant dip in Active power generation P(MW) has been observed, please explain the reasons for reduction/dip in active power in real-time but not reflected in model.

   Adani reply: As described in point no:2, preceding to the grid disturbance, Inverter were operating in reactive power injection mode as voltage at plant end bus was less then <0.99 pu. During grid disturbance plant end bus voltage immediately rose to 1.17pu and Inverter terminals might had observed voltages more than >1.2puPlant which led to tripping of few inverters which are distant from plant end substation. It is to be noted that dynamic simulation studies were carried out considering slack bus at remote end and not as per actual network conditions. Hence it is requested that actual grid disturbance should be simulated with present grid connection & network available with NRLDC for further analysis of the incident.

5. Reason for no/negligible MVAR absorption support by the Plants as per HVRT requirement in case of high voltage at POI may please be clarified.

   Adani reply: Please refer reply in point no:4

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6. Examination of annexure-I & II leads us to infer that improper setting of overvoltage and under voltage protection be one of the reason for not meeting CEA compliance at POI. It appears that there is some issue with inverter controls which is causing undersign variation in generation of plant during transients.

   Adani Reply: HVRT settings of inverter are set as per CEA regulation requirement. Further HVRT & LVRT settings are attached for your kind perusal please. Attached as **Annexure-2**

Yours sincerely,

(Sameer Ganju)
Head Northern Region
Sameer.ganju@adani.com

Copy to

Shri Surajit Banerjee
Chief General Manager
Northern Regional Load Despatch Centre (NRLDC)
18-A, Shaheed Jeet Singh Sansanwal Marg,
Katwaria Sarai,
New Delhi – 10016.

Encl.: Annexure 1 & 2 and MoM of CEA meeting.

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Annexure-1

A) Inverter HVRT Settings

Sungrow

Default Value of Protection Parameter

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Parameter	Default
Vmax-recover	878.0 V
Vmin-recover	722.0 V
Fmax-recover	51.98 Hz
Fmin-recover	47.52 Hz
HVRT	ON
HVRT K Factor	1.0
HVRT Voltage 1	880.0 V
HVRT Voltage 2	960.0 V
HVRT Voltage 3	1040.0 V
HVRT Time 1 (ms)	10.000 s
HVRT Time 2 (ms)	2.000 s
HVRT Time 3 (ms)	0.000 s
LVRT	ON
LVRT K Factor	2.0
LVRT Voltage 1	720.0 V
LVRT Voltage 2	680.0 V
LVRT Voltage 3	120.0 V
LVRT Time 1 (ms)	10.000 s
LVRT Time 2 (ms)	3.000 s
LVRT Time 3 (ms)	0.300 s

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Huawei

RE: Compliance to CEA guidelines w.r.t LVRT & HVRT settings in Huawei inverter

RS

Ravinder Singh (Ravinder, India Solar Inverter Business Dept) <ravinder.singh@huawei.com>
To Sureshkumar Mistri
Cc Vivek Ratna; jiangshuai (C); Gopal Singh Negi; Aman Khurana; Sunilkumar Desai; ANKUR KUMAA

NRLDC Communication_Adani Hybrid_F-2_25.02.22_reply.pdf
662 KB

SG250HX-IN Default Value of Pro
433 KB

Vmin-recover	722.0 V
Fmax-recover	51.98 Hz
Fmin-recover	47.52 Hz
HVRT	ON
HVRT K Factor	1.0
HVRT Voltage 1	880.0 V
HVRT Voltage 2	960.0 V
HVRT Voltage 3	1040.0 V
HVRT Time 1 (ms)	10.000 s
HVRT Time 2 (ms)	2.000 s
HVRT Time 3 (ms)	0.000 s
LVRT	ON
LVRT K Factor	2.0
LVRT Voltage 1	720.0 V
LVRT Voltage 2	680.0 V
LVRT Voltage 3	120.0 V
LVRT Time 1 (ms)	10.000 s
LVRT Time 2 (ms)	3.000 s
LVRT Time 3 (ms)	0.300 s

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TBEA

RE: Compliance to CEA guidelines w.r.t LVRT & HVRT settings in TBEA inverter

NK

Naveen Kumar <naveenkumar@tbea.com>

To Aman Khurana

Cc Jigar Thakkar; Nileshkumar Patel; Hiren Tailor; Sunilkumar Desai; Sureshkumar Mistri; HO Ele
vaibhavkaushik@tbea.com; pardeep@tbea.com

This message was sent with High importance.

Grid Over Frequency Level Protection Time	200ms
Vmax-recover (V)	878V
Vmin-recover (V)	722V
Fmax-recover (Hz)	51.98HZ
Fmin-recover (Hz)	47.52HZ
HVRT (ON/OFF)	ON
HVRT K Factor	0.95
HVRT Voltage 1	880V
HVRT Voltage 2	960V
HVRT Voltage 3	1040V
HVRT Time 1 (ms)	2000ms
HVRT Time 2 (ms)	200ms
HVRT Time 3 (ms)	0ms
LVRT (ON/OFF)	ON
LVRT K Factor	0.5
LVRT Voltage 1	720V
LVRT Voltage 2	680V
LVRT Voltage 3	120V
LVRT Time 1 (ms)	10000ms
LVRT Time 2 (ms)	3000ms
LVRT Time 3 (ms)	300ms

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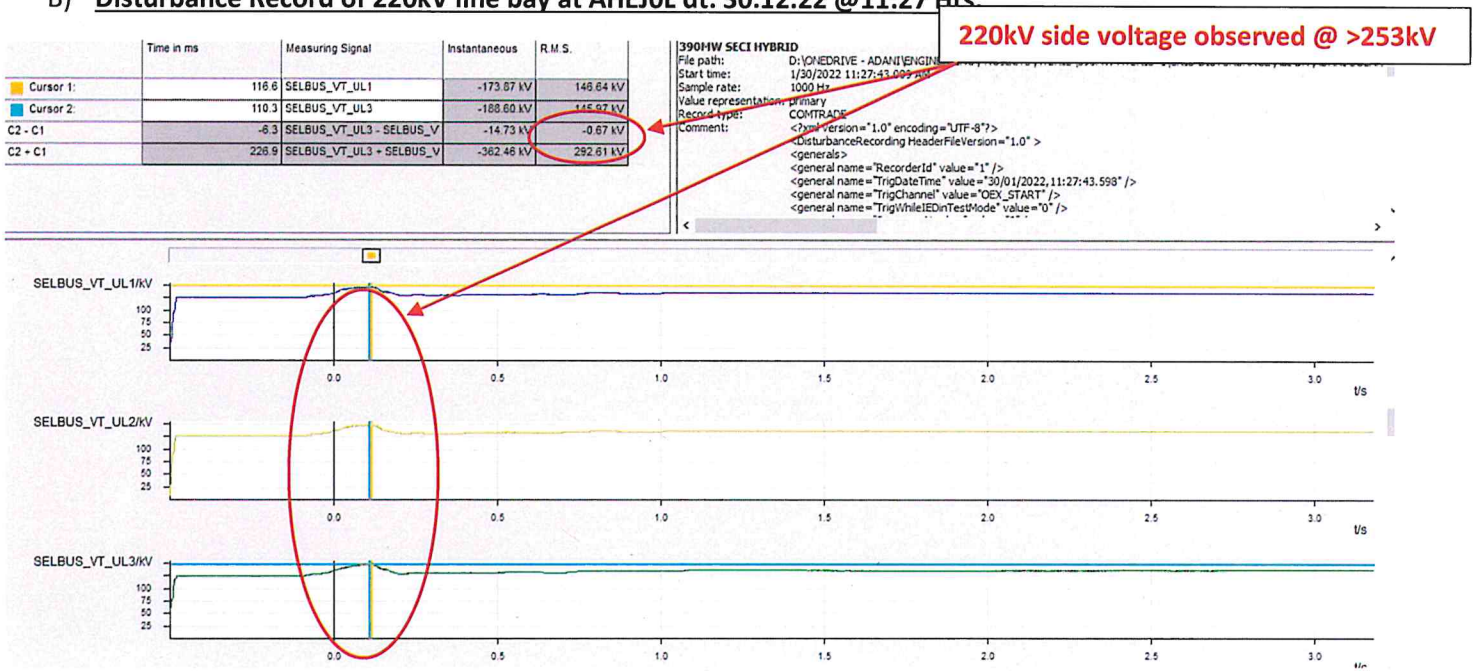
B) **Disturbance Record of 220kV line bay at AHEJ0L dt: 30.12.22 @11:27 Hrs.**



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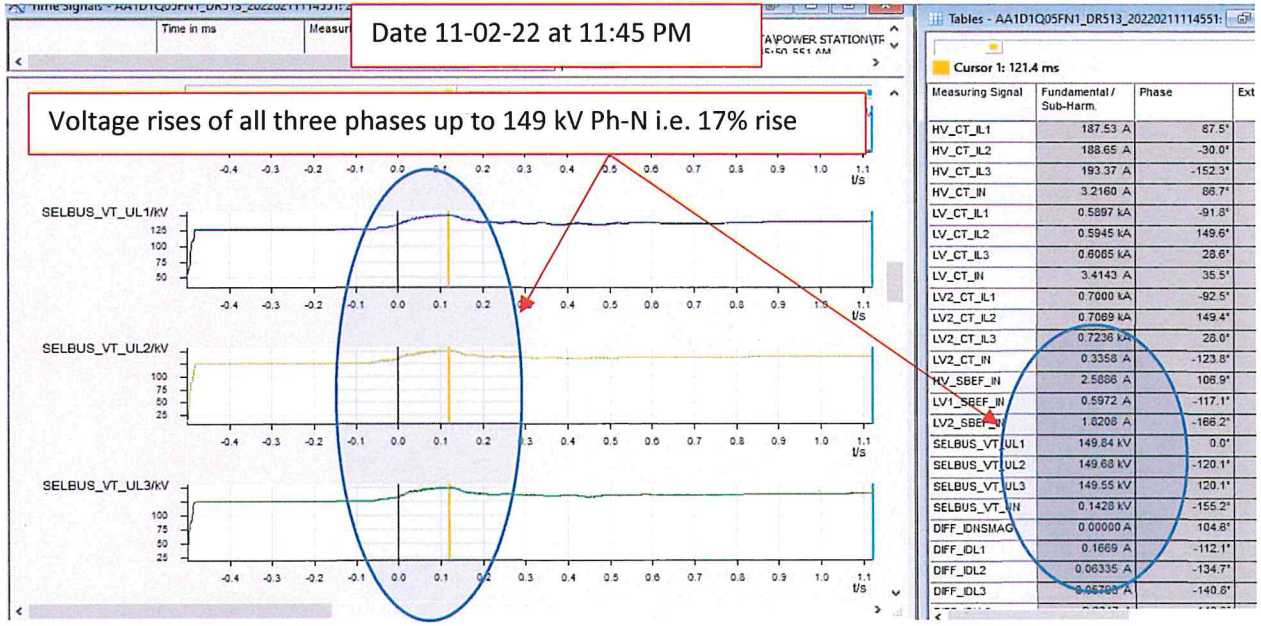
C) **Disturbance Record of 220kV line bay dt: 11.02.22 @11:45 Hrs**



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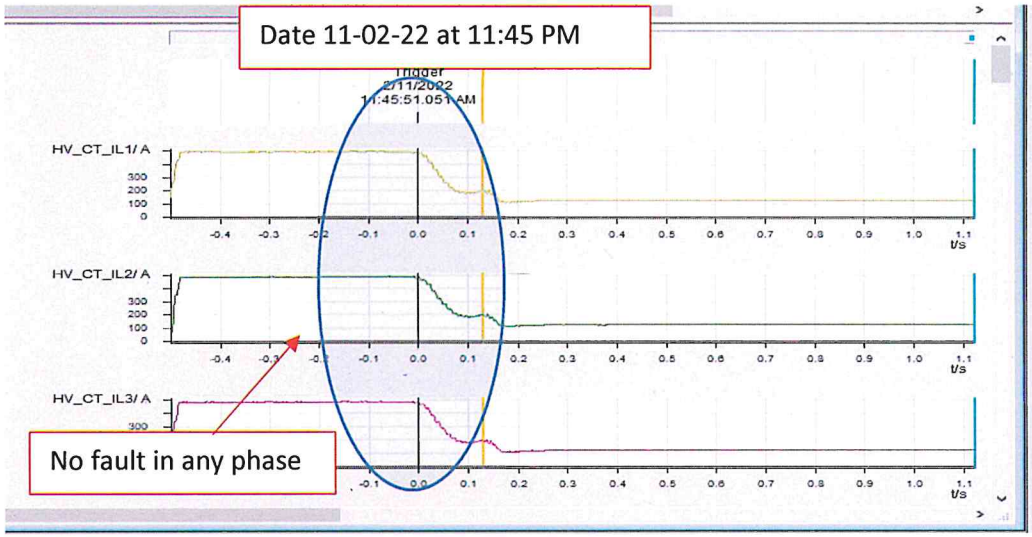

Cursor 1: 131.1 ms

Measuring Signal	Fundamental / Sub-Harm.	Phase	Ex
HV_CT_IL1	189.24 A	93.0°	
HV_CT_IL2	196.36 A	-27.0°	
HV_CT_IL3	191.41 A	-149.6°	
HV_CT_IN	3.0387 A	93.1°	
LV_CT_IL1	0.5927 kA	-86.2°	
LV_CT_IL2	0.6164 kA	152.4°	
LV_CT_IL3	0.5944 kA	31.2°	
LV_CT_IN	2.5573 A	56.4°	
LV2_CT_IL1	0.7066 kA	-87.3°	
LV2_CT_IL2	0.7356 kA	152.7°	
LV2_CT_IL3	0.7213 kA	30.7°	
LV2_CT_IN	0.3100 A	-11.7°	
HV_SBEF_IN	2.4983 A	108.9°	
LV1_SBEF_IN	0.3143 A	-78.8°	
LV2_SBEF_IN	0.7006 A	141.8°	
SELBUS_VT_UL1	148.95 kV	0.6°	
SELBUS_VT_UL2	148.61 kV	-119.3°	
SELBUS_VT_UL3	148.88 kV	120.6°	
SELBUS_VT_UN	0.1651 kV	-134.8°	
DIFF_IDNSMAG	0.00000 A	104.6°	
DIFF_IDL1	0.1421 A	-176.1°	
DIFF_IDL2	0.07336 A	-168.2°	
DIFF_IDL3	0.09618 A	155.0°	

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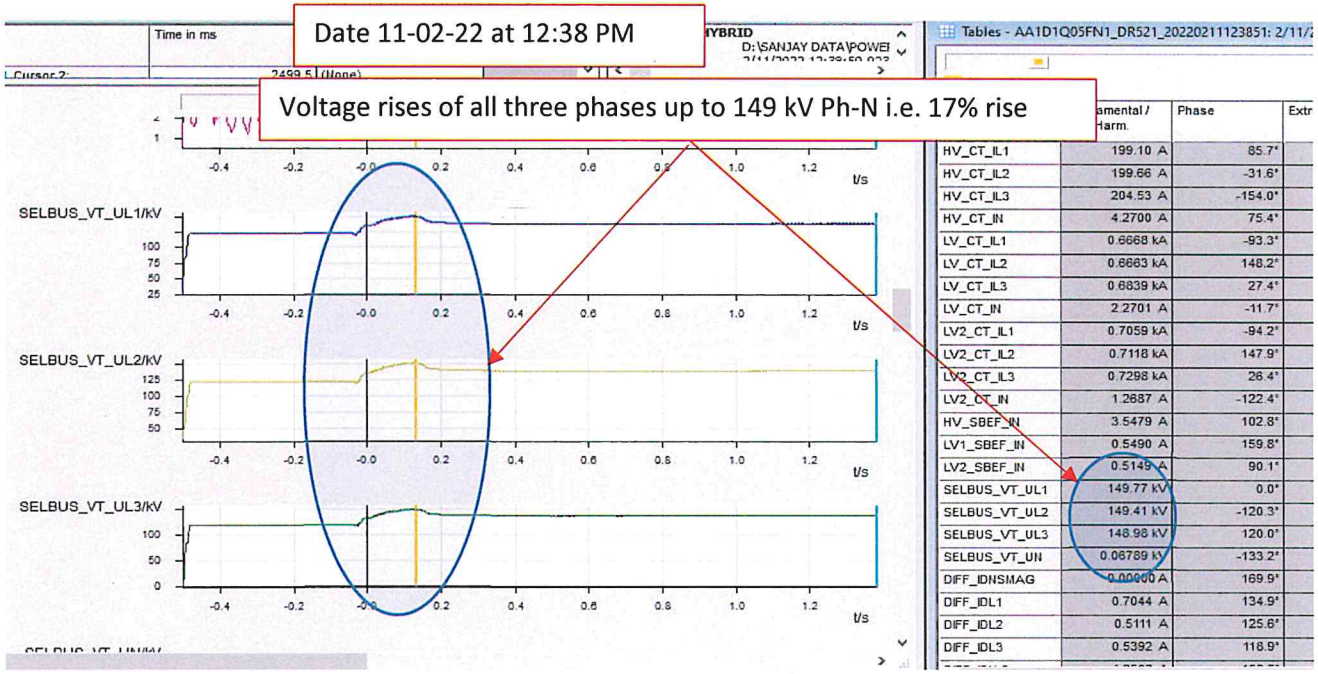
D) **Disturbance Record of 220kV line bay dt: 11.02.22 @12:38 Hrs**



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Annexure-2

A) TBEA

TBEA 特变电工
装备中国 装备世界

特变电工西安电气科技有限公司
企业地址：陕西西安市高新区上林苑四路70号 邮编：710119
联系电话：+86-29-68780666 传真：+86-29-68780500
http://www.tbeapower.com

TS208KTL-HV Parameters Settings -50MW Adani

Parameter	Default Values
Country	India
Protection level	Fifth Level
AC Under Voltage Level Protection Value	720V
AC Over Voltage Level Protection Value	880V
AC Under Frequency Level Protection Value	47.5HZ
Grid Over Frequency Level Protection Value	52HZ
AC Under Voltage Level Protection Time	10000ms
AC Over Voltage Level Protection Time	2000ms
AC Under Frequency Level Protection Time	200ms
Grid Over Frequency Level Protection Time	200ms
Vmax-recover (V)	878V
Vmin-recover (V)	722V
Fmax-recover (Hz)	51.98HZ
Fmin-recover (Hz)	47.52HZ
HVRT (ON/OFF)	ON
HVRT K Factor	0.95
HVRT Voltage 1	880V
HVRT Voltage 2	960V
HVRT Voltage 3	1040V
HVRT Time 1 (ms)	2000ms
HVRT Time 2 (ms)	200ms
HVRT Time 3 (ms)	0ms
LVRT (ON/OFF)	ON
LVRT K Factor	0.5
LVRT Voltage 1	720V
LVRT Voltage 2	680V
LVRT Voltage 3	120V
LVRT Time 1 (ms)	10000ms
LVRT Time 2 (ms)	3000ms
LVRT Time 3 (ms)	300ms

TBEA XI'AN ELECTRIC TECHNOLOGY CO., LTD.
Add: TBEA Xi'an Solar Industrial Park, No. 70, Shanglinyuan 4th Road, High-tech Zone, Xi'an (710019), China
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B) Sungrow

SUNGROW

SG250HX-IN

Default Value of Protection Parameters for India

SUNGROW

Version 1.0 EN

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Default Value of Protection Parameters

SUNGROW

Parameter	Default
Country	India
Protection level	Single level
AC Under Voltage Level Protection Value	680.0 V
AC Over Voltage Level Protection Value	880.0 V
AC Under Frequency Level Protection Value	47.5 Hz
Grid Over Frequency Level Protection Value	52.00 Hz
AC Under Voltage Level Protection Time	10.00 s
AC Over Voltage Level Protection Time	10.00 s
AC Under Frequency Level Protection Time	0.20 s
Grid Over Frequency Level Protection Time	0.20 s
AC Under Frequency Level Protection Value	47.50 Hz
Grid Over Frequency Level Protection Value	52.00 Hz

Default Value of Protection Parameter

SUNGROW

Parameter	Default
Vmax-recover	878.0 V
Vmin-recover	722.0 V
Fmax-recover	51.98 Hz
Fmin-recover	47.52 Hz
HVRT	ON
HVRT K Factor	1.0
HVRT Voltage 1	880.0 V
HVRT Voltage 2	960.0 V
HVRT Voltage 3	1040.0 V
HVRT Time 1 (ms)	10.000 s
HVRT Time 2 (ms)	2.000 s
HVRT Time 3 (ms)	0.000 s
LVRT	ON
LVRT K Factor	2.0
LVRT Voltage 1	720.0 V
LVRT Voltage 2	680.0 V
LVRT Voltage 3	120.0 V
LVRT Time 1 (ms)	10.000 s
LVRT Time 2 (ms)	3.000 s
LVRT Time 3 (ms)	0.300 s

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C) Huawei

Parameter	Default
Country	India
Protection level	Single level
AC Under Voltage Level Protection Value	680.0 V
AC Over Voltage Level Protection Value	880.0 V
AC Under Frequency Level Protection Value	47.5 Hz
Grid Over Frequency Level Protection Value	52.00 Hz
AC Under Voltage Level Protection Time	10.00 s
AC Over Voltage Level Protection Time	10.00 s
AC Under Frequency Level Protection Time	0.20 s
Grid Over Frequency Level Protection Time	0.20 s
AC Under Frequency Level Protection Value	47.50 Hz
Grid Over Frequency Level Protection Value	52.00 Hz

Parameter	Default
Vmax-recover	878.0 V
Vmin-recover	722.0 V
Fmax-recover	51.98 Hz
Fmin-recover	47.52 Hz
HVRT	ON
HVRT K Factor	1.0
HVRT Voltage 1	880.0 V
HVRT Voltage 2	960.0 V
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LVRT	ON
LVRT K Factor	2.0
LVRT Voltage 1	720.0 V
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LVRT Voltage 3	120.0 V
LVRT Time 1 (ms)	10.000 s
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LVRT Time 3 (ms)	0.300 s

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पावर सिस्टम ऑपरेशन कारपोरेशन लिमिटेड
(भारत सरकार का उद्यम)
POWER SYSTEM OPERATION CORPORATION LIMITED
(A Govt. of India Enterprise)
उत्तरी क्षेत्रीय भार प्रेशण केन्द्र / NORTHERN REGIONAL LOAD DESPATCH CENTRE
कार्यालय : 18-ए, शहीद जीत सिंह सनसनवाल मार्ग, कटवारिया सराय, नई दिल्ली- 110016
OFFICE : 18-A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi- 110016
CIN : U40105DL2009GOI188682, Website : www.nrldc.org, www.nrldc.in, Tel.: 011- 26519406, 26523869, Fax : 011- 26852747

Ref no. : NRLDC\ RES\TS-108\07

Date: 15-Feb-2022

To,
Chairman and CEO
ReNew Power, Commercial Block-1,
Zone 6, Golf Course Road, DLF City Phase-V,
Gurugram-122009, Haryana.

Sub: Frequent Outage of Solar/Wind generation in Northern region and suspected HVRT/LVRT failure.

Sir,

You are aware that in past 15-20 days, there have been several events of tripping of Renew Solar plants connected at 765/400/220kV Fatehgarh-II. Details of these events are mentioned below:

S. No.	Event	Generation loss of Renew Plants connected at Fatehgarh-II(PG) (MW)	Generation loss (MW) at Fatehgarh-II(PG) pooling	Frequency dip (Hz)
1	On 30th Jan 2022 at 11:27 Hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	981	2038	0.18
2	On 04th February 2022 at 13:16 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	761	1882	0.16
3	On 11th Feb 2022 at 11:45 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	1020	2316	0.20
4	On 11th Feb 2022 at 12:38 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	1111	2558	0.27

In all these events, solar generation reduced significantly at Renew plants. The generation at these locations picked up only after 2-3 minutes even though sustained high voltage was not observed. This large outage of solar generation could be interpreted either as failure of HVRT capability of the PV inverters or tripping of lines/transformer connecting the plants to respective pooling stations leading to islanding of plant. Such behaviour during transients is neither expected nor desirable. Outage of around 1500-2000 MW generation in these events also resulted in frequency excursion of the order of 0.2-0.3 Hz.

Therefore, these events need to be analysed in detail and a report may be submitted by Renew Power explaining reasons for non-operation of proper HVRT functionality, improper coordination of the protection of connecting lines and transformers with HVRT withstand time of the solar inverters along with remedial action plan to avoid such issues in future.

Regards

(Surajit Banerjee)
Chief General Manager

1. Member Secretary, NRPC, 18-A SJSS Marg, Katwaria Sarai, New Delhi-110016.
2. Dy. Chief Operating Officer (CTUIL), POWERGRID, Saudamini, Plot number-2, Sector-29, IFFCO Chowk, Gurgaon-122001
3. Member (Power System), Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi–110066
4. Chairman and Managing Director (POSOCO), POSOCO, B-9, Qutub Institutional Area, New Delhi-110016
5. Executive Director (NLDC), POSOCO, B-9, Qutub Institutional Area, New Delhi-110016

पावर सिस्टम ऑपरेशन कारपोरेशन लिमिटेड
(भारत सरकार का उद्यम)
POWER SYSTEM OPERATION CORPORATION LIMITED
(A Govt. of India Enterprise)
उत्तरी क्षेत्रीय भार प्रेशण केन्द्र / NORTHERN REGIONAL LOAD DESPATCH CENTRE
कार्यालय : 18-ए, शहीद जीत सिंह सनसनवाल मार्ग, कटवारिया सराय, नई दिल्ली- 110016
OFFICE : 18-A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi- 110016
CIN : U40105DL2009GOI188682, Website : www.nrldc.org, www.nrldc.in, Tel.: 011- 26519406, 26523869, Fax : 011- 26852747

Ref no. : NRLDC\ RES\TS-108\04 Date: 15-Feb-2022

To,

1. AGM, Renew Sun Bright Pvt Ltd., Commercial Block-1, Zone 6, Golf Course Road, DLF City Phase-V, Gurugram, Haryana-122009	2. AGM, ReNew Sun Waves Private Limited, Fatehgarh-II, Commercial Block-1, Zone 6, Golf Course Road, DLF City Phase-V, Gurugram, Haryana-122009
3. AGM, ReNew Solar Energy Jharkhand Three Pvt. Ltd., Commercial Block-1, Zone 6, Golf Course Road, DLF City Phase-V, Gurugram, Haryana-122009	4. AGM, RENEW SOLAR POWER Pvt. Ltd, Commercial Block-1, Zone 6, Golf Course Road, DLF City phase-V, Gurugram- 122009, Haryana

Sub: Suspected HVRT failure during recent events on 30th Jan, 4th Feb and 11th Feb 2022

Sir,

It is to bring to your notice that in several events in past 10-15 days, there have been tripping of Renew plants connected at 765/400/220kV Fatehgarh-II. Details of these events are mentioned below:

S. No.	Event	Generation loss of Renew Plants connected at Fatehgarh-II(PG) (MW)	Generation loss (MW) at Fatehgarh-II(PG) pooling	Frequency dip (Hz)
1	On 30th Jan 2022 at 11:27 Hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	981	2038	0.18
2	On 04th February 2022 at 13:16 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	761	1882	0.16
3	On 11th Feb 2022 at 11:45 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	1020	2316	0.20
4	On 11th Feb 2022 at 12:38 hrs, due to over voltage tripping of internal elements of Plants or suspected HVRT failure.	1111	2558	0.27

In all these events, it can be seen from the data available at NRLDC (Annexure-I) that the solar generation significantly reduced at Renew plants. The generation at these locations has picked up only after 2-3 minutes even though sustained high voltage was not observed. This large outage of solar generation could be interpreted as failure of HVRT capability of these solar plants. Such behaviour during transients is totally not expected nor desirable. Outage of around 1500-2000 MW in these events also resulted in frequency excursion of the order of 0.2-0.4 Hz.

It could be inferred from the sample plots for 30th Jan 2022 attached as Annexure-I that HVRT at Fatehgarh-II renew plants did not function as mandated by CEA standards/ CERC orders and the affidavit of compliance submitted by the plant owners. The plots also suggest differences in the PSSe model output submitted by plants at the time of registration and their performance in real-time. Such non-operation of HVRT leads to generation drop and therefore frequency dip and is severe threat to the security of the grid.

There is also need to have standard data retention practice to understand inverter behaviour during such transient events. It is also important that inverter and POI level settings are such that the plant is able to comply with all the mandated CEA standards and undertakings given before connection to the grid.

Therefore, the event needs to be analysed in detail and a report may be submitted before 20th Feb'22 explaining reasons for non-operation of proper HVRT functionality along with remedial action plan to avoid such issues in future.

Regards

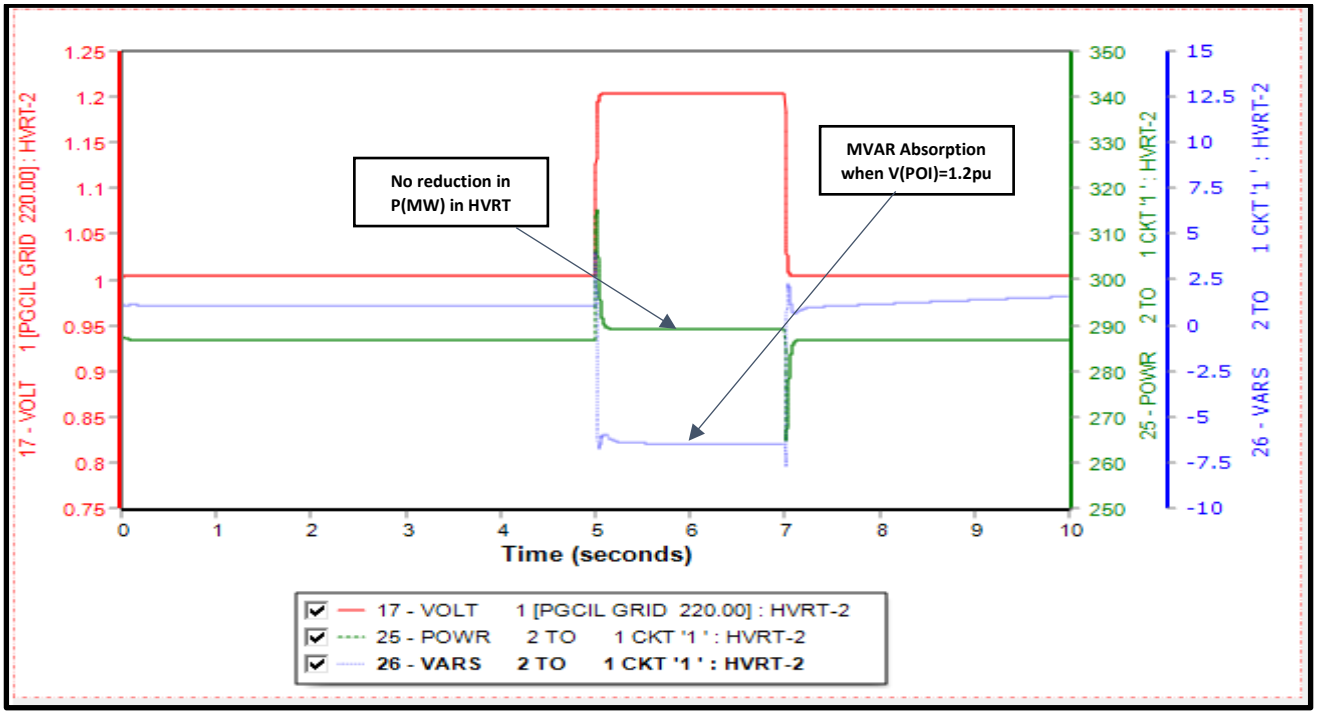
(Alok Kumar)
General Manager

1. Member Secretary, NRPC, 18-A SJSS Marg, Katwaria Sarai, New Delhi-110016.
2. Dy. Chief Operating Officer (CTUIL), POWERGRID, Saudamini, Plot number-2, Sector-29, IFFCO Chowk, Gurgaon-122001
3. Member (Power System), Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi–110066
4. Director (System Operations), POSOCO, B-9, Qutub Institutional Area, New Delhi-110016

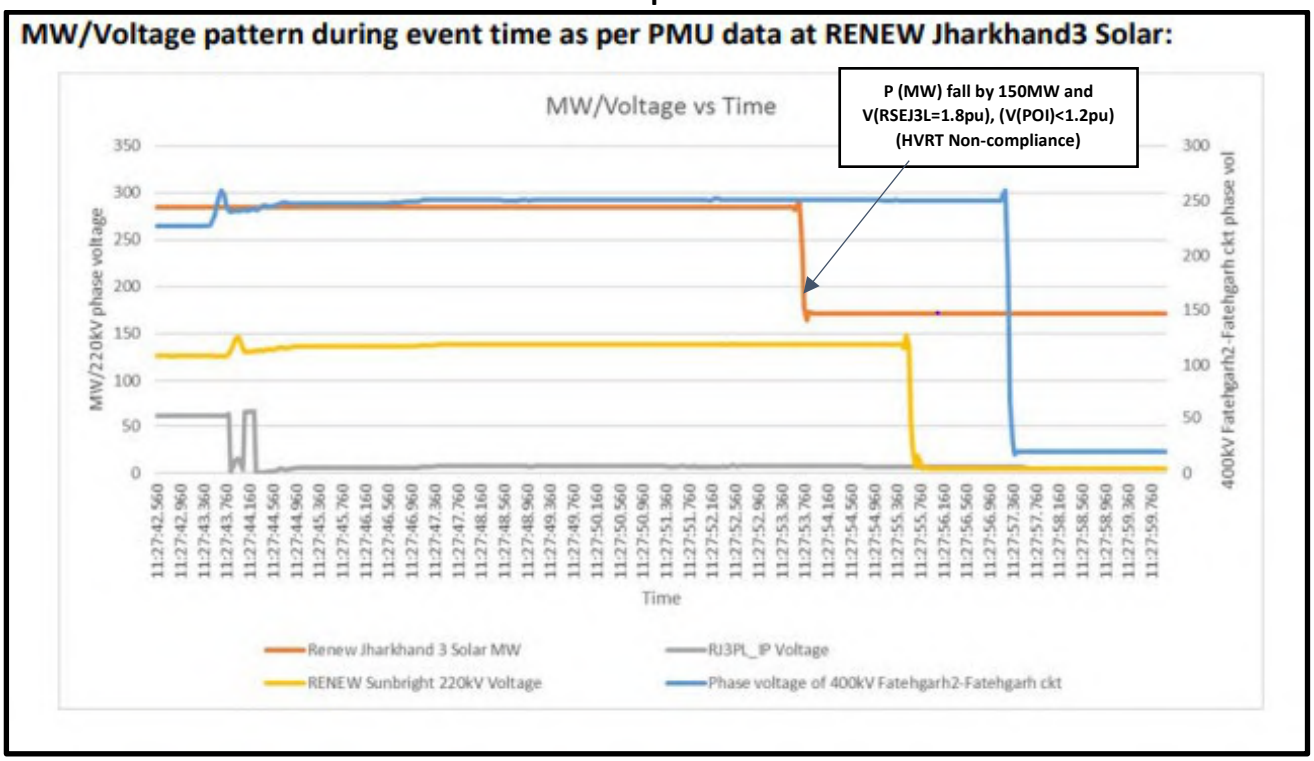
Annexure-I

Simulated response and Real-time response of RSEJ3L (Renew Solar energy Jharkhand 3)

Simulated response



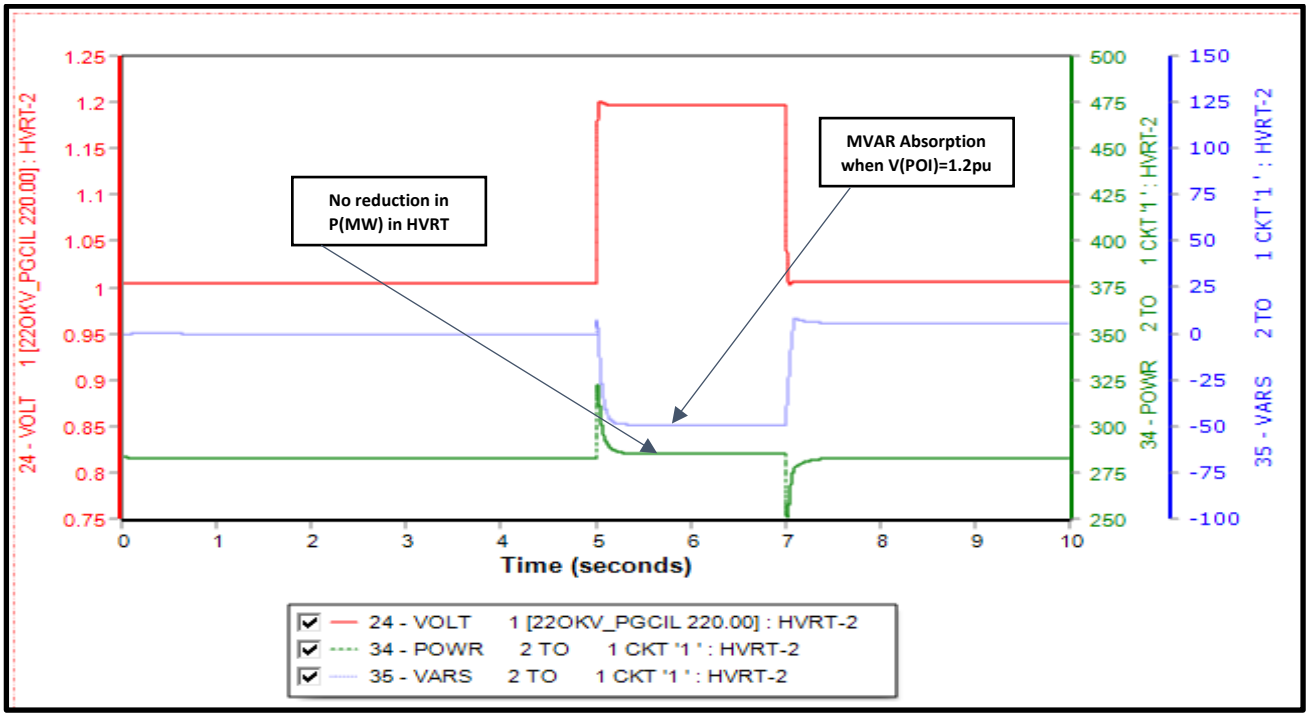
Actual response



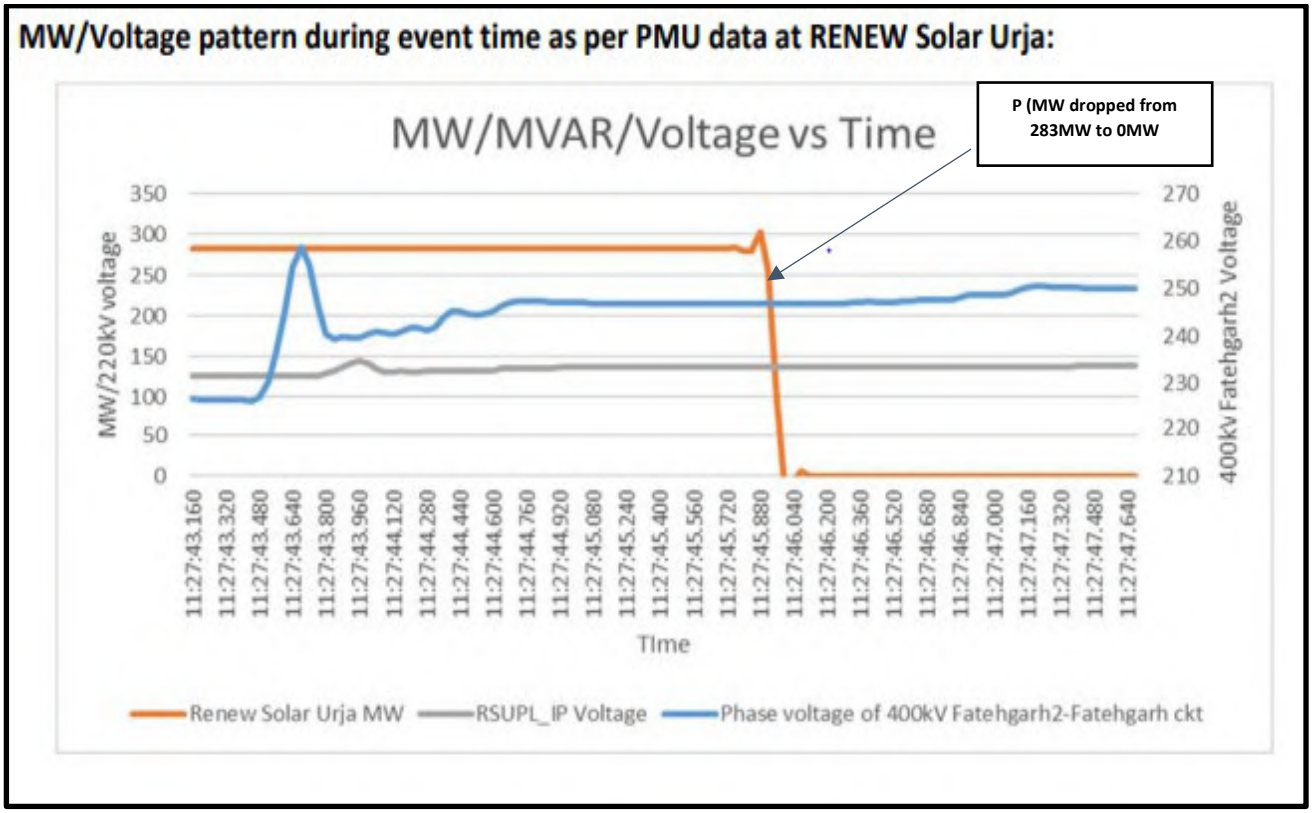
- **From the simulation result of model submitted at the time of registration, it can be inferred that when voltage at POI reaches to 1.2pu, plant would remain connected to grid without any reduction in P(MW) and absorb MVAR, however in real-time Plant generation P(MW) fall down by 120MW while V(POI)<1.2pu.**
- **No element tripping is observed at RENEW Jharkhand3 Solar plant**
- **Real time response of the plant is not matching with the validated model submitted at the time of registration and shows that plant failed to meet CEA HVRT compliance in Real time.**

Simulated response and Real-time response of RSUPL (Renew Solar Urja Pvt. Ltd.)

Simulated response



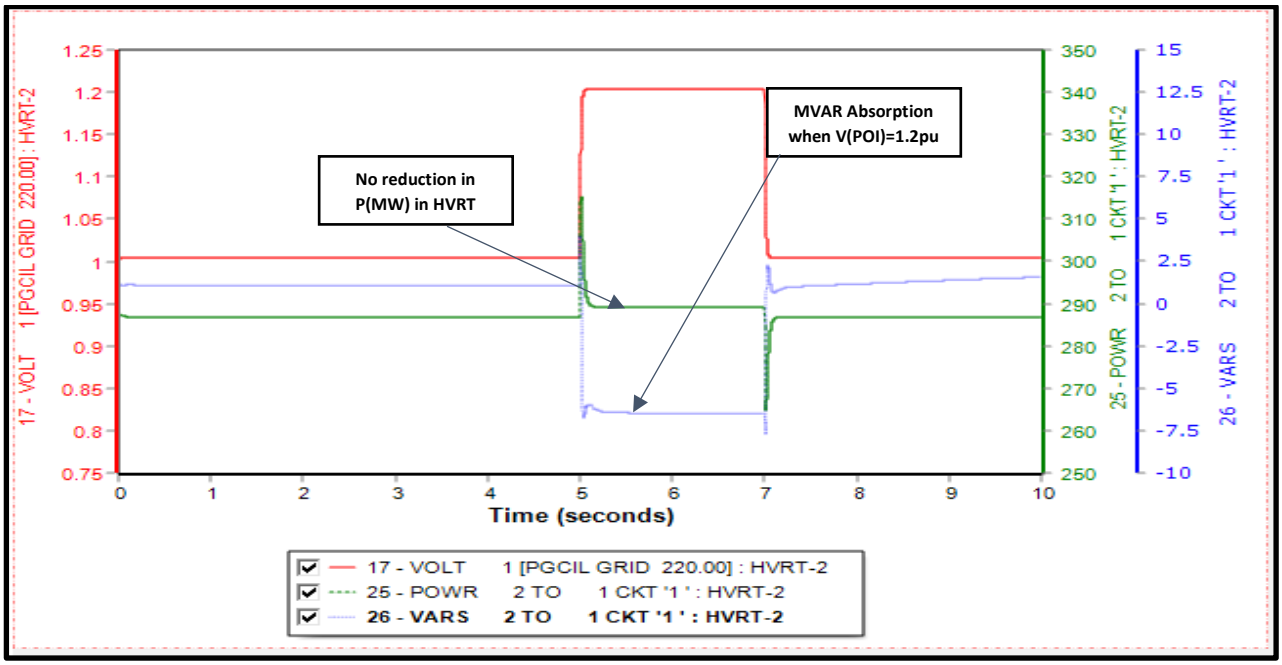
Actual response



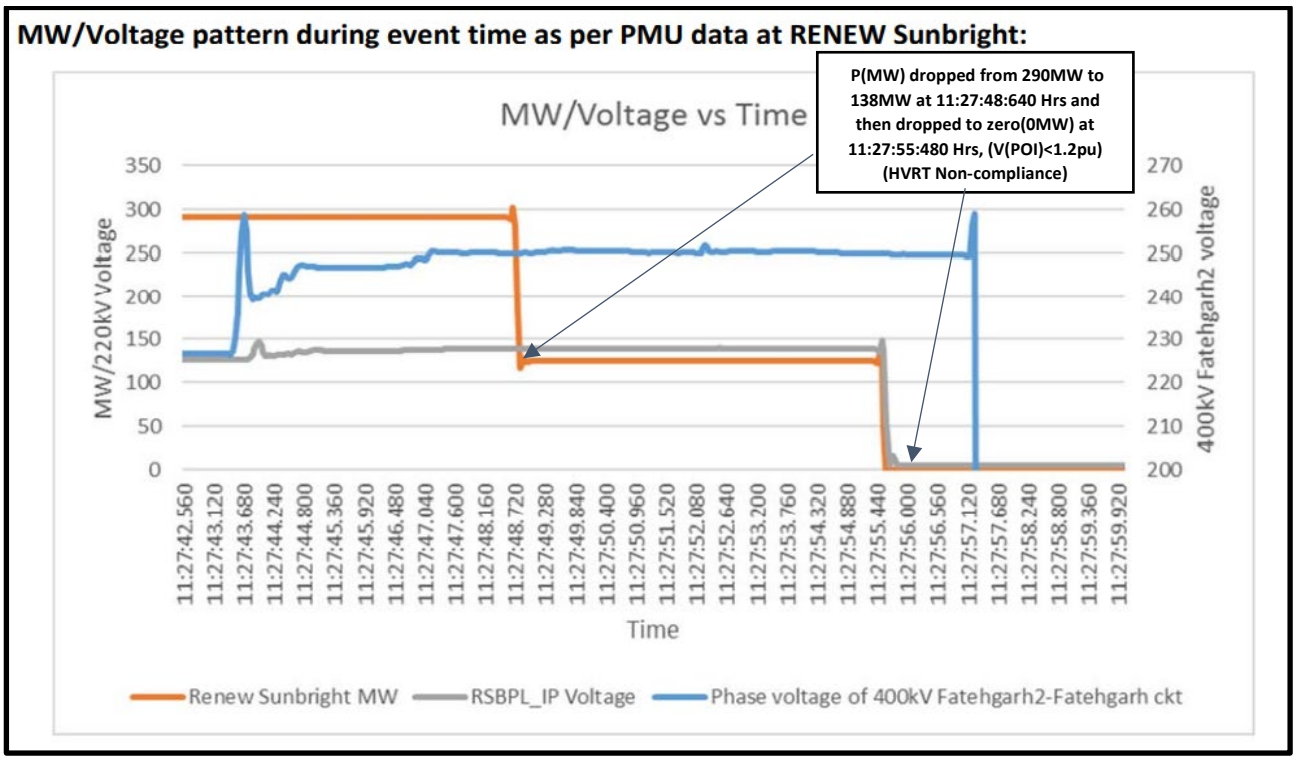
- **From the simulation result of model submitted at the time of registration, it can be inferred that when voltage at POI reaches to 1.2pu, plant would remain connected to grid without any reduction in P(MW) and absorb MVAR, however in real-time Plant generation P(MW) fall down to zero (0) due to tripping of 220/33kV Transformers and 33kV feeders on Overvoltage while V(POI)<1.2pu.**
- **Real time response of the plant is not matching with the validated model submitted at the time of registration and shows that plant failed to meet CEA HVRT compliance in Real time.**

Simulated response and Real-time response of RSBPL (Renew Sun Bright Pvt. Ltd.)

Simulated response



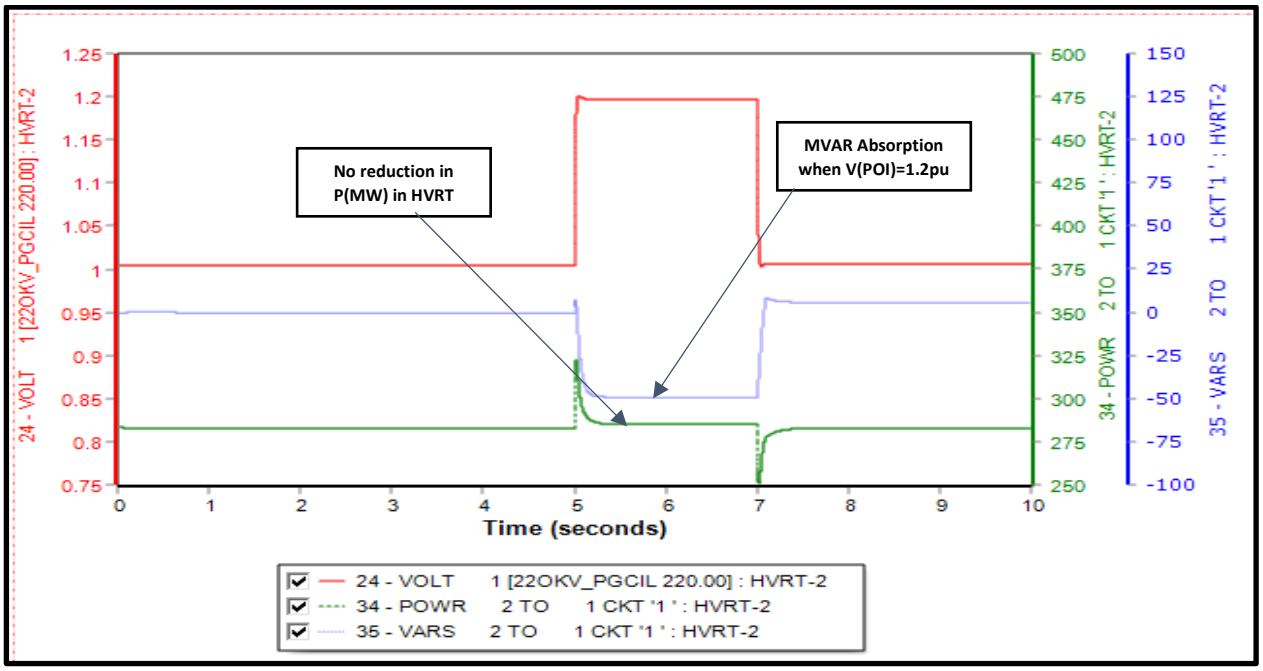
Actual response



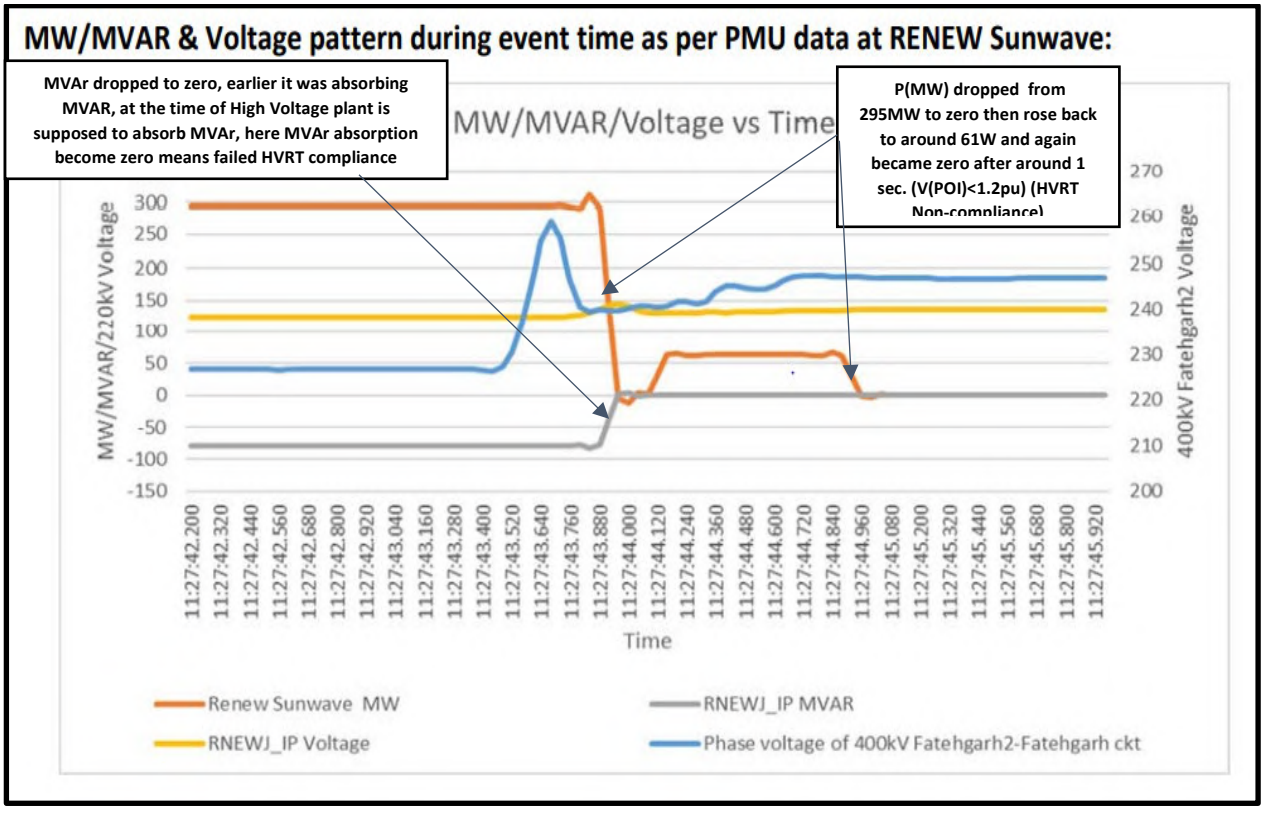
- **From the simulation result of model submitted at the time of registration, it can be inferred that when voltage at POI reaches to 1.2pu, plant would remain connected to grid without any reduction in P(MW) and absorb MVAR, however in real-time Plant generation P(MW) fall down to zero (0) due to tripping of 220/33kV Transformers and 220kV line to Fatehgarh2 on Overvoltage while V(POI)<1.2pu.**
- **Real time response of the plant is not matching with the validated model submitted at the time of registration and shows that plant failed to meet CEA HVRT compliance in Real time.**

Simulated response and Real-time response of RSWPL (Renew Sun wave Pvt. Ltd.)

Simulated response



Actual response



- **From the simulation result of model submitted at the time of registration, it can be inferred that when voltage at POI reaches to 1.2pu, plant would remain connected to grid without any reduction in P(MW) and absorb MVAR, however in real-time Plant generation P(MW) dropped from 295MW to zero then rose back to around 61W and again became zero after around 1 second while V(POI)<1.2pu.**
- **It was also observed that 220/33kV Transformers at RENEW Sunwave also tripped during the event**
- **Real time response of the plant is not matching with the validated model submitted at the time of registration and shows that plant failed to meet CEA HVRT compliance in Real time.**

Ideally there should not be any generation tripping/Backing down of generation in the incident, but tripping/baking down happened in real time its mean there might be some Over Voltage protection operated at in plant internal element or inverter responded undesirably, Over voltage setting of plant internal elements and PPC settings should be kept such that Plant would be able to meet CEA compliance at POI.

Following details is required from RE plants end for further analysis.

1. In which mode plant is being operated? (If it is in Voltage Control mode, which Reference voltage is being taken by PPC, (Is it 220kV voltage of Fatehgarh-II (PG) or 220kV Voltage at Plant end or something else?)).
2. Dead band of 220kV Voltage, i.e voltage above which or below which plant would start absorbing or injecting MVAR respectively.
3. Time delay setting after which it would start absorbing or injecting MVAR, once the voltage got changed at POI above or below dead band.
4. Following details from PPC.
    - Reference voltage for HVRT/LVRT.
    - Time delay setting for HVRT/LVRT operation.
    - HVRT/LVRT Voltage setting.
    - PPC mode of control (Voltage control/ PF control/ Q control).
    - PPC detailed communication mechanism with inverter, As per the details submitted by Plant for registration pertaining that PPC controls all the inverter, weather PPC controlling all the inverter individually or with 50MW block wise? Is there any false signal/command going to inverter to reduce its P(MW)?
5. Over voltage and overcurrent setting of 220kV line, 220/33kV power transformer, 33/0.6kV or 33/0.66kV IDT and Inverter/WTG and their time delay.
6. If there is any over voltage tripping of internal element then voltage at which it got tripped, and over voltage setting of that element.

Annexure-VIII
Annexure-IV

Review of over voltage protection settings at RE stations

Gmail

NRLDC SO-II <nrldcso2@gmail.com>

To review the over voltage protection settings at RE stations connected at 765/400 /220kV Fatehgarh2(PG)

4 messages

NRLDC SO-II <nrldcso2@gmail.com> Mon, Feb 14, 2022 at 3:11 PM
To: Shiv Verma <shiv.verma@adani.com>, Dejendra Sharma <Dejendra.Sharma@renewpower.in>, Neeraj Gupta <neeraj@renewpower.in>, Deepak Purohit <deepak.purohit@renewpower.in>, "Vikram.Yadav" <Vikram.Yadav@eden-re.com>, cpcc nr1 <cpccnr1@powergrid.co.in>
Cc: "Surajit Banerjee (सुरजीत बनर्जी)" <surajit.banerjee@posoco.in>, sheikhshadruddin@posoco.in, "Alok Kumar (आलोक कुमार)" <alok.kumar@posoco.in>, Suruchi Jain <suruchi.jain@posoco.in>, "Amit Gupta (अमित गुप्ता)" <amitgupta@posoco.in>, abhishek.deepak@posoco.in, asif@posoco.in, Deepak Kumar <deepak.kr@posoco.in>

Sir,

As you all are aware that multiple events of huge quantum of solar generation loss have been observed during recent days. It is observed that 220kV & 33kV elements (feeders, ICTs) connecting to RE stations connected at 765/400 /220kV Fatehgarh2(PG) tripped on over voltage protection operation during these events.

Therefore, RE stations may review the over voltage protection settings at their end w.r.t. following points:
1. As per protection philosophy, no over voltage protection is required in ICTs. Hence, over voltage protection in ICTs needs to be disabled at every RE station.
2. As per CEA standards for connectivity, over voltage protection is not recommended at 220kV & below voltage levels. RE stations may explain the reason for keeping the over voltage protection in 220kV and 33kV lines. RE stations may review and correct the over voltage protection settings in their 220kV & 33kV feeders.

Hence, RE stations are requested to take necessary action at their end and share the confirmation of action taken.

Regards
Deepak Kumar
NRLDC
Contact no: 9519446110

NRLDC SO-II <nrldcso2@gmail.com> Wed, Feb 16, 2022 at 11:10 AM
To: Shiv Verma <shiv.verma@adani.com>, Dejendra Sharma <Dejendra.Sharma@renewpower.in>, Neeraj Gupta <neeraj@renewpower.in>, Deepak Purohit <deepak.purohit@renewpower.in>, "Vikram.Yadav" <Vikram.Yadav@eden-re.com>, cpcc nr1 <cpccnr1@powergrid.co.in>
Cc: "Surajit Banerjee (सुरजीत बनर्जी)" <surajit.banerjee@posoco.in>, sheikhshadruddin@posoco.in, "Alok Kumar (आलोक कुमार)" <alok.kumar@posoco.in>, Suruchi Jain <suruchi.jain@posoco.in>, "Amit Gupta (अमित गुप्ता)" <amitgupta@posoco.in>, abhishek.deepak@posoco.in, asif@posoco.in, Deepak Kumar <deepak.kr@posoco.in>

Sir,

No confirmation of action taken is received from any of the RE stations as of now. It is again requested to share the confirmation of action taken by today evening on priority basis.

आभार ,
दीपक कुमार
संरक्षण विभाग
उ० क्षे० भा० प्रे० के०
नई दिल्ली

[Quoted text hidden]

Deepak Purohit <deepak.purohit@renewpower.in> Thu, Feb 17, 2022 at 8:17 AM
To: NRLDC SO-II <nrldcso2@gmail.com>, cpcc nr1 <cpccnr1@powergrid.co.in>
Cc: "Surajit Banerjee (सुरजीत बनर्जी)" <surajit.banerjee@posoco.in>, "sheikhshadruddin@posoco.in" <sheikhshadruddin@posoco.in>, "Alok Kumar (आलोक कुमार)" <alok.kumar@posoco.in>, Suruchi Jain <suruchi.jain@posoco.in>, "Amit Gupta (अमित गुप्ता)" <amitgupta@posoco.in>, "abhishek.deepak@posoco.in" <abhishek.deepak@posoco.in>, "asif@posoco.in" <asif@posoco.in>, Deepak Kumar <deepak.kr@posoco.in>, Bhawani Rathore <Bhawani.rathore@renewpower.in>, Dejendra Sharma <Dejendra.Sharma@renewpower.in>, Kailash Chandra Pandey <Kailash.Pandey@renewpower.in>, Vinit Kumar Kataria <vinit@renewpower.in>

Dear Sir,

This is for your information that we have disabled OV trip setting at 33 kv level and 220 kv. Side of power trafos as per instructions and guidelines all 4 plants of ReNew connected at Fatehgarh station.

However, in view of equipment protection and OEM recommendations we have kept OV trip setting active at main line breaker with delay of 5 sec.

Also, request you to keep Mr. Bhawani in loop for communication related to these four plants connected at Fatehgarh.

Thanks

Deepak Purohit

Get Outlook for iOS

From: NRLDC SO-II <nrldcso2@gmail.com>
Sent: Wednesday, February 16, 2022 11:11 AM
To: Shiv Verma; Dejendra Sharma; Neeraj Gupta; Deepak Purohit; Vikram.Yadav; cpcc nr1
Cc: Surajit Banerjee (सुरजीत बनर्जी); sheikhshadruddin@posoco.in; Alok Kumar (आलोक कुमार); Suruchi Jain; Amit Gupta (अमित गुप्ता); abhishek.deepak@posoco.in; asif@posoco.in; Deepak Kumar
Subject: Re: To review the over voltage protection settings at RE stations connected at 765/400/220kV Fatehgarh2(PG)

[Quoted text hidden]

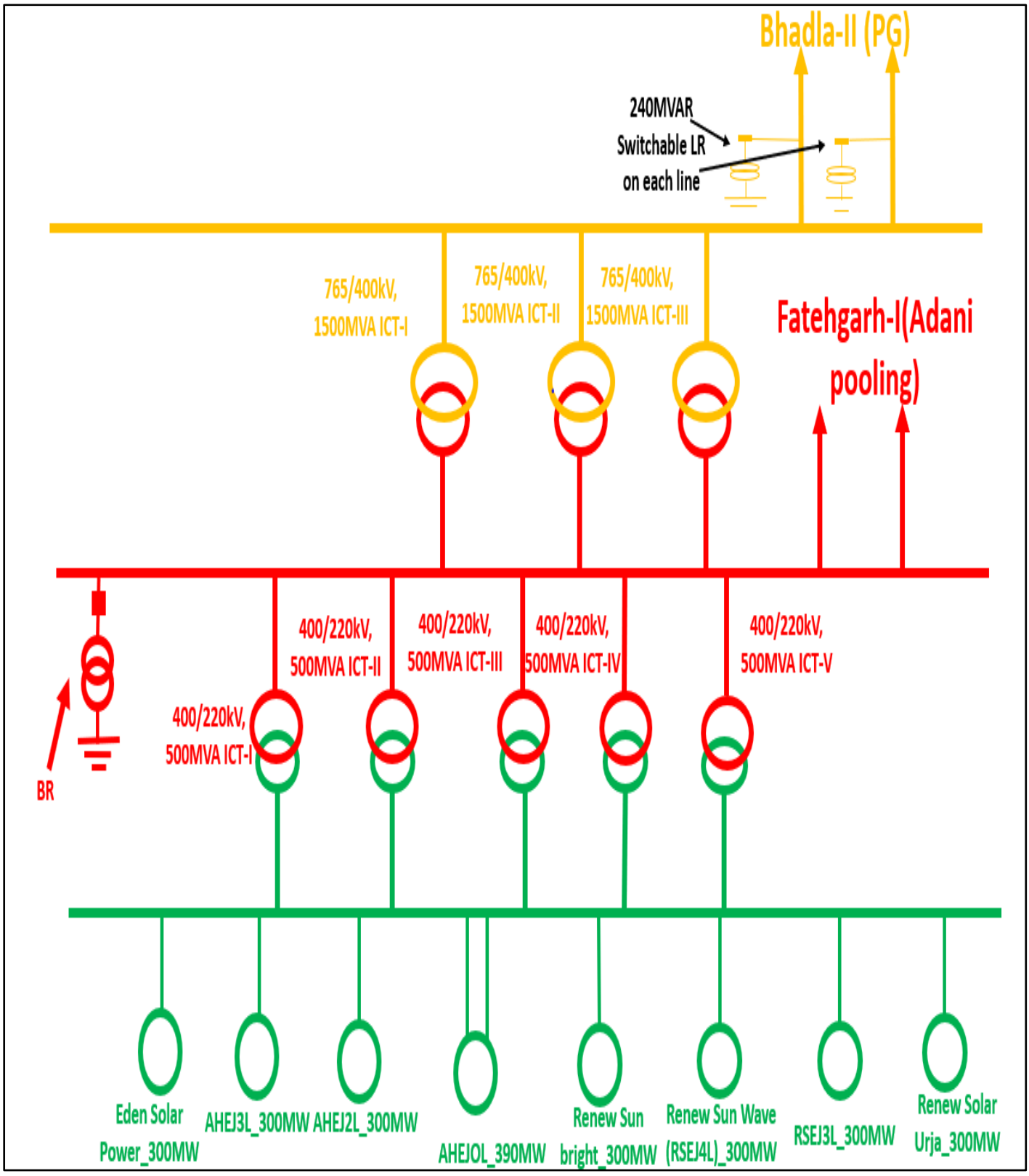
NRLDC SO-II <nrldcso2@gmail.com> Thu, Feb 17, 2022 at 9:42 AM
To: Bhawani.rathore@renewpower.in

[Quoted text hidden]

Status of response received from RE statrions conencted at Fatehgarh2 w.r.t. review of over voltage protection setting			
Sr. No	**Owner**	**RE Station**	**Remark**
1	ADANI	AHEJ2L	Confirmation of action taken not received.
		AHEJ3L	
		AHEJOL-1	
		AHEJOL-2	
		ASPS-I	
		ASPS-II	
		AWPS-III	
		AWPS-IV	
2	RENEW	RENEW Sunbright	Confirmation of action taken received.
		RENEW Jharkhand3	
		RENEW Sunwave	
		Renew Solar Urja	
3	EDEN	EDEN Solar	Confirmation of action taken not received.

Annexure-V

Connectivity diagram of 765/400/220kV Fatehgarh-II (PG)



Annexure-VI

Input By AGEL

adani Renewables

Appendix : Overvoltage Settings of Hybrid Plants

Plant Name: 1) AHEJ1L 2) AHEJ2L 3) AHEJ3L	Connected at :	765/400/220kV Fatehgarh-II ISTS			
Relay Settings	O/V Stage 1	O/V Stage 2	U/V Stage 1	U/V Stage 2	Overflux (In case of Transformer)
	with Delay setting	With Delay Setting	with Delay setting	With Delay Setting	
Transformer 220/33 kV	NA	NA	NA	NA	V/F Stage-1: 1.12pu, 100 Sec
					V/F Stage-2: 1.19pu, 60 Sec
					V/F Stage-3: 1.26pu, 40 Sec
					V/F Stage-4: 1.33pu, 10 Sec
					V/F Stage-5: 1.4pu, 2 Sec
33 kV feeders	PS: 1.15 pu	PS: 1.2 pu	NA	NA	
	TD: 5 Sec	TD: 1 Sec			
220 kV Line Settings at Plant end	PS: 1.15 pu	PS: 1.2 pu	NA	NA	
	TD: 5 Sec	TD: 1 Sec			

Input By Renew Power Pvt. Ltd.

Measures taken to Support Grid during HVRT:

1. **HVRT/LVRT Functionality at Inverters –** To Support Grid Voltage during Abrupt changes in Voltage, HVRT & LVRT is enabled in Inverters. As per CEA guidelines, Initially Reactive Power compensation was enabled in LVRT only and Inverter was only required to remain connected during High Voltage for a specified Time as per CEA guidelines. Now Reactive power compensation is enabled during HVRT along with control on instantaneous drop in active power to regularize Voltage.

	Previous Settings	Current Settings
HVRT	Enable	Enable
HVRT triggering threshold Voltage	1.10 Vnom	1.10 Vnom
HVRT Gradient (K Factor)	0	2

2. **Over Voltage Protection at Plant End: -** As per NRLDC Recommendations, Overvoltage protection settings modified as per below table:

Overvoltage Settings	Previous Settings	Current Settings
220 kV Line	110%/5 Sec	112%/6 Sec
220 kV Power Transformers	110%/5 Sec	Disabled
33kV Feeders	110%/3 Sec	Disabled

Post implementation of these changes at plants we have not observed power drop/ tripping issue which were there earlier.

Voltage Profile at 765/400/220kV Bhadla (PG) S/s for months of Jan'22-April'22

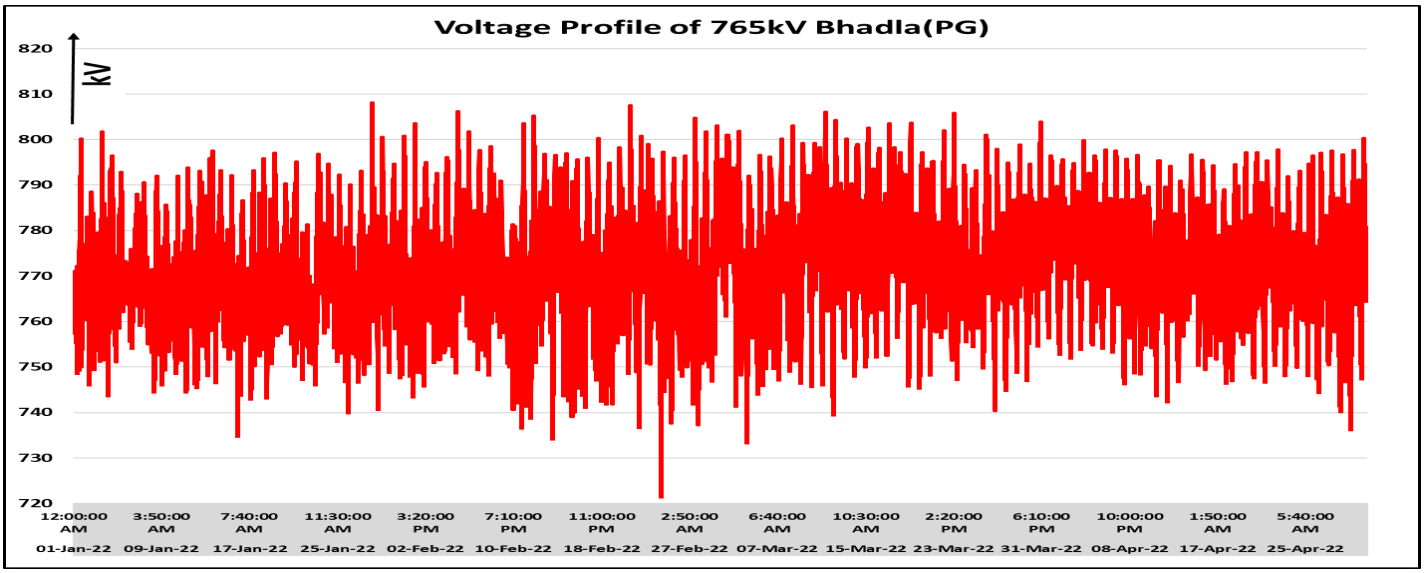


Fig-1: Voltage Profile of 765kV Bhadla (PG)

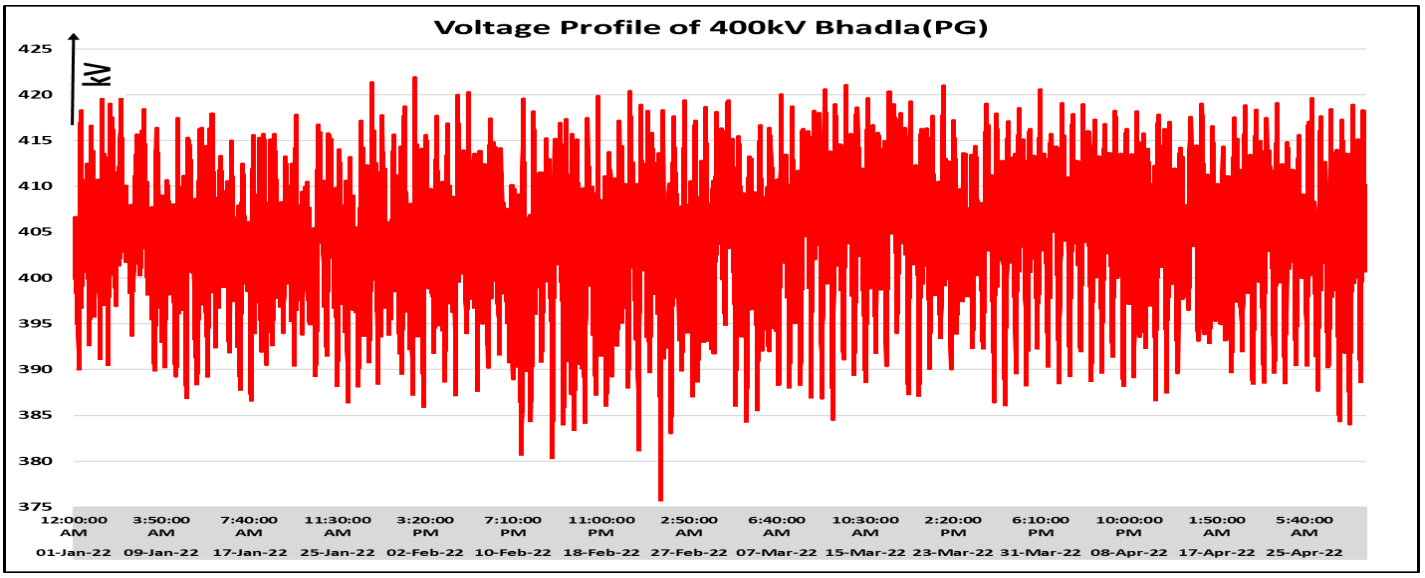


Fig-2: Voltage Profile of 400kV Bhadla (PG)

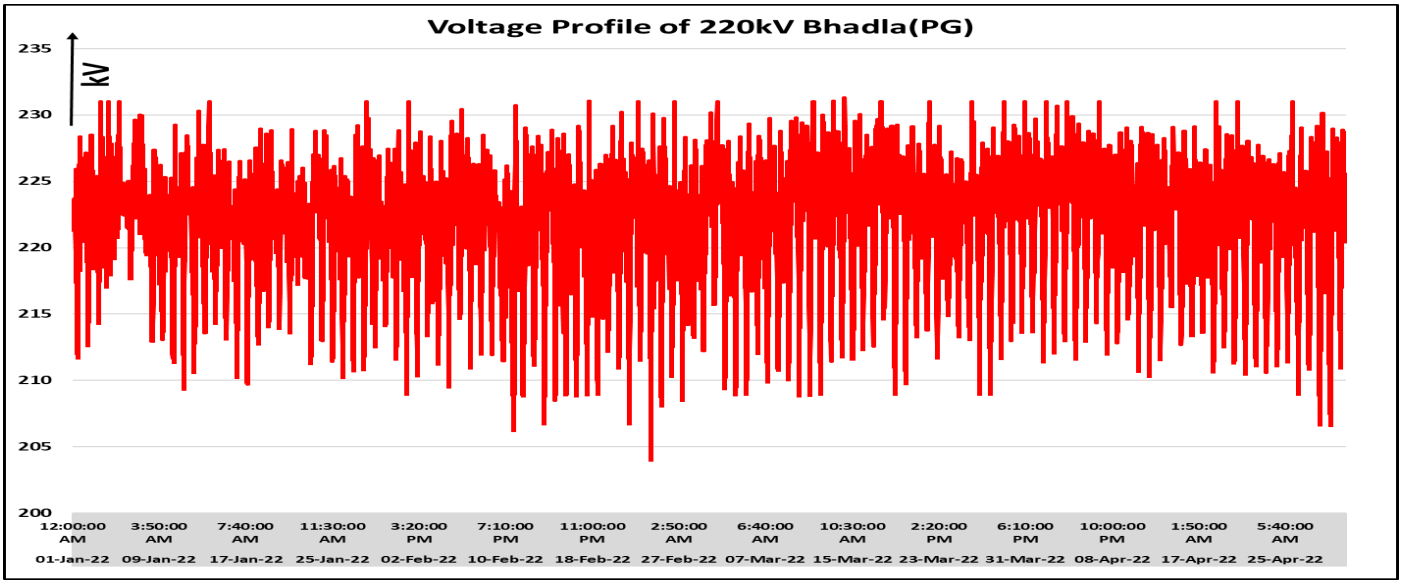


Fig-3: Voltage Profile of 220kV Bhadla (PG)

Voltage Profile at 765/400/220kV Fatehgarh-II (PG) S/s for months of Jan'22-April'22

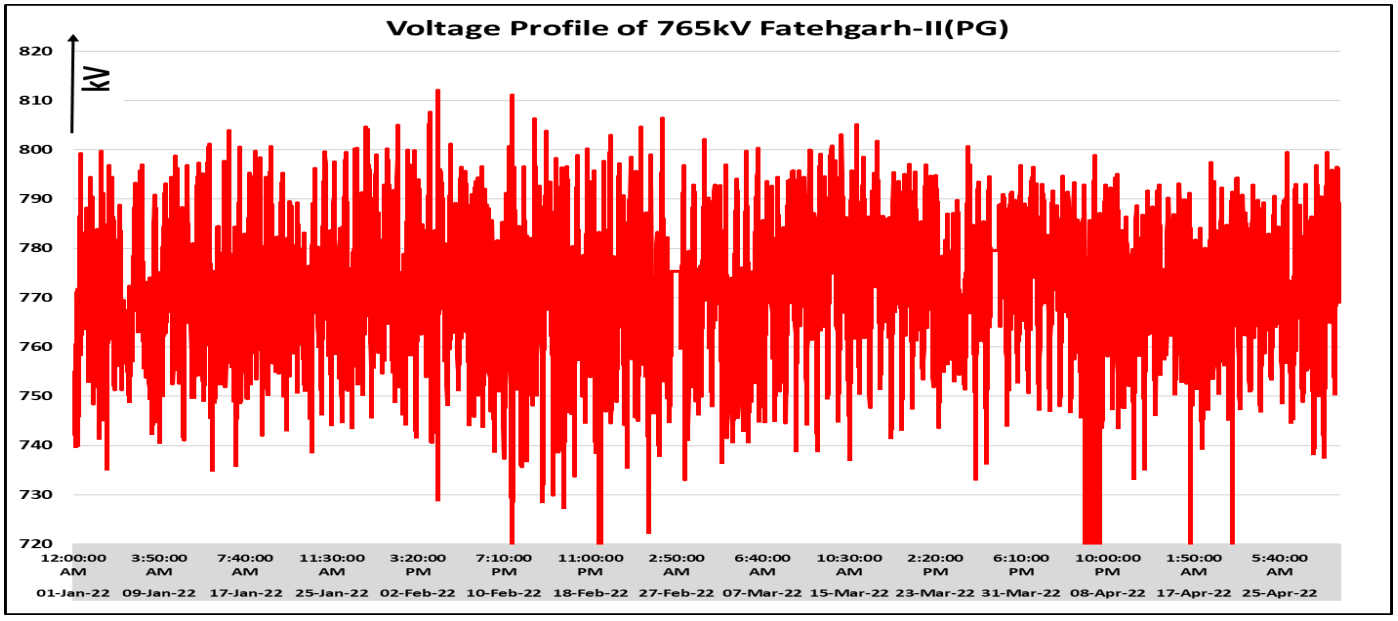


Fig-:3 Voltage Profile of 765kV Fatehgarh-II (PG)

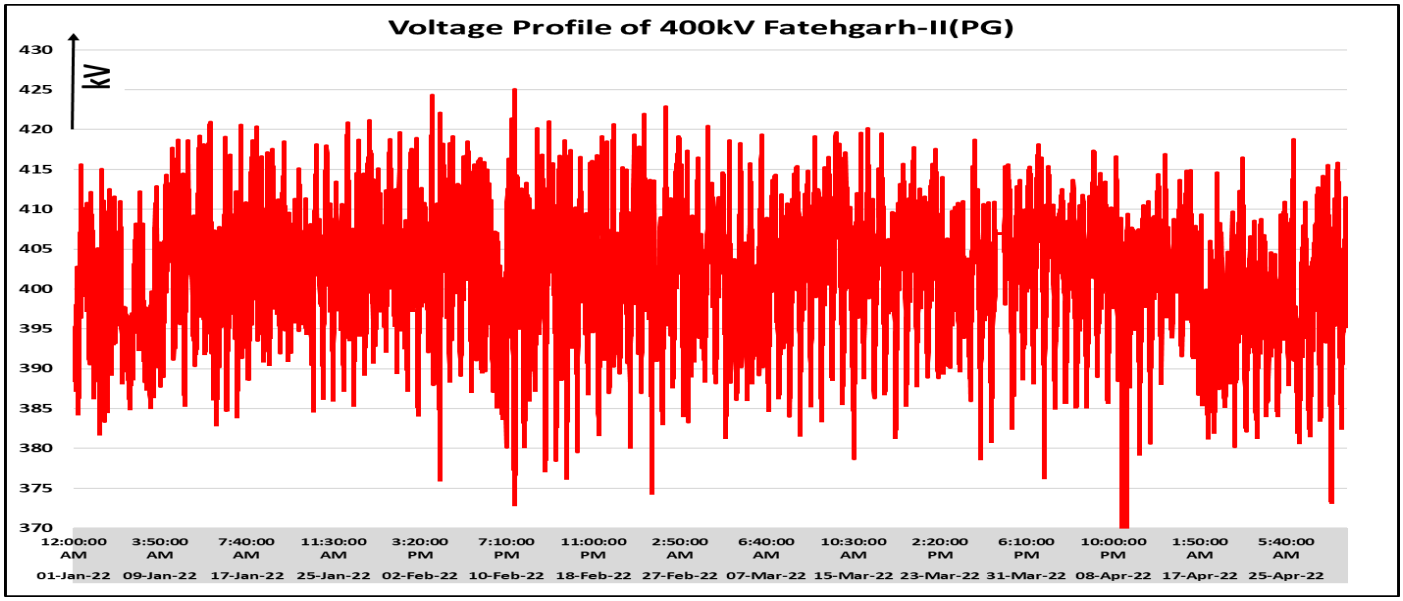


Fig-4: Voltage Profile of 400kV Fatehgarh-II (PG)

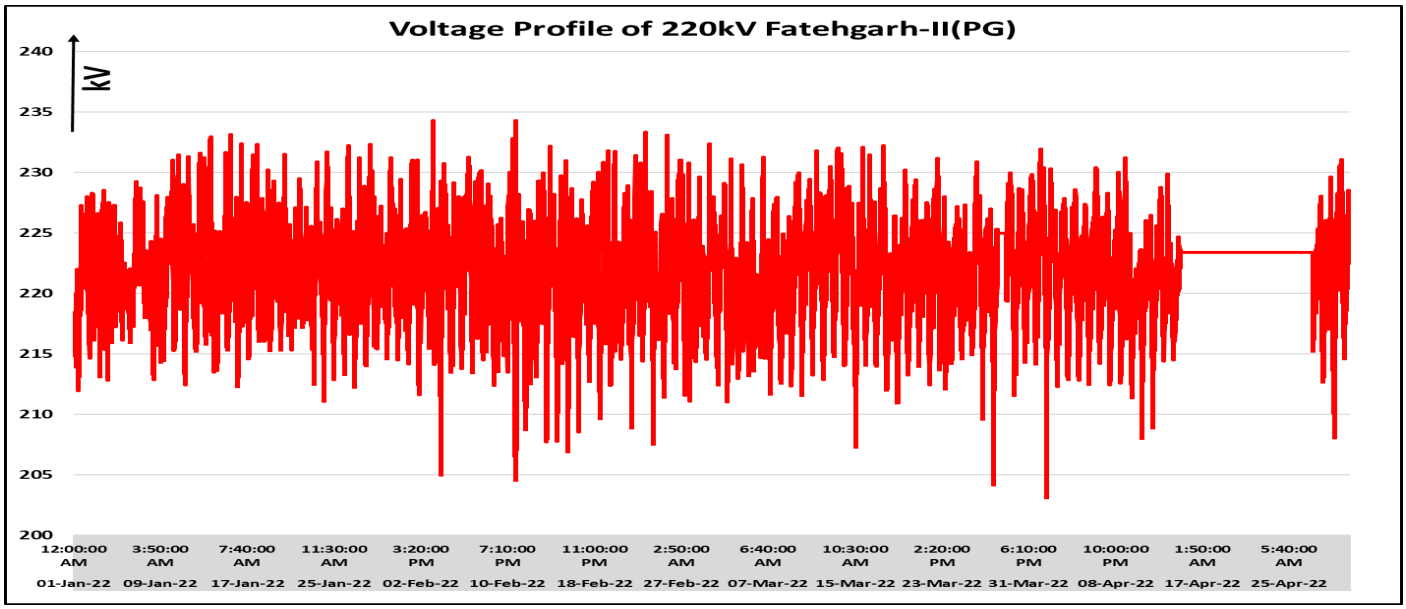


Fig-5: Voltage Profile of 2200kV Fatehgarh-II (PG)

Annexure-XII Annexure-VIII

पावर सिस्टम ऑपरेशन कॉर्पोरेशन लिमिटेड
(भारत सरकार का उद्यम)
आज़ादी का अमृत महोत्सव POWER SYSTEM OPERATION CORPORATION LIMITED
(A Govt. of India Enterprise)

उत्तरी क्षेत्रीय भार प्रेषण केन्द्र/NORTHERN REGIONAL LOAD DESPATCH CENTRE
कार्यालय : 18–ए, शहीद जीत सिंह सनसनवाल मार्ग, कटवारिया सराय, नई दिल्ली–110016
OFFICE : 18-A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi-110016
CIN: U40105L2009GOI188682, Website: www.nrldc.org, www.nrldc.in, Tel.: 01126519406, 26523869, Fax: 011-26852747

Ref No: NRLDC/SO-II/RE/416-433. Date: 13.04.22

To,
As per Distribution list,

Sub: Power Quality measurement and Harmonic distortion analysis for all newly commissioned RE generating stations in line with Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2013, Part-II, clause B1, Sub-clause (1), (2), (3) & (4)

महोदय,

As stipulated in Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2013, Part-II, clause B1, Sub-clause (1), (2), (3) & (4) about requirements with respect to Harmonics, Direct Current (DC) Injection and Flicker are as follows;

B1. Requirements with respect to Harmonics, Direct Current (DC) Injection and Flicker
(1) Harmonic current injections from a generating station shall not exceed the limits specified in Institute of Electrical and Electronics Engineers (IEEE) Standard 519.
(2) The Generating station shall not inject DC current greater than 0.5 % of the full rated output at the interconnection point.
(3) The generating station shall not introduce flicker beyond the limits specified in IEC 61000. Provided that the standards for flicker will come into effect from 1st April 2014.
(4) Measurement of harmonic content, DC injection and flicker shall be done at least once in a year in presence of the parties concerned and the indicative date for the same shall be mentioned in the connection agreement.
Provided that in addition to annual measurement, if distribution licensee or transmission licensee or the generating company, as the case may be, desires to measure harmonic content or DC-injection or flicker, it shall inform the other party in writing and the measurement shall be carried out within 5 working days.

It is requested to perform Power Quality measurement, Harmonic analysis test and Flicker test at Field as per CEA regulation as mentioned above and submit the Test report for Power Quality measurement, Harmonic analysis, DC injection and Flicker test showing the %THD and distortion due to nth Harmonic at Point of Interconnection for Voltage and Current, DC injection and Flicker at POI.

सादर,
आलोक
अलोक कुमार
महाप्रबंधक (प्रणाली प्रचालन)
एन.आर.एल.डी.सी

1. Member Secretary, NRPC, 18-A SJSS Marg, Katwaria Sarai, New Delhi-110016.
2. Dy. Chief Operating Officer (CTUIL), POWERGRID, Saudamini, Plot number2-, Sector29-, IFFCO Chowk, Gurgaon-122001
3. Member) Power System), Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi 110066–
4. Chairman & Managing Director, POSOCO, B-9, Qutub Institutional Area, New Delhi-110016
5. Executive Director (NLDC), POSOCO, B-9, Qutub Institutional Area, New Delhi-110016
6. CGM (I/C) (NRLDC), POSOCO, 18-A, Qutub Institutional Area, New Delhi-110016

Distribution list:

1. AGM, Renew Sun Bright Pvt Ltd., Commercial Block-1, Zone 6, Golf Course Road, DLF City Phase-V, Gurugram, Haryana-122009.

2. AGM, ReNew Sun Waves Private Limited, Fatehgarh-II, Commercial Block-1, Zone 6, Golf Course Road, DLF City Phase-V, Gurugram, Haryana-122009.

3. AGM, ReNew Solar Energy Jharkhand Three Pvt. Ltd., Commercial Block-1, Zone 6, Golf Course Road, DLF City Phase-V, Gurugram, Haryana-122009.

4. AGM, RENEW SOLAR POWER Pvt. Ltd, Commercial Block-1, Zone 6, Golf Course Road, DLF City phase-V, Gurugram- 122009, Haryana.

5. General Manager, M/s Eden Renewable Cite Pvt. Ltd. Unit No. 236 B & C, 1st Floor, DLF South Court, Saket, New Delhi-110017.

6. DGM, Adani Hybrid Energy Jaisalmer One Limited, Village Madhipura, Tehsil-Pokharan, Dist-Jaiselmer,, Rajasthan-345026.

7. DGM, Adani Hybrid Energy Jaisalmer Two Ltd, Fatehgarh-II, Village-Kajasar, Tehsil-Pokharan, Dist.:-Jaisalmer, Rajasthan-345026.

8. DGM, Adani Hybrid Energy Jaisalmer Three Ltd., Fatehgarh-II, Village-Kajasar, Tehsil-Pokharan, Dist.:-Jaisalmer, Rajasthan-345026.

9. Adani Renewable Energy Park Rajasthan Limited (AREPRL), 31(A), 6th floor, Plot No 5, Swej Farm, Mahima Triniti, New Sanganer Road, Jaipur-302019.

10. DGM, Adani Renewable Energy Park Rajasthan Limited, 4th Floor South Wing, Adani Corporate House, Santigram-SG highway, Ahmedabad.

11. General Manager, NTPC Renewable Energy wing, Engineering Office complex, Plot No. A-8A, sector-24, Noida, UP-201301.

12. Manager PD & Construction, Azure Power India Pvt. Ltd. 5th Floor, Southern Park, D-II, Saket Palace, Saket, New Delhi-110017.

13. AGM, Mahindra Susten Pvt. Ltd., 6th Floor, AFL House, Marol Maroshi Road, Andheri (East), Mumbai, Maharashtra-400059.

14. General Manager Avaada Energy Private Limited, C-11, Sector-65, Noida – 201301 (U.P).

15. General Manager, ACME Heergarh Powertech Pvt. Ltd., lot No. 152, Sector-44, Gurugram-122002, Haryana.

16. General Manager, SB ENERGY Pvt. Ltd. 5th Floor, Worldmark-2, Asset Area-8 Hospitality District, Aerocity, New Delhi- 110037.

17. General Manager, Saurya Urja Pvt. Ltd., 701-703, 7th floor, Kailash tower, Lal Kothi, Tonk Road, Jaipur-302015, Rajasthan.

18. General Manager, Tata Power Renewable Energy Ltd., Corporate center, A Sant Tukaram Road, Carnac Bunder, Mumbai, Maharashtra-400009.

Annexure-XIII **Annexure-IX**

आज़ादी का अमृत महोत्सव

पावर सिस्टम ऑपरेशन कॉर्पोरेशन लिमिटेड
(भारत सरकार का उद्यम)
POWER SYSTEM OPERATION CORPORATION LIMITED
(A Govt. of India Enterprise)

उत्तरी क्षेत्रीय भार प्रेषण केन्द्र/NORTHERN REGIONAL LOAD DESPATCH CENTRE
कार्यालय : 18-ए, शहीद जीत सिंह सनसनवाल मार्ग, कटवारिया सराय, नई दिल्ली-110016
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Ref: NRLDC/SO-II/TS-24/ 473-478 Date: 26th April, 2022

To,

1. Chief Operating Officer, CTUIL Saudamini, Plot No.2, Sector 29, Near IFFCO Chowk, Gurgaon (Haryana) – 122001	**2. Executive Director (Assett Management), Saudamini, Plot No.2, Sector 29, Near IFFCO Chowk, Gurgaon (Haryana) – 122001**

Subject: Bus-sectionalisation facilities at 220kV of 765/400/220kV Bhadla-I (PG)

Sir,

This has reference to bus sectionalization at 220kV bus of 765/400/220kV Bhadla-I pooling station. It is bring to your kind notice that at present, 220kV Bhadla-I (PG) bus sectionalization is having unequal 400/220kV ICT shares for solar generators connected at 220kV Bhadla-I(PG). Due to present arrangement of bus-sectionalization, it is not feasible to operate with bus-sectionalisers open for managing ICT overloading and reducing fault levels.

POSOCO has always been highlighting the issues related to transmission system planning for RE evacuation in Standing Committee meetings as well as through written communications. During standing committee meetings, it was discussed that Connectivity/LTA is being granted by CTUIL in line with the CERC RE Detailed Procedure and CEA Planning Criteria. However, it was agreed that suitable bus couplers and bus sectionalisers would be planned for such stations. Accordingly, CTU has already planned bus sectionalisers and bus couplers for different RE pooling substations. Discussion in respect of 765/400/220kV Bhadla-I S/s from 1st NRSCT held on 11.9.2018 at NRPC, New Delhi is mentioned below:

"19.0 Common facilities at 765/400 kV Bhadla-I Substation for Connectivity of Solar Power plants under Stage-II Connectivity.

19.1 CTU informed that for providing ISTS connectivity to different solar power plants at 220 kV bus of 765/400/220 kV Bhadla-I substation, following is proposed to be developed under ISTS at Bhadla-I S/s.

1. 220 kV Bus work including bus sectionaliser and bus coupler
2. Substation Automation system
.....
.....
.....
19.2 Members agreed for the same."

(1/3)

However, as per the SLD available at NRLDC control room (Annexure-I), it can be seen that there is unequal sharing of ICTs between solar generators connected at different bus sections at 220kV Bhadla(PG).

It can be seen from the SLD that the sharing of ICTs with different bus sections is as shown below:

Bus	ICTs	Solar Generation connected (MW)
Bus-A	4*500	750
Bus-B	2*500	1650
Bus-C	2*500	730
*one ICT under implementation at Bus-C		

Recently, one of the solar park developers (Saurya Urja Company of Rajasthan Limited) had requested for operation with bus-sectionalisers operation as failure of ICTs in solar park were observed due to suspected circulation of high short circuit current through the ICT during through faults. However, it was not feasible to operate with bus sectionaliser open due to uneven distribution of solar generators and ICTs on each section.

It is preferred that at the time of bus-sectionalisation, each section shall have commensurate ICT capacity to operate with all solar generators connected to that bus section. However, as per the present arrangement at Bhadla(PG), it is not prudent to operate bus sectionalisers independently if required to limit generation outage under N-1 contingency and control fault level of buses.

It is requested that suitable actions may be taken from your end to modify the position of line/ICT bays such that each bus section has optimal ICTs and underlying solar generation capacity so that bus-sectionaliser be opened as per the grid requirement. Moreover, for other pooling stations also having facility of bus-sectionalisation, the sections may be planned/ modified such that each section has optimal ICT share and solar generation capacity connected to each section.

Yours faithfully

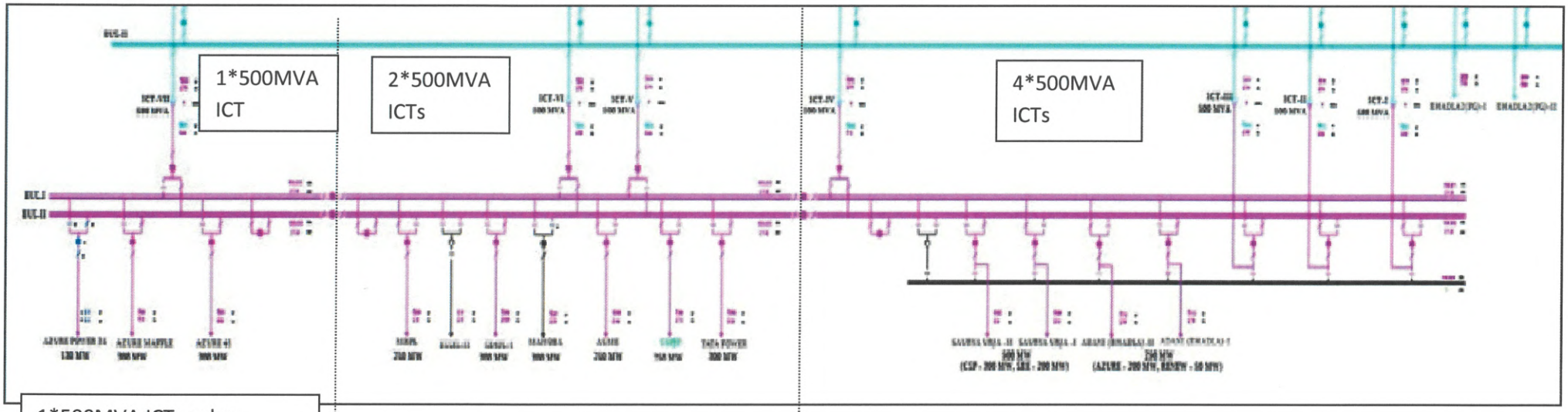
(Rajiv Porwal)
CGM (I/C)

Copy to :

1. Member (Power Systems), Central Electricity Authority, Sewa Bhawan, RK Puram, New Delhi-110066
2. Member Secretary, NRPC, 18-A SJSS Marg, New Delhi-110016
3. Executive Director, NLDC, B-9 SJSS Marg, New Delhi-110016
4. Executive Director (NR-1), SCO Bay No.5-10, Sector-16A, Faridabad - 121 002

...(2/3)

220kV Line diagram of Bhadla-I(PG)



1*500MVA ICT under implementation

730MW Solar generation capacity connected

1650MW Solar generation capacity connected

750MW Solar generation capacity connected