MINUTES

OF

179th OCC MEETING

Date: 21.05.2021

Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 179th OCC MEETING HELD ON 21.05.2021(FRIDAY) AT 10:30 HRS

Member Secretary, ERPC chaired the 179th OCC Meeting. He welcomed all the participants to the meeting and outlined the performance of ER Grid during April-2021 in brief. He mentioned the following points:

- *During the month of April-21, growth in energy consumption of ER was 51% compared to the same month of previous year.*
- *During the year 2021-22, the Peak Demand Met of ER was 24,666 MW in the month of April- 21 which is 36 % more than year Apr-20.*
- *Eastern Region registered average PLF of 77.5% in April-21. Moreover, during the month of April-21, 11 nos. of thermal plants have achieved more than 90% PLF including Bakreswar TPS of WBPDCL which has achieved highest PLF of 101%.*
- *During April-21, growth in net energy export by ER in 2021-22 was increased by 4% compared to Apr-20.*
- *During April-21, 75% of the time grid frequency was within IEGC band (49.90Hz – 50.05Hz)*

PART – A

ITEM NO. A.1: Confirmation of Minutes of 178th OCC Meeting held on 17th March 2021 through MS Teams online platform.

The minutes of 178th Operation Coordination sub-Committee meeting held on 17.03.2021 was circulated vide letter dated 30.04.2021.

Members may confirm the minutes of 178th OCC meeting.

Deliberation in the meeting:

Members confirmed the minutes of 178th OCC meeting.

PART B: ITEMS FOR DISCUSSION

ITEM NO. B.1: Un-interrupted and Reliable Power Supply to Oxygen Plants in ER.

MS ERPC, vide letter dated 04th and 05th May 2021, advised all concerned SLDCs to maintain an uninterrupted and reliable power supply to all Oxygen Gas manufacturing plants, to ensure adequate generation of Oxygen in the prevailing Covid-19 situation. In case, there is any interruption of power supply to the oxygen producing plants, the same may be intimated to ERPC and ERLDC at the earliest. The letter along with the advisory received from MoP is attached at **Annexure-B1**.

Members may update.

Deliberation in the meeting:

SE (Operation), ERPC raised serious concern about maintaining an un-interrupted and reliable power supply to the oxygen manufacturing plants in the current scenario of Covid-19 pandemic. He mentioned that during this time availability of oxygen is of utmost importance and all should make all out efforts to maintain un-interrupted and reliable power supply to the oxygen manufacturing plants. He also briefed about the actions taken by ERPC forum to maintain the power supply to Oxygen manufacturing plants.

During the deliberation, ERLDC pointed out about availability of power flow data on real time basis at SLDCs end because that would be very important in monitoring the un-interrupted and reliable power supply to these plants.

SLDC Odisha informed that they are monitoring power flow status to oxygen plants, related bus parameters and other requisite details in order to provide un-interrupted and reliable power supply to the oxygen manufacturing plants.

On query from MS ERPC, ERLDC informed that REC has set up a Nodal Control Room for monitoring the Oxygen Plants which monitors the power supply to these plants regularly and they are also collecting necessary data like tripping details etc in an audit report format.

MS, ERPC advised ERLDC to send a copy of tripping details to ERPC too.

ERLDC advised all the concerned STUs to share the details of the settings of relay installed in those oxygen generating plants so as to have a better understanding during system study in case of any outage.

In conclusion, OCC advised all SLDCs to be more vigilant in this regard and maintain a co-ordination with ERLDC and Oxygen Generating Plants in order to provide an uninterrupted and reliable power supply to all Oxygen Gas manufacturing plants.

ITEM NO. B.2: Early restoration of 220 kV Farakka-Lalmatia S/C line

220 kV Farakka-Lalmatia S/C has tower collapse at two locations one near Farakka (29-April-2021 event) and one near Lalmatia (on 21st April event). Due to ownership/maintenance/court litigation issue restoration of 220 kV Farakka-Lalmatia S/C is not taking place. This 220 /132/33 kV Lalmatia substation is relying on only 132 kV lines. In addition, the non-availability of 220 kV Farakka- Lalmatia S/C is also leading to islanding of Farakka Super thermal power plant out of scope.

220 kV Godda-Lalmatia D/C line also had tower collapse on 29-April-2021.

It may be noted that the Lalmatia Mines which is being supplied through this substation is the source of coal supply to 400 kV Kahalgaon NTPC and 400 kV Kahalgaon NTPC substation. Any loss of supply to mines for a longer period will result in the outage of these two power plants due to the coal supply issue from the affected mines.

As tower collapse is observed at two different locations close to both the ends so major part of the line cannot be kept anti-theft charged. Thus, continuous monitoring of the uncharged section is very much required. Also, arrangement for antitheft charging of the healthy portion of line is to be done at the earliest.

Hence NTPC Farakka, ECL and JUSNL/Jharkhand SLDC may share the restoration plan of 220 kV Farakka-Lalmatia S/C line.

NTPC Farakka, ECL and JUSNL may update

Deliberation in the meeting:

NTPC submitted that anti-theft charging of the 220 kV Farakka-Lalmatia S/C line is must and the said line is ready for anti-theft charging. NTPC also mentioned that ECL is ready for handing over the aforesaid asset to JUSNL and JUSNL is ought to take over the asset.

However, Jharkhand representative informed that dismantling of the conductors of the fallen towers (7 nos.) is yet to be done by NTPC. It was also informed that 220kV Godda-Lalmatia line would be charged by 25th/26th of May'2021.

In this regard OCC advised NTPC to do the dismantling work, if any, without delay in order to avoid any theft of the tower parts and conductor. Further OCC advised NTPC to do the anti-theft charging at the earliest in coordination with JUSNL and JBVNL.

ERLDC representative stressed over the fact that commissioning of 220kVTenughat-Govindpur line will increase the system reliability and the said line may be commissioned at the earliest. ERLDC also advised NTPC to submit the sketch/drawing of the portion of the line for which antitheft charging is to be done.

ECL representative expressed that early restoration of Farakka-Lalmatia line would ensure reliability of power supply to the coal mines. He also mentioned that handing over the subjected line should be done at the earliest for smooth operation of the grid.

After detailed deliberation the following were decided:
1) *220kV Godda-Lalmatia D/C line to be charged at the earliest.*
2) *NTPC to co-ordinate with JBVNL and JUSNL for anti-theft charging of the healthy part of220 kV Farakka-Lalmatia S/C line*
3) *A separate meeting would be convened by ERPC regarding handing over the said line and reliable power supply to Lalmatia/Godda/Sahebganj area.*

ITEM NO. B.3: Measures to be taken to address flood like situation at 400kV Kishanganj GIS S/s (PGCIL), 400/220 KV GIS Darbhanga (DMTCL), and 400/220 KV GIS Motihari (DMTCL)

It is well known that, 400kV Darbhanga (DMTCL) S/S was under complete shutdown during monsoon of 2020 due to Flood water of Kamla Balan river entering into the S/s and 400kV Kishanganj GIS S/s (PGCIL) was under complete shutdown during monsoon of 2017 due to change in river course of Mahananda river. Kindly intimate if any precautionary measures are to be taken this year to combat any such situation & what measures/preparedness are proposed in the event of 400kV & 220kV Darbhanga(DMTCL),Motihari (DMTCL) and Kishanganj(PGCIL) S/S needs to be completely bypassed in upcoming monsoon due to flood like situation.

PGCIL and DMTCL may update.

Deliberation in the meeting:

Powergrid informed that after 2017-18 floods, they have taken several measures for protection of the assets at 400 kV Kishanganj S/s as follows:

a) *Construction of wire mesh boulder revetment wall along the boundary wall having length about 1.5km.*
b) *Construction of 10 nos. of spurs having length of 20 meters each for deflection of water from the left bank of the Mahananda River.*
c) *Construction of retaining wall of RCC along the boundary wall inside the S/s.*
d) *Installation of 4 nos. of pumps having 7.5 hp capacity each, for dewatering in case of any water ingress into the S/s.*

DMTCL in respect of Darbhanga S/s submitted the following:

a) *Construction of flood protection wall (5 m of raft, 2.5 m of RCC wall and 1.5 of brick wall) is going on. 85% work has been completed and the work is scheduled to be completed by 10th June'2021.*
b) *6 nos. big size sub-immersible pumps have been installed along with proper drainage system around the periphery of the sub-station for dewatering.*

DMTCL in respect of Motihari S/s submitted the following:

a) *Motihari S/sis 2 m above the surrounding ground level. Soil filling and stone piling is being done in the S/s*
b) *No ingress of water has been experienced since last 4 years.*

OCC appreciated Powergrid and DMTCL for the measures taken to control the flooding of their sub-stations and also advised both to share presentation regarding the work done for this purpose, so that it can be used for future reference.

ITEM NO. B.4: Backing down of Teesta-V generation on 14.04.2021 from block no. 80 to 85

Teesta-V power station was scheduled to generate 504 MW on 14-04-2021 from 06:15 PM to 09:15 PM and was generating power accordingly. However at about 07:45 PM on 14- 04-2021, Power House control room of Teesta-V Power Station was intimated by local police Singtam about trapping of some local people in the Teesta River at Bagey khola near Mazhitar. Power station was requested to back down generation in order to rescue them. Sensing the urgency of the matter and human lives being at stake, immediate orders were issued to back down on generation, so that the river level could be lowered for safe evacuation of the locals involved and ERLDC was informed about the compelling reasons for doing so .Copies of e-mail are attached at **Annexure B4**. The rescue operation was completed by 9:15 PM (85th block). After receiving the rescue massage from SHO, Singtam, the generation of the units was resumed as per schedule approved by ERLDC. In order to avoid occurrence of such incidence in future, Teesta-V Power Station has requested district administration of East district & South district of Sikkim to issue necessary advisory to locals for desisting from entering the Teesta river especially after 05.00 PM.

Seeing the then situation, on humanitarian ground the prime priority left with NHPC was to rescue the lives of people rather than generation. As the above incident was beyond the control of NHPC and hence back down of generation was the force majeure condition before the power station, therefore, it is requested to waive off the deviation charges / additional deviation charges.

Members may discuss.

Deliberation in the meeting:

NHPC representative explained the event and requested for waiver off of additional deviation charges imposed during the time blocks 80 to 85 due to backing down of generation of Teesta V.

ED, ERLDC submitted that in case of Force Majeure the schedule should be made equal to actual and whatever extra Teesta-V had billed to the beneficiaries should be refunded by them to the beneficiaries.

ERLDC further submitted that there is no provision in regulation regarding waiving off the deviation charges even if there is a force majeure condition.

SE (Commercial), ERPC suggested that the additional deviation charges for the said time blocks may be waived off and refunded to Teesta-V as backing down of generation was a force majeure condition.

After detailed deliberation no consensus could be arrived at for waiving off the additional deviation charges for the said time blocks. Further in line with the forum's view, NHPC representative withdrew the request for waiving off the additional deviation charges.

ITEM NO. B.5: Outage of Important Transmission System.

1. **132kV Sagbari –Melli.**

   In the 174th OCC meeting, Sikkim informed that 132kVMelli-Sagabari S/C is under outage because of faulty breaker issue at Sagbari end. Sikkim informed that 132 kV Sagbari S/s is under DISCOM jurisdiction.

   In the 176th OCC meeting, Sikkim informed that the circuit breaker issue has been resolved.

   They further informed that as the line was under outage for more than two years, there were vegetation & RoW issues. They added that there is conductor snapping in the line between loc. 20 and loc. 29.

   In 177th OCC Meeting, Sikkim informed that necessary RoW clearance has been received for 80% section of the line and it would take two more weeks to get the clearance for remaining section of the line OCC advised Sikkim to expedite the work and restore the line at the earliest.

   In the 178th OCC meeting, Sikkim informed that necessary RoW clearance for charging of the line is being taken up by the Discom. They submitted that the issue would be resolved within a month.

   Sikkim may update.

Deliberation in the meeting:

Sikkim submitted that patrolling of the line has been completed and necessary maintenance in this regard has already been carried out for 80% of the line section. For the rest 20%, pruning and cutting of trees are to be done and for this they need clearance from the Forest Department.

OCC advised Sikkim to expedite the matter with the Forest Dept. of Sikkim and update the status to ERPC/ERLDC at the earliest.

2. **400 kV Maithon- Maithon RB D/C**

400kV Maithon-Maithon RB D/C is under continuous shutdown from 12-01-21, for re-conductoring work.
In 177th OCC Meeting, Powergrid submitted that 14 km of stringing has been completed out of 31 km for each circuit.

OCC advised Powergrid to submit the detailed plan and timeline of restoration of the line to ERPC secretariat/ERLDC within a week.

In the 178th OCC meeting, Powergrid informed that out of total 63 km circuit length of both circuits, HTLS stringing for 41.5 km has been completed till date and the target date for completion of the work is June' 21.

MPL informed that any long-term shutdown for the lines evacuating power from MPL would not be allowed after April'21 in view of summer demand.

OCC advised Powergrid to expedite the reconductoring work and to avail the shutdown of the 400 kV Maithon-MPL lines in consultation with MPL and ERLDC.

Powergrid may update the status of the work.

Deliberation in the meeting:

Powergrid submitted that both the circuits have been returned on 20.04.2021 after completion of 41.5 km of HTLS stringing.

OCC advised Powergrid to update the status of the work in detail to ERPC and ERLDC for keeping track of the work so that it can be taken up in upcoming winter.

3. **400 KV main bay of Patna-1 at Kishanganj S/s.**

The said bay has been out of service due to problem in Y-ph CB mechanism from 10/04/20.

In the 178th OCC meeting, Powergrid informed that the restoration work would be completed by May' 21 and added that 5-6 days of shutdown for 400 kV Kishanganj-Patna D/C lines would be required for completion of the work.

It was informed that shutdown of 400 kV Kishanganj-Patna lines have already been approved for the month of May-21 for LILO work of Saharsa and for shifting of line on pile foundation at Kankai river.

OCC advised Powergrid to optimize their plan for shutdown of 400 kV Kishanganj-Patna D/C lines and complete the work before high hydro period.

ERLDC stated that the shutdowns would be allowed based on the hydro situation.

Powergrid may update.

Deliberation in the meeting:

Powergrid submitted that due to the prevailing Covid pandemic and in view of the ongoing lockdown the team of engineers was unable to come at Kishanganj S/s for the rectification work. The said work is expected to be completed in June 2021 if the lockdown restriction is removed.

4. 400KV New Purnea-Gokarna & 400KV New Purnea-FSTPP.

In the 175th OCC meeting, Powergrid informed that the line has already been restored on ERS.

In 177th OCC Meeting, Powergrid informed that two out of two pile foundations had been completed and tower erection is under progress along with one open cast foundation.

They further informed that they want to avail the shutdown of both the lines from 23rd March 2021 for the bypass arrangement from Farakka to Gokarna as discussed in 177th OCC Maintenance program meeting.

In 178th OCC, Powergrid informed that the work could not be completed due to non-availability of shutdown by SLDC, West Bengal.

SLDC West Bengal informed that the shutdown would be allowed after getting some hydro supports i.e. end of May'21.

ERLDC stated that based on the discussion on the 178th OCC shutdown meeting, a study has been carried out and it was found that the proposed shutdown may be allowed in early May-21 before onset of the high hydro period.

OCC opined that after starting of the hydro season it would be difficult to carry out the restoration work at site and also allowing shutdown 400 kV Purnea-Farakka & Purnea-Gokrna line in high hydro is not desirable from grid operation point of view.

OCC advised SLDC West Bengal to facilitate the initial shutdown for two days for bypassing arrangement work in mid of May'21.

Powergrid may update.

Deliberation in the meeting:

Powergrid submitted that the work is in progress and is expected to be completed in the 1st week of June 2021.

On query about slow progress, Powergrid informed that one no. of tower is in the mid-stream of the river Ganges and due to high current in the river; they have to carry up the work very carefully.

5. **Shutdown of Transmission Lines for insulator replacement work.**

All transmission licensee may send list of lines in which insulator replacement work is to be done mentioning the locations for insulator replacement, location at which insulator already replaced and locations at which insulator replacement work is pending for better planning and optimisation of shutdown.

Members may discuss.

Deliberation in the meeting:

ERLDC submitted that Powergrid ER-I had submitted the necessary details.

OCC advised Powergrid ER-II and Powergrid Odisha to submit the details within a week to ERPC and ERLDC.

ITEM NO. B.6: Repeated disturbances at 132/66 kV Melli S/S in March 2021

The occurrence of repeated grid events at 132/66 kV Melli S/S has been reported in March 2021 resulting in power failure at Melli and Kalimpong areas. In 101st PCC Meeting held on 13.04.2021, the agenda was placed for discussion. PCC referred the issue to OCC for discussion as Sikkim representative were not present in the meeting.

In the 178th OCC meeting, OCC decided that a complete review protection system of Melli S/s may be carried out by a team comprising of the technical experts from Powergrid, West Bengal and Sikkim tentatively in the last week of April'21 and the team has to submit its report to ERPC. Further, OCC advised respective utilities to nominate one representative preferably from the nearby areas.

A site visit by the Team comprising of Powergrid, West Bengal and Sikkim was carried out on 05-05-2021.

Team members may update.

Deliberation in the meeting:

Powergrid informed that the team comprising of experts from Powergrid, WBSETCL and Sikkim visited the site on 05.05.2021 but as the lockdown had been announced from 6th May 2021 in Sikkim, major testing could not be done. The following were pointed out by the team:

- *It was found that from the Melli end for Zone-2 fault of 132 kV Rangpo-Melli line, the* *distance protection relay is not operating in desired manner.*

- *As they could not perform major testing due to paucity of time they could not access the healthiness of distance relay. However, as a temporary measure, the Zone 2 settings had been changed from 350 ms to 100msand kept in observation for any further tripping.*
- *Whenever the lockdown restriction eases, Powergrid would mobilize the workforce and do a thorough testing of the said relay. In case there is any problem found during the testing, the relay would be replaced by a spare one.*
- *There is single DC source for all the 132 kV elements in Melli S/s which is an EHV S/s. It is suggested that for ensuring reliable protection operation, there should be one more redundant set of DC supply, which is also as per CEA standards.*

Regarding DC supply, OCC advised Sikkim to check the PSDF proposal for Melli S/s, whether there is proposal for two sets of DC supplies. Sikkim representative informed that as of now there is only single DC source. OCC further advised Sikkim to include dual DC supplies under PSDF renovation proposal.

On query, Powergrid informed that they had checked the breaker and some minor issues had been found which were already rectified. Regarding the repeated faults at a particular location, Powergrid informed that they had visited the site and it had been found that there was some clearance issue at that particular location and to mitigate the issue some temporary measures had been taken. Powergrid further suggested that in case of further tripping, restringing of the conductor has to be done for that particular location where the fault is occurring.

In conclusion, OCC advised Powergrid to send updates about the issues observed at Melli S/s, if any, to ERPC/ERLDC so that the issue can be followed up in the PCC forum. Further OCC advised Sikkim to check the PSDF scheme for Melli whether there is proposal for two sets of DC supplies or not. If not, the proposal for dual DC supplies may be included under PSDF proposal.

ITEM NO. B.7: Repair/rectification of D/C tower at location 79 of 132kV Rangpo-Melli and 132 kV Rangpo –Gangtok line.

Powergrid had informed that their patrolling team had observed bent in part of tower no. 79 of 132kV Rangpo-Melli line and 132 kV Chuzachen (Rangpo)-Gangtok transmission lines which might further degrade the condition of tower.

In 137th OCC, Powergrid informed that tower no. 79 of 132kV Rangpo-Melli line and Chuzachen (Rangpo)-Gangtok transmission lines falls under the jurisdiction of Energy & Power Department, Govt. of Sikkim.

In 43rd ERPC Meeting, Powergrid informed that the tower at location no. 79 is in vulnerable condition and needs immediate attention so as to avoid any further devastation.

Sikkim informed that they are in process of obtaining approval from State Govt. for rectification of the defective tower

In view of importance of the said line for power supply to State Capital, ERPC advised Sikkim to resolve the issue on priority basis and same shall be monitored in lower forum of ERPC.

In the 178th OCC meeting, Sikkim informed that they would communicate the status of the proposal for rectification of the defective tower within a month.

Sikkim may update.

Deliberation in the meeting:

Sikkim representative informed that, they had already prepared the estimate which had been placed for approval in CMO office. As soon as the approval gets accorded by the Govt. they would start the work. He further added that the team is also ready for retrofitting.

OCC advised Sikkim to expedite their internal approval and place the work order as soon as possible.

ITEM NO. B.8: Shutdown proposal submitted by Powergrid.

The following shutdown proposal of Powergrid was placed in 179th OCC Shutdown meeting held on 17/05/2021 for discussion. However the shutdown request could not be finalized as Sikkim representative was not available in the meeting.

SL No.	Name of the element	From Date	From Time (Hrs)	To Date	To Time (Hrs)	Remarks	Reason
1	132KV-RANGIT-RANGPO-1	01-06-21	08:00	10-06-21	17:00	OCB	Re-routing of Loc 24 due to Hill sinking & Tower strengthening work at Loc 3 of LILO
2	132KV-RANGIT-KURSEONG-1	01-06-21	08:00	08-06-21	17:00	OCB	Re-routing of Loc 24 due to Hill sinking

Members may discuss.

Deliberation in the meeting:

Powergrid submitted that their team is ready and whenever the lockdown restriction eases, the team will be moved to the site.

Sikkim submitted that they would take up the matter with the higher level and intimate the same at the earliest.

Further, West Bengal requested Powergrid to adhere to the above mentioned shutdown time, since Kurseong S/s of West Bengal would be on single source.

OCC advised both Powergrid and Sikkim to co-ordinate for the aforesaid.

ITEM NO. B.9: List of Important Elements in ER

In compliance with IEGC 5.2 (c) List of Important Grid Elements of Eastern regional Grid has been prepared and draft version of the same is circulated by ERLDC via mail on 12-May-2021. Constituents are requested to review and give input by 25th May so that it can be finalized. The list is attached at **Annexure B.9**.

Members may update.

Deliberation in the meeting:

OCC advised all the concerned constituents to go through the list for any update or correction and submit their comments, if any, within a week, so that the list can be finalized.

ITEM NO. B.10: Sudden switching off of 315 MVA ICT-V at Malda S/S on 28.04.2021

RTAMC ER-II vide mail dated - April 28, 2021, had intimated that a hot spot observed at B-Phase CT clamp of LV side of 400/220 kV 315 MVA ICT-V at Malda Substation. The ICT was switched off at 07:48 hrs on 28/04/2021 and was later intimated to ERLDC through email. However, neither the consent from SLDC WB was taken nor was switching off code obtained from ERLDC Control Room.

While originally, request for Emergency Shutdown was placed on, April 27, 2021, same was categorically denied by West Bengal whose representative inspected the substation and found no emergency. The same was communicated to Powergrid, RTAMC ER-II & ERLDC Control Room.

Powergrid may explain.

Deliberation in the meeting:

Powergrid submitted that a hot spot was observed at B-Phase CT clamp of LV side of 400/220 kV 315 MVA ICT-V at Malda Substation due to which the ICT was switched off on an emergency basis.

ERLDC informed that Powergrid had applied for emergency shutdown for ICT-V of Malda on 27.04.2021 which was categorically denied by SLDC West Bengal. But suddenly on 28.04.2021, the Malda ICT-V was switched off by Powergrid without taking any code from ERLDC. It is a gross violation of operating procedure for such an important grid element.

SLDC, West Bengal submitted their concern regarding the sudden switching off of the said ICT. SLDC WB representative added that upon receiving an Emergency Shutdown request on 27.04.2021 by Powergrid, WBSETCL representatives inspected the substation and found no emergency and based on that the shutdown was categorically denied by West Bengal. He further informed that Powergrid switched off the said ICT deliberately to have enough clearance in order to shift an ICT from Malda S/s to Binaguri S/s and this incident majorly violates the IEGC regulations. Further, it was informed that the incident was occurred just before the date of assembly election and all the EVM machines were plugged-in for charging and they were lucky that no other contingencies happened during the outage period otherwise there might have major *power crisis in that area. He pointed that this kind of incident had been repeated in past also without taking any necessary consent so strict action to be taken to stop such mal-practices.*

The issue was discussed in detail and after analysis of the complete event OCC observed that the sudden switching off of ICT-V at Malda was a deliberate action which could have been avoided during the circumstances as explained by West Bengal and it violates the operating codes as per IEGC Regulations.

OCC took a serious note of the matter and expressed that such repetitive violations of operating codes is not expected by the organization like Powergrid and advised Powergrid to take immediate measures to stop such kind of gross mal-practices.. Further OCC advised MS, ERPC to write a letter addressing to CMD Powergrid conveying a strong message about the said incident with a copy to West Bengal.

ITEM NO. B.11: Status of implementation of AGC as a pilot project in States.

In 42nd TCC, DVC intimated that AGC shall be implemented in unit 7 and 8 of Mejia as per the given schedule by 31st July 2020.

WBPDCL informed that they have already collected offer from Siemens for implementation of AGC and they are awaiting the concurrence from SLDC.

SLDC, WB informed that they are not in a position to implement AGC unless a clear direction is given by WBERC. Further, implementation of intra state DSM is a prerequisite for implementation of AGC in the states.

It was decided to request CERC to include this as an issue in the Agenda for discussion in the meeting of Forum of Regulators.

In 169th OCC Meeting, SLDC DVC informed that due to COVID-19 pandemic, participation in the tender was very less therefore they are floating a new tender for implementation of AGC. AGC would be implemented by Feb 2021.

Odisha informed that they could not visit Barh NTPC and NLDC due to ongoing COVID 19 pandemic situation.

OCC advised SLDC Odisha and OPGC to interact with Barh NTPC & ERLDC to get the technical specifications & the procedure for implementation of AGC.

Latest status of implementation:

State	Station/Unit	Deliberation in 178th OCC Meeting
DVC	Mejia unit#7 &8	DVC updated that previous NIT had been cancelled and fresh indent to be placed in April'21.
West Bengal	Unit-5 of Bakreswar TPP	SLDC West Bengal informed that at present there is no relevant regulation by WBERC for implementation of AGC in state generators. They would proceed for AGC implementation only after getting direction from WBERC.

Odisha	Unit#3 of OPGC	OPGC informed that purchase order for AGC implementation is to be placed to M/s Siemens within one month.

Members may update.

Deliberation in the meeting:

State	Station/Unit	Deliberation in 179th OCC Meeting
DVC	Mejia unit#7 &8	*DVC informed that fresh indent to be placed in May21.*
West Bengal	Unit-5 of Bakreswar TPP	*SLDC West Bengal informed that at present there is no relevant regulation by WBERC for implementation of AGC in state generators. SLDC further informed that FOR should give necessary directions to WBERC on the issue and They would proceed for AGC implementation only after getting direction from WBERC.* *After detailed deliberation it was decided that the matter would be placed in forthcoming TCC meeting.*
Odisha	Unit#3 of OPGC	*OPGC informed that a meeting with M/s Siemens is schedule to be held on 25.05.2021 and after sharing necessary technical details with Siemens it would be finalized.*

ITEM NO. B.12: Review of implementation of PSDF approved projects of ER.

In 10th NPC meeting held on 09.04.2021, RPCs were advised take up the matter for improvement of the fund disbursement and expeditious implementation of the sanctioned projects under PSDF.

In view of the above, status review of the projects being executed under PSDF funding in Eastern Region would be carried out on regular basis for expediting the projects. All the constituents are requested to furnish/update the status of their respective project in every month.

Concerned utilities may update the present status of the project as given in the **Annexure-B12**.

Members may update.

Deliberation in the meeting:

Jharkhand, Odisha and Bihar have submitted the status.

WBPDCL submitted that they would submit the same by 28th May'2021.

WB, SLDC submitted that for SAMAST project, meter tender for 3rd time has been done and they are waiting for the response from the bidder.

OCC requested all the concerned utilities to submit the status to ERPC at the earliest.

*The updated status is attached at **Annexure B12**.*

ITEM NO. B.13: Review of System Protection Scheme (SPS) designed for NEW-SR grid integration - NLDC.

The existing SPS on NEW-SR corridor (for 765 kV Solapur-Raichur lines) were implemented during the synchronization of SR grid with NEW grid in the year 2014. Over the years, SR grid has been integrated with NEW grid through many inter-regional lines apart from 765 kV Solapur-Raichur. The newly commissioned HVDC Raigarh (WR)-Puglur (SR) Bipole is very soon expected to be in operation which will further strengthen the network connecting Southern Region.

In 176th OCC Meeting, ERLDC informed that the draft SOP has been prepared.

OCC advised SLDC Odisha and others to go through the SOP and submit their comments/observation, if any, at the earliest.

In 177th Meeting, OCC advised SLDC Odisha to submit their comments to ERLDC within a week.

In the 178th OCC meeting, SLDC Odisha informed that their observation would be submitted soon.

SLDC Odisha, vide letter no CLD (OS)-239/2020/906 dated 22.04.2021 gave in principle approval for the draft SOP.

Members may note.

Deliberation in the meeting:

ERLDC informed that they had received the draft SOP from Odisha.

OCC advised ERLDC to send the consent of Odisha to NLDC in order to finalize the SOP.

ITEM NO. B.14: Monthly Data on Category-wise consumption of electricity in states

The data of category-wise consumption of electricity in the states/UTs are being frequently referred to by CEA and Ministry of Power. In this regard, as advised by Member (GO &D), GM division of CEA has advised the following:

- The monthly data of category-wise consumption of electricity in the states/UTs may be discussed in the OCC meeting on regular basis with comparative analysis of the same for corresponding monthly data of previous years.
- In case the utilities have reservations on submitting unaudited data then the same may be mentioned in the data itself that these data are unaudited. In that case the data so received would be used only for the purpose of trend analysis and would not be used in any report of CEA.

In 177th OCC Meeting, OCC advised all SLDCs to take up the issue with their DISCOM(s) and submit the required data on monthly basis to ERPC secretariat.

In the 178th OCC meeting, CESC informed they had submitted the data. Odisha, Jharkhand &

Bihar informed that they would submit the date within a week.DVC & West Bengal informed that they had written a letter in this regard to their Discoms.

Members may update.

Deliberation in the meeting:

Odisha informed that they had submitted the data.

Jharkhand submitted that they would update the data after getting it from their commercial team.

DVC submitted that they would update the data after getting it from their commercial team.

West Bengal informed that they would submit the status by 24th May 2021.

ITEM NO. B.15: Additional Agenda

Item No. 1: Activation of Transient data record facility in the AVR, if available and sharing the information with RLDC whenever required.

Monitoring of response of all dynamic elements of the grid is extremely important for analyzing various events in the grid and validating dynamic models of the elements.

Modern AVR are having transient data recording facility and can record very high-resolution data. Therefore all generating station must activate the facility for understanding the dynamics of the grid in a much better way. Therefore all generators are requested to submit the following details:

Generator Name	AVR manufacturer	Transient Data recording facility available (Yes/No)	IS the data recording facility activated (Yes/No)

Members may discuss and update.

Deliberation in the meeting:

ERLDC submitted that they had received the data from some of the constituents. The list of the same is attached at **Annexure B15.1.**

ERLDC further suggested that all the generators having the transient data record facility in the AVR should activate the same facility at their end. Also in the upcoming new generators or in the generators where R& M work is going on, possibility of incorporating this feature should be explored.

OCC advised all the concerned utilities to submit the data at the earliest.

Item No. 2: Draft Technical Specifications (TS) of 5/15 minutes IEM with AMR, MDP system

As per NPC, CEA letter dated 02.12.2020; a Joint Committee comprising of members from RPCs, CEA, PGCIL/CTU & POSOCO has been constituted to finalize the Technical Specification (TS) of the 5/15 minute IEMs (Interface Energy Meters) with AMR, MDP system. **(Annexure-2.1)**

Subsequently NPC, vide email dated 28.01.2021, has circulated a draft Technical specification (TS) in two parts **(Annexure-2.2).** The 1st meeting of the joint committee held on 05th February'2021, where it was decided for further deliberation at RPC level on Technical Specifications with states/Utilities for consolidated comments of RPCs. It is further informed that ERPC Secretariat vide email dated 04.02.2021, sought comments from States/Utilities, but no comments has been received till date. **(Annexure-2.3)**

Deliberation in the meeting:

OCC advised all the concerned utilities to go through the draft Technical Specifications and submit their comments within a week.

Item No. 3: Healthiness of 89T isolator of ICT-V at Malda

On 13.03.21 400/220kV 315MVA ICT#5 at Malda required emergency outage (hand tripped), as 400kV side CB lockout occurred. POWERGRID informed via mail that 315 MVA ICT - V cannot be charged through 400 kV TBC because, it was observed that B-ph 89 T PG Isolator spring has broken and is not operational, which compelled for forced manual tripping of ICT-5. On 14.03.2021 early morning, during emergency restoration of ICT-5 through 400kV TBC bay, some shorting arrangement at 89T isolator of ICT-5 was made to restore ICT-5 through TBC.
On 19.04.2021 at 13:15 hrs, 315MVA, 400/220kV ICT- V at Malda has been Emergency hand tripped due to sudden flash over at 89T isolator. ICT -V was restored through Main Bay.

POWERGRID May update the healthiness of all isolators and CB of ICT-V at Malda.

Deliberation in the meeting:

Powergrid representative informed that problem in 89T isolator still persists, and for that they have already applied shutdown for normalization from TBC bay to Main Bay after isolating the faulty isolator.

Powergrid representative further added that as 89T is a line side Isolator, any maintenance of it would require shutdown of ICT 5. Upon query he mentioned that all the other isolators and breakers of the TBC have been replaced and there is no issue related to the operation. But the said bay isolator has problem due to ageing problem and it was planned to be replaced during the ICT augmentation work. However, Powergrid has planned for phase wise replacement of 89T and 89 M2 under O&M activity which will be done on daily basis shutdown and it would require 7-8 days in order to get the work done.

OCC advised Powergrid to submit the detailed replacement plan to ERPC/ERLDC for further action.

PART C: ITEMS FOR UPDATE

ITEM NO. C.1: ER Grid performance during April'2021

The average and maximum consumption of Eastern Region and Max/Min Demand (MW), Energy Export for the month April-2021 were as follows:

Average Consumption (MU)	Maximum Consumption (MU)/ Date	Maximum Demand (MW) Date/Time	Minimum Demand(MW) Date/Time	Schedule Export (MU)	Actual Export (MU)
492	525.3 28-04-2021	24656 MW, 27-04-2021 22:50 Hrs.	15910 MW, 22-04-2021 08:12 Hrs.	2267	2120

ERLDC may present performance of Eastern Regional Grid.

Deliberation in the meeting:

The presentation on performance of Eastern Regional Grid is placed at **Annexure C1***.*

Members noted.

ITEM NO. C.2: Primary frequency response of ER generating units in April'2021

Frequency response characteristics (FRC) have been analysed pan India for one event of sudden frequency change that occurred in the month of April 2021. The details of this event and the overall response of the Eastern region have been summarized in Table 1.

Table 1: Summary of the events and Frequency Response Characteristic (FRC) of the Eastern Region for the events.

Event	Frequency Change	Power Number ($\Delta MW/\Delta f$)	ER FRC
Event 1: On 08th April 2021 at 03:31:34 hrs, around 1045 MW generation loss occurred at Bhadla in NR.	49.994Hz to 49.903 Hz. Later stabilized at 49.95 Hz	11484	14 %

Summary of the analysis of these events are given below:

1. In spite of repeated reminders, generation end data (generation output in MW and frequency/speed measured at generator end) and FRCs are yet to be received from few regional generating stations (ISGS and IPP) and SLDCs respectively. List of such regional generating stations/SLDCs are shown below (as per status on 08th May2021).
   a) NTPC Farakka
   b) NTPC Kahalgaon

c) NTPC Talcher
d) NTPC Barh
e) NTPC Darlipalli
f) BRBCL
g) JITPL
h) Bihar SLDC
i) Jharkhand SLDC
j) WB SLDC

2. Based on data received from regional generating stations & SLDCs and SCADA data archived at ERLDC, regional generating stations' and state control areas' performance have been analyzed and summarized in Table 2.

3. Based on data received from state generating stations & SLDCs, the performance of state generating stations has been analyzed and summarized in Table 3.

Table 2: performance of regional generating stations and state control areas for the events in April 2021

Generating Station/ SLDC	Response observed
NTPC Farakka	Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)
NTPC Kahalgaon	Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)
NTPC Talcher	Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)
NTPC Barh	Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)
NTPC Darlipalli	Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)
BRBCL	Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)
NPGC Nabinagar	Non-Satisfactory
GMR	Unit 1 satisfactory; Unit 2 Non satisfactory
JITPL	Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)
MPL	Non-Satisfactory; Both the units were being run in VWO due to poor vaccum
Adhunik	Non-Satisfactory
Teesta V HEP	Unit not in service

Generating Station/ SLDC	Response observed
Teesta III HEP	Unit not in service
Dikchu HEP	Unit not in service
Bihar SLDC	Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)
Jharkhand SLDC	Satisfactory (As per FRC calculated based on ERLDC SCADA data)
DVC SLDC	Non-Satisfactory
GRIDCO SLDC	Non-Satisfactory
WB SLDC	Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)

Table 3: Performance of state generating stations for the events in April 2021 (Based on data received from SLDC/generating stations)

Generating Station	Response observed
HEL	**Satisfactory;**
BBGS	**Non-Satisfactory for unit 1 and 3**; Both units were being run at more than installed capacity. Satisfactory for unit 2.
GMR unit 3	Satisfactory
Koderma, RTPS, DSTPS	**Non-Satisfactory**

The Report on primary frequency response observed in the generating units of Eastern Region for April 2021 is attached at **Annexure C2**.

Members may update.

<u>Deliberation in the meeting:</u>

ERLDC submitted they would convene a meeting on 31st May 2021 for discussing the Final Frequency Response of ISGS and IPP. ERLDC further advised all the concerned generators to go through the details of un-satisfactory response which they had got during the period from August 2020 to April 2021 in the mean time and make brief presentation on it so that it can be discussed during the meeting on 31st May.

OCC requested all generators to be present in the meeting and act accordingly.

ITEM NO. C.3: Primary Frequency Response Testing of Generating Units

In 176th OCC Meeting, ERLDC informed that as per preliminary report received for units where PFR have been completed, the primary frequency response observed during testing were satisfactory.

In 177th OCC Meeting, ERLDC informed that information regarding testing schedule of JITPL & GMR has not been received.

OCC advised GMR & JITPL to share their schedule for PFR testing to ERLDC.

In the 178th OCC meeting, GMR updated that the PFR testing for their units have been scheduled in the month of May'21 and the date of scheduling would be intimated shortly.

The status of the testing schedule for the generators is enclosed at **Annexure C.3**.

Respective Generators may update.

Deliberation in the meeting:

GMR updated that the PFR testing for their units have been scheduled in the month of May'21 but due to the prevailing pandemic situation and lockdown restriction it has been delayed. On query GMR further updated that, once confirmed, the next date would be intimated to the OCC forum.

ITEM NO. C.4: Testing of Primary Frequency Response of State Generating units by third party agency.

In the 171st OCC Meeting, OCC advised all the SLDC's to prepare the action plan for their state generators and submit the details to ERPC and ERLDC at the earliest.

DVC vide-mail dated 6th Oct 2020 informed that the Primary Frequency Response Testing may be carried out for the following generating units:

Sl. No.	Name of the Units	Capacity (MW)
1	BTPS-A	500
2	CTPS Unit #7&8	2X250
3	DSTPS Unit#1&2	2X500
4	KTPS Unit # 1&2	2X500
5	MTPS Unit # 3 to 8	2 X 210 +2 X 250 + 2X 500
6	RTPS Unit # 1 & 2	2 X 600

DVC informed that both the agencies M/s Siemens & M/s Solvina have agreed to carry out the testing at pre-agreed rates, terms & conditions.

In the 176th OCC meeting, OPGC informed that they would finalize the order with Siemens by end of Feb'2021.

SLDC, DVC informed that indent has been placed for PFR testing of their generating units.

On request from WBPDCL, OCC advised ERLDC to share all relevant documents related to selection of the vendor for PFR Testing along with contact details of the vendors to West Bengal SLDC for further sharing by them with their state generators.

In 177th OCC Meeting, SLDC, Bihar informed that PFR testing for Barauni TPS would be completed by April '2021. OHPC informed that PFR testing is being planned to be carried out for units of Indravati & Rengali. OCC advised OHPC to submit a schedule for testing to ERLDC/ERPC secretariat.

OCC advised SLDC DVC, SLDC West Bengal & SLDC Jharkhand to coordinate with their generators and submit the schedule of PFR testing.

In the 178th OCC meeting, WBPDCL informed that they have received some of the relevant documents from SLDC West Bengal. Further they informed that they are collecting some other information to finalize the scope and purchase order for PFR testing.

DVC informed that the indent has been placed for PFR testing of generating units and the order would be placed tentatively in October'21.

Members may update.

Deliberation in the meeting:

WBPDCL submitted that they are in contact with Siemens in this regard and once they get any update, they would intimate the same in the next OCC meeting.

ITEM NO. C.5: PSS tuning of Generators in Eastern Region.

The PSS tuning activity is mandatory in line with IEGC and CEA regulations. The Procedure of PSS tuning for helping utilities in getting this activity carried out has been approved in 171st OCC Meeting and shared with all concerned utilities.

In 176th OCC Meeting, NTPC informed that PSS tuning schedule for BRBCL & Barh has been submitted. OCC advised NTPC to submit a complete schedule for PSS Tuning of all of their units to ERPC secretariat/ERLDC within two weeks.

OHPC informed that they have already taken up with OEM for PSS tuning of their units. OCC advised to submit a status report in this regard.

In 177th OCC Meeting, DVC informed that PSS tuning of Unit#1 of Bokaro-A TPS had been completed.

WBSEDCL stated that the status of PSS tuning in PPSP units would be submitted shortly.

In the 178th OCC meeting, ERLDC informed that PSS tuning for APNRL units were carried out however it was not successful due to some technical issue at APNRL end.

It was informed that PSS tuning of Unit#4 of Mejia TPS of DVC had been completed on 07.04.2021.

The updated schedule for PSS tuning of the units is attached at **Annexure C5**.

Members may update.

<u>Deliberation in the meeting:</u>

On query ERLDC submitted that they are yet to receive update from APNRL and JITPL.

ITEM NO. C.6: Status of UFRs healthiness installed in Eastern Region.

UFRs healthiness status has been received from West Bengal, DVC and CESC.

Members may update.

<u>Deliberation in the meeting:</u>

It was informed that Bihar, Odisha and Jharkhand had submitted the updated status to ERPC.

ITEM NO. C.7: Status of Islanding Schemes healthiness installed in Eastern Region.

In 108th OCC meeting, respective constituents agreed to certify that the islanding schemes under their control area are in service on monthly basis.

Details received from the constituents are as follows:

Sl. No	Name of Islanding Scheme	Confirmation from Generator Utility end	Confirmation from Transmission Utility end
1	CESC as a whole Islanding	Healthy	Healthy
2	BkTPS Islanding Scheme		
3	Tata Power Islanding Scheme Haldia		
4	Chandrapura TPS Islanding Scheme, DVC	Not in service	
5	Farakka Islanding Scheme, NTPC		
6	Bandel Islanding Islanding Scheme, WBPDCL		

In 178th OCC Meeting, OCC advised concerned constituents to update the status of Islanding scheme healthiness regularly on monthly basis by 7th of every month.

Members may update.

Deliberation in the meeting:

WBPDCL submitted that they had sent the status through hard copy. However, from next OCC meeting they would send the status to email.

OCC advised concerned constituents to update the status of Islanding Scheme healthiness regularly on monthly basis by 7th of every month.

ITEM NO. C.8: Transfer capability determination by the states.

Latest status of State ATC/TTC declared by states during the month of July-2021

Sl No	State/Utility	TTC (MW)		RM(MW)		ATC Import (MW)		Remark
		Import	Export	Import	Export	Import	Export	
1	BSPTCL	6075	--	122	--	5953	--	May-21
2	JUSNL	1577	--	52	--	1525	--	July-21
3	DVC	1728	3343	68	54	1660	3289	July-21
4	OPTCL	2167	1340	88	61	2079	1279	April-21
5	WBSETCL	5325	--	400	--	4925	--	June-21
6	Sikkim	315	--	2.44	--	315.56	--	Feb-21

Declaration of TTC/ATC on SLDC Website:

Sl. No	SLDC	Declared on Website	Website Link	Constraint Available on Website	Type of Website Link
1	BSPTCL	Yes	http://www.bsptcl.in/ViewATCTTCWeb.aspx?GL=12&PL=10	Yes	Static Link-Table
2	JUSNL	Yes	http://www.jusnl.in/pdf/download/ttc_atc_nov_2020.pdf	Yes	Static link –pdf file
3	DVC	Yes	https://application.dvc.gov.in/CLD/atcttcmenu.jsp#	Yes	Static Link-Word file
4	OPTCL	Yes	https://www.sldcorissa.org.in/TTC_ATC.aspx	Yes	Static Link-pdf file
5	WBSETCL	Yes	http://www.wbsldc.in/atc-ttc	No (Not updating)	Static Link-Table
6	Sikkim	No	https://power.sikkim.gov.in/atc-and-ttc	No (Not updating)	Static Link-Excel file

After collecting state ATC/TTC value from SLDCs, NLDC is publishing all value at a single location in their website; it is available under monthly ATC subsection of Market section. As some of the states in Eastern Region are not declaring ATC/TTC on 3- Month ahead while few don't declare constraint, it becomes very difficult to publish the values uniformly for all the states in a timely manner.

A meeting with the state reliability coordinators was held on 22nd April for harmonizing the TTC declaration process and to remove all the gaps. Following that meeting, response is yet to be received from any of the states. All states are requested to comply with the TTC declaration requirement with highest priority.

Members may update.

<u>Deliberation in the meeting:</u>

ERLDC informed that declaration from ATC/TTC for 3 months prior (June 2021 to August 2021) had been received from BSPTCL and OPTCL.

ITEM NO. C.9: Mock Black start exercises in Eastern Region

Mock black start date for financial year 2021-22 is as follows:

Sl. No	Name of Hydro Station	Schedule	Tentative Date	Schedule	Tentative Date
		Test-I		Test-II	
1	U. Kolab	Last week of Oct 2021		Second Week of Feb 2022	
2	Balimela	Second week of Nov 2021		First Week of March 2022	
3	Rengali	Second week of Nov 2021		First 2eek of March 2022	
4	Burla	Second week of Nov 2021		First Week of March 2022	
5	U. Indravati	Last week of Oct 2021		Second Week of Feb 2022	
6	Maithon	Third Week of Nov 2021		First Week of March 2022	
7	TLDP-III	Second week of Nov 2021		Second Week of Feb 2022	
8	TLDP-IV	Third Week of Nov 2021		First Week of March 2022	
9	Subarnarekha	Second week of Nov 2021		Second Week of Feb 2022	
10	Teesta-V	Third Week of Nov 2020		Third Week of March 2022	
11	Chuzachen	Second week of Nov 2021		First Week of March 2022	
12	Teesta-III	Third Week of Nov 2021		First Week of March 2022	

13	Jorethang	Third Week of Nov 2021		First Week of March 2022	
14	Tasheding	Second week of Nov 2021		First Week of March 2022	
15	Dikchu	Second week of Nov 2021		Second Week of Feb 2022	

Members may update.

Deliberation in the meeting:

ERLDC submitted that Chuzachen had done the Mock Black Start on 9th April 2021.

PART D: OPERATIONAL PLANNING

ITEM NO. D.1: Anticipated power supply position during June 2021

The abstract of peak demand (MW) vis-à-vis availability and energy requirement vis-à-vis availability (MU) for the month of June 2021 were prepared by ERPC Secretariat on the basis of LGBR for 2021-22 and feedback of constituents, keeping in view that the units are available for generation and expected load growth etc. is enclosed at **Annexure-D1**.

Members may update.

Deliberation in the meeting:

*The updated anticipated power supply position for the month of June, 2021 is placed at **Annexure D1**.*

ITEM NO. D.2: Preparedness for meeting summer demand in 2021.

This year, the mercury has started rising sharply from February end, which is a bit earlier than previous year and indicative of scorching summer that lies ahead. As per IMD forecast, higher Maximum temperature than usual is expected in Odisha, Jharkhand and Bihar in Eastern Region. With India's reasonably well fight back against COVID-19 and largest vaccination drive, this summer is likely to be extremely challenging for system operators to ensure reliable power supply, particularly to the remote corners of the region.

Therefore, very robust planning and preparedness is absolutely essential for meeting the system demand in a reliable manner. In view of this, dissemination of the following information and formulating action plans are extremely important:

Information:

1. Realistic forecast of peak and off-peak load to be met by each state for the months of April-21 to June-21.
2. Proper projection of availability of state internal generation
3. Anticipated network congestion in STU systems
4. Areas likely to experience low voltage in each state
5. Identification of nodes (at 132kV level) by each state, where very high amount of Air conditioning load is anticipated.

Action plan:

1. Ensuring maximum VAR support from all state generators as per their capability curve.
2. Ensuring timely completion of all over hauling maintenance activity of all generators and transmission elements and maintaining maximum possible resource adequacy.
3. Strengthening of network by restoring elements under long outage before April-21, where ever it is possible.
4. Timely Switching off/on of Bus reactors as per real time voltage as well as under RLDC instruction.

5. Monitoring the compliance of proper reactive power support by RE resources, as per CEA connectivity standard.
6. With higher maximum temperature higher sag of overhead transmission lines is expected. So regular tree cutting activity and preventing encroachment of vegetation in the corridor is extremely important. SLDCs to inform all transmission licensees under their respective jurisdiction, accordingly.

In addition to the above, SLDCs too may share their comprehensive summer preparedness plan.

In the 178th OCC meeting, ERLDC informed that they had received some of the data from SLDCs and further some additional information/data have been sought from all SLDCs. After receiving the same, the study would be carried out and the report would be finalized by April'21.

OCC advised all SLDCs to furnish the requisite data to ERLDC at the earliest so that the report can be finalized by end of April'21.

SLDCs may update.

Deliberation in the meeting:

ERLDC submitted that they had prepared and circulated the report to all the concerned utilities.

OCC advised all SLDCs to follow the guidelines of ERLDC. The report is attached at **Annexure D2.**

ITEM NO. D.3: Shutdown proposal of transmission lines for the month of June' 2021.

The Shutdown proposals of the transmission lines for the month of June, 2021 was discussed and finalized in the Shutdown meeting of Transmission line held on 17.05.2021.

Members may note.

Deliberation in the meeting:

The shutdown proposal for the month of June, 2021 was discussed and finalized in the Shutdown meeting held on 17.05.2021.

Adani submitted a shutdown proposal of 400 KV D/C RANCHI-MAITHON-RB (PGCIL) Line for continuous 3 days to get the work done related to LILO of these lines at Dhanbad S/s.

The issue was discussed in 179th OCC Shutdown meeting held on 17/05/2021 and consent was denied by MPL. However, Adani representative was not available in the meeting.

After detailed deliberation OCC opined that during the summer peak, shutdown of both the circuits would violate n-1 contingency and may affect evacuation of MPL power. Further OCC advised Adani to explore the possibility of ERS and submit their proposal with necessary diagram and sketch. Upon receipt of the same a separate meeting would be convened.

Members noted.

ITEM NO. D.4: Shutdown proposal of generating units for the month of June' 2021.

Generator unit shutdown schedule for June' 2021 is given in the table.

Proposed Maintenance Schedule of Thermal Generating Units of ER in the month of June '21 (as finalized in LGBR meeting for 2021-22)							
System	Station	Unit	Capacity (MW)	Period (as per LGBR 2020-21)		No. of Days	Reason
				From	To		
WBPDCL	Kolaghat TPS	4	210	10.06.2021	19.06.2021	10	Boiler Inspection
	Bakreshwar TPS	5	210	01.06.2021	05.07.2021	30	COH
Odisha	IB TPS	3	660	01.06.2021	25.06.2021	25	AOH
NTPC	TSTPS	4	500	01.06.2021	15.07.2021	30	OH
IPP	GMR	1	350	01.06.2021	15.07.2021	30	Turbine Overhauling

Members may update.

<u>Deliberation in the meeting:</u>

Members updated the status as follows:

Proposed Maintenance Schedule of Thermal Generating Units of ER in the month of June '21 (as finalized in LGBR meeting for 2021-22)							
System	Station	Unit	Capacity (MW)	Period (as per LGBR 2020-21)		No. of Days	Reason
				From	To		
WBPDCL	Kolaghat TPS	4	210	Postponed due to pandemic			Boiler Inspection
	Bakreshwar TPS	5	210				COH
Odisha	IB TPS	3	660	Postponed to August			AOH
	IB TPS	1	210	07.06.2021	08.07.2021	24	
NTPC	TSTPS	4	500	Postponed to August			OH
	FSTPS	1	200	22.06.2021	05.08.2021	45	AOH
IPP	GMR	1	350	Postponed to September.			Turbine Overhauling

ITEM NO. D.5: Major Generating Units/Transmission Element outages/shutdown in ER Grid (as on 10.05.2021)

a) Thermal Generating Stations outage report:

Sl. No	Station	State	Agency	Unit No.	Capacity in Mw	Reason(s)	Outage Date
1	KOLAGHAT	WEST BENGAL	WBPDCL	1	210	ESP R & M	07-Jun-18

2	KOLAGHAT	WEST BENGAL	WBPDCL	2	210	ESP & Ash Handling R & M	26-Dec-19
3	BOKARO'B'	DVC	DVC	3	210	INITAILLY OUT DUE TO ASH PONDAGE PROBLEM UPTO 31/12/21. LATER OUT DUE TO POLLUTION CLERANCE ISSUE	21-Oct-20
4	WARIA TPS	DVC	DVC	4	210	TAKEN OUT OF BAR DUE TO NON RECEIPT OF ENVIRONMENTAL CLEARANCE	31-Dec-20
5	BARAUNI TPS	BIHAR	BSPHCL	9	250	PROBLEM IN GT	05-Mar-21
6	TTPS	ODISHA	NTPC	6	110	HAND TRIPPED DUE TO SMOKE IN GENERATOR; Permanently closed	07-Mar-21
7	BARAUNI TPS	BIHAR	BSPHCL	6	110	ABNORMAL TSI PARAMETER	17-Mar-21
8	MEJIA TPS	DVC	DVC	3	210	Generator inter-turn fault	19-Mar-21
9	TTPS	ODISHA	NTPC	1	62.5	Hand tripped due to coal shortage; Permanently closed	22-Mar-21
10	TTPS	ODISHA	NTPC	2	62.5	Hand tripped due to coal shortage; Permanently closure	23-Mar-21
11	TTPS	ODISHA	NTPC	4	62.5	Hand tripped due to coal shortage; Permanently closed	23-Mar-21
12	TTPS	ODISHA	NTPC	5	110	Hand tripped due to coal shortage; Permanently closed	23-Mar-21
13	TTPS	ODISHA	NTPC	3	62.5	CLOSURE OF TTPS; Permanently closed	31-Mar-21
14	BANDEL TPS	WEST BENGAL	WBPDCL	1	82.5	Furnace wall tube leakage	20-Apr-21
15	DPL	WEST BENGAL	WBPDCL	7	300	SUPERHEATER SPRAY LINE LEAKAGE	20-Apr-21
16	TENUGHAT	JHARKHAND	TVNL	1	210	Maintenance Work	24-Apr-21
17	MUZAFFARPUR TPS	BIHAR	BSPHCL	2	110	Low Furnace Pressure	29-Apr-21
18	KOLAGHAT	WEST BENGAL	WBPDCL	6	210	Low System Demand	02-May-21
19	KOLAGHAT	WEST BENGAL	WBPDCL	4	210	Low System Demand	03-May-21
20	RTPS	DVC	DVC	2	600	Low System Demand	07-May-21
21	SAGARDIGHI	WEST BENGAL	WBPDCL	1	300	Generator hydrogen gas leakage into the stator cooling water system	08-May-21

All Generating stations are requested to update expected restoration time and reason outage to ERLDC/ERPC on weekly basis in case of any change at their end.

Generators/ constituents are requested to update the expected date of revival of the units.

b) Major Generating stations Out on Reserve Shutdown due to low system demand:

S.No	Station	State	Agency	Unit No.	Capacity in Mw	Reason(s)	Outage Date
1	KOLAGHAT	WEST BENGAL	WBPDCL	6	210	Low System Demand	02-May-21
2	KOLAGHAT	WEST BENGAL	WBPDCL	4	210	Low System Demand	03-May-21
3	RTPS	DVC	DVC	2	600	Low System Demand	07-May-21

c) Hydro Unit Outage Report:

Sl. No.	Station	State	Agency	Unit No	Capacity	Reason(s)	Outage
1	BALIMELA HPS	ODISHA	OHPC	1	60	R & M WORK	05-Aug-2016
2	BALIMELA HPS	ODISHA	OHPC	2	60	R & M WORK	20-Nov-2017
3	BURLA HPS/HIRAKUD I	ODISHA	OHPC	5	37.5	R & M WORK	25-Oct-2016
4	BURLA HPS/HIRAKUD I	ODISHA	OHPC	6	37.5	R & M WORK	16-Oct-2015
5	BURLA HPS/HIRAKUD I	ODISHA	OHPC	7	37.5	ANNUAL MAINTENANCE	20-Jan-2020
6	BALIMELA HPS	ODISHA	OHPC	5	60	STATOR EARTH FAULT	13-Dec-2020
7	RENGALI HPS	ODISHA	OHPC	2	50	Heavy oil leakage in cylinder of first gate	20-Mar-2021
8	U.KOLAB	ODISHA	OHPC	2	80	TGB PAD VIBRATION HIGH	19-Mar-2021
9	U.KOLAB	ODISHA	OHPC	3	80	Turbine Guide Bearing Problem	07-Jan-2021
10	JORETHANG	SIKKIM	DANS	1	48	ANNUAL MAINTENANCE	26-Feb-2021
11	RENGALI HPS	ODISHA	OHPC	5	50	ANNUAL MAINTENANCE WORK	16-Dec-2020

It is seen that about 552..5 MW hydro capacities in Odisha is under forced outage / planned outage and therefore not available for providing the much needed peaking support during evening peak. SLDC / OHPC may please indicate restoration plan of the units.

d) Long outage report of transmission lines:

SL NO	Transmission Element / ICT	Agency	Outage DATE	Reasons for Outage
1.	400 KV IBEUL JHARSUGUDA D/C	IBEUL	29-04-2018	TOWER COLLAPSE AT LOC 44,45
2.	220/132 KV 100 MVA ICT I AT LALMATIA	FSTPP/JUSNL	22-01-2019	FAILURE OF HV SIDE BREAKER

3.	220 KV PANDIABILI - SAMANGARA D/C	OPTCL	03-05-2019	49 NOS OF TOWER COLLAPSED.AS REPORTED BY SLDC OPTCL, TOTAL 60 NOS OF TOWER IN BETWEEN 220KV PANDIABILI – SAMANGARA LINE IN WHICH 48 NOS TOWERS FULLY DAMAGED AND 12 NOS TOWERS PARTIALLY DAMAGED. WORK UNDER PROGRESS.PRESENTLY CHARGED FROM PANDIABILLI END (LOC 156) TO LOC 58
4.	220kV Barauni-Hajipur Ckt-1	BSPTCL	28-09-2019	TOWER COLLAPSE AT LOCATION 38 & 39. CKT-2 IS ON ERS SINCE 13.01.2020.
5.	220/132 KV 100 MVA ICT 3 at Chandil	JUSNL	30-04-2020	ICT BURST AND DAMAGED AFTER FIRE REPORTED
6.	800KV HVDC ALIPURDUAR-AGRA-POLE-IV	PGCIL	10-04-2021	BLOCKED after healthiness testing, for overvoltage mitigation
7.	800KV HVDC ALIPURDUAR-AGRA-POLE-III	PGCIL	10-04-2021	BLOCKED after healthiness testing, for overvoltage mitigation
8.	220KV/132 KV 100 MVA ICT 4 AT RANGPO	PGCIL	08-04-2021	Hand Tripped after tripping of all 400/220 ICTs at Rangpo on 8.4.21 after disturbance and thereafter developed relay reset problem
9.	400KV/220KV 315 MVA ICT 2 AT RANGPO	PGCIL	20-02-2021	SD FOR SF6 GAS LEAKAGE RECTIFICATION WORK IN ICT-2 GIS MODULE UP TO 16/03/2021 16:00 HRS, FURTHER EXTENSION REQUESTED.
10.	400KV/220KV 315 MVA ICT 2 AT Meramandali	OPTCL	21-02-2021	FIRE HAZARD
11.	400KV-BINAGURI-TALA-4	PGCIL/ Bhutan	03-05-2021	VOLTAGE REGULATION AT BHUTAN END VOLTAGE REGULATION
12.	400KV-BINAGURI-TALA-2	PGCIL/ Bhutan	21-04-2021	
13.	400KV/220KV 315 MVA ICT 4 AT JEERAT	WBSETCL	09-04-2021	TRIPPED ON DIFFERENTIAL AND PRD PROTECTION OPTD
14.	220 KV GODDA-LALMATIA D/C	JUSNL	21-04-2021	Tower collapsed at loc. No. 4
15.	220KV-FSTPP-LALMATIA-1	JUSNL	21-04-2021	THREE TOWER COLLAPSED NEAR LALMATIA
16.	220KV-GODDA-LALMATIA-1&2	JUSNL	21-04-2021	TOWER COLLAPSED NEAR LALMATIA
17.	400KV-ALIPURDUAR (PG)-PUNASANGCHUN-JIGMELLING-2	PGCIL/ Bhutan	25-04-2021	VOLTAGE REGULATION
18.	765KV-ANGUL-JHARSUGUDA-3	PGCIL	01-05-2021	VOLTAGE REGULATION
19.	400KV-NEW PURNEA-	PGCIL	09-05-2021	Restoration of both lines from ERS

	FARAKKA-1			tower to permanent tower. (400kV-Farakka-Gokarna restored at 17:23hrs on 10.05.2021 as an interim arrangement)
20.	400KV-NEW PURNEA-GOKARNA-1	PGCIL	09-05-2021	Restoration of both lines from ERS tower to permanent tower. (400kV-Farakka-Gokarna restored at 17:23hrs on 10.05.2021 as an interim arrangement)

Transmission licensees/ Utilities are requested to update expected restoration date & work progress regarding restoration regularly to ERLDC/ERPC on monthly basis by 5th of each month so that status of restoration can be reviewed in OCC. Utilities are also requested to update outage of any elements within their substation premises like isolator/breaker to ERLDC/ERPC regularly. (Reported as per Clause 5.2(e) of IEGC).

Deliberation in the meeting:

DVC informed that DTPS U #4 is available from 04.05.2021.

Members noted.

ITEM NO. D.6: Commissioning of new units and transmission elements in Eastern Grid in the month of April-2021

The details of new units/transmission elements commissioned in the month of April -2021 based on the inputs received from beneficiaries:

Monthly commissioning List of Transmission element and generators: April 2021					
SL NO	Element Name	Owner	Charging Date	Charging Time	Remarks
1	220KV/132KV 100 MVA ICT 4 AT RANGPO	PGCIL	01-Apr-21	17:39	
2	400KV-SITAMARHI-MOTIHARI-2	PMTL	02-Apr-21	14:22	
3	400KV-SITAMARHI-DARBHANGA (DMTCL)-2	PMTL	02-Apr-21	15:29	
4	400KV TIE BAY OF (400KV-SITAMARHI--2 AND FUTURE) AT MOTIHARI	PMTL	02-Apr-21	14:23	
5	400KV MAIN BAY OF SITAMARHI -2 AT MOTIHARI	PMTL	02-Apr-21	14:22	
6	400KV MAIN BAY OF MOTIHARI-2 AT SITAMARHI	PMTL	02-Apr-21	13:25	
7	400KV MAIN BAY OF DARBHANGA (DMTCL)-2 AT SITAMARHI	PMTL	02-Apr-21	15:29	

8	400KV TIE BAY OF (SITAMARHI--1 AND SITAMARHI--2) AT DARBHANGA (DMTCL)	PMTL	02-Apr-21	15:30	
9	400KV MAIN BAY OF SITAMARHI -2 AT DARBHANGA (DMTCL)	PMTL	02-Apr-21	15:26	
10	400KV-SITAMARHI-MOTIHARI-1	PMTL	03-Apr-21	17:51	
11	400KV MAIN BAY OF SITAMARHI -1 AT MOTIHARI	PMTL	03-Apr-21	17:51	
12	400KV TIE BAY OF (125MVAR 400KV B/R-2 AND 400KV--MOTIHARI-1) AT SITAMARHI	PMTL	03-Apr-21	17:49	
13	400KV MAIN BAY OF MOTIHARI-1 AT SITAMARHI	PMTL	03-Apr-21	17:48	
14	220KV/11KV 10 MVA ST AT RONGNICHU	MBPCL	04-Apr-21	13:49	
15	220KV MAIN BAY OF STATION TRANSFORMER (ST) AT RONGNICHU	MBPCL	04-Apr-21	13:49	
16	125MVAR 400KV B/R-1 AT SITAMARHI	PMTL	04-Apr-21	16:34	
17	220KV MAIN BAY OF 11/220KV GT1 AT RONGNICHU	MBPCL	05-Apr-21	16:38	
18	220KV MAIN BAY OF 11/220KV GT2 AT RONGNICHU	MBPCL	05-Apr-21	16:43	
19	220KV-DARBHANGA(DMTCL)-LAUKAHI-2	BSPTCL	06-Apr-21	13:43	
20	400KV TIE BAY OF (400KV--DARBHANGA (DMTCL)-2 AND 400KV/220KV 500 MVA ICT 2) AT SITAMARHI	PMTL	07-Apr-21	18:05	
21	400KV MAIN BAY OF 400KV/220KV 500 MVA ICT 2 AT AT SITAMARHI	PMTL	07-Apr-21	18:05	
22	400KV TIE BAY OF (MOTIHARI-2 AND 500 MVA ICT 1) AT SITAMARHI	PMTL	07-Apr-21	16:03	
23	400KV MAIN BAY OF 400KV/220KV 500 MVA ICT 1 AT SITAMARHI	PMTL	07-Apr-21	16:03	
24	400KV/220KV 500 MVA ICT 2 AT SITAMARHI	PMTL	08-Apr-21	18:25	
25	400KV/220KV 500 MVA ICT 1 AT SITAMARHI	PMTL	08-Apr-21	17:25	

26	220KV BUS COUPLER BAY AT SITAMARHI	PMTL	08-Apr-21	18:09	
27	220KV/132KV 200 MVA ICT 2 AT SITAMARHI	PMTL	09-Apr-21	18:01	
28	220KV MAIN BAY OF 220KV/132KV 200 MVA ICT 2 AT SITAMARHI	PMTL	09-Apr-21	18:01	
29	220KV/132KV 200 MVA ICT 1 AT SITAMARHI	PMTL	10-Apr-21	17:15	
30	220KV MAIN BAY OF 220KV/132KV 200 MVA ICT 1 AT SITAMARHI	PMTL	10-Apr-21	17:15	
31	132KV MAIN BAY OF 220KV/132KV 200 MVA ICT 2 AT SITAMARHI	PMTL	10-Apr-21	15:55	
32	220KV MAIN BAY OF MOTIPUR-2 AT SITAMARHI	PMTL	10-Apr-21	11:51	
33	220KV MAIN BAY OF MOTIPUR-1 AT SITAMARHI	PMTL	10-Apr-21	12:00	
34	220KV MAIN BAY OF RAXAUL -2 AT SITAMARHI	PMTL	11-Apr-21	22:42	
35	220KV MAIN BAY OF RAXAUL -1 AT SITAMARHI	PMTL	11-Apr-21	22:32	
36	132KV MAIN BAY OF RUNNISAIDPUR-2 AT SITAMARHI	PMTL	11-Apr-21	18:03	Bay first time charged without line (not ready yet)
37	132KV MAIN BAY OF RUNNISAIDPUR-1 AT SITAMARHI	PMTL	11-Apr-21	17:58	Bay first time charged without line (not ready yet)
38	132KV MAIN BAY OF PUPRI-2 AT SITAMARHI	PMTL	11-Apr-21	17:43	Bay first time charged without line (not ready yet)
39	132KV MAIN BAY OF PUPRI-1 AT SITAMARHI	PMTL	11-Apr-21	17:29	Bay first time charged without line (not ready yet)
40	132KV MAIN BAY OF 220KV/132KV 200 MVA ICT 1 AT SITAMARHI	PMTL	11-Apr-21	14:52	
41	220KV-SITAMARHI-MOTIPUR-2	BSPTCL	12-Apr-21	17:01	
42	220KV-SITAMARHI-MOTIPUR-1	BSPTCL	12-Apr-21	18:10	

43	400KV/220KV 315 MVA ICT 3 AT JEYPORE	PGCIL	16-Apr-21	16:55	
44	400KV MAIN BAY OF 315 MVA ICT 3 AT MOTIHARI (DMTCL)	PMTL	18-Apr-21	16:54	
45	400KV TIE BAY OF (400KV-SITAMARHI--1 AND 315 MVA ICT 3) AT MOTIHARI	PMTL	19-Apr-21	17:00	
46	765KV 262 MVAr BR 1 AT DARLIPALI (DSTPS) along with Bays	NTPC Darlipali	22-Apr-21	10:28	
47	400KV/220KV 315 MVA ICT 1 AT DSTPS(ANDAL)	DVC	23-Apr-21	17:58	Ideal charged from 400kV Side
48	33KV/0.415KV 0.630 MVA ICT 1 AT ROURKELA	PMTL	28-Apr-21	12:14	
49	220KV MAIN BAY OF 400KV/220KV 315 MVA ICT 1 AT AT DSTPS(ANDAL)	DVC	28-Apr-21	12:28	

Members may update.

Deliberation in the meeting:

Bihar updated their element charging status for SL No. 19, 41 & 42.

Members noted.

ITEM NO. D.7: UFR operation during the month of April 2021

Frequency profile for the month as follows:

Month	Max	Min	Less IEGC Band (%)	Within IEGC Band (%)	More IEGC Band (%)
	(Date/Time)	(Date/Time)			
April, 2021	50.29 Hz, 04-04-2021 18:01 Hrs.	49.69 Hz , 11-04-2021 21:07 Hrs	7.97	75.06	16.97

Hence, no report of operation of UFR has been received from any of the constituents.

Members may note.

Deliberation in the meeting:

Members noted.

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Annexure- B1

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
पूर्वी क्षेत्रीय विद्युत समिति
Eastern Regional Power Committee
14, गोल्फ क्लब रोड, टालीगंज, कोलकाता-700033
14 Golf Club Road, Tollygunj, Kolkata-700033

Tel. No.: 033-24239651,24239658 FAX No.:033-24239652, 24239653 Web: **www.erpc.gov.in**

No.: ERPC/MS/2021-22/ 187 Date: 05.05.2021

To

As per list enclosed.

Subject: Advisory to ensure uninterrupted and reliable power supply to Oxygen Gas manufacturing plants - regarding.

Sir,

In continuation to the letter No. ERPC/MS/2021-22/180 dated 04.05.2021, an advisory received from Ministry of Power attached at **ANNEXURE-I**, which is to be followed to maintain an uninterrupted and reliable power supply to all Oxygen Gas manufacturing plants located in your control area to ensure adequate generation of Oxygen in the prevailing Covid-19 situation.

In addition, it is also requested that in case Oxygen generating power plant is taking power supply from captive power plant (CPP), an alternate supply from DISCOM may be taken up immediately.

This may be treated as **"most urgent"**.

Yours faithfully

Smondal
05/05/2021

(N. S. Mondal)
Member Secretary

LIST OF ADDRESSES:

1. Chief Engineer, Trans (O&M), Bihar State Power Transmission Limited, Vidyut Bhawan, Bailey Road, Patna-800021.
2. Electrical Superintending Engineer (CRITL), Bihar State Power Transmission Limited, Vidyut Bhawan, Bailey Road, Patna-800021.
3. Chief Engineer (SLDC), Damodar Valley Corporation, GOMD-I Premises, P.O.- Danesh Seikh Lane, Howrah- 711109.
4. Electrical Superintending Engineer (CLD), Jharkhand Urja Sancharan Nigam Limited, Kusai Colony, Doranda, Ranchi-834002.
5. Sr. General Manager (PP), GRIDCO, Janpath, Bhubaneswar.
6. Chief General Manager (O&M), OPTCL, Janpath, Bhubaneswar, Odisha – 751 022. FAX: 0674-2542932 cgm.onm@optcl.co.in
7. Chief Load Dispatcher, SLDC, OPTCL, P.O. Mancheswar Rly. Colony, Bhubaneswar-751017
8. Chief Engineer (CLD) WBSETCL, P.O. Danesh Sheikh Lane, Andul Road, Howrah-711109.
9. Addl. Chief Engineer (ALDC), West Bengal Electricity Distribution Company Ltd, Vidyut Bhavan, 7th Floor, Bidhannagar, Sector-I, Salt Lake City, Kolkata-700091(Fax-033-2334-5862)
10. GM (SYS OPERATION), CESC, CHOWRINGHEE SQUARE, KOLKATA (FAX NO.033-22253756/22129871)
11. Chief Engineer (Trans.), Power Deptt., Govt. of Sikkim, Gangtok-731010
12. Executive Director, ERLDC, POSOCO, Tollygunge, Kolkata-700033.

COPY TO:

1) Member (GO&D), CEA
2) Chairperson, TCC & Director (Technical), BSPGCL-cum-PMC, BSPHCL, Vidyut Bhavan, Bailey Road, Patna-800021.
3) Director (Operation), Bihar State Power Transmission Company Limited, Vidyut Bhavan, Bailey Road, Patna-800021.
4) Chief Engineer (Commercial), Bihar State Power Holding Company Ltd., Vidyut Bhavan, Bailey Road, Patna-800021.
5) Director (Project), North Bihar Power Distribution Company Limited, Vidyut Bhavan , Bailey Road, Patna-800021.
6) Director (Commercial), GRIDCO Ltd., Janpath, Bhubaneswar-751022.
7) Director (Operation), Odisha Power Transmission Corporation Ltd., Janpath, Bhubaneswar - 751022.
8) Director (Project), Jharkhand Urja Sancharan Nigam Limited, Engineering Building, HEC, Dhurwa, Ranchi-834004.
9) Chief Engineer (S&D-JBVNL), Jharkhand Urja Vikas Nigam Limited, Engineering Building, HEC, Dhurwa, Ranchi-834004.
10) Chief Engineer (S&D), Jharkhand Bijli Vitaran Nigam Limited, Engineering Building, HEC, Dhurwa, Ranchi-834004.

11) Director (Operations), West Bengal State Electricity Transmission Company Ltd., Vidyut Bhavan, 8th Floor, Block-DJ, Sector-II, Bidhannagar, Kolkata-700091.
12) Director (R&T), West Bengal State Electricity Distribution Company Ltd., Vidyut Bhavan, 7th Floor, Block-DJ, Sector-II, Bidhannagar, Kolkata-700091.-
13) Executive Director (Commercial), Damodar Valley Corporation, DVC Tower, VIP Road, Kolkata-700054.
14) Executive Director (Generation), CESC Ltd, CESC House, 1 Chowringhee Square, Kolkata-700001.

ANNEXURE-I

Advisory to ensure uninterrupted and reliable Power-Supply to Oxygen Gas manufacturing plants

In the Current pandemic situation with the increasing number of COVID-19 positive cases across the country, the manufacturing and distribution of Life-Saving **Oxygen Gas** is of vital importance. A reliable and continuous power supply to these oxygen generating plants is of utmost importance. Hence to maintain an uninterruptable and reliable power supply to these oxygen generating plants, the following measures may be taken.

1. The sub-station supplying to the Oxygen Gas plant to be operated with Double Bus Scheme with two independent sources as far as possible to maintain the reliability of power supply
2. All the Transmission/sub-transmission lines providing power supply to these Oxygen gas Plants to be patrolled thoroughly and necessary corrective action to be taken immediately
3. The protection settings to be checked to avoid any unwanted tripping.
4. Element Outages affecting the power- supply to the Oxygen Gas plants to be deferred (except for emergency) in the Vicinity of these Oxygen Gas plants
5. The Tap Position of the Inter-connected Transformed to be reviewed to maintain a better voltage profile
6. In case the sub-station supplying power-supply to the Oxygen plants are facing chronic and severe low-voltage, the Capacitor Banks to be taken in-service in and around the sub-station and if required augmentation of Capacitor banks to planned at the earliest
7. The line loadings at the sub-station feeding to the Oxygen Gas Plant to be within N-1 Limits
8. To enable continuous monitoring of the power supply to these Oxygen Gas Plants, a suitable SCADA display to be developed and monitored by the SLDC Operator

Gmail TEESTA STAGE-V POWER STATION <teestav.nhpc@gmail.com>

Trapping of personnel in middle of river of downstream of Teesta V Power Station for 14-04-2021

2 messages

TEESTA STAGE-V POWER STATION <teestav.nhpc@gmail.com> Wed, Apr 14, 2021 at 8:18 PM
To: ERLDC Control Room <erldccr@posoco.in>

Sir,
We have received a call from district police, Singtam for reducing the load as few students/girls were trapped in the middle of the river Teesta-V down stream near Singtam. So, we have reduced the load accordingly.
As we have given almost 1 and half hour peaking , we ask your good office to give three machine schedule for more 1 and half hour during the 22:30 hrs to 24:00 hrs to complete the 3 hours peaking for the day.
Shift Incharge
TEESTA-V POWER STATION
NHPC Ltd.
Mob. +919800003801

TEESTA STAGE-V POWER STATION <teestav.nhpc@gmail.com> Wed, Apr 14, 2021 at 9:27 PM
To: ERLDC Control Room <erldccr@posoco.in>

Sir,
In continuation to the trailing mail, the rescue operation of the said persons have successful. As we have stopped our generation for the said reason, the level in our dam has increased considerably, now we are ready to provide a full load of Three units (504MW). Hence, we request your good office to provide schedule for three machines for the remaining blocks as possible.

Thanking you and Regards
Shift Incharge
TEESTA-V POWER STATION
NHPC Ltd.
Mob. +919800003801

[Quoted text hidden]

Gmail **TEESTA STAGE-V POWER STATION <teestav.nhpc@gmail.com>**

Full PAF for 14.04.2021

1 message

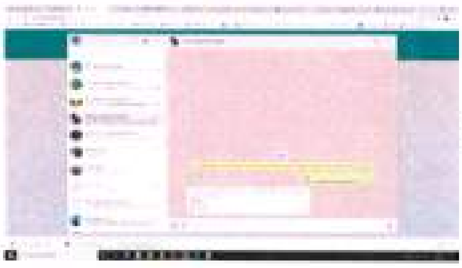
TEESTA STAGE-V POWER STATION <teestav.nhpc@gmail.com> Wed, Apr 14, 2021 at 10:29 PM
To: ERLDC Control Room <erldccr@posoco.in>, ERLDC Final Scheduling <finalschder@posoco.in>

Dear Sir,

As communicated to your good office earlier regarding the trapping of persons in the middle of downstream of Teesta river near Bagey Khola , Mazhitar town at around 19:45 Hrs. Accordingly, Power station have backed out generation as per the instruction of the local Police Station. After receiving confirmation from the police station about the rescuing of all persons, we have resumed Generation of three machines (504 MW). Hence, we ask your good office to give full PAF for the day and the penalty for the same may be waived off. A screenshot of the communication received from the police station is being attached for your ready reference.

Regards

GM(Electrical)
Power House
TEESTA-V POWER STATION
NHPC Ltd.
Mob. +919800003801



WhatsApp Image 2021-04-14 at 22.28.57.jpeg
154K

List of Important Grid Elements in Eastern Region

In compliance to IEGC section 5.2(c)

May -2021

Eastern Regional Load Despatch Centre
Power System Operation Corporation Ltd
14 Golf Club Road,
Kolkata 700033

Table of Contents

1.0 Introduction

Important Grid Elements of Eastern regional Grid has been issued in compliance with IEGC 5.2 (c).

1. The criterion that has been adopted for including a transmission line in this list is as follows:
    a) All HVDC Transmission elements including Poles & Back-to-back Blocks.
    b) All Transmission Lines, Bays, Buses, Bus Reactors, Line Reactors, Transformers, TCSC, FSC, Filter Banks and STATCOM connected at 400 kV and above voltage level.
    c) All Transmission Lines, Bays, Buses, Bus Reactors, Line Reactors, Transformers, TCSC, FSC, Filter Banks and STATCOM owned by ISTS Licensees, Central Sector Generating Stations, ISGS and Generating Stations whose dispatch schedules are being done by ERLDC
    d) All Transmission Lines, Bays, Buses, Bus Reactors, Line Reactors and Transformers connected to ISTS Licensees, Central Sector Generating Stations, ISGS and Generating Stations whose dispatch schedules are being done by ERLDC
    e) All Transmission Lines, Bays, Buses, Bus Reactors, Line Reactors and Transformers at 400 kV and above voltage level in state control areas (SLDC jurdisction).
    f) All Transmission elements from the territory of one State control area to other state control areas.
    g) All Transmission elements affecting system security or forming part of Islanding Scheme.
    h) 220 kV Transmission elements feeding loads of a strategic/sensitive nature
    i) All cross border AC and DC transmission elements

2. The transmission lines in the above context means a grid element from bus-bar to bus bar and includes all equipment such as associated circuit breakers, Line reactors , isolators, CVT's , CT's, LAs etc.

3. The criteria that has been adopted for including a generating unit is as follows:
    a) All Regional entities
    b) All thermal unit of 200 MW and above
    c) All Hydro unit of 25 MW and above

<u>In view of the network security ERLDC will also consider the following criteria for important grid element, inline with the IEGC and CEA grid standards operation liasion</u>

1. Before performing any operation (including switching in and switching out) by any of the USER, which would have an impact on the security and reliability of the regional grid, the same shall be intimated to ERLDC by the USER along with the likely time and status of normalization. SLDC should intimate such operation by any of their state control areas entities to ERLDC.

2. In respect of two main and transfer bus switching scheme at 400 kV substations, ERLDC shall be informed whenever the 400 kV transfer breakers at any substation is utilized for switching any line/ICT.

3. In respect of 765/400kV substation/Power station switchyard having breaker and a half switching scheme, outage within the substation (say main or tie circuit breaker) not affecting power flow on any line/ICT can be availed by the constituents only after obtaining code from ERLDC. However, while availing such shutdowns or carrying out switching operations it must be ensured by the substation that at least two Dias are complete even after such outage from the view point of network reliability. Any outage not fulfilling the above condition needs the approval of ERLDC.

4. Transmission elements/bays/buses commissioned after finalization of this documents and falls under above criteria will be under purview of important regional grid elements

2.0 HVDC Link

<table>
<tr><th>Sl.No</th><th>HVDC link</th><th>Link Capacity</th><th>Owned By</th><th colspan="3">Connected Substation</th><th>Connecting Region/Country</th></tr>
<tr><td>1</td><td>± 800 kV Agra-Alipurdwar- Bishwand Chariyali</td><td>6000 MW</td><td>Powergrid</td><td>400 kV Agra</td><td>400 kV Alipurdwar</td><td>400 kV Bishwand Chariyali</td><td>Norther Region with Eastern Region and Northeastern region</td></tr>
<tr><td>2</td><td>± 500 kV Talcher-Kolar</td><td>2500 MW (Including 500 MW overload capacity)</td><td>Powergrid</td><td>400 kV Talcher</td><td>400 kV Kolar</td><td></td><td>Eastern Region and Southern Region</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Back-to-Back at Gazuwaka Pole-1</td><td rowspan="2">500 MW</td><td rowspan="2">Powergrid</td><td>400 kV Gazuwaka (East Bus)</td><td>400 kV Gazuwaka (South Bus)</td><td rowspan="2"></td><td rowspan="2">Eastern Region and Southern Region</td></tr>
<tr><td colspan="2">Physically located in Southern Region</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Back-to-Back at Gazuwaka Pole-2</td><td rowspan="2">500 MW</td><td rowspan="2">Powergrid</td><td>400 kV Gazuwaka (East Bus)</td><td>400 kV Gazuwaka (South Bus)</td><td rowspan="2"></td><td rowspan="2">Eastern Region and Southern Region</td></tr>
<tr><td colspan="2">Physically located in Southern Region</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Back-to-Back at Sasaram Pole-1</td><td rowspan="2">500 MW</td><td rowspan="2">Powergrid</td><td>400 kV Sasaram (East Bus)</td><td>400 kV Sasaram (North Bus)</td><td rowspan="2"></td><td rowspan="2">Eastern Region and Northern Region</td></tr>
<tr><td colspan="2">Physically located in Eastern Region</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Back-to-Back at Bheramara</td><td rowspan="2">500 MW</td><td rowspan="2">PGCB</td><td>400 kV Bheramara</td><td>230 kV Bheramara</td><td rowspan="2"></td><td rowspan="2">Eastern Region (India) and Bangladesh</td></tr>
<tr><td colspan="2">Physically located in Bangladesh</td></tr>
</table>

3.0 STATCOM

SL No.	Substation	Owner	VSC	MSC	MSR
1	Jeypore	POWERGRID	± 2X100	2X125	2X125
2	Ranchi	POWERGRID	± 2X150	NIL	2X125
3	Rourkella	POWERGRID	± 2X150	NIL	2X125
4	Kishanganj	POWERGRID	± 2X100	NIL	2X125

4.0 List of Important Substations

400 kV and above

Sl. No.	Name of Sub-Station/ Power Station	Voltage Level (in kV)	Bus Arrangement Scheme	AIS/GIS	Ownership	Bus type (Load/Generator)	Fault level			Breaker Rating (Kamps)
							MVA (Max)	MVA (Min)	Kamps (Max)	
1	Darlipalli	765	1 & 1/2 Circuit Breaker (I-type)	AIS	NTPC	Generator	45398	45314	34.3	50 kAmps
2	Gaya	765	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	26712	26683	20.2	50 kAmps
		400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	30452	30365	44.0	63 kAmps
3	Sasaram	765	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	9886	9913	7.5	50 kAmps
		400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	11511	11537	16.6	63 kAmps
4	New Ranchi	765	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	18539	18566	14.0	50 kAmps
		400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	24742	24757	35.7	63 kAmps
5	Jharsuguda	765	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	56285	56123	42.5	50 kAmps
		400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	42954	42588	62.0	63 kAmps
6	Angul	765	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	29168	29178	22.0	50 kAmps
		400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	20835	20852	19.3	63 kAmps

Sl. No.	Name of Sub-Station/ Power Station	Voltage Level (in kV)	Bus Arrangement Scheme	AIS/GIS	Ownership	Bus type (Load/Generator)	Fault level			Breaker Rating (Kamps)
							MVA (Max)	MVA (Min)	Kamps (Max)	
7	Mednipur	765	1 & 1/2 Circuit Breaker (I-type)	AIS	PMJTL	Load				50 kAmps
		400	1 & 1/2 Circuit Breaker (I-type)	AIS	PMJTL	Load				63 kAmps
8	Adunik	400	1 & 1/2 Circuit Breaker (D-type)	AIS	APNRL	Generator	22414	22444	32.4	40 kAmps
9	Ailpurduar	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Load	15634	12647	22.6	40 kAmps
10	Arambagh	400	Double Main and Transfer	AIS	WBSETCL	Load	14395	14416	20.8	40 kAmps
11	Baharampur	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	19459	19388	28.1	40 kAmps
12	Bakreswar	400	Double Main and Transfer	AIS	WBSETCL	Load	9457	9458	13.7	40 kAmps
13	Banka	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	14629	14627	21.1	40 kAmps
14	Barh	400	1 & 1/2 Circuit Breaker (D-type)	AIS	NTPC	Generator	20021	19826	28.9	40 kAmps
15	Baripada	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	13301	13303	19.2	40 kAmps
16	Bidhannagar	400	Double Main and Transfer	AIS	WBSETCL	Load	19358	19379	27.9	40 kAmps
17	Biharshariff	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Load	28198	28005	40.7	40 kAmps

Sl. No.	Name of Sub-Station/ Power Station	Voltage Level (in kV)	Bus Arrangement Scheme	AIS/GIS	Ownership	Bus type (Load/Generator)	Fault level			Breaker Rating (Kamps)
							MVA (Max)	MVA (Min)	Kamps (Max)	
18	Binaguri	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	22236	16257	32.1	40 kAmps
19	Bokaro	400	Double Main	AIS	DVC	Generator	10468	10465	15.1	40 kAmps
20	Bolangir	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	5606	4922	8.1	40 kAmps
21	Chaibasa	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	17644	17687	25.5	40 kAmps
22	Chandwa	400	Double Main	AIS	POWERGRID	Load	17187	17213	24.8	40 kAmps
23	Daltonganj	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	3642	3660	5.3	40 kAmps
24	Darbhanga	400	1 & 1/2 Circuit Breaker (D-type)	GIS	DMTCL	Load	11788	11557	17.0	40 kAmps
25	Dikchu	400	1 & 1/2 Circuit Breaker (I-type)	AIS	DIKCHU	Generator	11698	6943	16.9	40 kAmps
26	DSTPS	400	1 & 1/2 Circuit Breaker (D-type)	AIS	DVC	Generator	15773	15812	22.8	40 kAmps
27	Durgapur A	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Generator	13342	13365	19.3	40 kAmps
28	Durgapur B	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Generator	19932	19945	28.8	40 kAmps
29	Farakka	400	1 & 1/2 Circuit Breaker (D-type)	AIS	NTPC	Generator	35486	34876	51.2	40 kAmps

Sl. No.	Name of Sub-Station/ Power Station	Voltage Level (in kV)	Bus Arrangement Scheme	AIS/GIS	Ownership	Bus type (Load/Generator)	Fault level			Breaker Rating (Kamps)
							MVA (Max)	MVA (Min)	Kamps (Max)	
30	Gokarna	400	Double Main and Transfer	AIS	WBSETCL	Load	8251	8284	11.9	40 kAmps
31	HEL	400	1 & 1/2 Circuit Breaker (D-type)	AIS	HEL	Generator	6760	6732	9.7	40 kAmps
32	GMR	400	1 & 1/2 Circuit Breaker (D-type)	AIS	GMR	Generator	15838	15306	22.9	40 kAmps
33	Ind Bharat	400	1 & 1/2 Circuit Breaker (I-type)	AIS	Ind Bharat	Generator	6639	6658	9.6	40 kAmps
34	Indravati	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Load	6302	4630	9.1	40 kAmps
35	Indravati	400	1 & 1/2 Circuit Breaker (D-type)	AIS	OHPC	Generator	6200	4545	8.9	40 kAmps
36	Jamshedpur	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Load	22532	22561	32.5	40 kAmps
37	Jeerat	400	Double Main and Transfer	AIS	WBSETCL	Load	11870	11908	17.1	40 kAmps
38	Jeypore	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Load	5993	4359	8.7	40 kAmps
39	JITPL	400	1 & 1/2 Circuit Breaker (I-type)	AIS	JITPL	Generator	9401	9417	13.6	40 kAmps
40	JSPL	400	1 & 1/2 Circuit Breaker (D-type)	AIS	OHPC	Generator	12118	11898	17.5	40 kAmps
41	Kahalgaon-A	400	1 & 1/2 Circuit Breaker (D-type)	AIS	NTPC	Generator	17293	17285	25.0	40 kAmps

Sl. No.	Name of Sub-Station/ Power Station	Voltage Level (in kV)	Bus Arrangement Scheme	AIS/GIS	Ownership	Bus type (Load/Generator)	Fault level			Breaker Rating (Kamps)
							MVA (Max)	MVA (Min)	Kamps (Max)	
42	Kahalgaon-B	400	1 & 1/2 Circuit Breaker (D-type)	AIS	NTPC	Generator	22777	22678	32.9	40 kAmps
43	Keonjhar	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	6453	6484	9.3	40 kAmps
44	Kharagpur	400	Double Main and Transfer	AIS	WBSETCL	Load	15419	15454	22.3	40 kAmps
45	Kishanganj	400	1 & 1/2 Circuit Breaker (I-type)	GIS	POWERGRID	Load	22878	18845	33.0	40 kAmps
46	Koderma	400	1 & 1/2 Circuit Breaker (D-type)	AIS	DVC	Generator	23146	23075	33.4	40 kAmps
47	Kolaghat	400	Double Main and Transfer	AIS	WBSETCL	Generator	14373	14367	20.7	40 kAmps
48	Lakhisarai	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	13088	13113	18.9	40 kAmps
49	Lapanga	400	1 & 1/2 Circuit Breaker (D-type)	AIS	OPTCL	Load	25427	25095	36.7	63 kAmps
50	Maithon A	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Generator	18018	18058	26.0	40 kAmps
51	Maithon B	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Generator	22353	22372	32.3	40 kAmps
52	Malda	400	Double Main and Transfer	AIS	POWERGRID	Load	18562	18434	27.2	40 kAmps
53	Mejia-B	400	1 & 1/2 Circuit Breaker (D-type)	AIS	DVC	Generator	16668	16695	24.1	40 kAmps

Sl. No.	Name of Sub-Station/ Power Station	Voltage Level (in kV)	Bus Arrangement Scheme	AIS/GIS	Ownership	Bus type (Load/Generator)	Fault level			Breaker Rating (Kamps)
							MVA (Max)	MVA (Min)	Kamps (Max)	
54	Meeramandali	400	1 & 1/2 Circuit Breaker (D-type)	AIS	OPTCL	Load	19755	18861	28.5	40 kAmps
55	Mendasal	400	1 & 1/2 Circuit Breaker (I-type)	AIS	OPTCL	Load	10176	9943	14.7	40 kAmps
56	Motihari	400	1 & 1/2 Circuit Breaker (D-type)	GIS	DMTCL	Load	3026	3053	4.4	40 kAmps
57	MPL	400	1 & 1/2 Circuit Breaker (D-type)	AIS	MPL	Generator	18219	18251	26.3	40 kAmps
58	Muzaffarpur	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	17862	17544	25.8	40 kAmps
59	Nabinagar	400	1 & 1/2 Circuit Breaker (D-type)	AIS	NTPC	Generator	7810	7824	11.3	40 kAmps
60	New Chanditala	400	Double Main and Transfer	AIS	WBSETCL	Load	15787	15816	22.8	40 kAmps
61	New Duburi	400	1 & 1/2 Circuit Breaker (I-type)	AIS	OPTCL	Load	10911	10778	15.7	40 kAmps
62	New PPSP	400	Double Main and Transfer	AIS	WBSETCL	Load	16494	16516	23.8	40 kAmps
63	NPGC	400	1 & 1/2 Circuit Breaker (D-type)	AIS	NTPC	Generator	16485	16493	23.8	40 kAmps
64	OPGC	400	1 & 1/2 Circuit Breaker (D-type)	AIS	OPGC	Generator	25560	25371	36.9	63 kAmps
65	Pandiabili	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	9493	9318	13.7	40 kAmps

Sl. No.	Name of Sub-Station/ Power Station	Voltage Level (in kV)	Bus Arrangement Scheme	AIS/GIS	Ownership	Bus type (Load/Generator)	Fault level			Breaker Rating (Kamps)
							MVA (Max)	MVA (Min)	Kamps (Max)	
66	Patna	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	24624	24226	35.5	40 kAmps
67	PPSP	400	Double Main	AIS	WBSETCL	Generator	16430	16452	23.7	40 kAmps
68	Purnea	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	21705	19533	31.3	40 kAmps
69	Raghunathpur	400	1 & 1/2 Circuit Breaker (D-type)	AIS	DVC	Generator	20086	20121	29.0	40 kAmps
70	Rajarhat	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	9291	9314	13.4	40 kAmps
71	Ranchi	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	27095	27106	39.1	40 kAmps
72	Rangpo	400	Double Main	AIS	POWERGRID	Load	13979	8550	20.2	40 kAmps
73	Rengali	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Load	18689	17857	27.0	40 kAmps
74	Rourkela	400	1 & 1/2 Circuit Breaker (D-type)	AIS	POWERGRID	Load	26391	26216	38.1	40 kAmps
75	SEL	400	1 & 1/2 Circuit Breaker (D-type)	AIS	SEL	Generator	25111	24897	36.2	40 kAmps
76	Subhasgram	400	1 & 1/2 Circuit Breaker (I-type)	AIS	POWERGRID	Load	9097	9093	13.1	40 kAmps
77	Talcher	400	1 & 1/2 Circuit Breaker (D-type)	AIS	NTPC	Generator	24537	23565	35.4	40 kAmps

Sl. No.	Name of Sub-Station/ Power Station	Voltage Level (in kV)	Bus Arrangement Scheme	AIS/GIS	Ownership	Bus type (Load/Generator)	Fault level			Breaker Rating (Kamps)
							MVA (Max)	MVA (Min)	Kamps (Max)	
78	Teesta III	400	Double Main	GIS	TUL	Generator	11403	6444	16.5	40 kAmps
79	Teesta V	400	Double Main	GIS	NHPC	Generator	12522	7835	18.1	40 kAmps
80	TISCO	400	1 & 1/2 Circuit Breaker (D-type)	AIS	DVC	Load	11366	11426	16.4	40 kAmps
81	Sitamarhi	400	1 & 1/2 Circuit Breaker (I-type)	AIS	PMTL	Load				63 kAmps

220 kV Important Substations

Sl No	Name of Substation	Sl No	Name of Substation	Sl No	Name of Substation
1	400/220 kV Kishanganj (220 kV Side)	52	400/220 kV New Purnea (220 kV Side)	102	220/132 kV Biharshariff (220 kV Side)
2	400/220 kV Patna (220 kV Side)	53	220/132 kV New town (220 kV Side)	103	220/132 kV Bishnupur (220 kV Side)
3	220/132 kV Purnea (220 kV Side)	54	220 kV New Melli	104	220/132 kV Bodhagya (220 kV Side)
4	400/220 kV Ranchi (220 kV Side)	55	220/132 kV Siliguri (220 kV Side)	105	220/132 kV Bokaro (220 kV Side)
5	400/220 kV Alipudwar	56	220/132 kV NJP WB (220 kV Side)	106	220/132 kV Budhipadar (220 kV Side)
6	220/132 Alipudwar WB (220 kV Side)	57	400/220 kV Pandiabilli (220 kV Side)	107	220/132 kV Burnpur (220 kV Side)
7	220/132 kV Arah (220 kV Side)	58	220/132 kV Parulia DVC (220 kV Side)	108	220/132 kV Chaibasa New(J) (220 kV Side)
8	220/132 kV Atri (220 kV Side)	59	400/220 kV Durgapur (220 kV Side)	109	220/132 kV Chandiposh (220 kV Side)
9	220/132 kV Balasore(220kV Side)	60	220/132 kV Puri (220 kV Side)	110	220/132 kV Chandrapura TPS B (220 kV Side)
10	400/220 kV Baripada (220 kV Side)	61	220/132 kV Nadokar (220 kV Side)	111	220/132 kV Waria (220 kV Side)
11	220/132 kV Begusarai	62	400/220 kV Sasaram (220 kV Side)	112	220/132 kV Uihep (220 kV Side)
12	400/220 kV Binaguri (220 kV Side)	63	400/220 kV Rajarhat (220 kV Side)	113	220/132 kV U. Kolab (220 kV Side)
13	220/132 kV Birpara (220 kV Side)	64	220/132 kV Ramchandrapur (220 kV Side)	114	220/132 kV Theruvali (220 kV Side)
14	220/132 kV Bodhgaya (220 kV Side)	65	400/220 kV Rangpo (220 kV Side)	115	220/132 kV Rengali (220 kV Side)
15	400/220 kV Bolangir (220 kV Side)	66	220 kV Rengali Odisha	116	220/132 kV Sadaipur (220 kV Side)
16	400/220 kV Chaibasa (220 kV Side)	67	400/220 kV Rengali (220 kV Side)	117	220/132 kV Sagardighi (220 kV Side)
17	220/132 kV Chaibasa New (220 kV Side)	68	220 kV Rengali Power House	118	220/132 kV Santaldih (220 kV Side)
18	220/132 kV Chandil (220 kV Side)	69	400/220 kV Rourkela (220 kV Side)	119	220/132 kV Satgachia (220 kV Side)
19	220 kV Chukha	70	220/132 kV Sahapuri (220 kV Side)	120	220/132 kV Patratu TPS (220 kV Side)
20	220/132 kV Dalkola WB (220 kV Side)	71	220 kV Salakati	121	220/132 kV Ramgarh (220 kV Side)
21	220 kV Dalkola	72	220/132 kV Sipara (220 kV Side)	122	400/220 kV Meramandali (220 kV Side)
22	400/220 kV Daltonganj (220 kV Side)	73	220/132 kV Sonnegar (220 kV Side)	123	220/132 kV Mejia (220 kV Side)
23	220/132 kV Dehri (220 kV Side)	74	220/132 kV Subhasgram WB (220 kV Side)	124	400/220 kV Mendhasal (220 kV Side)
24	220 kV Dhanbad	75	400/220 kV Subhasgram (220 kV Side)	125	220/132 kV Kolaghat TPS (220 kV Side)
25	220/132 kV Dumka (220 kV Side)	76	220/132 kV Tarkera (220 kV Side)	126	220/132 kV Kasba (220 kV Side)
26	220 kV EMSS	77	220 kV Tasheding	127	220/132 kV Katapalli (220 kV Side)
27	400/220 kV Farakka (220 kV Side)	78	400/220 kV Talcher STPS (220 kV Side)	128	220/132 kV Kharagpur (220 kV Side)
28	220/132 kV Fatuah (220 kV Side)	79	220/132 Talcher TPS (220 kV Side)	129	220/132 kV Krishnanagar (220 kV Side)
29	765/400/220 kV Gaya (220 kV Side)	80	220/132 kV Bhanjnagar (220 kV Side)	130	220/132 kV Kalyaneshwari (220 kV Side)
30	220/132 kV Gazol (220 kV Side)	81	220/132 kV Bidanasi (220 kV Side)	131	220/132 kV Gokarno (220 kV Side)
31	220/132 kV Kizirsarai (220 kV Side)	82	220/132 kV Budhipadar (220 kV Side)	132	220/132 kV Gopalganj (220 kV Side)
32	220/132 kV Hatia (220 kV Side)	83	220/132 kV Chandaka (220 kV Side)	133	220/132 kV Govindpur (220 kV Side)
33	220/132 kV Hazipur (220 kV Side)	84	220/132 kV Dharampur (220 kV Side)	134	220 kV IBTPS-1
34	400/220 kV Jeerat (220 kV Side)	85	220/132 kV Domjur (220 kV Side)	135	220/132 kV Jamshedpur (220 kV Side)
35	220/132 kV Jeynagar(220 kV Side)	86	220/132 kV Duburi(old) (220 kV Side)	136	220/132 kV Jayanagar (220 kV Side)
36	400/220 kV Jeypore (220 kV Side)	87	220/132 kV Lakhikantpur (220 kV Side)	137	220/132 kV Giridih (220 kV Side)
37	220 kV Jorthang	88	220/132 kV Laxmipur (220 kV Side)	138	220/132 kV Howrah (220 kV Side)
38	400/220 kV Keonjhar (220 kV Side)	89	220/132 kV Midnapore (220 kV Side)	139	220/132 kV Dharampur (220 kV Side)
39	220/132 kV Keonjhar (220 kV Side)	90	220/132 kV Narendrapur (220 kV Side)	140	220/132 kV DPL (220 kV Side)
40	220/132 kV Katapalli	91	220/132 kV Nayagarh (220 kV Side)	141	220/132 kV Darbhanga (220 kV Side)
41	220/132 kV New Khagaria (220 kV Side)	92	220/132 kV Rishra (220 kV Side)	142	220/132 kV Ctps A (220 kV Side)
42	220/131 kV Khagaul (220 kV Side)	93	400/220 kV Arambagh (220 kV Side)	143	400/220 kV Sitamarhi (220 kV Side)
43	220/132 kV Kishanganj Bihar(220 kV Side)	94	400/220 kV Bakreswar (220 kV Side)		
44	220/132 kV Kalyaneswari (220 kV Side)	95	220/132 kV Balimela (220 kV Side)		
45	220/132 kV Lalmatia (220 kV Side)	96	220/132 kV Barasat (220 kV Side)		
46	220/132 kV Madehpura (220 kV Side)	97	220/132 kV Barjora (220 kV Side)		
47	400/220 kV Maithon (220 kV Side)	98	220/132 kV Barkot (220 kV Side)		
48	400/220 kV Malabase (220 kV Side)	99	220/132 kV Begusarai (220 kV Side)		
49	400/220 kV Malda (220 kV Side)	100	220/132 kV Bhanjnagar (220 kV Side)		
50	400/220 kV Meramandali (220 kV Side)	101	400/220 kV Bidhannagar (220 kV Side)		
51	400/220 kV Muzzafarpur (220 kV Side)				

132 kV Important Substations

Sl No	Name of Substation	Sl No	Name of Substation
1	132 kV Jamaui	34	132 kV Kolaghat(Dvc)
2	132 kV Melli	35	132 kV Kolaghat(WB)
3	132 kV Njp	36	132 kV Kurseong
4	132 kV Rihand	37	132 kV Lakhisarai
5	132 kV Arha	38	132 kV Lalmatia
6	132 kV Bangiriposi	39	132 kV Maithon
7	132 kV Banka	40	132 kV Malda(PG)
8	132 kV Barhi	41	132 kV Malda(WB)
9	132 kV Baripada	42	132 kV Manique
10	132 kV Bethia(B)	43	132 kV Melli
11	132 kV Bhograi	44	132 kV Mohania
12	132 kV Birpara(PG)	45	132 kV Motihari(B)
13	132 kV Birpara(WB)	46	132 kV Motihari(DMTCL)
14	132 kV Chandauli	47	132 kV Nbu
15	132 kV Chandil	48	132 kV Pataratu(Dvc)
16	132 kV Chujachen	49	132 kV Patratu
17	132 kV Daltonganj	50	132 kV Patratu(Jharkahnd)
18	132 kV Daltonganj (PG)	51	132 kV Purnea
19	132 kV Dumraon	52	132 kV Purnea(PG)
20	132 kV Gangtok	53	132 kV Pusuali
21	132 kV Garwa	54	132 kV Rajgir
22	132 kV Jagdishpur	55	132 kV Rammam
23	132 kV Jaleswr	56	132 kV Rangit
24	132 kV Jamtara	57	132 kV Rangpo
25	132 kV Japla	58	132 kV Raxaul(B)
26	132 kV Joda	59	132 kV Rihand
27	132 kV Kahalgaon	60	132 kV Sabour
28	132 kV Karmanasa	61	132 kV Sagbari
29	132 kV Kendposi	62	132 kV Sahupuri
30	132 kV Kharagpur(Dvc)	63	132 kV Siliguri(PG)
31	132 kV Kharagpur(WB)	64	132 kV Sonenagar
32	132 kV Khudra	65	132 kV Sultangunj
33	132 kV Kisanganj	66	132 kV Sitamarhi (PMTL)

5.0 List of Important Transmission Lines

5.1 Trans-national lines: -

Sl No	Voltage Level	From Bus	To Bus	Ckt ID	Line Length		Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
					Total	Indian Portion			From End	To End			
1	400	Binaguri	Tala	T1	146	98	ACSR Twin Moose	POWERGRID + BPC	POWERGRID(ER)	DGPC(Bhutan)	D/C	874	560
2	400	Binaguri	Tala	T2	146	98	ACSR Twin Moose	POWERGRID + BPC	POWERGRID(ER)	DGPC(Bhutan)	D/C	874	560
3	400	Binaguri	Tala	T4	140	115	ACSR Twin Moose	POWERGRID + BPC	POWERGRID(ER)	DGPC(Bhutan)	D/C	874	560
4	400	Binaguri	Malbase	T3	125	115	ACSR Twin Moose	POWERGRID + BPC	POWERGRID(ER)	BPC(Bhutan)	D/C	874	560
5	400	Baharampur	Bheramara	T1	NA	100	ACSR Twin Moose	POWERGRID + Bangladesh Grid	POWERGRID(ER)	Bangladesh	D/C	874	560
6	400	Baharampur	Bheramara	T2	NA	100	ACSR Twin Moose	POWERGRID + Bangladesh Grid	POWERGRID(ER)	Bangladesh	D/C	874	560
7	400	Alipurduar	Jigmelling	Q1	162.2	63.93	ACSR Quad Moose	POWERGRID + BPC	POWERGRID(ER)	BPC(Bhutan)	D/C	1749	681
8	400	Alipurduar	Jigmelling	Q2	162.2	63.93	ACSR Quad Moose	POWERGRID + BPC	POWERGRID(ER)	BPC(Bhutan)	D/C	1749	681
9	400	Muzzafarpur	Dhalkebar	1	NA	128	ACSR Twin Moose	Cross Border Power Trans. Ltd.	POWERGRID(ER)	Nepal	D/C	874	560
10	400	Muzzafarpur	Dhalkebar	2	NA	128	ACSR Twin Moose	Cross Border Power Trans. Ltd.	POWERGRID(ER)	Nepal	D/C	874	560
11	220	Birpara	Chukha	1	70.2	38	Zebra	POWERGRID + BPC	POWERGRID	Druk Green (Bhutan)	D/C	213	131
12	220	Birpara	Chukha	2	70.2	38	Zebra	POWERGRID + BPC	POWERGRID	Druk Green (Bhutan)	D/C	213	131
13	220	Birpara	Malbase	1	40.7	38	Zebra	POWERGRID + BPC	POWERGRID	BPC(Bhutan)	S/C	213	131
14	132	Raxual	Parwanipur	1	NA	6.5	Panther	BSPTCL + Nepal	BSPTCL	Nepal	S/C	84	48
15	132	Kataiya	Kusaha	1	59	NA	HTLS	BSPTCL + Nepal	BSPTCL	Nepal	S/C	NA	NA
16	132	Kataiya	Kusaha	2	59	NA	HTLS	BSPTCL + Nepal	BSPTCL	Nepal	S/C	NA	NA
17	132	Gandak	Valmikinagar	1	NA	NA	Panther	BSPTCL + Nepal	BSPTCL	Nepal	S/C	84	48
18	33	Pupri	Jaleswar	1	NA	NA	NA	BSPTCL + Nepal	NBPDCL	Nepal	S/C	NA	NA
19	33	Raxual	Birganj	1	NA	NA	NA	BSPTCL + Nepal	NBPDCL	Nepal	S/C	NA	NA
20	33	Jainagar	Siraha	1	NA	NA	NA	BSPTCL + Nepal	NBPDCL	Nepal	S/C	NA	NA
21	33	Kataiya	Rajbiraj	1	NA	NA	NA	BSPTCL + Nepal	NBPDCL	Nepal	S/C	NA	NA

5.2 Inter regional lines : -

765 kV

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	Gaya	Balia	B1	237	Quad Bersimis	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	S/C	3880	2194
2	Sasaram	Fathepur	B1	356	Quad Bersimis	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	S/C	3880	2194
3	Gaya	Varanasi	B1	273	Quad Bersimis	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	S/C	3880	2194
4	Gaya	Varanasi	B2	272	Quad Bersimis	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	S/C	3880	2194
5	Ranchi	Dharamjayagarh	B1	303	Quad Bersimis	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	S/C	3880	2194
6	Ranchi	Dharamjayagarh	B2	354	Quad Bersimis	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	S/C	3880	2194
7	Jharsuguda	Dharamjayagarh	H1	152.67	Hexa Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	4452	2470
8	Jharsuguda	Dharamjayagarh	H2	152.67	Hexa Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	4452	2470
9	Jharsuguda	Dharamjayagarh	H3	147.79	Hexa Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	4452	2470
10	Jharsuguda	Dharamjayagarh	H4	147.79	Hexa Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	4452	2470
11	Jharsuguda	Raipur	H1	304.95	Hexa Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	4452	2470
12	Jharsuguda	Raipur	H2	304.95	Hexa Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	4452	2470
13	Angul	Srikakulam	H1	276.5	Hexa Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(SR)	D/C	4452	2470
14	Angul	Srikakulam	H2	276.5	Hexa Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(SR)	D/C	4452	2470

400 kV

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	Muzaffarpur	Gorakhpur	Q1	261	ACSR Quad Moose	POWERLINKS	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
2	Muzaffarpur	Gorakhpur	Q2	261	ACSR Quad Moose	POWERLINKS	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
3	Motihari	Gorakhpur	Q1	190	ACSR Quad Moose	POWERGRID+ DMTCL(LILO)	DMTCL	POWERGRID(NR)	D/C	1749	681
4	Motihari	Gorakhpur	Q2	190	ACSR Quad Moose	POWERGRID+ DMTCL(LILO)	DMTCL	POWERGRID(NR)	D/C	1749	681
5	Sasaram	Allahabad	T1	212	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	S/C	874	560
6	Biharshariff	Balia	Q1	241.8	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
7	Biharshariff	Balia	Q2	241.8	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
8	Patna	Balia	Q1	195.3	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
9	Patna	Balia	Q2	195.3	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
10	Patna	Balia	Q3	185	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
11	Patna	Balia	Q4	185	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
12	Biharshariff	Varanasi	Q1	321	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
13	Biharshariff	Varanasi	Q2	321	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	D/C	1749	681
14	Sasaram	Varanasi	T1	143.73	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NR)	S/C	874	560
15	Ranchi	Sipat	Q1	405.8	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	1749	681
16	Ranchi	Sipat	Q2	405.8	ACSR Quad Moose	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	1749	681
17	Jharsuguda	Raigarh	T1	114.5	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	874	560
18	Jharsuguda	Raigarh	T2	114.5	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	874	560

19	Jharsuguda	Raigarh	T3	152.33	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	874	560
20	Jharsuguda	Raigarh	T4	145.48	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(WR)	D/C	874	560
21	Jeypore	Gazuwaka	T1	220	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(SR)	D/C	874	560
22	Jeypore	Gazuwaka	T2	220	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(SR)	D/C	874	560
23	Binaguri	Bongaigaon	T1	218	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NER)	D/C	874	560
24	Binaguri	Bongaigaon	T2	218	ACSR Twin Moose	POWERGRID	POWERGRID(ER)	POWERGRID(NER)	D/C	874	560
25	Alipurduar	Bongaigaon	C1	105.69	AAAC Quad Moose	ENICL	POWERGRID(ER)	POWERGRID(NER)	D/C	1679	646
26	Alipurduar	Bongaigaon	C2	105.69	AAAC Quad Moose	ENICL	POWERGRID(ER)	POWERGRID(NER)	D/C	1679	646

220 kV

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	Pusauli	Sahupuri	1	71	Zebra	BSPHCL & UPPCL	POWERGRID(ER)	UPPCL	S/C	213	131
2	Budhipadar	Korba-E	1	184	Zebra	OPTCL & CSEB	OPTCL	NTPC	D/C	213	131
3	Budhipadar	Korba-E	2	184	Zebra	OPTCL & CSEB	OPTCL	NTPC	D/C	213	131
4	Budhipadar	Raigarh(PG)	1	83.37	Zebra	POWERGRID	OPTCL	POWERGRID(WR)	S/C	213	131
5	Alipurduar	Salakati	1	100.6	Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(NER)	D/C	213	131
6	Alipurduar	Salakati	2	100.6	Zebra	POWERGRID	POWERGRID(ER)	POWERGRID(NER)	D/C	213	131
7	Balimela	U. Silleru	1	24.7	Zebra	OPTCL & APTRANSCO	OHPC	APGENCO	S/C	213	131

132 kV

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	MACHKUND	VIZAG	1	160	Panther	OPTCL & APTRANSCO	OPTCL	APTRANSCO	S/C	84	48

5.2 Inter Utility lines : -

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
765 kV											
1	Jharsuguda	Darlipalli	H1	20.54	Hexa Zebra	POWERGRID	POWERGRID	NTPC	D/C	4452	2470
2	Jharsuguda	Darlipalli	H2	20.54	Hexa Zebra	POWERGRID	POWERGRID	NTPC	D/C	4452	2470
400 kV											
Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	Biharshariff	Koderma	Q1	110.7	ACSR Quad Moose	POWERGRID	POWERGRID	DVC	D/C	1749	681
2	Biharshariff	Koderma	Q2	110.7	ACSR Quad Moose	POWERGRID	POWERGRID	DVC	D/C	1749	681
3	Kahalgaon B	Banka	T1	47.7	ACSR Twin Moose	POWERGRID	NTPC	POWERGRID	D/C	874	560
4	Kahalgaon B	Banka	T2	47.7	ACSR Twin Moose	POWERGRID	NTPC	POWERGRID	D/C	874	560
5	Kahalgaon B	Barh	Q1	217.2	ACSR Quad Moose	POWERGRID	NTPC	NTPC	D/C	1749	681
6	Kahalgaon B	Barh	Q2	217.2	ACSR Quad Moose	POWERGRID	NTPC	NTPC	D/C	1749	681
7	Kahalgaon B	Maithon A	T1	172	ACSR Twin Moose	POWERGRID	NTPC	POWERGRID	D/C	874	560
8	Kahalgaon B	Farakka	T1	95.3	ACSR Twin Moose	POWERGRID	NTPC	NTPC	D/C	874	560
9	Kahalgaon B	Farakka	T2	95	ACSR Twin Moose	POWERGRID	NTPC	NTPC	D/C	874	560
10	Sasaram	Nabinagar	T1	81.7	ACSR Twin Lapwing	POWERGRID	POWERGRID	BRBCL	D/C	1071	564
11	Sasaram	Nabinagar	T2	81.7	ACSR Twin Lapwing	POWERGRID	POWERGRID	BRBCL	D/C	1071	564
12	Gaya	NPGC	Q1	95	ACSR Quad Moose	POWERGRID	POWERGRID	NTPC	D/C	1749	681
13	Gaya	NPGC	Q2	95	ACSR Quad Moose	POWERGRID	POWERGRID	NTPC	D/C	1749	681
14	Patna	NPGC	Q1	141	ACSR Quad Moose	POWERGRID	POWERGRID	NTPC	D/C	1749	681
15	Patna	NPGC	Q2	141	ACSR Quad Moose	POWERGRID	POWERGRID	NTPC	D/C	1749	681
16	Gaya	Koderma	Q1	82	ACSR Quad Moose	POWERGRID	POWERGRID	DVC	D/C	1749	681
17	Gaya	Koderma	Q2	82	ACSR Quad Moose	POWERGRID	POWERGRID	DVC	D/C	1749	681
18	Patna	Barh	Q1	93.1	ACSR Quad Moose	POWERGRID	POWERGRID	NTPC	D/C	1749	681
19	Patna	Barh	Q2	93.1	ACSR Quad Moose	POWERGRID	POWERGRID	NTPC	D/C	1749	681
20	Patna	Barh	Q3	68.7	ACSR Quad Moose	POWERGRID	POWERGRID	NTPC	D/C	1749	681
21	Patna	Barh	Q4	68.7	ACSR Quad Moose	POWERGRID	POWERGRID	NTPC	D/C	1749	681
22	Barh	Motihari	Q1	237	ACSR Quad Moose	POWERGRID	NTPC	DMTCL	D/C	1749	681
23	Barh	Motihari	Q2	237	ACSR Quad Moose	POWERGRID	NTPC	DMTCL	D/C	1749	681
24	Lakhisarai	Kahalgaon A	T1	145	ACSR Twin Moose	POWERGRID	POWERGRID	NTPC	D/C	874	560
25	Lakhisarai	Kahalgaon A	T2	145	ACSR Twin Moose	POWERGRID	POWERGRID	NTPC	D/C	874	560
26	Kishanganj	Teesta III	Q1	215	ACSR Quad Moose	TVPTL	POWERGRID	TUL	D/C	1749	681
27	Kahalgaon A	Maithon B	T1	172	ACSR Twin Moose	POWERGRID	NTPC	POWERGRID	D/C	874	560

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
28	Kahalgaon A	Farakka	T3	95.3	ACSR Twin Moose	POWERGRID	NTPC	NTPC	D/C	874	560
29	Kahalgaon A	Farakka	T4	95	ACSR Twin Moose	POWERGRID	NTPC	NTPC	D/C	874	560
30	MPL	Ranchi	T1	187.6	ACSR Twin Moose	POWERGRID	MPL	POWERGRID	D/C	874	560
31	MPL	Ranchi	T2	187.6	ACSR Twin Moose	POWERGRID	MPL	POWERGRID	D/C	874	560
32	MPL	Maithon B	T1	31.5	ACSR Twin Moose	POWERGRID	MPL	POWERGRID	D/C	874	560
33	MPL	Maithon B	T2	31.5	ACSR Twin Moose	POWERGRID	MPL	POWERGRID	D/C	874	560
34	Adhuinik	Jamshedpur	Q1	0.3	ACSR Quad Moose	APNRL	APNRL	POWERGRID	D/C	1749	681
35	Adhuinik	Jamshedpur	Q2	0.3	ACSR Quad Moose	APNRL	APNRL	POWERGRID	D/C	1749	681
36	New Ranchi	New PPSP	T1	113	ACSR Twin Moose	PKTCL	POWERGRID	WBSETCL	D/C	874	560
37	New Ranchi	New PPSP	T2	113	ACSR Twin Moose	PKTCL	POWERGRID	WBSETCL	D/C	874	560
38	Ranchi	Raghunathpur	Q2	155.5	ACSR Quad Moose	DVC	POWERGRID	DVC	D/C	1749	681
39	Ranchi	Raghunathpur	Q3	155.5	ACSR Quad Moose	DVC	POWERGRID	DVC	D/C	1749	681
40	Ranchi	Raghunathpur	T1	155.5	ACSR Twin Moose	POWERGRID	POWERGRID	DVC	D/C	874	560
41	Raghunathpur	Maithon B	T1	44	ACSR Twin Moose	POWERGRID	DVC	POWERGRID	D/C	874	560
42	Andal	Jamshedpur	T1	156.8	ACSR Twin Moose	POWERGRID	DVC	POWERGRID	D/C	874	560
43	Andal	Jamshedpur	T2	156.8	ACSR Twin Moose	POWERGRID	DVC	POWERGRID	D/C	874	560
44	Mejia	Maithon A	T2	60	ACSR Twin Moose	POWERGRID	DVC	POWERGRID	D/C	874	560
45	Mejia	Maithon A	T3	60	ACSR Twin Moose	POWERGRID	DVC	POWERGRID	D/C	874	560
46	Mejia	Jamshedpur	T1	167.7	ACSR Twin Moose	POWERGRID	DVC	POWERGRID	D/C	874	560
47	Mejia	Maithon B	T1	83.7	ACSR Twin Moose	POWERGRID	DVC	POWERGRID	D/C	874	560
48	TISCO	Jamshedpur	Q1	32	ACSR Quad Moose	POWERGRID	DVC	POWERGRID	D/C	1749	681
49	TISCO	Baripada	Q1	108.3	ACSR Quad Moose	POWERGRID	DVC	POWERGRID	D/C	1749	681
50	Chaibasa	Kharagpur	T1	161.6	ACSR Twin Moose	PKTCL	POWERGRID	WBSETCL	D/C	874	560
51	Chaibasa	Kharagpur	T2	161.6	ACSR Twin Moose	PKTCL	POWERGRID	WBSETCL	D/C	874	560
52	GMR	Angul	T1	31	ACSR Twin Moose	GMR	GMR	POWERGRID	D/C	874	560
53	GMR	Angul	T2	31	ACSR Twin Moose	GMR	GMR	POWERGRID	D/C	874	560
54	Indravati	Indravati	T1	3.7	ACSR Twin Moose	OPTCL	OHPC	POWERGRID	D/C	874	560
55	Meramundali	Talcher	T1	51	ACSR Twin Moose	POWERGRID	OPTCL	POWERGRID	D/C	874	560
56	Meramundali	Talcher	T2	88.61	ACSR Twin Moose	POWERGRID	OPTCL	NTPC	D/C	874	560
57	Meramundali	Bolangir	T1	221.4	ACSR Twin Moose	POWERGRID	OPTCL	POWERGRID	D/C	874	560
58	New Dubri	Baripada	T1	190.2	ACSR Twin Moose	POWERGRID	OPTCL	POWERGRID	D/C	874	560
59	New Dubri	Pandiabili	T1	142	ACSR Twin Moose	POWERGRID	OPTCL	POWERGRID	D/C	874	560
60	Sterlite	Jharsuguda	T1	45.1	ACSR Twin Moose	OPTCL	OPTCL	POWERGRID	D/C	874	560
61	Sterlite	Jharsuguda	T2	45.1	ACSR Twin Moose	OPTCL	OPTCL	POWERGRID	D/C	874	560
62	Rourkella	Talcher	T1	171	ACSR Twin Moose	POWERGRID	POWERGRID	NTPC	D/C	874	560
63	Rourkella	Talcher	T2	171	ACSR Twin Moose	POWERGRID	POWERGRID	NTPC	D/C	874	560
64	Talcher	Rengali	T1	24	ACSR Twin Moose	POWERGRID	NTPC	POWERGRID	D/C	874	560
65	Talcher	Rengali	T2	24	ACSR Twin Moose	POWERGRID	NTPC	POWERGRID	D/C	874	560
66	Baripada	Kharagpur	T1	98.6	ACSR Twin Moose	WBSETCL & OPTCL	POWERGRID	WBSETCL	D/C	874	560

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
67	Angul	Jitpl	T1	80	ACSR Twin Moose	JINDAL	POWERGRID	JINDAL	D/C	874	560
68	Angul	Jitpl	T2	80	ACSR Twin Moose	JINDAL	POWERGRID	JINDAL	D/C	874	560
69	Jharsuguda	Ind Bharat	T1	64	ACSR Twin Moose	IBEUL	POWERGRID	IBEUL	D/C	874	560
70	Jharsuguda	Ind Bharat	T2	64	ACSR Twin Moose	IBEUL	POWERGRID	IBEUL	D/C	874	560
71	Jharsuguda	OPGC	S1	51.3	Tripple Snowbird	OGPTL	POWERGRID	OPGC	D/C	1320	610
72	Jharsuguda	OPGC	S2	51.3	Tripple Snowbird	OGPTL	POWERGRID	OPGC	D/C	1320	610
73	Sagardighi	Subhasgram	T1	246	ACSR Twin Moose	POWERGRID	WBPDCL	POWERGRID	D/C	874	560
74	Jeerat	Rajarhat	T1	41	ACSR Twin Moose	POWERGRID	WBSETCL	POWERGRID	D/C	874	560
75	Sagardighi	Farakka	T1	55	ACSR Twin Moose	POWERGRID	WBPDCL	NTPC	D/C	874	560
76	Sagardighi	Farakka	T2	76	ACSR Twin Moose	POWERGRID	WBPDCL	NTPC	D/C	874	560
77	Sagardighi	Durgapur B	T1	127	ACSR Twin Moose	WBSETCL	WBPDCL	POWERGRID	D/C	874	560
78	Sagardighi	Durgapur B	T2	127	ACSR Twin Moose	WBSETCL	WBPDCL	POWERGRID	D/C	874	560
79	Sagardighi	Baharampur	E1	30	Twin HTLS	POWERGRID	WBPDCL	POWERGRID	D/C	1749	560
80	Sagardighi	Baharampur	E2	30	Twin HTLS	POWERGRID	WBPDCL	POWERGRID	D/C	1749	560
81	Bidhannagar	Durgapur B	T1	11	ACSR Twin Moose	WBSETCL	WBSETCL	POWERGRID	D/C	874	560
82	Bidhannagar	Durgapur B	T2	11	ACSR Twin Moose	WBSETCL	WBSETCL	POWERGRID	D/C	874	560
83	Farakka	Durgapur B	T1	146	ACSR Twin Moose	POWERGRID	NTPC	POWERGRID	D/C	874	560
84	Farakka	Malda	E1	40	Twin HTLS	POWERGRID	NTPC	POWERGRID	D/C	1749	560
85	Farakka	Malda	E2	40	Twin HTLS	POWERGRID	NTPC	POWERGRID	D/C	1749	560
86	Farakka	Baharampur	E1	82.34	Twin HTLS	POWERGRID	NTPC	POWERGRID	D/C	1749	560
87	Farakka	Baharampur	E2	82.34	Twin HTLS	POWERGRID	NTPC	POWERGRID	D/C	1749	560
88	Farakka	Gokarna	S1	119.7	Tripple Snowbird	POWERGRID	NTPC	WBSETCL	D/C	1320	610
89	PURNEA(PG)	Gokarna	S1	250	Tripple Snowbird	POWERGRID	POWERGRID	WBSETCL	D/C	1320	610
90	Farakka	PURNEA(PG)	S1	171	Tripple Snowbird	POWERGRID	NTPC	WBSETCL	D/C	1320	610
91	Farakka	Durgapur A	T2	150	ACSR Twin Moose	POWERGRID	NTPC	POWERGRID	D/C	874	560
92	Haldia	Subhasgram	T1	89	ACSR Twin Moose	HEL	HEL	POWERGRID	D/C	874	560
93	Haldia	Subhasgram	T2	89	ACSR Twin Moose	HEL	HEL	POWERGRID	D/C	874	560
94	Teesta V	Rangpo	T1	11.6	ACSR Twin Moose	POWERGRID	NHPC	POWERGRID	D/C	874	560
95	Teesta V	Rangpo	T2	11.6	ACSR Twin Moose	POWERGRID	NHPC	POWERGRID	D/C	874	560
96	Rangpo	Dikchu	Q1	32.4	ACSR Quad Moose	POWERGRID+DIKCHU+TVPTL	POWERGRID	Greenko	D/C	1749	681
97	Dikchu	Teesta III	Q1	15.1	ACSR Quad Moose	DIKCHU+TVPTL	Greenko	TUL	D/C	1749	681
98	KISHANGANJ	DARBHANGA	Q1	209	QUAD-MOOSE	ATL	POWERGRID	DMTCL	D/C	1749	681
99	KISHANGANJ	DARBHANGA	Q2	209	QUAD-MOOSE	ATL	POWERGRID	DMTCL	D/C	1749	681
100	Sitamarhi	Darbhanga(DMTCL)	S1	80	Tripple Snowbird	PMTL	POWERGRID	DMTCL	D/C	1320	610
101	Sitamarhi	Darbhanga(DMTCL)	S2	80	Tripple Snowbird	PMTL	POWERGRID	DMTCL	D/C	1320	610
102	Sitamarhi	Motihari(DMTCL)	S1	80	Tripple Snowbird	PMTL	POWERGRID	DMTCL	D/C	1320	610
103	Sitamarhi	Motihari(DMTCL)	S2	80	Tripple Snowbird	PMTL	POWERGRID	DMTCL	D/C	1320	610
104	Medinipur	Kharagpur	T1	115.15	ACSR Twin Moose	PMJTL/WBSETCL	POWERGRID	WBSETCL	D/C	874	560

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
105	Medinipur	Kharagpur	T2	115.15	ACSR Twin Moose	PMJTL/WBSETCL	POWERGRID	WBSETCL	D/C	874	560
106	Medinipur	New Chanditala	T1	96.11	ACSR Twin Moose	PMJTL/WBSETCL	POWERGRID	WBSETCL	D/C	874	560
107	Medinipur	New Chanditala	T2	96.11	ACSR Twin Moose	PMJTL/WBSETCL	POWERGRID	WBSETCL	D/C	874	560
220 kV											
Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	Begusarai	New Purnea	1	189	Zebra	BSPTCL	BSPTCL	POWERGRID	D/C	213	131
2	Begusarai	New Purnea	2	189	Zebra	BSPTCL	BSPTCL	POWERGRID	D/C	213	131
3	Biharsharif(B)	Biharsharif (PG)	1	1.67	Zebra	BSPTCL	BSPTCL	POWERGRID	S/C	213	131
4	Biharsharif(B)	Biharsharif (PG)	2	1.67	Zebra	BSPTCL	BSPTCL	POWERGRID	S/C	213	131
5	Biharsharif(B)	Biharsharif (PG)	3	1.67	Zebra	BSPTCL	BSPTCL	POWERGRID	S/C	213	131
6	Biharsharif(B)	Tenughat	1	180	Moose	BSPHCL & JUSNL	BSPTCL	TVNL	S/C	213	131
7	Dehri	Pusauli	1	65	Zebra	BSPHCL	BSPTCL	POWERGRID	S/C	213	131
8	Dehri	Gaya	1	95	Zebra	BSPHCL & PG	BSPTCL	POWERGRID	D/C	213	131
9	Dehri	Gaya	2	95	Zebra	BSPHCL & PG	BSPTCL	POWERGRID	D/C	213	131
10	Darbhanga	DMTCL (Darbhanga)	1	2.92	Zebra	BSPTCL	BSPTCL	DMTCL	D/C	213	131
11	Darbhanga	DMTCL (Darbhanga)	1	2.92	Zebra	BSPTCL	BSPTCL	DMTCL	D/C	213	131
11	DMTCL (Darbhanga)	Samastipur (Ujiyrpur)	2	50	Zebra	BSPTCL	DMTCL	BSPTCL	D/C	213	131
12	DMTCL (Darbhanga)	Motipur	1	109	Zebra	BSPTCL	DMTCL	BSPTCL	D/C	213	131
13	DMTCL (Darbhanga)	Motipur	2	109	Zebra	BSPTCL	DMTCL	BSPTCL	D/C	213	131
14	DMTCL (Darbhanga)	Laukahi	1	88.8	Zebra	BSPTCL	DMTCL	BSPTCL	D/C	213	131
15	DMTCL (Darbhanga)	Laukahi	2	88.8	Zebra	BSPTCL	DMTCL	BSPTCL	D/C	213	131
16	Fatuha	Patna	1	26	Zebra	BSPTCL	BSPTCL	POWERGRID	S/C	213	131
17	New Purnea	Madhepura	1	100	Zebra	BSPTCL	POWERGRID	BSPTCL	D/C	213	131
18	New Purnea	Madhepura	2	100	Zebra	BSPTCL	POWERGRID	BSPTCL	D/C	213	131
19	Muzzafarpur	Hazipur	1	51	Zebra	BSPTCL	POWERGRID	BSPTCL	D/C	213	131
20	Muzzafarpur	Hazipur	2	51	Zebra	BSPTCL	POWERGRID	BSPTCL	D/C	213	131
21	Muzzafarpur	MTPS	1	17	Zebra	POWERLINKS	POWERGRID	BSPTCL	D/C	213	131
22	Muzzafarpur	MTPS	2	17	Zebra	POWERLINKS	POWERGRID	BSPTCL	D/C	213	131
23	Arrah	Khagaul	1	48.3	Zebra	POWERGRID	POWERGRID	BSPTCL	D/C	213	131
24	Arrah	Khagaul	2	48.3	Zebra	POWERGRID	POWERGRID	BSPTCL	D/C	213	131
25	Arrah	Pusauli New	1	112	Zebra	POWERGRID	POWERGRID	BSPTCL	D/C	213	131
26	Pusauli	Pusauli New	1	6.5	Zebra	POWERGRID	POWERGRID	BSPTCL	D/C	213	131

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
27	Gaya	Sonenagr New	1	91.59	Zebra	BSPTCL	POWERGRID	BSPTCL	D/C	213	131
28	Gaya	Sonenagr New	2	91.59	Zebra	BSPTCL	POWERGRID	BSPTCL	D/C	213	131
29	Gaya	Khizisarai GIS	1	51.69	Zebra	BSPHCL & PG	POWERGRID	BSPTCL	D/C	213	131
30	Gaya	Khizisarai GIS	2	51.69	Zebra	BSPHCL & PG	POWERGRID	BSPTCL	D/C	213	131
31	Patna	Khagaul	1	40	Zebra	BSPHCL	POWERGRID	BSPTCL	D/C	213	131
32	Patna	Khagaul	2	25.5	Zebra	BSPHCL	POWERGRID	BSPTCL	D/C	213	131
33	Patna	Khagaul	3	25.5	Zebra	BSPHCL	POWERGRID	BSPTCL	D/C	213	131
34	Patna	Sipara	1	0.45	Zebra	BSPHCL	POWERGRID	BSPTCL	D/C	213	131
35	Patna	Sipara	2	0.45	Zebra	BSPHCL	POWERGRID	BSPTCL	D/C	213	131
36	Patna	Sipara	3	0.25	Zebra	BSPHCL	POWERGRID	BSPTCL	D/C	213	131
37	Kishanganj (B)	Kishanganj (PG)	1	4.49	Zebra	POWERGRID	BSPTCL	POWERGRID	D/C	213	131
38	Kishanganj (B)	Kishanganj (PG)	2	4.24	Zebra	POWERGRID	BSPTCL	POWERGRID	D/C	213	131
39	Kishanganj (B)	Kishanganj (PG)	3	4.49	Zebra	POWERGRID	BSPTCL	POWERGRID	D/C	213	131
40	Kishanganj (B)	Kishanganj (PG)	4	4.24	Zebra	POWERGRID	BSPTCL	POWERGRID	D/C	213	131
41	Chandil	Ranchi	1	78.4	Zebra	JUSNL	JUSNL	POWERGRID	D/C	213	131
42	Chandil	Santaldhi	1	98	Zebra	WBSETCL & JUSNL	JUSNL	WBPDCL	D/C	213	131
43	Ramchandrapur	Joda	1	130	Zebra	OPTCL & JUSNL	JUSNL	OPTCL	D/C	213	131
44	Lalmatia	Farakka	1	79	Zebra	ECL	JUSNL	NTPC	D/C	213	131
45	Hatia	Ranchi	1	40.1	Zebra	JUSNL	JUSNL	POWERGRID	D/C	213	131
46	Hatia	Ranchi	2	35	Zebra	JUSNL	JUSNL	POWERGRID	D/C	213	131
47	Hatia	Ranchi	3	40.1	Zebra	JUSNL	JUSNL	POWERGRID	D/C	213	131
48	Dumka New	Maithon	1	73.2	Zebra	JUSNL	JUSNL	POWERGRID	D/C	213	131
49	Dumka New	Maithon	2	73.2	Zebra	JUSNL	JUSNL	POWERGRID	D/C	213	131
50	Chaibasa (PG)	Chaibasa New(J)	1	0.7	Zebra	JUSNL	POWERGRID	JUSNL	D/C	213	131
51	Chaibasa (PG)	Chaibasa New(J)	2	0.7	Zebra	JUSNL	POWERGRID	JUSNL	D/C	213	131
52	Waria	Bidhannagar	1	17.2	Zebra	DVC & WBSETCL	DVC	WBSETCL	D/C	213	131
53	Waria	Bidhannagar	2	17.2	Zebra	DVC & WBSETCL	DVC	WBSETCL	D/C	213	131
54	Paruliad	Parulia	1	1	Zebra	DVC	DVC	POWERGRID	D/C	213	131
55	Paruliad	Parulia	2	1	Zebra	DVC	DVC	POWERGRID	D/C	213	131
56	Kalyaneswari	Maithon	1	7.6	Zebra	DVC	DVC	POWERGRID	D/C	213	131
57	Kalyaneswari	Maithon	2	7.6	Zebra	DVC	DVC	POWERGRID	D/C	213	131
58	Dhanbad	Maithon	1	51.8	Zebra	DVC	DVC	POWERGRID	D/C	213	131
59	Dhanbad	Maithon	2	51.8	Zebra	DVC	DVC	POWERGRID	D/C	213	131
60	Jeynagar	Jeypur	1	7.7	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
61	Jeynagar	Jeypur	2	7.7	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
62	TTPS	TSTPP	1	34.5	Zebra	OPTCL	OPTCL	NTPC	S/C	213	131
63	Tarkera	Rourkella	1	15.3	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
64	Tarkera	Rourkella	2	15.3	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
65	Rengali	Rengali Pg	1	1	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
66	Rengali	Rengali Pg	2	1	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
67	Balasor	Baripada	1	74.2	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
68	Balasor	Baripada	2	74.2	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
69	Katapalli	Bolangir	1	116.7	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
70	Bolangir	New Bolangir	1	2.8	Zebra	OPTCL	POWERGRID	OPTCL	D/C	213	131
71	Keonjhar_Op	Keonjhar	1	7.48	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
72	Keonjhar_Op	Keonjhar	2	7.48	Zebra	OPTCL	OPTCL	POWERGRID	D/C	213	131
73	Pandiabili	Atri	1	45	Zebra	OPTCL	POWERGRID	OPTCL	D/C	213	131
74	Pandiabili	Atri	2	45	Zebra	OPTCL	POWERGRID	OPTCL	D/C	213	131
75	Pandiabili	Samangara (Puri)	1	45	Zebra	OPTCL	POWERGRID	OPTCL	D/C	213	131
76	Pandiabili	Samangara (Puri)	2	45	Zebra	OPTCL	POWERGRID	OPTCL	D/C	213	131
77	Dalkhola_WB	Dalkola	1	1.1	Zebra	POWERGRID	WBSETCL	POWERGRID	D/C	213	131
78	Dalkhola_WB	Dalkola	2	1.1	Zebra	POWERGRID	WBSETCL	POWERGRID	D/C	213	131
79	Subhasgram	Subhasgram (PG)	T1	1	Zebra	WBSETCL	WBSETCL	POWERGRID	D/C	213	131
80	Subhasgram	Subhasgram (PG)	T2	1	Zebra	WBSETCL	WBSETCL	POWERGRID	D/C	213	131
81	NJP(W)	Binaguri	1	0.1	Zebra	POWERGRID	WBSETCL	POWERGRID	D/C	213	131
82	NJP(W)	Binaguri	2	0.1	Zebra	POWERGRID	WBSETCL	POWERGRID	D/C	213	131
83	CLC	Subhasgram (PG)	1	19	Zebra	WBSETCL	WBSETCL	POWERGRID	D/C	213	131
84	New Town AA-III	Subhasgram (PG)	1	22.5	Zebra	WBSETCL	WBSETCL	POWERGRID	D/C	213	131
85	New Town AA-III	Rajarhat	1	7.5	Zebra	WBSETCL	WBSETCL	POWERGRID	D/C	213	131
86	New Town AA-III	Rajarhat	2	7.5	Zebra	WBSETCL	WBSETCL	POWERGRID	D/C	213	131
87	Subhasgram (PG)	EMSS (CESC)	1	23	HTLS	CESC	POWERGRID	CESC	D/C	540	131
88	Subhasgram (PG)	EMSS (CESC)	2	23	HTLS	CESC	POWERGRID	CESC	D/C	540	131
89	Alipuduar (WB)	Alipurduar (PG)	T1	6.34	Zebra	POWERGRID	WBSETCL	POWERGRID	D/C	213	131
90	Alipuduar (WB)	Alipurduar (PG)	T2	6.34	Zebra	POWERGRID	WBSETCL	POWERGRID	D/C	213	131
91	Rangpo	Tasiding	1	46.1	Zebra	POWERGRID + SIKKIM	POWERGRID	Dans Energy	D/C	213	131
92	New Melli	Jorthang	1	21	Zebra	DANS	POWERGRID	Dans Energy	D/C	213	131
93	New Melli	Jorthang	2	21	Zebra	DANS	POWERGRID	Dans Energy	D/C	213	131
94	New Melli	Tasiding	1	18.1	Zebra	POWERGRID + SIKKIM	POWERGRID	Dans Energy	D/C	213	131
95	Dalkhola	Gazole	1	98.31	ZEBRA	POWERGRID	POWERGRID	WBSETCL	D/C	213	131
96	Dalkhola	Gazole	2	98.31	ZEBRA	POWERGRID	POWERGRID	WBSETCL	D/C	213	131
97	Malda	Gazole	1	18.14	ZEBRA	POWERGRID	POWERGRID	WBSETCL	D/C	213	131
98	Malda	Gazole	2	18.14	ZEBRA	POWERGRID	POWERGRID	WBSETCL	D/C	213	131
99	Sasaram	Nadokhar	1	6.98	ZEBRA	POWERGRID	POWERGRID	BSPTCL	D/C	213	131
100	Sasaram	Nadokhar	2	6.98	ZEBRA	POWERGRID	POWERGRID	BSPTCL	D/C	213	131
101	Arrah	Nadokhar	1	112	ZEBRA	POWERGRID	POWERGRID	BSPTCL	D/C	213	131
102	Arrah	Nadokhar	2	112	ZEBRA	POWERGRID	POWERGRID	BSPTCL	D/C	213	131
103	Sitamarhi	Motipur	2	52.1	Zebra	BSPTCL	POWERGRID	BSPTCL	D/C	213	131

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
104	Rangpo	Rongnichu	1	7.26	ACSR Zebra	MBPCL	POWERGRID	MBPCL	D/C	213	131
105	Rangpo	Rongnichu	1	7.26	ACSR Zebra	MBPCL	POWERGRID	MBPCL	D/C	213	131

132 kV

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	Barhi	B'Shariff	1	170	Panther	BSPTCL & DVC	DVC	BSPTCL	S/C	84	48
2	Barhi	Rajgir	1	125	Panther	BSPTCL & DVC	DVC	BSPTCL	S/C	84	48
3	Kahalgaon	Kahalgaon	1	2	Panther	BSPTCL	BSPTCL	NTPC	S/C	84	48
4	Arrah	Arrah	1	3	Panther	POWERGRID+BSPTCL	BSPTCL	POWERGRID	S/C	84	48
5	Dumraon	Arrah	1	61	Panther	POWERGRID+BSPTCL	BSPTCL	POWERGRID	S/C	84	48
6	Purnea	Purnea(Pg)	1	1	Panther	BSPTCL	BSPTCL	POWERGRID	S/C	84	48
7	Purnea	Purnea(Pg)	1	1	Panther	BSPTCL	BSPTCL	POWERGRID	S/C	84	48
8	Purnea	Purnea(Pg)	1	1	Panther	BSPTCL	BSPTCL	POWERGRID	S/C	84	48
9	Purnea(Pg)	Kisanganj	1	70	Panther	BSPTCL	POWERGRID	BSPTCL	S/C	84	48
10	Khudra	Pusuali	1	15	Panther	BSPTCL	BSPTCL	POWERGRID	S/C	84	48
11	Mohania	Pusuali	1	16	Panther	BSPTCL	BSPTCL	POWERGRID	S/C	84	48
12	Karmanasa	Sahupuri	1	27	Panther	BSPTCL & UPPCL	BSPTCL	UPPCL	S/C	84	48
13	Karmanasa	Chandauli	1	25	Panther	BSPTCL & UPPCL	BSPTCL	UPPCL	S/C	84	48
14	Sonenagar	Rihand	1	139	Panther	BSPTCL & UPPCL	BSPTCL	UPPCL	S/C	84	48
15	Lakhisarai	Jamaui	1	25	Panther	BSPTCL	POWERGRID	BSPTCL	D/C	84	48
16	Lakhisarai	Jamaui	2	25	Panther	BSPTCL	POWERGRID	BSPTCL	D/C	84	48
17	Banka	Sultangunj	1	46.5	Panther	BSPTCL	POWERGRID	BSPTCL	D/C	84	48
18	Banka	Sultangunj	2	46.5	Panther	BSPTCL	POWERGRID	BSPTCL	D/C	84	48
19	Motihari(Dmtcl)	Motihari(B)	1	39	Panther	BSPTCL	DMTCL	BSPTCL	D/C	84	48
20	Motihari(Dmtcl)	Motihari(B)	2	39	Panther	BSPTCL	DMTCL	BSPTCL	D/C	84	48
21	Motihari(Dmtcl)	Bethia(B)	1	39	Panther	BSPTCL	DMTCL	BSPTCL	D/C	84	48
22	Motihari(Dmtcl)	Bethia(B)	2	39	Panther	BSPTCL	DMTCL	BSPTCL	D/C	84	48
23	Motihari(Dmtcl)	Raxaul(B)	1	59	Panther	BSPTCL	DMTCL	BSPTCL	D/C	84	48
24	Motihari(Dmtcl)	Raxaul(B)	2	59	Panther	BSPTCL	DMTCL	BSPTCL	D/C	84	48
25	Daltonganj	Daltonganj (Pg)	1	20	Panther	JUSNL	JUSNL	POWERGRID	D/C	84	48
26	Daltonganj	Daltonganj (Pg)	2	20	Panther	JUSNL	JUSNL	POWERGRID	D/C	84	48
27	Maithon	Jamtara	1	100	Panther	DVC & JUSNL	DVC	JUSNL	S/C	84	48
28	Pataratu(Dvc)	Patratu(Jharkahnd)	1	1	Panther	DVC & JUSNL	DVC	JUSNL	D/C	84	48
29	Pataratu(Dvc)	Patratu(Jharkahnd)	2	1	Panther	DVC & JUSNL	DVC	JUSNL	D/C	84	48
30	Kharagpur(Dvc)	Kharagpur(Wb)	1	Bus Extention	Panther	DVC	DVC	WBSETCL	S/C	84	48

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
31	Kolaghat(Dvc)	Kolaghat(Wb)	2	Bus Extention	Panther	DVC	DVC	WBSETCL	S/C	84	48
32	Joda	Kendposi	1	48	Panther	OPTCL & JUSNL	OPTCL	JUSNL	S/C	84	48
33	Baripada	Bangiriposi	1	31.2	Panther	OPTCL	POWERGRID	OPTCL	S/C	84	48
34	Baripada	Baripada	1	11	Panther	OPTCL	POWERGRID	OPTCL	S/C	84	48
35	Bhograi	Baripda	1	112	Panther	OPTCL	OPTCL	POWERGRID	S/C	84	48
36	Jaleswr	Baripda	1	88	Panther	OPTCL	OPTCL	POWERGRID	S/C	84	48
37	Japla	Sonenagar	1	49.5	Panther	BSPTCL & JUSNL	JUSNL	BSPTCL	S/C	84	48
38	Lalmatia	Sabour	1	72	Panther	BSPTCL & JUSNL	JUSNL	BSPTCL	S/C	84	48
39	Chandil	Manique	1	1	Panther	JUSNL & DVC	JUSNL	DVC	D/C	84	48
40	Chandil	Manique	2	1	Panther	JUSNL & DVC	JUSNL	DVC	D/C	84	48
41	Patratu	Patratu	1	3	Panther	JUSNL & DVC	JUSNL	DVC	S/C	84	48
42	Garwa	Rihand	1	30	Panther	JUSNL & UPPCL	JUSNL	UPPCL	S/C	84	48
43	Rangit	Rammam	1	27	Panther	POWERGRID	NHPC	WBSETCL	S/C	84	48
44	Kahalgaon	Sabour	1	37	Panther	BSPTCL	NTPC	BSPTCL	S/C	84	48
45	Kahalgaon	Lalmatia	1	34	Panther	BSPTCL	NTPC	JUSNL	S/C	84	48
46	Birpara(Pg)	Birpara(Wb)	1	1	Panther	WBSETCL	POWERGRID	WBSETCL	D/C	84	48
47	Birpara(Pg)	Birpara(Wb)	2	1	Panther	WBSETCL	POWERGRID	WBSETCL	D/C	84	48
48	Malda(Pg)	Malda(Wb)	1	6	Panther	WBSETCL	POWERGRID	WBSETCL	D/C	84	48
49	Malda(Pg)	Malda(Wb)	2	6	Panther	WBSETCL	POWERGRID	WBSETCL	D/C	84	48
50	Siliguri(Pg)	Nbu	1	8	Panther	WBSETCL	POWERGRID	WBSETCL	S/C	84	48
51	Siliguri(Pg)	Njp	1	15	Panther	WBSETCL	POWERGRID	WBSETCL	S/C	84	48
52	Rangit	Sagbari	1	32.5	Panther	SIKKIM	NHPC	SIKKIM	S/C	84	48
53	Arha	Jagdishpur	1	30	Panther	BSPTCL	POWERGRID	BSPTCL	S/C	84	48
54	Rangit	Rangpo	1	54	Panther	POWERGRID	NHPC	POWERGRID	S/C	84	48
55	Rangit	Kurseong	1	61	Panther	POWERGRID & WBSETCL	NHPC	WBSETCL	S/C	84	48
56	Siliguri(PG)	Kurseong	1	32	Panther	POWERGRID & WBSETCL	POWERGRID	WBSETCL	S/C	84	48
57	Rangit	Sagbari	1	25	Panther	SIKKIM	NHPC	SIKKIM	S/C	84	48
58	Banka	Sabour	1	45	Panther	BSPTCL	POWERGRID	BSPTCL	D/C	84	48
59	Banka	Sabour	2	45	Panther	BSPTCL	POWERGRID	BSPTCL	D/C	84	48
60	Banka	Banka	1	11	Panther	BSPTCL	POWERGRID	BSPTCL	D/C	84	48
61	Banka	Banka	2	11	Panther	BSPTCL	POWERGRID	BSPTCL	D/C	84	48
62	Rangpo	Chujachen	1	20	Panther	GATI INFRA	POWERGRID	GATI	S/C	84	48
63	Rangpo	Chujachen	2	20	Panther	GATI INFRA	POWERGRID	GATI	S/C	84	48
64	Siliguri(Pg)	Melli	1	90	Panther	POWERGRID	POWERGRID	SIKKIM	S/C	84	48
65	Rangpo	Melli	1	17	Panther	POWERGRID	POWERGRID	SIKKIM	S/C	84	48

5.3 Other important lines

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
765 kV											
1	Jharsuguda	Angul	H1	272	Quad Bersimis	POWERGRID	POWERGRID	POWERGRID	D/C	4452	2470
2	Jharsuguda	Angul	H2	272	Quad Bersimis	POWERGRID	POWERGRID	POWERGRID	D/C	4452	2470
3	Jharsuguda	Angul	H3	295	Hexa Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	4452	2470
4	Jharsuguda	Angul	H4	295	Hexa Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	4452.063396	2470
5	Medinipur	New Ranchi	H1	269.04	Quad Bersimis	PMJTL	PMJTL	POWERGRID	D/C	4452.063396	2470
6	Medinipur	New Ranchi	H2	269.04	Quad Bersimis	PMJTL	PMJTL	POWERGRID	D/C	4452.063396	2470
400 kV											
Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	Baripada	Pandiabili	T1	302	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
2	Baripada	Pandiabili	T2	302	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
3	Lakhisarai	Biharsariff	T1	89	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
4	Lakhisarai	Biharsariff	T2	89	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
5	New Ranchi	Chandwa	Q1	68	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
6	New Ranchi	Chandwa	Q2	68	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
7	Ailpurduar	Binaguri	Q1	123.711	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
8	Ailpurduar	Binaguri	Q2	123.711	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
9	Ailpurduar	Binaguri	Q3	117.98	ACSR Quad Moose	ATL	POWERGRID	POWERGRID	D/C	1749	681
10	Ailpurduar	Binaguri	Q4	117.98	ACSR Quad Moose	ATL	POWERGRID	POWERGRID	D/C	1749	681
11	Bakreswar	Arambagh	T1	130	ACSR Twin Moose	WBSETCL	WBPDCL	WBSETCL	S/C	874	560
12	Bakreswar	Jeerat	T2	162	ACSR Twin Moose	WBSETCL	WBPDCL	WBSETCL	S/C	874	560
13	Banka	Biharsariff	T1	184	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
14	Banka	Biharsariff	T2	184	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
15	Baripada	Pandiabili	T1	301	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	S/C	874	560
16	Biharshariff	Pusauli	T1	195	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
17	Biharshariff	Pusauli	T2	195	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
18	Biharshariff	Muzaffarpur	T1	130	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
19	Biharshariff	Muzaffarpur	T2	130	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
20	Biharshariff	Purnea	Q1	231	ACSR Quad Moose	ENICL	POWERGRID	POWERGRID	D/C	1749	681

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
21	Biharshariff	Purnea	Q2	231	ACSR Quad Moose	ENICL	POWERGRID	POWERGRID	D/C	1749	681
22	Binaguri	Alipurduar	T1	217	ACSR Twin Moose	ENICL	POWERGRID(ER)	POWERGRID(ER)	D/C	874	560
23	Binaguri	Alipurduar	T2	217	ACSR Twin Moose	ENICL	POWERGRID(ER)	POWERGRID(ER)	D/C	874	560
24	Binaguri	Kishanganj	Q1	98	ACSR Quad Moose	POWERLINKS	POWERGRID	POWERGRID	D/C	1749	681
25	Binaguri	Kishanganj	Q2	98	ACSR Quad Moose	POWERLINKS	POWERGRID	POWERGRID	D/C	1749	681
26	Binaguri	Rangpo	E1	110	Twin HTLS	POWERGRID	POWERGRID	POWERGRID	D/C	2000	560
27	Binaguri	Rangpo	E2	110	Twin HTLS	POWERGRID	POWERGRID	POWERGRID	D/C	2000	560
28	Kishanganj	Rangpo	Q1	189	ACSR Quad Moose	TVPTL	POWERGRID	POWERGRID	D/C	1749	681
29	Bokaro	Koderma	T1	99	ACSR Twin Moose	POWERGRID	DVC	DVC	D/C	874	560
30	Bokaro	Koderma	T2	99	ACSR Twin Moose	POWERGRID	DVC	DVC	D/C	874	560
31	Chaibasa	Rourkela	T1	120	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
32	Chaibasa	Rourkela	T2	120	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
33	DSTPS	Raghunathpur	T1	72.5	ACSR Twin Moose	DVC	DVC	DVC	D/C	874	560
34	DSTPS	Raghunathpur	T2	72.5	ACSR Twin Moose	DVC	DVC	DVC	D/C	874	560
35	Farakka	Kahalgaon	T1	95	ACSR Twin Moose	POWERGRID	NTPC	NTPC	D/C	874	560
36	Farakka	Kahalgaon	T2	95	ACSR Twin Moose	POWERGRID	NTPC	NTPC	D/C	874	560
37	Farakka	Kahalgaon	T3	95	ACSR Twin Moose	POWERGRID	NTPC	NTPC	D/C	874	560
38	Farakka	Kahalgaon	T4	95	ACSR Twin Moose	POWERGRID	NTPC	NTPC	D/C	874	560
39	Gaya	Chandwa	Q1	117	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
40	Gaya	Chandwa	Q2	117	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
41	Indravati	Rengali	T1	356	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	S/C	874	560
42	Jamshedpur	Chaibasa	T1	82	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
43	Jamshedpur	Chaibasa	T2	82	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
44	Jamshedpur	Baripada	T1	141	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	S/C	874	560
45	Jeypore	Indravati	T1	72	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	S/C	874	560
46	Kahalgaon	Barh	Q1	217	ACSR Quad Moose	POWERGRID	NTPC	NTPC	D/C	1749	681
47	Kahalgaon	Barh	Q2	217	ACSR Quad Moose	POWERGRID	NTPC	NTPC	D/C	1749	681
48	Keonjhar	Baripada	T1	156	ACSR Twin Moose	OPTCL	POWERGRID	POWERGRID	S/C	874	560
51	Bidhannagar	New Chanditala	T1	151.87	ACSR Twin Moose	WBSETCL	WBSETCL	WBSETCL	S/C	874	560
52	Arambagh	New Chanditala	T1	59.22	ACSR Twin Moose	WBSETCL	WBSETCL	WBSETCL	S/C	874	560
53	Kolaghat TPS	Arambagh	T1	75	ACSR Twin Moose	WBSETCL	WBPDCL	WBSETCL	S/C	874	560
54	Kolaghat TPS	New Chanditala	T1	64.68	ACSR Twin Moose	WBSETCL	WBPDCL	WBSETCL	S/C	874	560
55	Kolaghat TPS	Khargpur	T1	98	ACSR Twin Moose	WBSETCL	WBPDCL	WBSETCL	S/C	874	560

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
56	Kolaghat TPS	Khargpur	T1	80	ACSR Twin Moose	WBSETCL	WBPDCL	WBSETCL	S/C	874	560
57	Maithon	Jamshedpur	T1	153	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	S/C	874	560
58	Maithon	Ranchi	T1	200	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
59	Maithon	Ranchi	T2	200	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
60	Maithon	Gaya	Q1	277	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
61	Maithon	Gaya	Q2	277	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
62	Malda	Purnea	T1	167	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
63	Malda	Purnea	T2	167	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
64	Meeramundali	New Duburi	T1	90	ACSR Twin Moose	POWERGRID	OPTCL	OPTCL	D/C	874	560
65	Meeramundali	New Duburi	T2	90	ACSR Twin Moose	POWERGRID	OPTCL	OPTCL	D/C	874	560
66	Meramundali	Mendasal	T1	99	ACSR Twin Moose	OPTCL	OPTCL	OPTCL	D/C	874	560
67	Meramundali	Mendasal	T2	99	ACSR Twin Moose	OPTCL	OPTCL	OPTCL	D/C	874	560
68	Muzaffarpur	Darbhanga	S1	62.8	TRIPLE SNOWBIRD	DMTCL	POWERGRID(ER)	DMTCL	D/C	1320	610
69	Muzaffarpur	Darbhanga	S2	62.8	TRIPLE SNOWBIRD	DMTCL	POWERGRID(ER)	DMTCL	D/C	1320	610
70	New Chanditala	Jeerat	T1	79.85	ACSR Twin Moose	WBSETCL	WBSETCL	WBSETCL	S/C	874	560
71	New PPSP	Arambagh	T1	207	ACSR Twin Moose	WBSETCL	WBSETCL	WBSETCL	D/C	874	560
72	New PPSP	Arambagh	T2	207	ACSR Twin Moose	WBSETCL	WBSETCL	WBSETCL	D/C	874	560
73	New PPSP	PPSP	T1	2	ACSR Twin Moose	WBSETCL	WBSETCL	WBSETCL	D/C	874	560
74	New PPSP	PPSP	T2	2	ACSR Twin Moose	WBSETCL	WBSETCL	WBSETCL	D/C	874	560
75	Parulia	Jamshedpur	T1	177	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	S/C	874	560
76	Patna	Kishanganj	Q1	347	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
77	Patna	Kishanganj	Q2	347	ACSR Quad Moose	POWERGRID	POWERGRID	POWERGRID	D/C	1749	681
78	PPSP	Bidhanagar	T1	185	ACSR Twin Moose	WBSETCL	WBPDCL	WBSETCL	D/C	874	560
79	PPSP	Bidhanagar	T2	185	ACSR Twin Moose	WBSETCL	WBPDCL	WBSETCL	D/C	874	560
80	Purnea	Binaguri	E1	168	Twin HTLS	POWERGRID	POWERGRID	POWERGRID	D/C	1749	560
81	Purnea	Binaguri	E2	168	Twin HTLS	POWERGRID	POWERGRID	POWERGRID	D/C	1749	560
82	Purnea	Muzaffarpur	Q1	240	ACSR Twin Moose	POWERLINKS	POWERGRID	POWERGRID	D/C	1749	681
83	Purnea	Muzaffarpur	Q2	240	ACSR Twin Moose	POWERLINKS	POWERGRID	POWERGRID	D/C	1749	681
84	Purnea	Kishanganj	Q1	71	ACSR Twin Moose	POWERLINKS	POWERGRID	POWERGRID	D/C	1749	681
85	Purnea	Kishanganj	Q2	71	ACSR Twin Moose	POWERLINKS	POWERGRID	POWERGRID	D/C	1749	681
86	Ranchi	Ranchi New	Q1	77	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	Q/C	1749	681
87	Ranchi	Ranchi New	Q2	77	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	Q/C	1749	681
88	Ranchi	Ranchi New	Q3	79	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	Q/C	1749	681
89	Ranchi	Ranchi New	Q4	79	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	Q/C	1749	681

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
90	Ranchi	Rourkela	T1	143	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
91	Ranchi	Rourkela	T2	143	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
92	Rengali	Keonjhar	T1	100	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	S/C	874	560
93	Rourkela	Jharsuguda	T1	143	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
94	Rourkela	Jharsuguda	T2	143	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
95	Rourkela	Jharsuguda	T3	130.6	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
96	Rourkela	Jharsuguda	T4	124.4	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
97	Sasaram	Daltonganj	T1	196.19	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
98	Sasaram	Daltonganj	T2	196.19	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
99	SEL	Lapanga	T1	18.6	ACSR Twin Moose	OPTCL	SEL	OPTCL	D/C	874	560
100	SEL	Lapanga	T2	18.6	ACSR Twin Moose	OPTCL	SEL	OPTCL	D/C	874	560
101	Meeramandali	Lapanga	T1	214.8	ACSR Twin Moose	OPTCL	OPTCL	OPTCL	D/C	874	560
102	Meeramandali	Lapanga	T2	214.8	ACSR Twin Moose	OPTCL	OPTCL	OPTCL	D/C	874	560
103	OPGC	Lapanga	A1	24.5	AAAC Twin Moose	OPTCL	OPTCL	OPTCL	D/C	1406	524
104	OPGC	Lapanga	A2	24.5	AAAC Twin Moose	OPTCL	OPTCL	OPTCL	D/C	1406	524
105	Rajarhat	Subhasgram	T1	34	ACSR Twin Moose	POWERGRID	POWERGRID	POWERGRID	D/C	874	560
106	New Duburi	TSL Kalinganagar	T1	8.65	ACSR Twin Moose	OPTCL	OPTCL	OPTCL	D/C	874	560
107	New Duburi	TSL Kalinganagar	T2	8.65	ACSR Twin Moose	OPTCL	OPTCL	OPTCL	D/C	874	560

220 kV

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	Alipurduar	Birpara	1	57.486	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
2	Alipurduar	Birpara	2	57.486	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
3	Arambagh	Domjur	1	57	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
4	Arambagh	Domjur	2	57	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
5	Arambagh	Midnapore	1	71	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
6	Arambagh	Midnapore	2	71	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
7	Arambagh	Rishra	1	73	Zebra	WBSETCL	WBSETCL	WBSETCL	S/C	213	131
8	Arambagh	N.Bishnupur	1	55	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
9	Arambagh	N.Bishnupur	2	55	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
10	Bakreswar	Sadaipur	1	20.5	Zebra	WBSETCL	WBPDCL	WBSETCL	D/C	213	131
11	Bakreswar	Sadaipur	2	20.5	Zebra	WBSETCL	WBPDCL	WBSETCL	D/C	213	131
12	Balimela	Jeynagar	1	93	Zebra	OPTCL	OHPC	OPTCL	T/C	213	131
13	Balimela	Jeynagar	2	93	Zebra	OPTCL	OHPC	OPTCL	T/C	213	131
14	Balimela	Jeynagar	3	93	Zebra	OPTCL	OHPC	OPTCL	T/C	213	131
15	Barasat	Kasba	1	23	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
16	Barasat	Kasba	2	23	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
17	Bidhannagar	Bakreswar	1	47	Zebra	WBSETCL	WBSETCL	WBPDCL	D/C	213	131
18	Bidhannagar	Bakreswar	2	47	Zebra	WBSETCL	WBSETCL	WBPDCL	D/C	213	131
19	Bidhannagar	DPL	1	5	Zebra	WBSETCL	WBSETCL	DPL	D/C	213	131
20	Bidhannagar	DPL	2	5	Zebra	WBSETCL	WBSETCL	DPL	D/C	213	131
21	Biharshariff	Begusarai	1	75	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
22	Biharshariff	Begusarai	2	75	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
23	Biharshariff	Bodhagya	1	85	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
24	Biharshariff	Bodhagya	2	85	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
25	Biharshariff	Fatuah	1	40	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
26	Biharshariff	Fatuah	2	40	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
27	Binaguri	Siliguri	1	8	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
28	Binaguri	Siliguri	2	8	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
31	Birpara	Binaguri	1	80	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
32	Birpara	Binaguri	2	80	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
34	Bishnupur	Santaldih	1	92	Zebra	WBSETCL	WBSETCL	WBPDCL	D/C	213	131
35	Bishnupur	Santaldih	2	92	Zebra	WBSETCL	WBSETCL	WBPDCL	D/C	213	131
36	Bokaro	Chandrapura TPS B	1	42	Zebra	DVC	DVC	DVC	D/C	213	131
37	Bokaro	Chandrapura TPS B	2	42	Zebra	DVC	DVC	DVC	D/C	213	131
38	Bokaro	Jamshedpur	1	150	Zebra	DVC	DVC	DVC	D/C	213	131
39	Bokaro	Jamshedpur	2	150	Zebra	DVC	DVC	DVC	D/C	213	131
40	Bokaro	Ramgarh	1	55	Zebra	DVC	DVC	DVC	D/C	213	131
41	Bokaro	Ramgarh	2	55	Zebra	DVC	DVC	DVC	D/C	213	131
42	Burnpur	Mejia	1	70	Zebra	DVC	DVC	DVC	S/C	213	131
43	Chandil	Ramchandrapur	1	30	Zebra	JUSNL	JUSNL	JUSNL	S/C	213	131
44	Ctps A	Dhanbad	1	63	Zebra	DVC	DVC	DVC	S/C	213	131
45	Ctps B	Dhanbad	2	63	Zebra	DVC	DVC	DVC	S/C	213	131
46	Dalkhola	Kishanganj	1	30	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
47	Dalkhola	Kishanganj	2	30	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
48	Dalkhola	Purnea	1	41	Zebra	POWERGRID	WBSETCL	WBSETCL	D/C	213	131
49	Dalkhola	Purnea	2	41	Zebra	POWERGRID	WBSETCL	WBSETCL	D/C	213	131
50	Dhanbad	Giridih	1	44	Zebra	DVC	DVC	DVC	D/C	213	131
51	Dhanbad	Giridih	2	44	Zebra	DVC	DVC	DVC	D/C	213	131
52	Dharampur	Rishra	1	25	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
53	Dharampur	Rishra	2	25	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
54	Farakka	Lalmatia	1	79	Zebra	ECL	NTPC	NTPC	S/C	213	131
55	Gokarno	Krishnanagar	1	105	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
56	Gokarno	Krishnanagar	2	105	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
57	Gokarno	Sagardighi	1	39	Zebra	WBSETCL	WBSETCL	WBPDCL	D/C	213	131
58	Gokarno	Sagardighi	2	39	Zebra	WBSETCL	WBSETCL	WBPDCL	D/C	213	131

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
59	IBTPS	Budhipadar	1	25	Zebra	OPTCL	OPGC	OPTCL	Q/C	213	131
60	IBTPS	Budhipadar	2	25	Zebra	OPTCL	OPGC	OPTCL	Q/C	213	131
61	IBTPS	Budhipadar	3	25	Zebra	OPTCL	OPGC	OPTCL	Q/C	213	131
62	IBTPS	Budhipadar	4	25	Zebra	OPTCL	OPGC	OPTCL	Q/C	213	131
63	Jayanagar	Laxmipur	1	81	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
64	Jayanagar	Laxmipur	2	81	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
65	Jeerat	Dharampur	1	30	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
66	Jeerat	Dharampur	2	30	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
67	Jeerat	Barasat	1	42	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
68	Jeerat	Barasat	2	42	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
69	Jeerat	Newtown	1	80	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
70	Jeerat	Newtown	2	80	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
71	Jeyanagar	U.Kolab	1	6	Zebra	OPTCL	OPTCL	OHPC	D/C	213	131
72	Jeyanagar	U.Kolab	2	6	Zebra	OPTCL	OPTCL	OHPC	D/C	213	131
73	Kalyaneshwari	Burnpur	1	18	Zebra	DVC	DVC	DVC	S/C	213	131
74	Kalyaneshwari	Mejia	1	55	Zebra	DVC	DVC	DVC	T/C	213	131
75	Kalyaneshwari	Mejia	2	55	Zebra	DVC	DVC	DVC	T/C	213	131
76	Kalyaneshwari	Mejia	3	55	Zebra	DVC	DVC	DVC	T/C	213	131
77	Kasba	EM bypass	1	1	Single Core XLPE	CESC	WBSETCL	CESC	S/C	213	131
78	Kasba	Subhasgram(Wb)	1	20	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
79	Kasba	Subhasgram(Wb)	2	20	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
80	Katapalli	Budhipadar	1	61	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
81	Katapalli	Budhipadar	2	61	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
82	Kharagpur	Midnapore	1	46	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
83	Kharagpur	Midnapore	2	46	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
84	Kolaghat TPS	Howrah	1	71	Zebra	WBSETCL	WBPDCL	WBSETCL	D/C	213	131
85	Kolaghat TPS	Howrah	2	71	Zebra	WBSETCL	WBPDCL	WBSETCL	D/C	213	131
86	Mejia	Barjora	1	16	Zebra	DVC	DVC	DVC	D/C	213	131
87	Mejia	Barjora	2	16	Zebra	DVC	DVC	DVC	D/C	213	131
88	Mejia	Muchipara	1	31	Zebra	DVC	DVC	DVC	D/C	213	131
89	Mejia	Muchipara	2	31	Zebra	DVC	DVC	DVC	D/C	213	131
90	Mendhasal	Chandaka	1	20	Zebra	OPTCL	OPTCL	OPTCL	Q/C	213	131
91	Mendhasal	Chandaka	2	20	Zebra	OPTCL	OPTCL	OPTCL	Q/C	213	131
92	Mendhasal	Narendrapur	1	174	Zebra	OPTCL	OPTCL	OPTCL	S/C	213	131
93	Mendhasal	Nayagarh	1	65	Zebra	OPTCL	OPTCL	OPTCL	S/C	213	131
94	Mendhasal	Bhanjnagar	1	135	Zebra	OPTCL	OPTCL	OPTCL	S/C	213	131
95	Meramandali	NALCO	1	10	Zebra	OPTCL	OPTCL	NALCO	D/C	213	131
96	Meramandali	NALCO	2	10	Zebra	OPTCL	OPTCL	NALCO	D/C	213	131
97	Meramundali	Bhanjnagar	1	134	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
98	Meramundali	Narsinghpur	1	56	Zebra	OPTCL	OPTCL	OPTCL	S/C	213	131
100	Meramundali	Bidanasi	1	90	ACSR Twin Moose	OPTCL	OPTCL	OPTCL	D/C	213	131
101	Meramundali	Bidanasi	2	90	ACSR Twin Moose	OPTCL	OPTCL	OPTCL	D/C	213	131
102	Meramundali	Duburi(old)	1	95	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
103	Meramundali	Duburi(old)	2	95	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
104	MTPS	Begusarai	1	152	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
105	MTPS	Begusarai	2	152	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
106	MTPS	Darbhanga	1	68	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
107	MTPS	Darbhanga	2	68	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
108	MTPS	Gopalganj	1	101	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
109	MTPS	Gopalganj	2	101	Zebra	BSPTCL	BSPTCL	BSPTCL	D/C	213	131
110	Nayagarh	Bhanjnagar	1	68.7	Zebra	OPTCL	OPTCL	OPTCL	S/C	213	131
111	Parulia	Muchipara	1	16	Zebra	DVC	DVC	DVC	D/C	213	131
112	Parulia	Muchipara	2	16	Zebra	DVC	DVC	DVC	D/C	213	131
113	Patratu TPS	Hatia	1	51	Zebra	JUSNL	JUSNL	JUSNL	D/C	213	131
114	Patratu TPS	Hatia	2	51	Zebra	JUSNL	JUSNL	JUSNL	D/C	213	131
115	Patratu TPS	Tenughat	1	53	ACSR Twin Moose	JUSNL	JUSNL	TVNL	S/C	213	131
116	Rangpoo	New Melli	1	20	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
117	Rangpoo	New Melli	2	20	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
118	Rengali	Barkot	1	34	Zebra	OPTCL	OPTCL	OPTCL	S/C	213	131
119	Rengali	Chandiposh	1	102	Zebra	OPTCL	OPTCL	OPTCL	S/C	213	131
120	Sadaipur	Gokarno	1	61.5	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
121	Sadaipur	Gokarno	2	61.5	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
122	Santaldih	Bidhannagr	1	100	Zebra	WBSETCL	WBPDCL	WBSETCL	S/C	213	131
123	Satgachia	Bakreswar	1	140	Zebra	WBSETCL	WBSETCL	WBPDCL	D/C	213	131
124	Satgachia	Bakreswar	2	140	Zebra	WBSETCL	WBSETCL	WBPDCL	D/C	213	131
125	Satgachia	Krishnanagar	1	53	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
126	Satgachia	Krishnanagar	2	53	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
127	Siliguri	Kishanganj	1	108	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
128	Siliguri	Kishanganj	2	108	Zebra	POWERGRID	POWERGRID	POWERGRID	D/C	213	131
129	Subhasgram (WB)	Lakhikantpur	1	50	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
130	Subhasgram (WB)	Lakhikantpur	2	50	Zebra	WBSETCL	WBSETCL	WBSETCL	D/C	213	131
131	Talcher	Meramundali	1	20	Zebra	OPTCL	NTPC	OPTCL	S/C	213	131
132	Tarkera	Barkot	1	101	Zebra	OPTCL	OPTCL	OPTCL	S/C	213	131
133	Tarkera	Budhipadar	1	120	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
134	Tarkera	Budhipadar	2	120	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
135	Tarkera	Chandiposh	1	30	Zebra	OPTCL	OPTCL	OPTCL	S/C	213	131
136	Theruvalli	Bhanjnagar	1	176	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
137	Theruvalli	Bhanjnagar	2	176	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
138	Theruvalli	Laxmipur	1	64	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131

Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
139	Theruvalli	Laxmipur	2	64	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
140	Theruvalli	Narendrapur	1	196	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
141	Theruvalli	Narendrapur	2	196	Zebra	OPTCL	OPTCL	OPTCL	D/C	213	131
142	U. Kolab	Jayanagar	1	6	Zebra	OPTCL	OHPC	OPTCL	D/C	213	131
143	U. Kolab	Jayanagar	2	6	Zebra	OPTCL	OHPC	OPTCL	D/C	213	131
144	U. Kolab	Theruvali	1	136	Zebra	OPTCL	OHPC	OPTCL	S/C	213	131
145	Uihep	Theruvali	1	90	Zebra	OPTCL	OHPC	OPTCL	Q/C	213	131
146	Uihep	Theruvali	2	90	Zebra	OPTCL	OHPC	OPTCL	Q/C	213	131
147	Uihep	Theruvali	3	90	Zebra	OPTCL	OHPC	OPTCL	Q/C	213	131
148	Uihep	Theruvali	4	90	Zebra	OPTCL	OHPC	OPTCL	Q/C	213	131
149	Waria	Mejia	1	34	Zebra	DVC	DVC	DVC	D/C	213	131
150	Waria	Mejia	2	34	Zebra	DVC	DVC	DVC	D/C	213	131
151	Waria	Parulia	1	21	Zebra	DVC	DVC	DVC	D/C	213	131
152	Waria	Parulia	2	21	Zebra	DVC	DVC	DVC	D/C	213	131
153	Dumka New	Govindpur	1	101.54	Zebra	JUSNL	JUSNL	JUSNL	D/C	213	131
154	Dumka New	Govindpur	2	101.54	Zebra	JUSNL	JUSNL	JUSNL	D/C	213	131
155	Ramchandrapur	Chaibasa New(J)	1	39.6	Zebra	JUSNL	JUSNL	JUSNL	D/C	213	131
156	Ramchandrapur	Chaibasa New(J)	2	39.6	Zebra	JUSNL	JUSNL	JUSNL	D/C	213	131
132 kV											
Sl No	From Bus	To Bus	Ckt ID	Line Length	Conductor type	Line Owner	Owner		Circuit Configuration	Thermal Loading Limit (MVA)	SIL (MW)
							From End	To End			
1	Gangtok	Rangpo	1	48	Panther	POWERGRID	POWERGRID	POWERGRID	D/C	84	48
2	Gangtok	Rangpo	1	48	Panther	POWERGRID	POWERGRID	POWERGRID	D/C	84	48

.

6.0 List of Important Transformer

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
Angul	6000	765/400	1	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			2	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			3	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			4	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
Gaya	6000	765/400	1	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			2	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			3	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			4	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
Jharsuguda	6000	765/400	1	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			2	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			3	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			4	1500	1-	POWERGRID	HV	23	4	12	12	NA

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
New Ranchi	3000	765/400	1	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			2	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
Darlipalli	510	765/132	1	255	1-Phase	POWERGRID	HV	23	4	12	12	NA
			2	255	1-Phase	POWERGRID	HV	23	4	12	12	NA
New Sasaram	1500	765/400	1	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
Mednipur	3000	765/400	1	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
			2	1500	1-Phase	POWERGRID	HV	23	4	12	12	NA
Alipurduar	630	400/220	1	315	3-Phase	POWERGRID	NA	NA	NA	NA	NA	NA
			2	315	3-Phase	POWERGRID	NA	NA	NA	NA	NA	NA
Baripada	1130	400/220	1	315	3-Phase	POWERGRID	HV	17	5	11	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	11	9	NA
			3	500	3-Phase	POWERGRID	NA	NA	NA	NA	NA	NA
Biharshariff	1445	400/220	1	315	3-	POWERGRID	HV	17	5	12	9	NA

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
			2	315	3-Phase	POWERGRID	HV	17	5	12	9	NA
			3	315	3-Phase	POWERGRID	HV	17	5	12	9	NA
			4	500	3-Phase	POWERGRID	HV	17	5	12	9	NA
Binaguri	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	10	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	10	9	NA
Bolangir	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	9B	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	9B	9	NA
Chaibasa	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
			2	315	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
Darbhanga	1000	400/220	1	500	3-Phase	DMTCL	NA	NA	NA	NA	NA	NA
			2	500	3-Phase	DMTCL	NA	NA	NA	NA	NA	NA
Motihari	715	400/220	1	200	3-Phase	DMTCL	HV	17	5	7	9	NA
			2	200	3-	DMTCL	HV	17	5	7	9	NA

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
			3	315	3-Phase	DMTCL	HV	17	5	7	9	NA
Dikchu	270	400/132	1	270	1-Phase	Green Co	NA	NA	NA	NA	NA	NA
FSTPP	315	400/220	1	315	3-Phase	NTPC	HV	17	5	11	9B	NA
Gaya	1315	400/220	1	315	3-Phase	POWERGRID	HV	17	5	12	9	NA
			2	500	3-Phase	POWERGRID	HV	17	5	12	9	NA
			3	500	3-Phase	POWERGRID	HV	17	5	12	9	NA
Indravati	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	9B	9	NA
			2	315	3-Phase	OPTCL	HV	17	5	9B	9	NA
Jamshedpur	945	400/220	1	315	3-Phase	POWERGRID	HV	17	5	13	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	13	9	NA
			3	315	3-Phase	POWERGRID	HV	17	5	13	9	NA
Jeypore	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	14	9	NA
			2	315	1-	POWERGRID	HV	17	5	14	9	NA

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
Keonjhar	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
			2	315	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
Kishangunj	1000	400/220	1	500	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
			2	500	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
Maithon	1000	400/220	1	500	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
			2	500	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
Malda	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	10	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	10	9	NA
Muzzaffarpur	1130	400/220	1	315	3-Phase	POWERGRID	HV	17	5	12	9B	NA
			2	315	3-Phase	POWERGRID	HV	17	5	12	9B	NA
			3	500	3-Phase	POWERGRID	HV	17	5	12	9B	NA
New Purnea	1000	400/220	1	500	3-Phase	POWERGRID	HV	17	5	11	9	Alstom
			2	500	3-	POWERGRID	HV	17	5	11	9	Alstom

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
Pandiabili	1000	400/220	1	500	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
			2	500	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
Parulia	945	400/220	1	315	3-Phase	POWERGRID	HV	17	5	11	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	11	9	NA
			3	315	3-Phase	POWERGRID	HV	17	5	11	9	NA
Patna	1500	400/220	1	500	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
			2	500	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
			3	500	3-Phase	POWERGRID	HV	17	5	9B	9B	NA
Ranchi	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	9B	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	9B	9	NA
Rangpo	1575	400/220	1	315	1-Phase	POWERGRID	HV	17	5	9	9	NA
			2	315	1-Phase	POWERGRID	HV	17	5	9	9	NA
			3	315	1-	POWERGRID	HV	17	5	9	9	NA

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
			4	315	1-Phase	POWERGRID	HV	17	5	9	9	NA
			5	315	1-Phase	POWERGRID	HV	17	5	9	9	NA
Rengali	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	9	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	9	9	NA
Rourkela	630	400/220	1	315	3-Phase	POWERGRID	HV	17	5	10	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	10	9	NA
Sasaram	1000	400/220	1	500	3-Phase	POWERGRID	HV	17	5	7	9	NA
			2	500	3-Phase	POWERGRID	HV	17	5	7	9	NA
Subhasgram	1760	400/220	1	315	3-Phase	POWERGRID	HV	17	5	9	9	NA
			2	315	3-Phase	POWERGRID	HV	17	5	9	9	NA
			3	315	3-Phase	CESC	HV	17	5	9	9	NA
			4	315	3-Phase	CESC	HV	17	5	9	9	NA
			5	500	3-	POWERGRID	HV	17	5	9	9	NA

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
TSTPP	630	400/220	1	315	3-Phase	NTPC	HV	17	5	13	9	NA
			2	315	3-Phase	NTPC	HV	17	5	13	9	NA
Banka	715	400/220	1	200	3-Phase	POWERGRID	HV	17	5	7	9	NA
			2	200	3-Phase	POWERGRID	HV	17	5	7	9	NA
			3	315	3-Phase	POWERGRID	HV	17	5	7	9	NA
Barh	400	400/220	1	200	3-Phase	NTPC	NA	NA	NA	NA	NA	NA
			2	200	3-Phase	NTPC	NA	NA	NA	NA	NA	NA
KhSTPP	400	400/220	1	200	3-Phase	NTPC	HV	17	5	10	9	NA
			2	200	3-Phase	NTPC	HV	17	5	10	9	NA
Lakhisarai	715	400/220	1	200	3-Phase	POWERGRID	HV	17	5	9	9	NA
			2	200	3-Phase	POWERGRID	HV	17	5	9	9	NA
			3	315	3-Phase	POWERGRID	HV	17	5	9	9	NA
Nabinagar	400	400/132	1	200	3-	BRBCL	NA	NA	NA	NA	NA	NA

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
			2	200	3-Phase	BRBCL	NA	NA	NA	NA	NA	NA
			3	200	3-Phase	BRBCL	NA	NA	NA	NA	NA	NA
Bokaro A	630	400/220	1	315	3-Phase	DVC	NA	NA	NA	NA	NA	NA
			2	315	3-Phase	DVC	NA	NA	NA	NA	NA	NA
Koderma	630	400/220	1	315	3-Phase	DVC	HV	17	5	9B	9B	NA
			2	315	3-Phase	DVC	HV	17	5	9B	9B	NA
RTPS	630	400/220	1	315	3-Phase	DVC	NA	NA	NA	NA	NA	NA
			2	315	3-Phase	DVC	NA	NA	NA	NA	NA	NA
TISCO	630	400/132	1	315	3-Phase	DVC	HV	17	5	9B	9B	NA
			2	315	3-Phase	DVC	HV	17	5	9B	9B	NA
DSTPS	630	400/220	1	315	3-Phase	DVC	NA	NA	NA	NA	NA	NA
			2	315	3-Phase	DVC	NA	NA	NA	NA	NA	NA
Mendasal	630	400/220	1	315	3-	OPTCL	HV	17	5	9	9	NA

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
			2	315	3-Phase	OPTCL	HV	17	5	9	9	NA
Meramundali	630	400/220	1	315	3-Phase	OPTCL	HV	17	5	10	9	NA
			2	315	3-Phase	OPTCL	HV	17	5	10	9	NA
New Duburi	630	400/220	1	315	3-Phase	OPTCL	HV	17	5	9	9	NA
			2	315	3-Phase	OPTCL	HV	17	5	9	9	NA
STERLITE	630	400/220	1	315	3-Phase	OPTCL	HV	17	5	11	9	NA
			2	315	3-Phase	OPTCL	HV	17	5	11	9	NA
Lapanga	630	400/220	1	315	3-Phase	OPTCL	HV	17	5	11	9	NA
			2	315	3-Phase	OPTCL	HV	17	5	11	9	NA
Arambag	1260	400/220	1	315	3-Phase	WBSETCL	HV	17	5	11	9	NA
			2	315	3-Phase	WBSETCL	HV	17	5	11	9	NA
			3	315	3-Phase	WBSETCL	HV	17	5	11	9	NA
			4	315	3-	WBSETCL	HV	17	5	11	9	NA

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
Bakreswar	630	400/220	1	315	3-Phase	WBSETCL	LV (220KV)	17	2.75	11	9	FUJI
			2	315	3-Phase	WBSETCL	LV (220KV)	17	2.75	11	9	FUJI
Bidhannagar	630	400/220	1	315	3-Phase	WBSETCL	HV	17	5	9B	9	NA
			2	315	3-Phase	WBSETCL	HV	17	5	9B	9	NA
Gokarna	630	400/220	1	315	3-Phase	WBSETCL	HV	17	5	9B	9B	Xi'an XD Transformer Co. Ltd., P.R. China
			2	315	3-Phase	WBSETCL	HV	17	5	9B	9B	
Jeerat	1260	400/220	1	315	3-Phase	WBSETCL	LV	17	2.88	11	NA	NA
			2	315	3-Phase	WBSETCL	LV	17	2.88	11	NA	NA
			3	315	3-Phase	WBSETCL	LV	17	2.88	11	NA	NA
			4	315	3-Phase	WBSETCL	LV	17	2.88	11	NA	NA
Kharagpur	945	400/220	1	315	3-Phase	WBSETCL	HV	17	5	7	9	Areva
			2	315	3-Phase	WBSETCL	HV	17	5	7	9	Areva
			3	315	3-	WBSETCL	HV	17	5	7	9	EMCO

Name of S/S	Total Capacity	Voltage level	ICT No	Rating (MVA)	Unit type	Owner	Tap provided in which side	No of Taps	Voltage (kV) change per Tap	Present Tap position	Nominal Tap position	Make
					Phase							
KTPP	630	400/220	1	315	3-Phase	WBSETCL	HV	17	5	12	9	NA
			2	315	3-Phase	WBSETCL	HV	17	5	12	9	NA
Sagardighi	315	400/220	1	315	3-Phase	WBSETCL	HV	17	5	10	9	NA
Sitamarhi	1000	400/220	1	500	3-Phase	PMTL	NA	NA	NA	NA	NA	NA
			2	500	3-Phase	PMTL	NA	NA	NA	NA	NA	NA

7.0 List of Important Generators

Sl No.	Station	Total Install Capacity	Unit No	Fuel Type	Size	Type	GT			Owner	Make	Commissioned in
							Rating (MVA)	Voltage Ratio	Present Tap (Total Tap)			
Central Sector												
1	Farakka STPS Stage I & II	1600	1	Coal	200	Pit Head	247	400/15.75	3(5)	NTPC	BHEL	Jan-86
			2	Coal	200	Pit Head	247	400/15.75	6(13)	NTPC	BHEL	Dec-86
			3	Coal	200	Pit Head	247	400/15.75	6(13)	NTPC	BHEL	Aug-87
			4	Coal	500	Pit Head	588	400/21	7(13)	NTPC	BHEL	Sep-92
			5	Coal	500	Pit Head	588	400/21	7(13)	NTPC	BHEL	Feb-94
2	Farakka STPS Stage III	500	6	Coal	500	Pit Head	588	400/21	7(13)	NTPC	BHEL	Mar-11
3	Kahalgaon STPS Stage I	840	1	Coal	210	Pit Head	247	NA	NA	NTPC	Electrosila USSR	Mar-92
			2	Coal	210	Pit Head	247	NA	NA	NTPC	Electrosila USSR	Mar-94
			3	Coal	210	Pit Head	247	NA	NA	NTPC	Electrosila USSR	Mar-95
			4	Coal	210	Pit Head	247	NA	NA	NTPC	Electrosila USSR	Mar-96
4	Kahalgaon STPS Stage II	1500	5	Coal	500	Pit Head	588	NA	NA	NTPC	BHEL	Mar-07
			6	Coal	500	Pit Head	588	NA	NA	NTPC	BHEL	Mar-08
			7	Coal	500	Pit Head	588	NA	NA	NTPC	BHEL	Jun-09
5	Talcher STPS Stage I	1000	1	Coal	500	Pit Head	588	400/21	8(13)	NTPC	ABB Germany	Feb-95
			2	Coal	500	Pit Head	588	400/21	8(13)	NTPC	ABB Germany	Mar-96
6	Talcher STPS Stage II	2000	3	Coal	500	Pit Head	588	NA	NA	NTPC	BHEL	Jan-03
			4	Coal	500	Pit Head	588	NA	NA	NTPC	BHEL	Oct-03
			5	Coal	500	Pit Head	588	NA	NA	NTPC	BHEL	May-04
			6	Coal	500	Pit Head	588	NA	NA	NTPC	BHEL	Feb-05
7	Barh STPS Stage II	1320	4	Coal	660	Pit Head	777	NA	NA	NTPC	BHEL	15-11-2014
			5	Coal	660	Pit Head	777	NA	NA	NTPC	BHEL	18-02-2016
8	Nabinagar	750	1	Coal	250	Pit Head	295	NA	NA	NTPC	BHEL	15-01-2017
			2	Coal	250	Pit Head	295	NA	NA	NTPC	BHEL	10-09-2017
			3	Coal	250	Pit Head	295	NA	NA	NTPC	BHEL	26-02-2019
9	KBUNL Stage II	390	3	Coal	195	Pit Head	247	NA	NA	NTPC	BHEL	18-03-2017
			4	Coal	195	Pit Head	247	NA	NA	NTPC	BHEL	01-07-2017
10	Nabinagar STPP Stage I	660	1	Coal	660	Pit Head	777	NA	NA	NTPC	BHEL & Alstom	06-09-2019
11	Darlipali STPP	800	1	Coal	800	Pit Head	942	NA	NA	NTPC	Toshiba JSW	
12	Teesta V	510	1	Hydro	170	Run of River	210	400/13.8	3(5)	NHPC	Toshiba	28-03-2008
			2	Hydro	170	Run of River	210	400/13.8	3(5)	NHPC	Toshiba	06-02-2008
			3	Hydro	170	Run of River	210	400/13.8	3(5)	NHPC	Toshiba	20-03-2008
Jharkhand												
1	Tenughat	2x210	1	Coal	210	Pit Head	294	220/15.75	1(9)	TVNL	NA	Sep-96
			2	Coal	210	Pit Head	294	220/15.75	1(9)	TVNL	NA	Sep-97
2	Subarnarekha	2X65	1	Hydro	65	Pondage	94	132/11	2(5)	JUVNL	NA	

Sl No.	Station	Total Install Capacity	Unit No	Fuel Type	Size	Type	GT			Owner	Make	Commissioned in
							Rating (MVA)	Voltage Ratio	Present Tap (Total Tap)			
			2	Hydro	65	Pondage	94	132/11	2(5)	JUVNL	NA	
DVC												
1	Waria	(U#4) 210	4	Thermal	210	Load Center	294	220/16	NA	DVC	BHEL	Sep-82
2	Mejia	1340	1	Thermal	210	Pit Head	247	220/15.75	NA	DVC	BHEL	Dec-97
			2	Thermal	210	Pit Head	247	220/15.75	NA	DVC	BHEL	Mar-99
			3	Thermal	210	Pit Head	247	220/15.75	NA	DVC	BHEL	Sep-99
			4	Thermal	210	Pit Head	247	220/15.75	NA	DVC	BHEL	Feb-05
			5	Thermal	250	Pit Head	294	220/16.5	NA	DVC	BHEL	Feb-08
			6	Thermal	250	Pit Head	294	220/16.5	NA	DVC	BHEL	Sep-08
3	Mejia-B	1000	7	Thermal	500	Pit Head	588	400/21	4(9)	DVC	BHEL	Aug-11
			8	Thermal	500	Pit Head	588	400/21	4(9)	DVC	BHEL	Aug-12
4	CTPS B	500	7	Thermal	250	Pit Head	294	NA	NA	DVC	BHEL	Nov-11
			8	Thermal	250	Pit Head	294	NA	NA	DVC	BHEL	Jul-11
5	Koderma TPS	1000	1	Thermal	500	Pit Head	588	400/21	5(9)	DVC	BHEL	Jul-13
			2	Thermal	500	Pit Head	588	400/21	5(9)	DVC	BHEL	Jun-14
6	Bokaro"B"	210	3	Thermal	210	Pit Head	247	NA	NA	DVC	BHEL	Apr-94
7	Bokaro"A"	500	1	Thermal	500	Pit Head	588	NA	NA	DVC	BHEL	23-02-2017
8	RAGHUNATHPUR	1200	1	Thermal	600	Pit Head	706	NA	NA	DVC	Shanghai Electric	Mar-16
			2	Thermal	600	Pit Head	706	NA	NA	DVC	Shanghai Electric	Mar-16
9	DSTPS	1000	1	Thermal	500	Pit Head	588	400/21	5(9)	DVC	BHEL	May-12
			2	Thermal	500	Pit Head	588	400/21	5(9)	DVC	BHEL	Mar-13
West Bengal												
1	Kolaghat	1260	1	Thermal	210	Pit Head	247	220/15.75	3(5)	WBPDCL	BHEL	09-09-1990
			2	Thermal	210	Pit Head	247	220/15.75	3(5)	WBPDCL	BHEL	09-03-1986
			3	Thermal	210	Pit Head	247	220/15.75	3(5)	WBPDCL	BHEL	12-10-1984
			4	Thermal	210	Pit Head	247	420/15.75	4(5)	WBPDCL	BHEL	01-04-1995
			5	Thermal	210	Pit Head	247	420/15.75	5(5)	WBPDCL	BHEL	14-05-1991
			6	Thermal	210	Pit Head	247	420/15.75	4(5)	WBPDCL	BHEL	01-01-1994
2	Sagardighi	1600	1	Thermal	300	Pit Head	370	400/20	3(5)	WBPDCL	Dongfang	Sep-08
			2	Thermal	300	Pit Head	370	400/20	3(5)	WBPDCL	Dongfang	Nov-08
			3	Thermal	500	Pit Head	588	NA	NA	WBPDCL	BHEL	Jul-16
			4	Thermal	500	Pit Head	588	NA	NA	WBPDCL	BHEL	Jan-17
3	Bakreswar	1050	1	Thermal	210	Pit Head	250	220/15.75	3(5)	WBPDCL	BHEL	29-11-2000
			2	Thermal	210	Pit Head	250	220/15.75	3(5)	WBPDCL	BHEL	01-04-2001
			3	Thermal	210	Pit Head	250	220/15.75	3(5)	WBPDCL	BHEL	11-10-2001
			4	Thermal	210	Pit Head	250	420/15.75	4(5)	WBPDCL	BHEL	08-03-2009
			5	Thermal	210	Pit Head	250	420/15.75	4(5)	WBPDCL	BHEL	27-06-2009

Sl No.	Station	Total Install Capacity	*Unit No*	Fuel Type	Size	Type	GT			Owner	Make	Commissioned in
							Rating (MVA)	Voltage Ratio	Present Tap (Total Tap)			
4	Santaldih	500	5	Thermal	250	Pit Head	294	220/16.5	4(5)	WBPDCL	BHEL	
			6	Thermal	250	Pit Head	294	220/16.5	4(5)	WBPDCL	BHEL	
5	Bandel	U#5 (210)	5	Thermal	210	Load Center	276	138/15.75	3(3)	WBPDCL	BHEL	
6	TLDP III	132	1	Hydro	33	Run of River	39	NA	NA	WBSEDCL	NA	19-05-2013
			2	Hydro	33	Run of River	39	NA	NA	WBSEDCL	NA	01-04-2013
			3	Hydro	33	Run of River	39	NA	NA	WBSEDCL	NA	01-04-2013
			4	Hydro	33	Run of River	39	NA	NA	WBSEDCL	NA	01-05-2013
7	TLDP IV	160	1	Hydro	40	Run of River	47	NA	NA	WBSEDCL	NA	11-03-2016
			2	Hydro	40	Run of River	47	NA	NA	WBSEDCL	NA	21-03-2016
			3	Hydro	40	Run of River	47	NA	NA	WBSEDCL	NA	17-07-2016
			4	Hydro	40	Run of River	47	NA	NA	WBSEDCL	NA	19-08-2016
8	PPSP*	900	1	Hydro	225	Pump Storage	295	NA	NA	WBSEDCL	Mitsui	
			2	Hydro	225	Pump Storage	295	NA	NA	WBSEDCL	Mitsui	
			3	Hydro	225	Pump Storage	295	NA	NA	WBSEDCL	Mitsui	
			4	Hydro	225	Pump Storage	295	NA	NA	WBSEDCL	Mitsui	
9	DPL	550	7	Thermal	300	Pit Head	370	220/20	3(5)	WBPDCL	Dongfang	30-04-2008
			8	Thermal	250	Pit Head	315	220/16.5	3(5)	WBPDCL	Dongfang	01-10-2014
10	HALDIA	600	1	Thermal	300	Pit Head	370	NA	NA	HEL	Shanghai Electric	28-01-2015
			2	Thermal	300	Pit Head	370	NA	NA	HEL	Shanghai Electric	21-02-2015
11	Budge-Budge	750	1	Thermal	250	Load Center	294	132/16.5	6(9)	CESC	Parson	
			2	Thermal	250	Load Center	294	132/16.5	6(9)	CESC	Parson	
			3	Thermal	250	Load Center	294	235/16.5	5(9)	CESC	BHEL	

* PPSP machines also operate in motor mode and their rating as motor is 250 MW each

Odisha

1	IBTPS Stage I	420	1	Thermal	210	Pit Head	294	220/15.75	NA	OPGC	NA	1994
			2	Thermal	210	Pit Head	294	220/15.75	NA	OPGC	NA	1996
2	IBTPS Stage II	1320	1	Thermal	660	Pit Head	777	NA	NA	OPGC	BHEL	03-07-2019
			2	Thermal	660	Pit Head	777	NA	NA	OPGC	BHEL	21-08-2019
3	Balimela	510	1	Hydro	60	Pondage	71	132/11	NA	OHPC	NA	14-03-1973
			2	Hydro	60	Pondage	71	132/11	NA	OHPC	NA	25-01-1974
			3	Hydro	60	Pondage	71	132/11	NA	OHPC	NA	24-08-1974
			4	Hydro	60	Pondage	71	132/11	NA	OHPC	NA	26-03-1975
			5	Hydro	60	Pondage	71	132/11	NA	OHPC	NA	07-05-1976
			6	Hydro	60	Pondage	71	132/11	NA	OHPC	NA	05-01-1977
			7	Hydro	75	Pondage	88	132/11	NA	OHPC	NA	23-12-2008
			8	Hydro	75	Pondage	88	132/11	NA	OHPC	NA	23-01-2009
4	U-Kolab	320	1	Hydro	80	Pondage	94	220/11	NA	OHPC	NA	15.03.1988
			2	Hydro	80	Pondage	94	220/11	NA	OHPC	NA	14.04.1988

Sl No.	Station	Total Install Capacity	*Unit No*	Fuel Type	Size	Type	GT			Owner	Make	Commissioned in
							Rating (MVA)	Voltage Ratio	Present Tap (Total Tap)			
			3	Hydro	80	Pondage	94	220/11	NA	OHPC	NA	10.02.1990
			4	Hydro	80	Pondage	94	220/11	NA	OHPC	NA	12.01.1993
5	U-Indravati	600	1	Hydro	150	Pondage	177	NA	NA	OHPC	NA	19.09.1999
			2	Hydro	150	Pondage	177	NA	NA	OHPC	NA	28.12.1999
			3	Hydro	150	Pondage	177	NA	NA	OHPC	NA	04.10.2000
			4	Hydro	150	Pondage	177	NA	NA	OHPC	NA	19.04.2001
6	Rengali	200	1	Hydro	50	Pondage	59	220/11	NA	OHPC	NA	27.08.1985
			2	Hydro	50	Pondage	59	220/11	NA	OHPC	NA	26.03.1986
			3	Hydro	50	Pondage	59	220/11	NA	OHPC	NA	10.08.1989
			4	Hydro	50	Pondage	59	220/11	NA	OHPC	NA	19.03.1990
7	Sterlite (CPP)	2400	1	Thermal	600	Pit Head	750	242.4/22	3(5)	Vedanta	BHEL	30-03-2011
			2	Thermal	600	Pit Head	750	242.4/22	3(5)	Vedanta	BHEL	29-11-2010
			3	Thermal	600	Pit Head	750	242.4/22	3(5)	Vedanta	BHEL	19-08-2011
			4	Thermal	600	Pit Head	750	242.4/22	3(5)	Vedanta	BHEL	26-04-2012
IPPs												
1	MPL	1050	1	Thermal	525	Pit Head	617	NA	NA	MPL	BHEL	01-09-2011
			2	Thermal	525	Pit Head	617	NA	NA	MPL	BHEL	24-07-2012
2	ADHUNIK	540	1	Thermal	270	Pit Head	330	400/16.5	8(19)	APNRL	BHEL	21-01-2013
			2	Thermal	270	Pit Head	340	400/16.5	3(5)	APNRL	BHEL	19-05-2013
3	GMR	1050	1	Thermal	350	Pit Head	412	NA	NA	GMR	Shanghai Electric	28-03-2013
			2	Thermal	350	Pit Head	412	NA	NA	GMR	Shanghai Electric	29-09-2013
			3*	Thermal	350	Pit Head	412	NA	NA	GMR	Shanghai Electric	25-03-2014
4	JITPL	1200	1	Thermal	600	Pit Head	706	NA	NA	Jindal	BHEL	06-06-2014
			2	Thermal	600	Pit Head	706	NA	NA	Jindal	BHEL	12-02-2015
5	INDBHARAT	700	1	Thermal	350	Pit Head	412	NA	NA		NA	19-07-2016
			2	Thermal	350	Pit Head	412	NA	NA		NA	
6	JLHEP	96	1	Hydro	48	Run of River	63	220/11	3(5)	Dans Energy	Alstom	26-09-2015
			2	Hydro	48	Run of River	63	220/11	3(5)	Dans Energy	Alstom	01-10-2015
7	TEESTA -III	1200	1	Hydro	200	Run of River	246	420/15	3(5)	TUL	Andritz	28-02-2017
			2	Hydro	200	Run of River	246	420/15	3(5)	TUL	Andritz	23-02-2017
			3	Hydro	200	Run of River	246	420/15	3(5)	TUL	Andritz	23-02-2017
			4	Hydro	200	Run of River	246	420/15	3(5)	TUL	Andritz	23-02-2017
			5	Hydro	200	Run of River	246	420/15	3(5)	TUL	Andritz	28-02-2017
			6	Hydro	200	Run of River	246	420/15	3(5)	TUL	Andritz	28-02-2017
8	DIKCHU	96	1	Hydro	48	Run of River	60	NA	NA	Green Co	Alstom	12-04-2017
			2	Hydro	48	Run of River	60	NA	NA	Green Co	Alstom	28-05-2017
9	Tashding	97	1	Hydro	48.5	Run of River	60	NA	NA	Dans Energy	Alstom	18-10-2017
			2	Hydro	48.5	Run of River	60	NA	NA	Dans Energy	Alstom	18-10-2017

Sl No.	Station	Total Install Capacity	Unit No	Fuel Type	Size	Type	GT			Owner	Make	Commissioned in
							Rating (MVA)	Voltage Ratio	Present Tap (Total Tap)			
10	CHJACHEN	110	1	Hydro	55	Run of River	65	132/11	4(5)	Gati Infra	Alstom	
			2	Hydro	55	Run of River	65	132/11	4(5)	Gati Infra	Alstom	
* Unit-3 of GMR is Dedicated to Odisha												
Bhutan												
1	Tala	1020	1	Hydro	170	Run of River	200	NA	NA	Druk Green	BHEL	12-02-2007
			2	Hydro	170	Run of River	200	NA	NA	Druk Green	BHEL	20-11-2006
			3	Hydro	170	Run of River	200	NA	NA	Druk Green	BHEL	30-03-2007
			4	Hydro	170	Run of River	200	NA	NA	Druk Green	BHEL	10-11-2006
			5	Hydro	170	Run of River	200	NA	NA	Druk Green	BHEL	07-10-2006
			6	Hydro	170	Run of River	200	NA	NA	Druk Green	BHEL	31-07-2006
2	Chukha	336	1	Hydro	84	Run of River	99	NA	NA	Druk Green	NA	07-09-1986
			2	Hydro	84	Run of River	99	NA	NA	Druk Green	NA	30-10-1986
			3	Hydro	84	Run of River	99	NA	NA	Druk Green	NA	13-03-1988
			4	Hydro	84	Run of River	99	NA	NA	Druk Green	NA	22-08-1988
3	Mandechu	720	1	Hydro	180	Run of River	212	NA	NA	Druk Green	BHEL	28-06-2019
			2	Hydro	180	Run of River	212	NA	NA	Druk Green	BHEL	08-07-2019
			3	Hydro	180	Run of River	212	NA	NA	Druk Green	BHEL	16-08-2019
			4	Hydro	180	Run of River	212	NA	NA	Druk Green	BHEL	14-08-2019
5	Dagachu	126	1	Hydro	63	Run of River	75	NA	NA	Tata Power	NA	
			2	Hydro	63	Run of River	75	NA	NA	Tata Power	NA	

8.1 List of line reactors

Sl No	Voltage	From Bus	To Bus	Line Owner	Ckt ID	Line Length	Reactor (MVAr)								Remarks
							From End				To End				
							Rating	Unit Type	Switchable(with additional CB) : YES or NO?	Provision to use as Bus reactor	Rating	Unit Type	Switchable(with additional CB) : YES or NO?	Provision to use as Bus reactor	
1	765	Angul	Srikakulam	POWERGRID	1	277	1X240	1-Phase	YES	YES	1X240	1-Phase			
2	765	Angul	Srikakulam	POWERGRID	2	277	1X240	1-Phase	YES	YES	1X240	1-Phase			
3	765	Angul	Jharsuguda	POWERGRID	1	273	1X240	1-Phase	YES	YES	1X240	1-Phase	NO	YES	
4	765	Angul	Jharsuguda	POWERGRID	2	273	1X240	1-Phase	YES	YES	1X240	1-Phase	NO	YES	
5	765	Angul	Jharsuguda	POWERGRID	3	273	1X240	1-Phase	YES	YES	1X240	1-Phase	NO	YES	
6	765	Angul	Jharsuguda	POWERGRID	4	273	1X240	1-Phase	YES	YES	1X240	1-Phase	NO	YES	
7	765	Gaya	Balia	POWERGRID	1	120	1X240	1-Phase	YES	YES	1X240	1-Phase	YES		
8	765	Gaya	Varanasi	POWERGRID	1	272	1X240	1-Phase	YES	YES	1X240	1-Phase	NO		
9	765	Gaya	Varanasi	POWERGRID	2	272	1X240	1-Phase	YES	YES	1X240	1-Phase	NO		
10	765	Jharsuguda	Dharamjaygarh	POWERGRID	1	151	-				1X330	1-Phase			
11	765	Jharsuguda	Dharamjaygarh	POWERGRID	2	151	-				1X330	1-Phase			
12	765	Jharsuguda	Dharamjaygarh	POWERGRID	3	148	-				1X330	1-Phase			
13	765	Jharsuguda	Dharamjaygarh	POWERGRID	4	148	-				1X330	1-Phase			
14	765	Jharsuguda	Raipur	POWERGRID	1	303	1X240	1-Phase	YES	YES	1X240	1-Phase			
15	765	Jharsuguda	Raipur	POWERGRID	2	303	1X240	1-Phase	YES	YES	1X240	1-Phase			
16	765	Ranchi (new)	Dharamjaygarh	POWERGRID	1	303	1X240	1-Phase	YES	YES	1X330	1-Phase	NO		
17	765	Ranchi (new)	Dharamjaygarh	POWERGRID	2	303	1X240	1-Phase	YES	YES	1X330	1-Phase	NO		
18	765	Sasaram	Fatehpur	POWERGRID	1	356	1X330	1-Phase	YES	YES	1X330	1-Phase	NO	YES	
19	765	Ranchi (new)	Mednipur	PMJTL	1	269	1X240	1-Phase	YES	YES	1X240	1-Phase	YES	YES	
20	765	Ranchi (new)	Mednipur	PMJTL	2	269	1X240	1-Phase	YES	YES	1X240	1-Phase	YES	YES	
21	400	Meramundali	Bolangir	POWERGRID	1	221.4	-				1X50	3-Phase	YES	YES	
22	400	Banka	B'shariff	POWERGRID	1	184.55	1X50	3-Phase	YES	YES	-				
23	400	Banka	B'shariff	POWERGRID	2	184.55	1X50	3-Phase	YES	YES	-				
24	400	Baripada	Pandiabili	POWERGRID	1	301	-				1X63	3-Phase	YES	YES	
25	400	Baripada	New Duburi	POWERGRID	1	190.2	1X63	3-Phase	YES	YES					
26	400	Biharsariff	Varanasi	POWERGRID	1	321	1X50	3-Phase	YES	YES	-				
27	400	Biharsariff	Varanasi	POWERGRID	2	321	1X50	3-Phase	YES	YES	-				
28	400	Binaguri	Alipurduar	ENICL + POWERGRID	1	224	1X80	3-Phase	YES	YES	-				
29	400	Binaguri	Alipurduar	ENICL + POWERGRID	2	224	1X80	3-Phase	YES	YES	-				
30	400	Binaguri	Bongaigaon	POWERGRID	1	216	-				1X63	3-Phase			
31	400	Binaguri	Bongaigaon	POWERGRID	2	216	-				1X63	3-Phase			
32	400	Binaguri	Tala	POWERGRID	1	115	1X63	3-Phase	NO	YES	-				
33	400	Binaguri	Tala	POWERGRID	2	115	1X63	3-Phase	NO	YES	-				
34	400	Binaguri	Tala	POWERGRID	4	98	1X63	3-Phase	NO	YES	-				
35	400	Bolangir	Jeypore	POWERGRID	1	288	1X50	3-Phase	YES	YES	1X80	3-Phase	NO	YES	
36	400	B'shariff	Balia	POWERGRID	1	242	-				1X50	3-Phase	NO		

Sl No	Voltage	From Bus	To Bus	Line Owner	Ckt ID	Line Length	Reactor (MVAr)								Remarks
							From End				To End				
							Rating	Unit Type	Switchable(with additional CB) : YES or NO?	Provision to use as Bus reactor	Rating	Unit Type	Switchable(with additional CB) : YES or NO?	Provision to use as Bus reactor	
37	400	B'shariff	Balia	POWERGRID	2	242	-				1X50	3-Phase	NO		
38	400	B'shariff	New purnea	ENICL	1	232	1X80	3-Phase	YES	YES	-				
39	400	B'shariff	New purnea	ENICL	2	232	1X80	3-Phase	YES	YES	-				
40	400	B'shariff	Sasaram	POWERGRID	1	195	1X50	3-Phase	YES	NO					
41	400	Farakka	Durgapur	POWERGRID	1	150	1X50	3-Phase	NO	NO	-				
42	400	Farakka	Gokorno	POWERGRID	1	119.7	1X80	3-Phase	YES	YES					
43	400	Farakka	Baharampur	POWERGRID	2	82.34	1X50	3-Phase	YES	YES					
44	400	Farakka	Rajarhat	POWERGRID	1		1X80	3-Phase	YES	YES					
45	400	Gorakhpur	Motihari	POWERGRID + DMTCL(LILO)	1	190	1X80	3-Phase			1X50	3-Phase	YES	NO	
46	400	Gorakhpur	Motihari	POWERGRID + DMTCL(LILO)	2	190	1X80	3-Phase			1X50	3-Phase	YES	NO	
47	400	Jeypore	Gajuwaka	POWERGRID	1	220	-				1X80	3-Phase			
48	400	Jeypore	Gajuwaka	POWERGRID	2	220	-				1X80	3-Phase			
49	400	K'gaon	Maithon	POWERGRID	1	172	-				1X50	3-Phase	NO	NO	
50	400	K'gaon	Maithon	POWERGRID	2	172	-				1X50	3-Phase	NO	NO	
51	400	Kharagpur	Chaibasa	PKTCL	1	162	-				1X63	3-Phase	NO	YES	
52	400	Kharagpur	Chaibasa	PKTCL	2	162	-				1X63	3-Phase	NO	YES	
53	400	Lakhisarai	Khstpp	POWERGRID	1	145	1X50	3-Phase	NO	YES	-				
54	400	Lakhisarai	Khstpp	POWERGRID	2	145	1X50	3-Phase	NO	YES	-				
55	400	Lakhisarai	B'shariff	POWERGRID	2	89	-				1X50	3-Phase	YES	NO	
56	400	Maithon	Gaya	POWERGRID	1	235	1X50	3-Phase	YES	NO	1X50	3-Phase	YES	YES	
57	400	Maithon	Gaya	POWERGRID	2	235	1X50	3-Phase	YES	NO	1X50	3-Phase	YES	YES	
58	400	Maithon	Mejia	POWERGRID	1	83	1X50	3-Phase	YES	NO	-				
59	400	Malda	New purnea	POWERGRID	1	167	1X63	3-Phase	NO	NO	-				
60	400	Malda	New purnea	POWERGRID	2	167	1X63	3-Phase	NO	NO	-				
61	400	Meramundali	Talcher	POWERGRID	1	88.61	1X63	3-Phase	YES	NO	-				
62	400	Motihari	Barh	POWERGRID	1	237	1X80	3-Phase	YES	NO	1X63	3-Phase	YES	NO	
63	400	Motihari	Barh	POWERGRID	2	237	1X80	3-Phase	YES	NO	1X63	3-Phase	YES	NO	
64	400	Patna	NPGC	POWERGRID	1	141	1X80	3-Phase	YES	YES					
65	400	Patna	NPGC	POWERGRID	1	141	1X80	3-Phase	YES	YES					
66	400	Patna	Barh	POWERGRID	1	93.1	1X80	3-Phase	YES	YES					
67	400	Patna	Barh	POWERGRID	2	93.1	1X125	3-Phase	YES	YES					
68	400	Mpl	Ranchi	POWERGRID	1	188	1X50	3-Phase	YES	NO	1X50	3-Phase	YES	YES	
69	400	Mpl	Ranchi	POWERGRID	2	188	1X50	3-Phase	YES	NO	1X50	3-Phase	YES	YES	
70	400	Muzaffarpur	Gorakhpur	POWERLINKS	1	260	1X63	3-Phase	YES	YES	-				
71	400	Muzaffarpur	Gorakhpur	POWERLINKS	2	260	1X50	3-Phase	YES	YES	-				
72	400	New purnea	Farakka	POWERGRID	1		1X80	3-Phase	YES	YES					
73	400	New purnea	Muzaffarpur	POWERGRID	1	240	1X63	3-Phase	YES	YES	1X63	3-Phase	YES	YES	

Sl No	Voltage	From Bus	To Bus	Line Owner	Ckt ID	Line Length	Reactor (MVAr)								Remarks
							From End				To End				
							Rating	Unit Type	Switchable(with additional CB) : YES or NO?	Provision to use as Bus reactor	Rating	Unit Type	Switchable(with additional CB) : YES or NO?	Provision to use as Bus reactor	
74	400	New purnea	Muzaffarpur	POWERGRID	2	240	1X63	3-Phase	YES	YES	1X63	3-Phase	YES	YES	
75	400	New ranchi	New PPSP	PKTCL	1	117	1X50	3-Phase	NO	YES	-				
76	400	New ranchi	New PPSP	PKTCL	2	117	1X50	3-Phase	NO	YES	-				
77	400	Pandiabili	Mendasal	POWERGRID	1	273	1X63	3-Phase	NO	NO					LR at Medhasal end shifted to Pandiabili
78	400	Pandiabili	Mendasal	POWERGRID	2	273	1X63	3-Phase	NO	NO					
79	400	Patna	Kishangunj	POWERGRID	1	352	1X63	3-Phase	NO	YES	1X80	3-Phase	YES	YES	
80	400	Patna	Kishangunj	POWERGRID	2	352	1X63	3-Phase	NO	YES	1X80	3-Phase	YES	YES	
81	400	Patna	Balia	POWERGRID	1	185	-				1X63	3-Phase	NO	NO	
82	400	Patna	Balia	POWERGRID	2	185	-				1X63	3-Phase	NO	NO	
83	400	Purnea	Binaguri	POWERGRID	1	168	1X63	3-Phase	NO	YES	-				
84	400	Purnea	Kishanganj	POWERGRID	1	71	1X63	3-Phase	NO	YES	-				
85	400	Rajarhat	Gokorna	POWERGRID	1		1X80	3-Phase	YES	YES	-				Line not yet commissioned
86	400	Rajarhat	Farakka	POWERGRID	1		1X80	3-Phase	YES	YES	-				Line not yet commissioned
87	400	Ranchi	Sipat	POWERGRID	1	405	1X80	3-Phase	NO	YES	1X80	3-Phase			
88	400	Ranchi	Sipat	POWERGRID	2		1X80	3-Phase	NO	YES	1X80	3-Phase			
89	400	Rengali	Indravati(s/c)	POWERGRID	1	356	1X50	3-Phase	NO	YES	1X50	3-Phase	NO	NO	
90	400	Rengali	Keonjhor	POWERGRID	1	100	1X63	3-Phase	NO	NO					
91	400	Rourkela	Chaibasa	POWERGRID	1	120	1X50	3-Phase	YES	YES	-				
92	400	Rourkela	Chaibasa	POWERGRID	2	120	1X50	3-Phase	NO	YES	-				
93	400	Rourkela	Jharsuguda	POWERGRID	1	142	1X63	3-Phase	NO	YES	-				
94	400	Rourkela	Jharsuguda	POWERGRID	2	142	1X63	3-Phase	NO	YES	-				
95	400	Rourkela	Talcher	POWERGRID	1	175	-				1X50	3-Phase	NO	NO	
96	400	Rourkela	Talcher	POWERGRID	2	175	-				1X50	3-Phase	NO	NO	
97	400	RTPS	Ranchi	POWERGRID	2	155.5	1X50	3-Phase	NO	NO	-				
98	400	RTPS	Ranchi	POWERGRID	3	155.5	1X50	3-Phase	NO	NO	-				
99	400	Sagardighi	Subashgram	POWERGRID	1	256.3					1X50	3-Phase	YES	NO	
100	400	Sasaram	Allahabad	POWERGRID	1	271	1X63	3-Phase	YES	YES	-				
101	400	Sasaram	Sarnath	POWERGRID	1	77	1X63	3-Phase	YES	YES	-				
102	400	Sasaram	Biharshariff	POWERGRID	1	195	1X63	3-Phase	YES	YES	-				
103	400	Sasaram	Biharshariff	POWERGRID	2	198.9	1X63	3-Phase	YES	YES	-				
104	400	Darbhanga	Kishanganj	ATL	1	209	1X80	3-Phase	Yes	No	1X80	3-Phase	YES	YES	
105	400	Darbhanga	Kishanganj	ATL	2	209	1X80	3-Phase	Yes	No	1X80	3-Phase	YES	YES	
106	400	Teesta-III	Kishanganj	TVPTL	1	215	-				1X63	3-Phase	YES	YES	
107	400	Pandiabili	New Duburi	POWERGRID	1	143.35	1X63	3-Phase	YES	YES	-				
108	400	Baripada	Keonjhar	POWERGRID	1	156.25	3X16.67	1-Phase	YES	NO	-				

Sl No	Voltage	From Bus	To Bus	Line Owner	Ckt ID	Line Length	Reactor (MVAr)								Remarks
							From End				To End				
							Rating	Unit Type	Switchable(with additional CB) : YES or NO?	Provision to use as Bus reactor	Rating	Unit Type	Switchable(with additional CB) : YES or NO?	Provision to use as Bus reactor	
109	400	Jeerat	Bakreswar	WBSETCL	1	162	1X50	3-Phase	NO	NO					
110	400	Arambag	Bakreswar	WBSETCL	1	130	1X63	3-Phase	NO	NO					

8.2 List of Bus reactors

Sl No	Name of Substation	Voltage Level	Reactor (MVAr)	Unit Type	Remarks	Owner
1	ANGUL	765	2X330	1-Phase		POWERGRID
		400	3X125	3-Phase		POWERGRID
2	GAYA	765	2X240	1-Phase		POWERGRID
		400	2X125	3-Phase		POWERGRID
3	JHARSUGUDA	765	2X240	1-Phase		POWERGRID
		400	2X125	3-Phase		POWERGRID
4	RANCHI (NEW)	765	2X240	1-Phase		POWERGRID
		400	2X125	3-Phase		POWERGRID
5	SASARAM	765	1X330	1-Phase		POWERGRID
		400	2X125	3-Phase		POWERGRID
6	MEDNIPUR	765	2X330	1-Phase		PJMTL
		400	2X125	3-Phase		PJMTL
7	ALIPURDUAR	400	2X125	3-Phase		POWERGRID
8	ARAMBAGH	400	1X50 +1X125	3-Phase		POWERGRID
9	BAKRESWAR	400	1X50	3-Phase		POWERGRID
10	BANKA	400	1X80 + 1X125	3-Phase		POWERGRID
11	BARH	400	1X80	3-Phase		POWERGRID
12	BARIPDA	400	2X125	3-Phase		POWERGRID
13	BEHRAMPUR	400	1X80 + 1X125	3-Phase		POWERGRID
14	BIDHANNAGAR	400	1X50	3-Phase		WBSETCL
15	BIHARSHARIFF	400	1X50 + 1X80 + 1X125	3-Phase		POWERGRID
16	BINAGURI	400	2X125	3-Phase		POWERGRID
17	BOLANGIR	400	1X80+1X125	3-Phase		POWERGRID
18	CHAIBASA	400	1X80	3-Phase		POWERGRID
19	CHANDWA	400	2X125	3-Phase		POWERGRID
20	DALTONGANJ	400	1X80	3-Phase		POWERGRID
21	DARBHANGA	400	2X125	3-Phase		POWERGRID
22	DUBURI	400	1X80	3-Phase		OPTCL
23	DURGAPUR	400	1X50+3X125	3-Phase		POWERGRID
24	FARAKKA	400	2X50	3-Phase		NTPC
25	GOKARNA	400	1X80	3-Phase		WBSETCL
26	INDRAVATI	400	1X125	3-Phase		POWERGRID
27	JAMSHEDPUR	400	1X50+2X125	3-Phase		POWERGRID
28	JEERAT	400	2X50	3-Phase		WBSETCL
29	JEYPORE	33	31.5	3-Phase	Tertiary	POWERGRID
		400	1 X 63+1X125	3-Phase		POWERGRID
30	JITPL	400	2X50	3-Phase		JITPL
31	KAHALGAON	400	2X50	3-Phase		NTPC
32	KEONJHAR	400	1X80+1X125	3-Phase		POWERGRID
33	KHARAGPUR	400	1X80	3-Phase		WBSETCL
34	KISHANGANJ	400	2X125	3-Phase		POWERGRID
35	KODERMA	400	2X50	3-Phase		DVC
36	LAKHISARAI	400	1X80+1X125	3-Phase		POWERGRID
37	MAITHON	400	1X50+2X125	3-Phase		POWERGRID
38	MAITHON RB	400	2X50	3-Phase		MPL
39	MOTIHARI	400	2X125	3-Phase		DMTCL
40	MUZAFFARPUR	400	2X125	3-Phase		POWERGRID
41	NABINAGAR (BRBCL)	400	1X50	3-Phase		BRBCL
42	NEW CHANDITALA	400	1X80	3-Phase		POWERGRID
43	NEW PPSP	400	1X80	3-Phase		WBSETCL
44	NEW PURNIA	400	2X125	3-Phase		POWERGRID
45	PANDIABALLI	400	1X80+1X63	3-Phase		POWERGRID
46	PATNA	400	1X80+2X125	3-Phase		POWERGRID
47	RAGUNATHPUR	400	2X50	3-Phase		DVC
48	RAJARHAT	400	2X125	3-Phase		POWERGRID
49	RANCHI	400	1X80+1X125	3-Phase		POWERGRID
50	RANGPO	400	2X80	3-Phase		POWERGRID
51	RENGALI	33	31.5	3-Phase	Tertiary	POWERGRID
		400	2X125	3-Phase		POWERGRID
52	ROURKELA	400	2X125	3-Phase		POWERGRID
53	SUBHASGRAM	400	1x125	3-Phase		POWERGRID
54	NEW MELLI	220	2X31.5	3-Phase		POWERGRID

9 Series Compensation and Harmonic Filters

SERIES COMPENSATION DETAILS			
S.NO	**Line**	**End at which installed**	**Compensation**
1	400kV Purnea – Muzaffarpur D/C	Purnea	40% fixed, +15%/-5% dynamic
2	400kV Jeypore-Bolangir S/C	Jeypore	63% (fixed)
3	400kV Rengali-Indravati S/C	Rengali	40% (fixed)
4	400kV Jeypore-Gajuwaka D/C	Jeypore	40% (fixed)
5	400kV Ranchi-Sipat D/C	Ranchi	40% (fixed)

HVDC Fliter Details

Filters at Gazuwaka East	**Number**
106 MVAR Doubled Damped Filter	1
106 MVAR 3rd Harmonic/Doubled Damped Filter	2
50 MVAR Bus Reactor	2
Filters at Talcher	**Number**
Doubled Damped filter	
120 MVAR (Switchable)	6
97 MVAR	3
66 MVAR Shunt Capacitor	1
72.6 MVAR Shunt Capacitor	2
Filters at Pusauli	**Number**
112 MVAR at North Bus	4
112 MVAR at East Bus	4
Filters at Bheremara	**Number**
91 MVAR at 400 kV Side	4
91 MVAR at 230 kV Side	4
Filters at Alipurduar	
FILTER BANK 1	
HP 12 (125 Mvar)	125
HP 12B (160 Mvar)	160
HP 24/36 (125 Mvar)	125
HP 3 (159 Mvar)	159
HP 12B (160 Mvar)	160
FILTER BANK 2	
HP 12 (125 Mvar)	125
HP 12B (160 Mvar)	160
HP 24/36 (125 Mvar)	125
HP 3 (159 Mvar)	159

10 List of important buses

10.1 765 kV Buses

Sl No	Name of Substation	Name of Buses
1	765 /400/220 kV Sasaram (765 kV Side)	765 kV Main Bus-1 at 765 /400/220 kV Sasaram
		765 kV Main Bus-2 at 765 /400/220 kV Sasaram
2	765/400/220 kV Gaya (765 kV Side)	765 kV Main Bus-1 at 765/400/220 kV Gaya
		765 kV Main Bus-2 at 765/400/220 kV Gaya
3	765/400 kV New Ranchi (765 kV Side)	765 kV Main Bus-1 at 765/400 kV New Ranchi
		765 kV Main Bus-2 at 765/400 kV New Ranchi
4	765/400 kV Jharsuguda (765 kV Side)	765 kV Main Bus-1 at 765/400 kV Jharsuguda
		765 kV Main Bus-2 at 765/400 kV Jharsuguda
		765 kV Main Bus-3 at 765/400 kV Jharsuguda
		765 kV Main Bus-4 at 765/400 kV Jharsuguda
5	765 kV Darlipalli(765 kV Side)	765 kV Main Bus-1 at 765 kV Darlipalli
		765 kV Main Bus-2 at 765 kV Darlipalli
6	765/400 kV Angul (765 kV Side)	765 kV Main Bus-1 at 765/400 kV Angul
		765 kV Main Bus-2 at 765/400 kV Angul
7	765/400 kV Mednipur (765 kV Side)	765 kV Main Bus-1 at 765/400 kV Mednipur
		765 kV Main Bus-2 at 765/400 kV Mednipur

10.2 400 kV Buses

Sl No	Name of Substation	Name of Buses
1	765/400 kV Angul (400 kV Side)	400 kV Main Bus-1 at 765/400 kV Angul
		400 kV Main Bus-2 at 765/400 kV Angul
		400 kV Main Bus-3 at 765/400 kV Angul
		400 kV Main Bus-4 at 765/400 kV Angul
2	400/220 kV Baripada (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Baripada
		400 kV Main Bus-2 at 400/220 kV Baripada
3	400/220 kV Bolangir (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Bolangir
		400 kV Main Bus-2 at 400/220 kV Bolangir
4	400 kV Indravati(400 kV Side)	400 kV Main Bus-1 at 400 kV Indravati
		400 kV Main Bus-2 at 400 kV Indravati
5	400/220 kV Jeypore (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Jeypore
		400 kV Main Bus-2 at 400/220 kV Jeypore
6	400/220 kV Keonjhar (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Keonjhar
		400 kV Main Bus-2 at 400/220 kV Keonjhar

Sl No	Name of Substation	Name of Buses
7	400/220 kV Lapanga (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Lapanga
		400 kV Main Bus-2 at 400/220 kV Lapanga
8	400/220 kV Pandiabilli (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Pandiabilli
		400 kV Main Bus-2 at 400/220 kV Pandiabilli
9	400/220 kV Rourkela (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Rourkela
		400 kV Main Bus-2 at 400/220 kV Rourkela
10	400/220 kV Rengali (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Rengali
		400 kV Main Bus-2 at 400/220 kV Rengali
11	400/220 kV Chaibasa (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Chaibasa
		400 kV Main Bus-2 at 400/220 kV Chaibasa
12	400 kV Chandwa(400 kV Side)	400 kV Main Bus-1 at 400 kV Chandwa
		400 kV Main Bus-2 at 400 kV Chandwa
13	765/400 kV New Ranchi (400 kV Side)	400 kV Main Bus-1 at 765/400 kV New Ranchi
		400 kV Main Bus-2 at 765/400 kV New Ranchi
14	400/220 kV Bakreswar TPS (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Bakreswar TPS
		400 kV Main Bus-2 at 400/220 kV Bakreswar TPS
		400 kV Transfer Bus at 400/220 kV Bakreswar TPS
15	400 kV Bahrampur(400 kV Side)	400 kV Main Bus-1 at 400 kV Bahrampur
		400 kV Main Bus-2 at 400 kV Bahrampur
16	400/220 kV Binaguri (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Binaguri
		400 kV Main Bus-2 at 400/220 kV Binaguri
17	400/220 kV Gokarno (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Gokarno
		400 kV Main Bus-2 at 400/220 kV Gokarno
18	400/220 kV Maithon(400 kV Side)	400 kV Main Bus-1 at 400/220 kV Maithon
		400 kV Main Bus-2 at 400/220 kV Maithon
19	400/220 kV Malda (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Malda
		400 kV Main Bus-2 at 400/220 kV Malda
		400 kV Transfer Bus at 400/220 kV Malda
20	400 kV New PPSP(400 kV Side)	400 kV Main Bus-1 at 400 kV New PPSP
		400 kV Main Bus-2 at 400 kV New PPSP
21	400/220 kV Rajarhat(400 kV Side)	400 kV Main Bus-1 at 400/220 kV Rajarhat
		400 kV Main Bus-2 at 400/220 kV Rajarhat
22	400/220 kV Subhasgram (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Subhasgram
		400 kV Main Bus-2 at 400/220 kV Subhasgram
23	400 kV GMR(400 kV Side)	400 kV Main Bus-1 at 400 kV GMR
		400 kV Main Bus-2 at 400 kV GMR
24	400 kV JITPL(400 kV Side)	400 kV Main Bus-1 at 400 kV JITPL
		400 kV Main Bus-2 at 400 kV JITPL
25	400 kV Adhunik(400 kV Side)	400 kV Main Bus-1 at 400 kV Adhunik
		400 kV Main Bus-2 at 400 kV Adhunik
26	400/220 kV Arambag (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Arambag

Sl No	Name of Substation	Name of Buses
		400 kV Main Bus-2 at 400/220 kV Arambag
		400 kV Transfer Bus at 400/220 kV Arambag
27	765/400 kV Jharsuguda (400 kV Side)	400 kV Main Bus-1 at 765/400 kV Jharsuguda
		400 kV Main Bus-2 at 765/400 kV Jharsuguda
		400 kV Main Bus-3 at 765/400 kV Jharsuguda
		400 kV Main Bus-4 at 765/400 kV Jharsuguda
28	400/220 kV Jamsedpur (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Jamsedpur
		400 kV Main Bus-2 at 400/220 kV Jamsedpur
29	400/220 kV Daltonganj (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Daltonganj
		400 kV Main Bus-2 at 400/220 kV Daltonganj
30	400/220 kV Koderma (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Koderma
		400 kV Main Bus-2 at 400/220 kV Koderma
31	400/220 kV Ranchi (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Ranchi
		400 kV Main Bus-2 at 400/220 kV Ranchi
32	400/220 kV Bidhannagar (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Bidhannagar
		400 kV Main Bus-2 at 400/220 kV Bidhannagar
		400 kV Transfer Bus at 400/220 kV Bidhannagar
33	400/220 kV DSTPS (400 kV Side)	400 kV Main Bus-1 at 400/220 kV DSTPS
		400 kV Main Bus-2 at 400/220 kV DSTPS
34	400/220 kV Farakka (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Farakka
		400 kV Main Bus-2 at 400/220 kV Farakka
35	400 kV Maithon Right Bank(400 kV Side)	400 kV Main Bus-1 at 400 kV Maithon Right Bank
		400 kV Main Bus-2 at 400 kV Maithon Right Bank
36	400/220 kV Alipurdwar(400 kV Side)	400 kV Main Bus-1 at 400/220 kV Alipurdwar
		400 kV Main Bus-2 at 400/220 kV Alipurdwar
37	400/132 kV Banka (400 kV Side)	400 kV Main Bus-1 at 400/132 kV Banka
		400 kV Main Bus-2 at 400/132 kV Banka
38	400/132 kV Barh (400 kV Side)	400 kV Main Bus-1 at 400/132 kV Barh
		400 kV Main Bus-2 at 400/132 kV Barh
39	400/220 kV Biharsariff (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Biharsariff
		400 kV Main Bus-2 at 400/220 kV Biharsariff
40	400/220 kV Darbhanga (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Darbhanga
		400 kV Main Bus-2 at 400/220 kV Darbhanga
41	400/220 kV Durgapur (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Durgapur
		400 kV Main Bus-2 at 400/220 kV Durgapur
42	765/400/220 kV Gaya (400 kV Side)	400 kV Main Bus-1 at 765/400/220 kV Gaya
		400 kV Main Bus-2 at 765/400/220 kV Gaya
43	400/132 kV Kahalgaon (400 kV Side)	400 kV Main Bus-1 at 400/132 kV Kahalgaon
		400 kV Main Bus-2 at 400/132 kV Kahalgaon
44	400/220 kV Bokaro A (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Bokaro A
		400 kV Main Bus-2 at 400/220 kV Bokaro A
45	400kV BRBCL(400 kV Side)	400 kV Main Bus-1 at 400kV BRBCL

Sl No	Name of Substation	Name of Buses
		400 kV Main Bus-2 at 400kV BRBCL
46	400kV Dikchu(400 kV Side)	400 kV Main Bus-1 at 400kV Dikchu
		400 kV Main Bus-2 at 400kV Dikchu
47	400 kV Haldia(400 kV Side)	400 kV Main Bus-1 at 400 kV Haldia
		400 kV Main Bus-2 at 400 kV Haldia
48	400 kV IB TPS Stage-2(400 kV Side)	400 kV Main Bus-1 at 400 kV IB TPS Stage-2
		400 kV Main Bus-2 at 400 kV IB TPS Stage-2
49	400 kV Indbhara(400 kV Side)	400 kV Main Bus-1 at 400 kV Indbharat
		400 kV Main Bus-2 at 400 kV Indbharat
50	400/220 kV Indravati(400 kV Side)	400 kV Main Bus-1 at 400/220 kV Indravati
		400 kV Main Bus-2 at 400/220 kV Indravati
51	400/220 kV Jeerat(400 kV Side)	400 kV Main Bus-1 at 400/220 kV Jeerat
		400 kV Main Bus-2 at 400/220 kV Jeerat
		400 kV Transfer Bus at 400/220 kV Jeerat
52	400/220 kV JSPL(400 kV Side)	400 kV Main Bus-1 at 400/220 kV JSPL
		400 kV Main Bus-2 at 400/220 kV JSPL
53	400/220 kV Kharagpur (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Kharagpur
		400 kV Main Bus-2 at 400/220 kV Kharagpur
		400 kV Transfer Bus at 400/220 kV Kharagpur
54	400/220 kV Kishanganj (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Kishanganj
		400 kV Main Bus-2 at 400/220 kV Kishanganj
55	400/220 kV Kolagha(400 kV Side)	400 kV Main Bus-1 at 400/220 kV Kolaghat
		400 kV Main Bus-2 at 400/220 kV Kolaghat
56	400/132 kV Lakhisarai (400 kV Side)	400 kV Main Bus-1 at 400/132 kV Lakhisarai
		400 kV Main Bus-2 at 400/132 kV Lakhisarai
57	400 kV Mejia B TPS(400 kV Side)	400 kV Main Bus-1 at 400 kV Mejia B TPS
		400 kV Main Bus-2 at 400 kV Mejia B TPS
58	400/220 kV Mendasal (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Mendasal
		400 kV Main Bus-2 at 400/220 kV Mendasal
59	400/220 kV Meramandali (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Meramandali
		400 kV Main Bus-2 at 400/220 kV Meramandali
60	400/132 kV Motihari(400 kV Side)	400 kV Main Bus-1 at 400/132 kV Motihari
		400 kV Main Bus-2 at 400/132 kV Motihari
61	400/220 kV Muzaffarpur (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Muzaffarpur
		400 kV Main Bus-2 at 400/220 kV Muzaffarpur
62	400 kV Nabinagar STPS(400 kV Side)	400 kV Main Bus-1 at 400 kV Nabinagar STPS
		400 kV Main Bus-2 at 400 kV Nabinagar STPS
63	400/220 kV New Chanditala(400 kV Side)	400 kV Main Bus-1 at 400/220 kV New Chanditala
		400 kV Main Bus-2 at 400/220 kV New Chanditala
64	400/220 kV New Duburi (400 kV Side)	400 kV Main Bus-1 at 400/220 kV New Duburi

Sl No	Name of Substation	Name of Buses
		400 kV Main Bus-2 at 400/220 kV New Duburi
65	400/220 kV New Purnea(400 kV Side)	400 kV Main Bus-1 at 400/220 kV New Purnea
		400 kV Main Bus-2 at 400/220 kV New Purnea
66	400/220 kV Patna(400 kV Side)	400 kV Main Bus-1 at 400/220 kV Patna
		400 kV Main Bus-2 at 400/220 kV Patna
67	400 kV PPSP(400 kV Side)	400 kV Main Bus-1 at 400 kV PPSP
		400 kV Main Bus-2 at 400 kV PPSP
68	400 kV Raghunathpur(400 kV Side)	400 kV Main Bus-1 at 400 kV Raghunathpur
		400 kV Main Bus-2 at 400 kV Raghunathpur
69	400/220 kV Rangpo (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Rangpo
		400 kV Main Bus-2 at 400/220 kV Rangpo
70	400/220 kV Sagardighi TPS (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Sagardighi TPS
		400 kV Main Bus-2 at 400/220 kV Sagardighi TPS
71	400 kV Talcher HVDC Sustation AC Side(400 kV Side)	400 kV Main Bus-1 at 400 kV Talcher HVDC Sustation AC Side
		400 kV Main Bus-2 at 400 kV Talcher HVDC Sustation AC Side
72	765/400/220 kV Sasaram (400 kV Side)	400 kV Main Bus-1 at 765/400/220 kV Sasaram
		400 kV Main Bus-2 at 765/400/220 kV Sasaram
73	400/132 kV TISCO (400 kV Side)	400 kV Main Bus-1 at 400/132 kV TISCO
		400 kV Main Bus-2 at 400/132 kV TISCO
74	400 kV Teesta-III(400 kV Side)	400 kV Main Bus-1 at 400 kV Teesta-III
		400 kV Main Bus-2 at 400 kV Teesta-III
75	400 kV Teesta-V(400 kV Side)	400 kV Main Bus-1 at 400 kV Teesta-V
		400 kV Main Bus-2 at 400 kV Teesta-V
76	400/220 kV Sterlite(400 kV Side)	400 kV Main Bus-1 at 400/220 kV Sterlite
		400 kV Main Bus-2 at 400/220 kV Sterlite
77	400/220 kV Talcher St-1(400 kV Side)	400 kV Main Bus-1 at 400/220 kV Talcher St-1
		400 kV Main Bus-2 at 400/220 kV Talcher St-1
		400 kV Main Bus-1 at 400/220 kV Talcher St-2
		400 kV Main Bus-2 at 400/220 kV Talcher St-2
78	400/220 kV Talcher St-2(400 kV Side)	400 kV Main Bus-3 at 400/220 kV Talcher St-2
		400 kV Main Bus-4 at 400/220 kV Talcher St-2
79	765/400 kV Mednipur (400 kV Side)	400 kV Main Bus-1 at 765/400 kV Mednipur
		400 kV Main Bus-2 at 765/400 kV Mednipur
80	400/220 kV Sitamarhi (400 kV Side)	400 kV Main Bus-1 at 400/220 kV Sitamarhi
		400 kV Main Bus-2 at 400/220 kV Sitamarhi

10.3 220 kV Buses

Sl No	Name of Substation	Name of Buses
1	400/220 kV Kishanganj (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Kishanganj
		220 kV Main Bus-2 at 400/220 kV Kishanganj
2	400/220 kV Patna (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Patna
		220 kV Main Bus-2 at 400/220 kV Patna
		220 kV Transfer Bus at 400/220 kV Patna
3	220/132 kV Purnea (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Purnea
		220 kV Main Bus-2 at 220/132 kV Purnea
		220 kV Transfer Bus at 220/132 kV Purnea
4	400/220 kV Ranchi (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Ranchi
		220 kV Main Bus-2 at 400/220 kV Ranchi
		220 kV Transfer Bus at 400/220 kV Ranchi
5	400/220 kV Alipudwar	220 kV Main Bus-1 at 400/220 kV Alipudwar
		220 kV Main Bus-2 at 400/220 kV Alipudwar
6	220/132 Alipudwar WB (220 kV Side)	220 kV Main Bus-1 at 220/132 Alipudwar WB
		220 kV Main Bus-2 at 220/132 Alipudwar WB
		220 kV Transfer Bus at 220/132 Alipudwar WB
7	220/132 kV Arah (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Arah
		220 kV Main Bus-2 at 220/132 kV Arah
		220 kV Transfer Bus at 220/132 kV Arah
8	220/132 kV Atri (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Atri
		220 kV Main Bus-2 at 220/132 kV Atri
		220 kV Transfer Bus at 220/132 kV Atri
9	220/132 kV Balasore(220kV Side)	220 kV Main Bus-1 at 220/132 kV Balasore
		220 kV Main Bus-2 at 220/132 kV Balasore
		220 kV Transfer Bus at 220/132 kV Balasore
10	400/220 kV Baripada (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Baripada
		220 kV Main Bus-2 at 400/220 kV Baripada
		220 kV Transfer Bus at 400/220 kV Baripada
11	220/132 kV Begusarai	220 kV Main Bus-1 at 220/132 kV Begusarai
		220 kV Main Bus-2 at 220/132 kV Begusarai
		220 kV Transfer Bus at 220/132 kV Begusarai
12	400/220 kV Binaguri (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Binaguri
		220 kV Main Bus-2 at 400/220 kV Binaguri
		220 kV Transfer Bus at 400/220 kV Binaguri
13	220/132 kV Birpara (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Birpara
		220 kV Main Bus-2 at 220/132 kV Birpara
		220 kV Transfer Bus at 220/132 kV Birpara
14	220/132 kV Bodhgaya (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bodhgaya
		220 kV Main Bus-2 at 220/132 kV Bodhgaya
		220 kV Transfer Bus at 220/132 kV Bodhgaya
15	400/220 kV Bolangir (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Bolangir
		220 kV Main Bus-2 at 400/220 kV Bolangir

Sl No	Name of Substation	Name of Buses
		220 kV Transfer Bus at 400/220 kV Bolangir
16	400/220 kV Chaibasa (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Chaibasa
		220 kV Main Bus-2 at 400/220 kV Chaibasa
		220 kV Transfer Bus at 400/220 kV Chaibasa
17	220/132 kV Chaibasa New (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Chaibasa New
		220 kV Main Bus-2 at 220/132 kV Chaibasa New
		220 kV Transfer Bus at 220/132 kV Chaibasa New
18	220/132 kV Chandil (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Chandil
		220 kV Main Bus-2 at 220/132 kV Chandil
		220 kV Transfer Bus at 220/132 kV Chandil
19	220 kV Chukha	220 kV Main Bus-1 at 220 kV Chukha
		220 kV Main Bus-2 at 220 kV Chukha
		220 kV Transfer Bus at 220 kV Chukha
20	220/132 kV Dalkola WB (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Dalkola WB
		220 kV Main Bus-2 at 220/132 kV Dalkola WB
		220 kV Transfer Bus at 220/132 kV Dalkola WB
21	220 kV Dalkola	220 kV Main Bus-1 at 220 kV Dalkola
		220 kV Main Bus-2 at 220 kV Dalkola
		220 kV Transfer Bus at 220 kV Dalkola
22	400/220 kV Daltonganj (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Daltonganj
		220 kV Main Bus-2 at 400/220 kV Daltonganj
		220 kV Transfer Bus at 400/220 kV Daltonganj
23	220/132 kV Dehri (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Dehri
		220 kV Main Bus-2 at 220/132 kV Dehri
		220 kV Transfer Bus at 220/132 kV Dehri
24	220 kV Dhanbad	220 kV Main Bus-1 at 220/132 kV Dhanbad
		220 kV Main Bus-2 at 220/132 kV Dhanbad
		220 kV Transfer Bus at 220/132 kV Dhanbad
25	220/132 kV Dumka (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Dumka
		220 kV Main Bus-2 at 220/132 kV Dumka
		220 kV Transfer Bus at 220/132 kV Dumka
26	220 kV EMSS	220 kV Main Bus-1 at 220 kV EMSS
		220 kV Main Bus-2 at 220 kV EMSS
		220 kV Transfer Bus at 220 kV EMSS
27	400/220 kV Farakka (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Farakka
		220 kV Main Bus-2 at 400/220 kV Farakka
		220 kV Transfer Bus at 400/220 kV Farakka
28	220/132 kV Fatuah (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Fatuah
		220 kV Main Bus-2 at 220/132 kV Fatuah
		220 kV Transfer Bus at 220/132 kV Fatuah
29	765/400/220 kV Gaya (220 kV Side)	220 kV Main Bus-1 at 765/400/220 kV Gaya
		220 kV Main Bus-2 at 765/400/220 kV Gaya
		220 kV Transfer Bus at 765/400/220 kV Gaya

Sl No	Name of Substation	Name of Buses
30	220/132 kV Gazol (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Gazol
		220 kV Main Bus-2 at 220/132 kV Gazol
		220 kV Transfer Bus at 220/132 kV Gazol
31	220/132 kV Kizirsarai (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Kizirsarai
		220 kV Main Bus-2 at 220/132 kV Kizirsarai
		220 kV Transfer Bus at 220/132 kV Kizirsarai
32	220/132 kV Hatia (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Hatia
		220 kV Main Bus-2 at 220/132 kV Hatia
		220 kV Transfer Bus at 220/132 kV Hatia
33	220/132 kV Hazipur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Hazipur
		220 kV Main Bus-2 at 220/132 kV Hazipur
		220 kV Transfer Bus at 220/132 kV Hazipur
34	400/220 kV Jeerat (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Jeerat
		220 kV Main Bus-2 at 400/220 kV Jeerat
		220 kV Transfer Bus at 400/220 kV Jeerat
35	220/132 kV Jeynagar(220 kV Side)	220 kV Main Bus-1 at 220/132 kV Jeynagar
		220 kV Main Bus-2 at 220/132 kV Jeynagar
		220 kV Transfer Bus at 220/132 kV Jeynagar
36	400/220 kV Jeypore (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Jeypore
		220 kV Main Bus-2 at 400/220 kV Jeypore
		220 kV Transfer Bus at 400/220 kV Jeypore
37	220 kV Jorthang	220 kV Main Bus-1 at 220 kV Jorthang
		220 kV Main Bus-2 at 220 kV Jorthang
38	400/220 kV Keonjhar (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Keonjhar
		220 kV Main Bus-2 at 400/220 kV Keonjhar
		220 kV Transfer Bus at 400/220 kV Keonjhar
39	220/132 kV Keonjhar Odisha (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Keonjhar
		220 kV Main Bus-2 at 220/132 kV Keonjhar
		220 kV Transfer Bus at 220/132 kV Keonjhar
40	220/132 kV Katapalli	220 kV Main Bus-1 at 220/132 kV Katapalli
		220 kV Main Bus-2 at 220/132 kV Katapalli
		220 kV Transfer Bus at 220/132 kV Katapalli
41	220/132 kV New Khagaria (220 kV Side)	220 kV Main Bus-1 at 220/132 kV New Khagaria
		220 kV Main Bus-2 at 220/132 kV New Khagaria
		220 kV Transfer Bus at 220/132 kV New Khagaria
42	220/131 kV Khagaul (220 kV Side)	220 kV Main Bus-1 at 220/131 kV Khagaul
		220 kV Main Bus-2 at 220/131 kV Khagaul
		220 kV Transfer Bus at 220/131 kV Khagaul
43	220/132 kV Kishanganj Bihar(220 kV Side)	220 kV Main Bus-1 at 220/132 kV Kishanganj Bihar
		220 kV Main Bus-2 at 220/132 kV Kishanganj Bihar
		220 kV Transfer Bus at 220/132 kV Kishanganj Bihar
44	220/132 kV Kalyaneswari (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Kalyaneswari
		220 kV Main Bus-2 at 220/132 kV Kalyaneswari

Sl No	Name of Substation	Name of Buses
		220 kV Transfer Bus at 220/132 kV Kalyaneswari
45	220/132 kV Lalmatia (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Lalmatia
		220 kV Main Bus-2 at 220/132 kV Lalmatia
		220 kV Transfer Bus at 220/132 kV Lalmatia
46	220/132 kV Madehpura (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Madehpura
		220 kV Main Bus-2 at 400/220 kV Madehpura
		220 kV Transfer Bus at 400/220 kV Madehpura
47	400/220 kV Maithon (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Maithon
		220 kV Main Bus-2 at 400/220 kV Maithon
		220 kV Transfer Bus at 400/220 kV Maithon
48	400/220 kV Malabase (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Malabase
		220 kV Main Bus-2 at 400/220 kV Malabase
		220 kV Transfer Bus at 400/220 kV Malabase
49	400/220 kV Malda (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Malda
		220 kV Main Bus-2 at 400/220 kV Malda
		220 kV Transfer Bus at 400/220 kV Malda
50	400/220 kV Meramandali (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Meramandali
		220 kV Main Bus-2 at 400/220 kV Meramandali
		220 kV Transfer Bus at 400/220 kV Meramandali
51	400/220 kV Muzzafarpur (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Muzzafarpur
		220 kV Main Bus-2 at 400/220 kV Muzzafarpur
		220 kV Transfer Bus at 400/220 kV Muzzafarpur
52	400/220 kV New Purnea (220 kV Side)	220 kV Main Bus-1 at 400/220 kV New Purnea
		220 kV Main Bus-2 at 400/220 kV New Purnea
		220 kV Transfer Bus at 400/220 kV New Purnea
53	220/132 kV New town (220 kV Side)	220 kV Main Bus-1 at 220/132 kV New town
		220 kV Main Bus-2 at 220/132 kV New town
		220 kV Transfer Bus at 220/132 kV New town
54	220 kV New Melli	220 kV Main Bus-1 at 220 kV New Melli
		220 kV Main Bus-2 at 220 kV New Melli
55	220/132 kV Siliguri (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Siliguri
		220 kV Main Bus-2 at 220/132 kV Siliguri
		220 kV Transfer Bus at 220/132 kV Siliguri
56	220/132 kV NJP WB (220 kV Side)	220 kV Main Bus-1 at 220/132 kV NJP WB
		220 kV Main Bus-2 at 220/132 kV NJP WB
		220 kV Transfer Bus at 220/132 kV NJP WB
57	400/220 kV Pandiabilli (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Pandiabilli
		220 kV Main Bus-2 at 400/220 kV Pandiabilli
		220 kV Transfer Bus at 400/220 kV Pandiabilli
58	220/132 kV Parulia DVC (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Parulia DVC
		220 kV Main Bus-2 at 220/132 kV Parulia DVC
		220 kV Transfer Bus at 220/132 kV Parulia DVC
59	400/220 kV Durgapur (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Durgapur

Sl No	Name of Substation	Name of Buses
		220 kV Main Bus-2 at 400/220 kV Durgapur
		220 kV Transfer Bus at 400/220 kV Durgapur
60	220/132 kV Puri (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Puri
		220 kV Main Bus-2 at 220/132 kV Puri
		220 kV Transfer Bus at 220/132 kV Puri
61	220/132 kV Nadokar (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Nadokar
		220 kV Main Bus-2 at 220/132 kV Nadokar
		220 kV Transfer Bus at 220/132 kV Nadokar
62	400/220 kV Sasaram (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Sasaram
		220 kV Main Bus-2 at 400/220 kV Sasaram
		220 kV Transfer Bus at 400/220 kV Sasaram
63	400/220 kV Rajarhat (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Rajarhat
		220 kV Main Bus-2 at 400/220 kV Rajarhat
		220 kV Transfer Bus at 400/220 kV Rajarhat
64	220/132 kV Ramchandrapur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Ramchandrapur
		220 kV Main Bus-2 at 220/132 kV Ramchandrapur
		220 kV Transfer Bus at 220/132 kV Ramchandrapur
65	400/220 kV Rangpo (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Rangpo
		220 kV Main Bus-2 at 400/220 kV Rangpo
66	220 kV Rengali Odisha	220 kV Main Bus-1 at 220 kV Rengali Odisha
		220 kV Main Bus-2 at 220 kV Rengali Odisha
		220 kV Transfer Bus at 220 kV Rengali Odisha
67	400/220 kV Rengali (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Rengali
		220 kV Main Bus-2 at 400/220 kV Rengali
		220 kV Transfer Bus at 400/220 kV Rengali
68	220 kV Rengali Power House	220 kV Main Bus-1 at 220 kV Rengali Power House
		220 kV Main Bus-2 at 220 kV Rengali Power House
		220 kV Transfer Bus at 220 kV Rengali Power House
69	400/220 kV Rourkela (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Rourkela
		220 kV Main Bus-2 at 400/220 kV Rourkela
		220 kV Transfer Bus at 400/220 kV Rourkela
70	220/132 kV Sahapuri (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Sahapuri
		220 kV Main Bus-2 at 220/132 kV Sahapuri
		220 kV Transfer Bus at 220/132 kV Sahapuri
71	220 kV Salakati	220 kV Main Bus-1 at 220 kV Salakati
		220 kV Main Bus-2 at 220 kV Salakati
		220 kV Transfer Bus at 220 kV Salakati
72	220/132 kV Sipara (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Sipara
		220 kV Main Bus-2 at 220/132 kV Sipara
		220 kV Transfer Bus at 220/132 kV Sipara
73	220/132 kV Sonnegar (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Sonnegar
		220 kV Main Bus-2 at 220/132 kV Sonnegar
		220 kV Transfer Bus at 220/132 kV Sonnegar

Sl No	Name of Substation	Name of Buses
74	220/132 kV Subhasgram WB (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Subhasgram WB
		220 kV Main Bus-2 at 220/132 kV Subhasgram WB
		220 kV Transfer Bus at 220/132 kV Subhasgram WB
75	400/220 kV Subhasgram (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Subhasgram
		220 kV Main Bus-2 at 400/220 kV Subhasgram
		220 kV Transfer Bus at 400/220 kV Subhasgram
76	220/132 kV Tarkera (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Tarkera
		220 kV Main Bus-2 at 220/132 kV Tarkera
		220 kV Transfer Bus at 220/132 kV Tarkera
77	220 kV Tasheding	220 kV Main Bus-1 at 220 kV Tasheding
		220 kV Main Bus-2 at 220 kV Tasheding
78	400/220 kV Talcher STPS (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Talcher STPS
		220 kV Main Bus-2 at 400/220 kV Talcher STPS
		220 kV Transfer Bus at 400/220 kV Talcher STPS
79	220/132 Talcher TPS (220 kV Side)	220 kV Main Bus-1 at 220/132 Talcher TPS
		220 kV Main Bus-2 at 220/132 Talcher TPS
		220 kV Transfer Bus at 220/132 Talcher TPS
80	220/132 kV Bhanjnagar (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bhanjnagar
		220 kV Main Bus-2 at 220/132 kV Bhanjnagar
		220 kV Transfer Bus at 220/132 kV Bhanjnagar
81	220/132 kV Bidanasi (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bidanasi
		220 kV Main Bus-2 at 220/132 kV Bidanasi
		220 kV Transfer Bus at 220/132 kV Bidanasi
82	220/132 kV Budhipadar (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Budhipadar
		220 kV Main Bus-2 at 220/132 kV Budhipadar
		220 kV Transfer Bus at 220/132 kV Budhipadar
83	220/132 kV Chandaka (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Chandaka
		220 kV Main Bus-2 at 220/132 kV Chandaka
		220 kV Transfer Bus at 220/132 kV Chandaka
84	220/132 kV Dharampur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Dharampur
		220 kV Main Bus-2 at 220/132 kV Dharampur
		220 kV Transfer Bus at 220/132 kV Dharampur
85	220/132 kV Domjur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Domjur
		220 kV Main Bus-2 at 220/132 kV Domjur
		220 kV Transfer Bus at 220/132 kV Domjur
86	220/132 kV Duburi(old) (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Duburi
		220 kV Main Bus-2 at 220/132 kV Duburi
		220 kV Transfer Bus at 220/132 kV Duburi
87	220/132 kV Lakhikantpur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Lakhikantpur
		220 kV Main Bus-2 at 220/132 kV Lakhikantpur
		220 kV Transfer Bus at 220/132 kV Lakhikantpur
88	220/132 kV Laxmipur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Laxmipur
		220 kV Main Bus-2 at 220/132 kV Laxmipur

Sl No	Name of Substation	Name of Buses
		220 kV Transfer Bus at 220/132 kV Laxmipur
89	220/132 kV Midnapore (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Midnapore
		220 kV Main Bus-2 at 220/132 kV Midnapore
		220 kV Transfer Bus at 220/132 kV Midnapore
90	220/132 kV Narendrapur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Narendrapur
		220 kV Main Bus-2 at 220/132 kV Narendrapur
		220 kV Transfer Bus at 220/132 kV Narendrapur
91	220/132 kV Nayagarh (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Nayagarh
		220 kV Main Bus-2 at 220/132 kV Nayagarh
		220 kV Transfer Bus at 220/132 kV Nayagarh
92	220/132 kV Rishra (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Rishra
		220 kV Main Bus-2 at 220/132 kV Rishra
		220 kV Transfer Bus at 220/132 kV Rishra
93	400/220 kV Arambagh (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Arambagh
		220 kV Main Bus-2 at 400/220 kV Arambagh
		220 kV Transfer Bus at 400/220 kV Arambagh
94	400/220 kV Bakreswar (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Bakreswar
		220 kV Main Bus-2 at 400/220 kV Bakreswar
		220 kV Transfer Bus at 400/220 kV Bakreswar
95	220/132 kV Balimela (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Balimela
		220 kV Main Bus-2 at 220/132 kV Balimela
		220 kV Transfer Bus at 220/132 kV Balimela
96	220/132 kV Barasat (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Barasat
		220 kV Main Bus-2 at 220/132 kV Barasat
		220 kV Transfer Bus at 220/132 kV Barasat
97	220/132 kV Barjora (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Barjora
		220 kV Main Bus-2 at 220/132 kV Barjora
		220 kV Transfer Bus at 220/132 kV Barjora
98	220/132 kV Barkot (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Barkot
		220 kV Main Bus-2 at 220/132 kV Barkot
		220 kV Transfer Bus at 220/132 kV Barkot
99	220/132 kV Begusarai (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Begusarai
		220 kV Main Bus-2 at 220/132 kV Begusarai
		220 kV Transfer Bus at 220/132 kV Begusarai
100	220/132 kV Bhanjnagar (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bhanjnagar
		220 kV Main Bus-2 at 220/132 kV Bhanjnagar
		220 kV Transfer Bus at 220/132 kV Bhanjnagar
101	400/220 kV Bidhannagar (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Bidhannagar
		220 kV Main Bus-2 at 400/220 kV Bidhannagar
		220 kV Transfer Bus at 400/220 kV Bidhannagar
102	220/132 kV Biharshariff (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Biharshariff
		220 kV Main Bus-2 at 220/132 kV Biharshariff
		220 kV Transfer Bus at 220/132 kV Biharshariff

Sl No	Name of Substation	Name of Buses
103	220/132 kV Bishnupur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bishnupur
		220 kV Main Bus-2 at 220/132 kV Bishnupur
		220 kV Transfer Bus at 220/132 kV Bishnupur
104	220/132 kV Bodhagya (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bodhagya
		220 kV Main Bus-2 at 220/132 kV Bodhagya
		220 kV Transfer Bus at 220/132 kV Bodhagya
105	220/132 kV Bokaro (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bokaro
		220 kV Main Bus-2 at 220/132 kV Bokaro
		220 kV Transfer Bus at 220/132 kV Bokaro
106	220/132 kV Budhipadar (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Budhipadar
		220 kV Main Bus-2 at 220/132 kV Budhipadar
		220 kV Transfer Bus at 220/132 kV Budhipadar
107	220/132 kV Burnpur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Burnpur
		220 kV Main Bus-2 at 220/132 kV Burnpur
		220 kV Transfer Bus at 220/132 kV Burnpur
108	220/132 kV Chaibasa New(J) (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Chaibasa New
		220 kV Main Bus-2 at 220/132 kV Chaibasa New
		220 kV Transfer Bus at 220/132 kV Chaibasa New
109	220/132 kV Chandiposh (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Chandiposh
		220 kV Main Bus-2 at 220/132 kV Chandiposh
		220 kV Transfer Bus at 220/132 kV Chandiposh
110	220/132 kV Chandrapura TPS B (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Chandrapura TPS B
		220 kV Main Bus-2 at 220/132 kV Chandrapura TPS B
		220 kV Transfer Bus at 220/132 kV Chandrapura TPS B
111	220/132 kV Waria (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Waria
		220 kV Main Bus-2 at 220/132 kV Waria
		220 kV Transfer Bus at 220/132 kV Waria
112	220/132 kV Uihep (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Uihep
		220 kV Main Bus-2 at 220/132 kV Uihep
		220 kV Transfer Bus at 220/132 kV Uihep
113	220/132 kV U. Kolab (220 kV Side)	220 kV Main Bus-1 at 220/132 kV U. Kolab
		220 kV Main Bus-2 at 220/132 kV U. Kolab
		220 kV Transfer Bus at 220/132 kV U. Kolab
114	220/132 kV Theruvali (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Theruvali
		220 kV Main Bus-2 at 220/132 kV Theruvali
		220 kV Transfer Bus at 220/132 kV Theruvali
115	220/132 kV Rengali (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Rengali
		220 kV Main Bus-2 at 220/132 kV Rengali
		220 kV Transfer Bus at 220/132 kV Rengali
116	220/132 kV Sadaipur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Sadaipur
		220 kV Main Bus-2 at 220/132 kV Sadaipur
		220 kV Transfer Bus at 220/132 kV Sadaipur
117	220/132 kV Sagardighi (220 kV	220 kV Main Bus-1 at 220/132 kV Sagardighi

Sl No	Name of Substation	Name of Buses
	Side)	220 kV Main Bus-2 at 220/132 kV Sagardighi
		220 kV Transfer Bus at 220/132 kV Sagardighi
118	220/132 kV Santaldih (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Santaldih
		220 kV Main Bus-2 at 220/132 kV Santaldih
		220 kV Transfer Bus at 220/132 kV Santaldih
119	220/132 kV Satgachia (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Satgachia
		220 kV Main Bus-2 at 220/132 kV Satgachia
		220 kV Transfer Bus at 220/132 kV Satgachia
120	220/132 kV Patratu TPS (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Patratu TPS
		220 kV Main Bus-2 at 220/132 kV Patratu TPS
		220 kV Transfer Bus at 220/132 kV Patratu TPS
121	220/132 kV Ramgarh (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Ramgarh
		220 kV Main Bus-2 at 220/132 kV Ramgarh
		220 kV Transfer Bus at 220/132 kV Ramgarh
122	400/220 kV Meramandali (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Meramandali
		220 kV Main Bus-2 at 400/220 kV Meramandali
		220 kV Transfer Bus at 400/220 kV Meramandali
123	220/132 kV Mejia (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Mejia
		220 kV Main Bus-2 at 220/132 kV Mejia
		220 kV Transfer Bus at 220/132 kV Mejia
124	400/220 kV Mendhasal (220 kV Side)	220 kV Main Bus-1 at 400/220 kV Mendhasal
		220 kV Main Bus-2 at 400/220 kV Mendhasal
		220 kV Transfer Bus at 400/220 kV Mendhasal
125	220/132 kV Kolaghat TPS (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Kolaghat TPS
		220 kV Main Bus-2 at 220/132 kV Kolaghat TPS
		220 kV Transfer Bus at 220/132 kV Kolaghat TPS
126	220/132 kV Kasba (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Kasba
		220 kV Main Bus-2 at 220/132 kV Kasba
		220 kV Transfer Bus at 220/132 kV Kasba
127	220/132 kV Katapalli (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Katapalli
		220 kV Main Bus-2 at 220/132 kV Katapalli
		220 kV Transfer Bus at 220/132 kV Katapalli
128	220/132 kV Kharagpur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Kharagpur
		220 kV Main Bus-2 at 220/132 kV Kharagpur
		220 kV Transfer Bus at 220/132 kV Kharagpur
129	220/132 kV Krishnanagar (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Krishnanagar
		220 kV Main Bus-2 at 220/132 kV Krishnanagar
		220 kV Transfer Bus at 220/132 kV Krishnanagar
130	220/132 kV Kalyaneshwari (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Kalyaneshwari
		220 kV Main Bus-2 at 220/132 kV Kalyaneshwari
		220 kV Transfer Bus at 220/132 kV Kalyaneshwari
131	220/132 kV Gokarno (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Gokarno
		220 kV Main Bus-2 at 220/132 kV Gokarno

Sl No	Name of Substation	Name of Buses
		220 kV Transfer Bus at 220/132 kV Gokarno
132	220/132 kV Gopalganj (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Gopalganj
		220 kV Main Bus-2 at 220/132 kV Gopalganj
		220 kV Transfer Bus at 220/132 kV Gopalganj
1333	220/132 kV Govindpur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Govindpur
		220 kV Main Bus-2 at 220/132 kV Govindpur
		220 kV Transfer Bus at 220/132 kV Govindpur
134	220 kV IBTPS-1	220 kV Main Bus-1 at 220 kV IBTPS-1
		220 kV Main Bus-2 at 220 kV IBTPS-1
		220 kV Transfer Bus at 220 kV IBTPS-1
135	220/132 kV Jamshedpur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Jamshedpur
		220 kV Main Bus-2 at 220/132 kV Jamshedpur
		220 kV Transfer Bus at 220/132 kV Jamshedpur
136	220/132 kV Jayanagar (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Jayanagar
		220 kV Main Bus-2 at 220/132 kV Jayanagar
		220 kV Transfer Bus at 220/132 kV Jayanagar
137	220/132 kV Giridih (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Giridih
		220 kV Main Bus-2 at 220/132 kV Giridih
		220 kV Transfer Bus at 220/132 kV Giridih
138	220/132 kV Howrah (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Howrah
		220 kV Main Bus-2 at 220/132 kV Howrah
		220 kV Transfer Bus at 220/132 kV Howrah
139	220/132 kV Dharampur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Dharampur
		220 kV Main Bus-2 at 220/132 kV Dharampur
		220 kV Transfer Bus at 220/132 kV Dharampur
140	220/132 kV DPL (220 kV Side)	220 kV Main Bus-1 at 220/132 kV DPL
		220 kV Main Bus-2 at 220/132 kV DPL
		220 kV Transfer Bus at 220/132 kV DPL
141	220/132 kV Darbhanga (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Darbhanga
		220 kV Main Bus-2 at 220/132 kV Darbhanga
		220 kV Transfer Bus at 220/132 kV Darbhanga
142	220/132 kV Ctps A (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Ctps A
		220 kV Main Bus-2 at 220/132 kV Ctps A
		220 kV Transfer Bus at 220/132 kV Ctps A
143	220/132 kV Tarkera (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Tarkera
		220 kV Main Bus-2 at 220/132 kV Tarkera
		220 kV Transfer Bus at 220/132 kV Tarkera
144	220/132 kV Bishnupur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bishnupur
		220 kV Main Bus-2 at 220/132 kV Bishnupur
		220 kV Transfer Bus at 220/132 kV Bishnupur
145	220/132 kV Bodhagya (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bodhagya
		220 kV Main Bus-2 at 220/132 kV Bodhagya
		220 kV Transfer Bus at 220/132 kV Bodhagya

Sl No	Name of Substation	Name of Buses
146	220/132 kV Bokaro (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Bokaro
		220 kV Main Bus-2 at 220/132 kV Bokaro
		220 kV Transfer Bus at 220/132 kV Bokaro
147	220/132 kV Budhipadar (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Budhipadar
		220 kV Main Bus-2 at 220/132 kV Budhipadar
		220 kV Transfer Bus at 220/132 kV Budhipadar
148	220/132 kV Burnpur (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Burnpur
		220 kV Main Bus-2 at 220/132 kV Burnpur
		220 kV Transfer Bus at 220/132 kV Burnpur
149	220/132 kV Chandiposh (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Chandiposh
		220 kV Main Bus-2 at 220/132 kV Chandiposh
		220 kV Transfer Bus at 220/132 kV Chandiposh
150	220/132 kV Chandrapura TPS B (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Chandrapura TPS B
		220 kV Main Bus-2 at 220/132 kV Chandrapura TPS B
		220 kV Transfer Bus at 220/132 kV Chandrapura TPS B
151	220/132 kV Chaibasa New(J) (220 kV Side)	220 kV Main Bus-1 at 220/132 kV Chaibasa New(J)
		220 kV Main Bus-2 at 220/132 kV Chaibasa New(J)
		220 kV Transfer Bus at 220/132 kV Chaibasa New(J)
152	400/220/132 kV Sitamarhi (220 kV Side)	220 kV Main Bus-1 at 400/220/132 kV Sitamarhi
		220 kV Main Bus-2 at 400/220/132 kV Sitamarhi
		220 kV Transfer Bus at 400/220/132 kV Sitamarhi

10.4 132 kV Buses

Sl No	Name of Substation	Name of Buses
1	132 kV Jamaui	132 kV Main Bus-1 at 132 kV Jamaui
		132 kV Transfer Bus at 132 kV Jamaui
2	132 kV Melli	132 kV Main Bus-1 at 132 kV Melli
		132 kV Transfer Bus at 132 kV Melli
3	132 kV Njp	132 kV Main Bus-1 at 132 kV Njp
		132 kV Transfer Bus at 132 kV Njp
4	132 kV Rihand	132 kV Main Bus-1 at 132 kV Rihand
		132 kV Transfer Bus at 132 kV Rihand
5	132 kV Arha	132 kV Main Bus-1 at 132 kV Arha
		132 kV Transfer Bus at 132 kV Arha
6	132 kV Bangiriposi	132 kV Main Bus-1 at 132 kV Bangiriposi
		132 kV Transfer Bus at 132 kV Bangiriposi
7	132 kV Banka	132 kV Main Bus-1 at 132 kV Banka
		132 kV Transfer Bus at 132 kV Banka
8	132 kV Barhi	132 kV Main Bus-1 at 132 kV Barhi
		132 kV Transfer Bus at 132 kV Barhi
9	132 kV Baripada	132 kV Main Bus-1 at 132 kV Baripada
		132 kV Transfer Bus at 132 kV Baripada

Sl No	Name of Substation	Name of Buses
10	132 kV Bethia(B)	132 kV Main Bus-1 at 132 kV Bethia(B)
		132 kV Transfer Bus at 132 kV Bethia(B)
11	132 kV Bhograi	132 kV Main Bus-1 at 132 kV Bhograi
		132 kV Transfer Bus at 132 kV Bhograi
12	132 kV Birpara(PG)	132 kV Main Bus-1 at 132 kV Birpara(PG)
		132 kV Transfer Bus at 132 kV Birpara(PG)
13	132 kV Birpara(WB)	132 kV Main Bus-1 at 132 kV Birpara(WB)
		132 kV Transfer Bus at 132 kV Birpara(WB)
14	132 kV Chandauli	132 kV Main Bus-1 at 132 kV Chandauli
		132 kV Transfer Bus at 132 kV Chandauli
15	132 kV Chandil	132 kV Main Bus-1 at 132 kV Chandil
		132 kV Transfer Bus at 132 kV Chandil
16	132 kV Chujachen	132 kV Main Bus-1 at 132 kV Chujachen
		132 kV Transfer Bus at 132 kV Chujachen
17	132 kV Daltonganj	132 kV Main Bus-1 at 132 kV Daltonganj
		132 kV Transfer Bus at 132 kV Daltonganj
18	132 kV Daltonganj (PG)	132 kV Main Bus-1 at 132 kV Daltonganj (PG)
		132 kV Transfer Bus at 132 kV Daltonganj (PG)
19	132 kV Dumraon	132 kV Main Bus-1 at 132 kV Dumraon
		132 kV Transfer Bus at 132 kV Dumraon
20	132 kV Gangtok	132 kV Main Bus-1 at 132 kV Gangtok
		132 kV Transfer Bus at 132 kV Gangtok
21	132 kV Garwa	132 kV Main Bus-1 at 132 kV Garwa
		132 kV Transfer Bus at 132 kV Garwa
22	132 kV Jagdishpur	132 kV Main Bus-1 at 132 kV Jagdishpur
		132 kV Transfer Bus at 132 kV Jagdishpur
23	132 kV Jaleswr	132 kV Main Bus-1 at 132 kV Jaleswr
		132 kV Transfer Bus at 132 kV Jaleswr
24	132 kV Jamtara	132 kV Main Bus-1 at 132 kV Jamtara
		132 kV Transfer Bus at 132 kV Jamtara
25	132 kV Japla	132 kV Main Bus-1 at 132 kV Japla
		132 kV Transfer Bus at 132 kV Japla
26	132 kV Joda	132 kV Main Bus-1 at 132 kV Joda
		132 kV Transfer Bus at 132 kV Joda
27	132 kV Kahalgaon	132 kV Main Bus-1 at 132 kV Kahalgaon
		132 kV Transfer Bus at 132 kV Kahalgaon
28	132 kV Karmanasa	132 kV Main Bus-1 at 132 kV Karmanasa
		132 kV Transfer Bus at 132 kV Karmanasa
29	132 kV Kendposi	132 kV Main Bus-1 at 132 kV Kendposi
		132 kV Transfer Bus at 132 kV Kendposi
30	132 kV Kharagpur(Dvc)	132 kV Main Bus-1 at 132 kV Kharagpur(Dvc)
		132 kV Transfer Bus at 132 kV Kharagpur(Dvc)
31	132 kV Kharagpur(WB)	132 kV Main Bus-1 at 132 kV Kharagpur(WB)

Sl No	Name of Substation	Name of Buses
		132 kV Transfer Bus at 132 kV Kharagpur(WB)
32	132 kV Khudra	132 kV Main Bus-1 at 132 kV Khudra
		132 kV Transfer Bus at 132 kV Khudra
33	132 kV Kisanganj	132 kV Main Bus-1 at 132 kV Kisanganj
		132 kV Transfer Bus at 132 kV Kisanganj
34	132 kV Kolaghat(Dvc)	132 kV Main Bus-1 at 132 kV Kolaghat(Dvc)
		132 kV Transfer Bus at 132 kV Kolaghat(Dvc)
35	132 kV Kolaghat(WB)	132 kV Main Bus-1 at 132 kV Kolaghat(WB)
		132 kV Transfer Bus at 132 kV Kolaghat(WB)
36	132 kV Kurseong	132 kV Main Bus-1 at 132 kV Kurseong
		132 kV Transfer Bus at 132 kV Kurseong
37	132 kV Lakhisarai	132 kV Main Bus-1 at 132 kV Lakhisarai
		132 kV Transfer Bus at 132 kV Lakhisarai
38	132 kV Lalmatia	132 kV Main Bus-1 at 132 kV Lalmatia
		132 kV Transfer Bus at 132 kV Lalmatia
39	132 kV Maithon	132 kV Main Bus-1 at 132 kV Maithon
		132 kV Transfer Bus at 132 kV Maithon
40	132 kV Malda(PG)	132 kV Main Bus-1 at 132 kV Malda(PG)
		132 kV Transfer Bus at 132 kV Malda(PG)
41	132 kV Malda(WB)	132 kV Main Bus-1 at 132 kV Malda(WB)
		132 kV Transfer Bus at 132 kV Malda(WB)
42	132 kV Manique	132 kV Main Bus-1 at 132 kV Manique
		132 kV Transfer Bus at 132 kV Manique
43	132 kV Melli	132 kV Main Bus-1 at 132 kV Melli
		132 kV Transfer Bus at 132 kV Melli
44	132 kV Mohania	132 kV Main Bus-1 at 132 kV Mohania
		132 kV Transfer Bus at 132 kV Mohania
45	132 kV Motihari(B)	132 kV Main Bus-1 at 132 kV Motihari(B)
		132 kV Transfer Bus at 132 kV Motihari(B)
46	132 kV Motihari(DMTCL)	132 kV Main Bus-1 at 132 kV Motihari(DMTCL)
		132 kV Transfer Bus at 132 kV Motihari(DMTCL)
47	132 kV Nbu	132 kV Main Bus-1 at 132 kV Nbu
		132 kV Transfer Bus at 132 kV Nbu
48	132 kV Pataratu(Dvc)	132 kV Main Bus-1 at 132 kV Pataratu(Dvc)
		132 kV Transfer Bus at 132 kV Pataratu(Dvc)
49	132 kV Patratu	132 kV Main Bus-1 at 132 kV Patratu
		132 kV Transfer Bus at 132 kV Patratu
50	132 kV Patratu(Jharkahnd)	132 kV Main Bus-1 at 132 kV Patratu(Jharkahnd)
		132 kV Transfer Bus at 132 kV Patratu(Jharkahnd)
51	132 kV Purnea	132 kV Main Bus-1 at 132 kV Purnea
		132 kV Transfer Bus at 132 kV Purnea

Sl No	Name of Substation	Name of Buses
52	132 kV Purnea(PG)	132 kV Main Bus-1 at 132 kV Purnea(PG)
		132 kV Transfer Bus at 132 kV Purnea(PG)
53	132 kV Pusuali	132 kV Main Bus-1 at 132 kV Pusuali
		132 kV Transfer Bus at 132 kV Pusuali
54	132 kV Rajgir	132 kV Main Bus-1 at 132 kV Rajgir
		132 kV Transfer Bus at 132 kV Rajgir
55	132 kV Rammam	132 kV Main Bus-1 at 132 kV Rammam
		132 kV Transfer Bus at 132 kV Rammam
56	132 kV Rangit	132 kV Main Bus-1 at 132 kV Rangit
		132 kV Transfer Bus at 132 kV Rangit
57	132 kV Rangpo	132 kV Main Bus-1 at 132 kV Rangpo
		132 kV Main Bus-2 at 132 kV Rangpo
58	132 kV Raxaul(B)	132 kV Main Bus-1 at 132 kV Raxaul(B)
		132 kV Transfer Bus at 132 kV Raxaul(B)
59	132 kV Rihand	132 kV Main Bus-1 at 132 kV Rihand
		132 kV Transfer Bus at 132 kV Rihand
60	132 kV Sabour	132 kV Main Bus-1 at 132 kV Sabour
		132 kV Transfer Bus at 132 kV Sabour
61	132 kV Sagbari	132 kV Main Bus-1 at 132 kV Sagbari
		132 kV Transfer Bus at 132 kV Sagbari
62	132 kV Sahupuri	132 kV Main Bus-1 at 132 kV Sahupuri
		132 kV Transfer Bus at 132 kV Sahupuri
63	132 kV Siliguri(PG)	132 kV Main Bus-1 at 132 kV Siliguri(PG)
		132 kV Transfer Bus at 132 kV Siliguri(PG)
64	132 kV Sonenagar	132 kV Main Bus-1 at 132 kV Sonenagar
		132 kV Transfer Bus at 132 kV Sonenagar
65	132 kV Sultangunj	132 kV Main Bus-1 at 132 kV Sultangunj
		132 kV Transfer Bus at 132 kV Sultangunj
66	132 kV Sitamarhi	132 kV Main Bus-1 at 132 kV Sitamarhi
		132 kV Transfer Bus at 132 kV Sitamarhi

11 List of important bays

11.1 765 kV bays

Sl No	Name of Substation	Name of Bay
1	765 /400 kV Sasaram (765 kV Side)	765 kV Main Bay of Fathepur with line reactor
2		765 kV Main Bay of 765/400 kV 1500 MVA ICT
3		765 kV Main Bay of 330 MVAr Bus Reactor
4		765 kV Tie Bay of Fathepur and765/400 kV 1500 MVA ICT
5	765/400 kV Gaya (765 kV Side)	765 kV Main Bay of Varanasi-2 with Line Reactor
6		765 kV Main Bay of Varanasi-1 With Line Reactor
7		765 kV Main Bay of Balia With Line Reactor
8		765 kV Main Bay of 240 MVAr Bus Reactor-2
9		765 kV Main Bay of 240 MVAr Bus Reactor-1
10		765 kV Main Bay of 765/400 kV 1500 MVA ICT -1
11		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 2
12		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 3
13		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 4
14		765 kV Tie Bay of Varanasi-2 with Line reactor and Future
15		765 kV Tie Bay of Varanasi-1 with line reactor and ICT-4
16		765 kV Tie Bay of Balia with line reactor and ICT-3
17		765 kV Tie Bay of Bus Reactor-2 and ICT-2
18		765 kV Tie Bay of Bus Reactor-1 and ICT-1
19	765/400 kV New Ranchi (765 kV Side)	765 kV Main Bay of Future-1
20		765 kV Main Bay of Future-2
21		765 kV Main Bay of Future-3

Sl No	Name of Substation	Name of Bay
22		765 kV Main Bay of Future-4
23		765 kV Main Bay of Future-5
24		765 kV Main Bay of Future-6
25		765 kV Main Bay of 240 MVAr Bus Rector-1
26		765 kV Main Bay of 240 MVAr Bus Rector-2
27		765 kV Main Bay of Dharamjaygarh-1
28		765 kV Main Bay of Mednipur-2
29		765 kV Main Bay of Mednipur-1
30		765 kV Main Bay of Dharamjaygarh-2
31		765 kV Main Bay of 765/400 kV 1500 MVA ICT -1
32		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 2
33		765 kV Tie Bay of Future-1 and Mednipur-2
34		765 kV Tie Bay of Future-2 and Mednipur-1
35		765 kV Tie Bay of Dharamjaygarh-2 and Future-3
36		765 kV Tie Bay of Bus Rector-1 and Future-4
37		765 kV Tie Bay of Bus Rector-2 and Future-5
38		765 kV Tie Bay of Dharamjaygarh-1 and ICT-2
39		765 kV Tie Bay of ICT-1 and Future-6
40	765/400 kV Jharsuguda (765 kV Side)	765 kV Main Bay of 240 MVAr Bus Rector-1
41		765 kV Main Bay of 240 MVAr Bus Rector-2
42		765 kV Main Bay of Angul-1 with line reactor
43		765 kV Main Bay of Angul-2 with line reactor
44		765 kV Main Bay of Angul-3 with line reactor
45		765 kV Main Bay of Angul-4 with line reactor
46		765 kV Main Bay of Darlipalli-1
47		765 kV Main Bay of Darlipalli-2
48		765 kV Main Bay of Future-1

Sl No	Name of Substation	Name of Bay
49		765 kV Main Bay of Future-2
50		765 kV Bus Sectionalizer Bay-1
51		765 kV Bus Sectionalizer Bay-2
52		765 kV Main Bay of 765/400 kV 1500 MVA ICT -1
53		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 2
54		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 3
55		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 4
56		765 kV Main Bay of Raipur-1 with line reactor
57		765 kV Main Bay of Raipur-2 with line reactor
58		765 kV Main Bay of Dharamjaygarh-1
59		765 kV Main Bay of Dharamjaygarh-2
60		765 kV Main Bay of Dharamjaygarh-3
61		765 kV Main Bay of Dharamjaygarh-4
62		765 kV Tie Bay of Bus Reactor-1 and ICT-1
63		765 kV Tie Bay of Bus Reactor-2 and ICT-2
64		765 kV Tie Bay of Raipur-2 with line reactor and Angul-4 with line reactor
65		765 kV Tie Bay of Raipur-1 with line reactor and Angul-3 with line reactor
66		765 kV Tie Bay of Dharamjaygarh-3 and Angul-2 with line reactor
67		765 kV Tie Bay of Angul-1 with line reactor and Dharamjaygah-4
68		765 kV Tie Bay of Dharamjaygarh-1 and Darlipalli STPP-1
69		765 kV Tie Bay of Dharamjaygarh-2 and Darlipalli STPP-2
70		765 kV Tie Bay of Future-1 and ICT-3
71		765 kV Tie Bay of Future-2 and ICT-4
72	765 kV Darlipalli	765 kV Bus Sectionalizer Bay-1
73		765 kV Bus Sectionalizer Bay-2
74		765 kV Main Bay of GT-1
75		765 kV Main Bay of GT-2

Sl No	Name of Substation	Name of Bay
76		765 kV Main Bay of Future-1
77		765 kV Main Bay of Future-2
78		765 kV Main Bay of Future-3
79		765 kV Main Bay of Future-4
80		765 kV Main Bay of Jharsuguda-1
81		765 kV Main Bay of Jharsuguda-2
82		765 kV Main Bay of 765/132 kV 255 MVA Tic Transformer-1
83		765 kV Main Bay of 765/132 kV 255 MVA Tic Transformer-2
84		765 kV Main Bay of Future-5
85		765 kV Main Bay of Bus Reactor-1
86		765 kV Tie Bay of Future-4 and Future-5
87		765 kV Tie Bay of Future-3 and Tic Transformer-2
88		765 kV Tie Bay of Jharsuguda-1 and Tic Transformer-1
89		765 kV Tie Bay of Jharsuguda-2 and GT-2
90		765 kV Tie Bay of Bus Reactor-1 and GT-1
91		765 kV Tie Bay of Future-1 and Future-2
92	765/400 kV Angul (765 kV Side)	765 kV Main Bay of Srikakulum-1
93		765 kV Main Bay of Srikakulum-2
94		765 kV Main Bay of Jharsuguda-1
95		765 kV Main Bay of Jharsuguda-2
96		765 kV Main Bay of Jharsuguda-3
97		765 kV Main Bay of Jharsuguda-4
98		765 kV Main Bay of 765/400 kV 1500 MVA ICT -1
99		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 2
100		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 3
101		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 4
102		765 kV Main Bay of 330 MVAr Bus Reactor-1

Sl No	Name of Substation	Name of Bay
103		765 kV Main Bay of 330 MVAr Bus Reactor-2
104		765 kV Tie Bay of Srikakulum-1 and Future-1(shorted)
105		765 kV Tie Bay of Srikakulum-2 and Future-2(shorted)
106		765 kV Tie Bay of Jharsuguda-3 and Future-3(shorted)
107		765 kV Tie Bay of Jharsuguda-4 and Future-4(shorted)
108		765 kV Main Bay of Future-1
109		765 kV Main Bay of Future-2
110		765 kV Main Bay of Future-3
111		765 kV Main Bay of Future-4
112		765 kV Tie Bay of Bus Reactor-2 and ICT-4
113		765 kV Tie Bay of Bus Reactor-1 and ICT-3
114		765 kV Tie Bay of Jharsuguda-1 and ICT-2
115		765 kV Tie Bay of Jharsuguda-2 and ICT-1
116	765/400 kV Mednipur (765 kV Side)	765 kV Main Bay of New Ranchi-1
117		765 kV Main Bay of New Ranchi-2
118		765 kV Main Bay of New Jeerat-1
119		765 kV Main Bay of New Jeerat-2
120		765 kV Main Bay of 765/400 kV 1500 MVA ICT -1
121		765 kV Main Bay of 765/400 kV 1500 MVA ICT - 2
122		765 kV Main Bay of Future-1
123		765 kV Main Bay of Future-2
124		765 kV Main Bay of Future ICT-1
125		765 kV Main Bay of Future ICT-2
126		765 kV Main Bay of Bus Reactor-1
127		765 kV Main Bay of Bus Reactor-2
128		765 kV Tie Bay of Bus Reactor-1 and New Ranchi-1
129		765 kV Tie Bay of Bus Reactor-2 and New Ranchi-2

Sl No	Name of Substation	Name of Bay
130		765 kV Tie Bay of Jeerat-2 and ICT-1
131		765 kV Tie Bay of Jeerat-1 and ICT-2
132		765 kV Tie Bay of Future-1 and Future ICT-1
133		765 kV Tie Bay of Future-2 and Future ICT-2

11.2 400 kV bays

Sl No	Name of Substation	Name of Bay
1	765/400 kV Angul (400 kV Side)	400 kV Main Bay of JITPL 1
2		400 kV Tie Bay of JITPL 1 And GMR 2
3		400 kV Main Bay of GMR 2
4		400 kV Main Bay of JITPL 2
5		400 kV Tie Bay of JITPL 2 And GMR 1
6		400 kV Main Bay of GMR 1
7		400 kV Main Bay of 765/400 kV, 1500 MVA ICT 4
8		400 kV Tie Bay of ICT 4 and Future 1
9		400 kV Main Bay of Bus Reactor 1 (125 MVAr)
10		400 kV Tie Bay of Bus Reactor 1 and Monet-2
11		400 kV Main Bay of 765/400 kV, 1500 MVA ICT 3
12		400 kV Tie Bay of ICT 3 and Monet-1
13		400 kV Main Bay of Bus Reactor 2 (125 MVAr)

Sl No	Name of Substation	Name of Bay
14		400 kV Tie Bay of Bus Reactor 2 And Meramundali 2
15		400 kV Main Bay of 765/400 kV, 1500 MVA ICT 2
16		400 kV Tie Bay of ICT 2 and Talcher
17		400 kV Main Bay of Bus Reactor 3 (125 MVAr)
18		400 kV Tie Bay of Bus Reactor 3 And Meramundali 1
19		400 kV Main Bay of 765/400 kV, 1500 MVA ICT 1
20		400 kV Tie Bay of ICT 1 and Bolangir
21		400 kV Main Bay of Meramundali 2
22		400 kV Main Bay of Talcher
23		400 kV Main Bay of Meramundali 1
24		400 kV Main Bay of Bolangir
25	400/220 kV Baripada (400 kV Side)	400 kV Main Bay of ICT 1 (400/220 kV, 500 MVA)
26		400 kV Main Bay of Future 1
27		400 kV Tie Bay of ICT 1 And Keonjhar
28		400 kV Main Bay of Keonjhar with Line Reactor
29		400 kV Main Bay of ICT 2 (400/220 kV, 315 MVA)
30		400 kV Tie Bay of ICT 2 And Kharagpur
31		400 kV Main Bay of Kharagpur
32		400 kV Main Bay of New Dubri with Line Reactor
33		400 kV Tie Bay of New Dubri And Jamshedpur
34		400 kV Main Bay of Jamshedpur
35		400 kV Main Bay of Pandiabili
36		400 kV Tie Bay of Pandiabili And Tisco
37		400 kV Main Bay of Tisco
38		400 kV Main Bay of ICT 3 (400/220 kV, 315 MVA)

Sl No	Name of Substation	Name of Bay
39		400 kV Tie Bay of ICT 3 And 125 MVAr Bus Reactor 1
40		400 kV Main Bay of Bus Reactor 1 (125 MVAr)
41		400 kV Tie Bay of Future-1 and Bus Reactor 2
42		400 kV Main Bay of Bus Reactor 2 (125 MVAr)
43	400/220 kV Bolangir (400 kV Side)	400 kV Main Bay of Jeypore with Line Reactor (50 MVAr)
44		400 kV Tie Bay of Jeypore And ICT 2
45		400 kV Main Bay of ICT 2 (400/220 kV, 315 MVA)
46		400 kV Main Bay of Meramundali/ Angul with Line Reactor (50 MVAr)
47		400 kV Main Bay of Future 2
48		400 kV Tie Bay of Meramundali/Angul and ICT 1
49		400 kV Main Bay of ICT 1 (400/220 kV, 315 MVA)
50		400 kV Main Bay of Future-1
51		400 kV Main Bay of Bus Reactor -1 (80 MVAr)
52		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
53		400 kV Tie Bay of Bus Reactor-2 and Future-2
54		400 kV Tie Bay of Bus Reactor-1 and Future-1
55	400 kV Indravati	400 kV Main Bay of Bus Reactor (125 MVAr)
56		400 kV Tie Bay of Bus Reactor and Upper Indravati HEP
57		400 kV Main Bay of Upper Indravati HEP
58		400 kV Main Bay of Jeypore
59		400 kV Tie Bay of Rengali And Jeypore
60		400 kV Main Bay of Rengali with Line Reactor (50 MVAr)
61	400/220 kV Jeypore (400 kV Side)	400 kV Main Bay of Bolangir with Line Reactor (80 MVAr) and FSC
62		400 kV Tie Bay of Bolangir And Gazuwaka 2 with FSC
63		400 kV Main Bay of Gazuwaka 2 with FSC

Sl No	Name of Substation	Name of Bay
64		400 kV Main Bay of Gazuwaka 1 with FSC
65		400 kV Tie Bay of Indravati 1 And Gazuwaka 1 with FSC
66		400 kV Main Bay of ICT 2 (400/220/33 kV, 315 MVA)
67		400 kV Main Bay of ICT 1 (400/220/33 kV, 315 MVA)
68		400 kV Main Bay of Indravati
69		400 kV Main Bay of Future-1
70		400 kV Tie Bay of ICT 2 And Bus Reactor 1
71		400 kV Main Bay of Bus Reactor 1 (63 MVAr)
72		400 kV Main Bay of Bus Reactor 2 (125 MVAr)
73		400 kV Tie Bay of ICT 1 And Bus Reactor 2.
74		400 kV Main Bay of Coupling Transformer (400/28 kV , 500 MVA)
75		400 kV Tie Bay of Coupling Transformer and Future-1
76	400/220 kV Keonjhar (400 kV Side)	400 kV Main Bay of Baripada
77		400 kV Tie Bay of Baripada And Bus Reactor 1
78		400 kV Main Bay of r Bus Reactor 1 (80 MVA)
79		400 kV Main Bay of Rengali
80		400 kV Tie Bay of Rengali And ICT 1
81		400 kV Main of ICT 1 (400/220 kV, 315 MVA)
82		400 kV Main of ICT 2 (400/220 kV, 315 MVA)
83		400 kV Tie Bay of ICT 2 And Future
84		400 kV Main Bay of Bus Reactor 2 (125 MVAr)
85		400 kV Tie Bay of 125 MVAr Bus Reactor 2 And Future
86		400 kV Main Bay of Future-1
87		400 kV Main Bay of Future-2
88		400 kV Main Bay of Future-3

Sl No	Name of Substation	Name of Bay
89		400 kV Main Bay of Future-4
90		400 kV Main Bay of Future-5
91		400 kV Main Bay of Future-6
92		400 kV Main Bay of Future-7
93		400 kV Main Bay of Future-8
94		400 kV Main Bay of Future-9
95		400 kV Main Bay of Future-10
96		400 kV Main Bay of Future-11
97		400 kV Main Bay of Future-12
98		400 kV Main Bay of Future-13
99		400 kV Main Bay of Future-14
100		400 kV Tie Bay of Future -1 And Future -2
101		400 kV Tie Bay of Future -3 And Future -4
102		400 kV Tie Bay of Future -5 And Future -6
103		400 kV Tie Bay of Future -7 And Future -8
104		400 kV Tie Bay of Future -9 And Future -10
105		400 kV Tie Bay of Future -11 And Future -12
106	400/220 kV Lapanga (400 kV Side)	400 kV Main Bay of Future 1
107		400 kV Tie Bay of Future 1 And IBTPP ST II -2
108		400 kV Main Bay of IBTPP ST II -2
109		400 kV Main Bay of IBTPP ST II -1
110		400 kV Tie Bay of IBTPP ST II -1 And Meramundali 1
111		400 kV Main Bay of Meramundali 1 with Line Reactor (63 MVAr)
112		400 kV Main Bay of Meramundali 2 with Line Reactor (63 MVAr)
113		400 kV Tie Bay Meramundali 2 And Staerlite TPP - 2

Sl No	Name of Substation	Name of Bay
114		400 kV Main Bay of Sterlite TPP- 2
115		400 kV Main Bay of Sterlite TPP -1
116		400 kV Tie Bay of SterliteTPP-1 And Future 8
117		400 kV Main Bay of Future 8
118		400 kV Main Bay of Future 11
119		400 kV Tie Bay of Future 11 And ICT 1
120		400 kV Main Bay of ICT 1 (400/220 kV, 315 MVA)
121		400 kV Main Bay of ICT 2 (400/220 kV, 315 MVA)
122		400 kV Main Bay of Future 9
123		400 kV Main Bay of Future 10
124		400 kV Tie Bay of Future 9 And Future 10
125		400 kV Tie Bay of ICT 2 And Future 12
126		400 kV Main Bay of Future 12
127	400/220 kV Pandiabilli (400 kV Side)	400 kV Main Bay of Baripada with Line Reactor (63 MVAr)
128		400 kV Tie Bay of Baripada Andn 80 MVAr Bus Reactor 1
129		400 kV Main Bay of 80 MVAr Bus Reactor 1
130		400 kV Main of ICT 1 (400/220 kV, 500 MVA)
131		400 kV Tie Bay of 400/220 kV ICT 1 And New Dubri
132		400 kV Main Bay of New Dubri with Line Reactor (63 MVAr)
133		400 kV Main Bay of Mendhasal 2
134		400 kV Tie Bay of Mendhasal 2 And ICT 2
135		400 kV Main of ICT 2 (400/220 kV, 500 MVA)
136		400 kV Main Bay of Mendhasal 1
137		400 kV Tie Bay of Mendhasal 1 And Future for ICT 3
138		400 kV Main Bay of Future for ICT 3

Sl No	Name of Substation	Name of Bay
139	400/220 kV Rourkela (400 kV Side)	400 kV Main Bay of Future-1
140		400 kV Tie Bay of Talcher-1 And Future-1
141		400 kV Main Bay of Talcher-1
142		400 kV Main Bay of Talcher-2
143		400 kV Tie Bay of Talcher-2 And Chaibasa-2 with Line Reactor
144		400 kV Main Bay of Chaibasa-2 with Line Reactor(50 MVAr)
145		400 kV Main Bay of STATCOM (300 MVAr)
146		400 kV Tie Bay of STATCOM And Future -2
147		400 kV Main Bay of Future -2
148		400 kV Main Bay of Future -3
149		400 kV Tie Bay of (ICT-2 & ICT-4) And Future 3
150		400 kV Main Bay of ICT-2 & ICT -4 (400 kV, 2 x 315 MVA)
151		400 kV Main Bay of Chaibasa-1
152		400 kV Tie Bay of Jharsuguda--1 with Line Reactor And Chaibasa-1
153		400 kV Main Bay of Jharsuguda--1 with Line Reactor(50 MVAr)
154		400 kV Main Bay of Jharsuguda--3 with Line Reactor(63 MVAr)
155		400 kV Tie Bay of Jharsuguda--3 with Line Reactor And Ranchi-2
156		400 kV Main Bay of Ranchi-2
157		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
158		400 kV Tie Bay of Bus Reactor -1 And ICT-1 & ICT 3
159		400 kV Main Bay of ICT-1 & ICT -3 (400 kV, 2 x 315 MVA)
160		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
161		400 kV Tie Bay of Bus Reactor -2 And Jharsuguda--4
162		400 kV Main Bay of Jharsuguda--4
163		400 kV Main Bay of Ranchi-1

Sl No	Name of Substation	Name of Bay
164		400 kV Tie Bay of Ranchi-1 And Jharsuguda--2
165		400 kV Main Bay of Jharsuguda-2
166	400/220 kV Rengali (400 kV Side)	400 kV Main Bay of Keonjhar
167		400 kV Tie Bay of Keonjhar And Talcher 2
168		400 kV Main Bay of Talcher 2
169		400 kV Main Bay of Talcher 1
170		400 kV Tie Bay of Talcher 1 & Future-2
171		400 kV Main Bay of ICT 1 (400/220 kV, 315 MVA)
172		400 kV Tie Bay of ICT-1 And ICT-2
173		400 kV Main Bay of ICT 2 (400/220 kV, 315 MVA)
174		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
175		400 kV Tie Bay of Indravati with FSC and Line Reactor And Bus Reactor-1
176		400 kV Main Bay of Indravati with FSC and Line Reactor (63 MVAr)
177		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
178		400 kV Tie Bay of Bus Reactor -2 And Future -1
179		400 kV Main Bay of Future -1
180	400/220 kV Chaibasa (400 kV Side)	400 kV Main Bay of Bus Reactor -1 (80 MVAr)
181		400kV Main Bay of Future for ICT-3
182		400 kV Main Bay of ICT 1 (400/220 kV, 315 MVA)
183		400 kV Main Bay of ICT 2 (400/220 kV, 315 MVA)
184		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
185		400kV Main Bay of Future
186		400kV Main Bay of Rourkela-2
187		400kV Main Bay of Jamshedpur-2
188		400kV Main Bay of Rourkela-1

Sl No	Name of Substation	Name of Bay
189		400kV Main Bay of Jamshedpur-1
190		400kV Main Bay of Kharagpur-1 with Line Reactor (63 MVAr)
191		400kV Main Bay of Kharagpur-2 with Line Reactor (63 MVAr)
192		400kV Tie Bay Rourkela-2 & Bus Reactor -1
193		400kV Tie Bay Jamshedpur-2 & ICT-3
194		400kV Tie Bay Rourkela-1 & ICT-2
195		400kV Tie Bay Jamshedpur-1 & ICT-1
196		400kV Tie Bay Kharagpur-1 & Bus Reactor -2
197		400kV Tie Bay Kharagpur-2 & Future
198	400 kV Chandwa	400 kV Main Bay of New Ranchi 1
199		400 kV Main Bay of New Ranchi 2
200		400 kV May Bay of Gaya 1
201		400 kV May Bay of Gaya 2
202		400kV Main Bay of Bus Reactor -2 (125 MVAr)
203		400kV Main Bay of Bus Reactor -1 (125 MVAr)
204		400 kV Main Bay of Future 1 for Essar -2
205		400 kV Main Bay of Future-2 for Essar -1
206		400 kV Main Bay of Future-3 for CPL -2
207		400 kV Main Bay of Future-4 for CPL -1
208		400 kV Main Bay of Future-5 for Karanpura -1
209		400 kV Main Bay of Future-6 for Karanpura -2
210		400 kV Main Bay of Future 7
211		400 kV Main Bay of Future 8
212		400 kV Main Bay of Future 9
213		400 kV Main Bay of Future 10

Sl No	Name of Substation	Name of Bay
214		400 kV Main Bay of Future 11
215		400 kV Main Bay of Future 12
216		400 kV Main Bay of Future 13
217		400 kV Main Bay of Future 14
218		400 kV Main Bay of Future 15
219		400 kV Main Bay of Future 16
220		400 kV Bus Coupler Bay
221	765/400 kV New Ranchi (400 kV Side)	400kV Main Bay of Ranchi-1
222		400kV Main Bay of Ranchi-2
223		400kV Main Bay of Ranchi-3
224		400kV Main Bay of Ranchi-4
225		400kV Main Bay of Patratu-I
226		400kV Main Bay of Patratu-II
227		400kV Main Bay of Chandwa-1
228		400kV Main Bay of Chandwa-2
229		400kV Main Bay of Bus Reactor -2 (125 MVAr)
230		400kV Main Bay of Bus Reactor -1 (125 MVAr)
231		400kV Main Bay of ICT-1 (765/400 kV, 1500 MVA)
232		400kV Main Bay of ICT-2 (765/400 kV, 1500 MVA)
233		400kV Main Bay of STATCOM
234		400kV Main Bay of New PPSP-1 with line Reactor (50 MVAr)
235		400kV Main Bay of New PPSP-2 with line Reactor (50 MVAr)
236		400kV Tie Bay of Ranchi-1 & Bus Reactor -2
237		400kV Tie Bay of Ranchi-2 & ICT-2
238		400kV Tie Bay of Ranchi-3 & Bus Reactor -1

Sl No	Name of Substation	Name of Bay
239		400kV Tie Bay of Ranchi-4 & ICT-1
240		400kV Tie Bay of STATCOM & Future 4
241		400kV Tie Bay of Patratu-I & New PPSP -1
242		400kV Tie Bay of Patratu-2 & New PPSP -2
243		400kV Tie Bay of Chandwa-1 & Future -3
244		400kV Tie Bay of Chandwa-1 & Future -2
245		400kV Main Bay of Future-1 for ICT
246		400kV Main Bay of Future-2
247		400kV Main Bay of Future-3
248		400kV Main Bay of Future-4
249		400kV Tie Bay of Future-1 for ICT and Future-5
250	400/220 kV Bakreswar TPS (400 kV Side)	400 kV Main Bay of 400 Arambag with Line Reactor(63 MVAr)
251		400 kV Main Bay of Jeerat
252		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
253		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
254		400 kV Main Bay of Unit-1
255		400 kV Main Bay of Unit-2
256		400kV Main Bay of Bus Reactor -1 (50 MVAr)
257		400 kV Transfer Bus Coupler
258		400 kV Bus Coupler Bay
259	400 kV Bherampore	400 kV Main Bay of Sagardighi-II
260		400 kV Main Bay of Farakka-II
261		400 kV Tie Bay of Sagardighi-II And Farakka-II
262		400 kV Main Bay of Sagardighi-I
263		400 kV Main Bay of Farakka-I

Sl No	Name of Substation	Name of Bay
264		400 kV Tie Bay of Sagardighi-I And Farakka-I
265		400 kV Main Bay of Bheramara-I
266		400kV Main Bay of Bus Reactor -2 (125 MVAr)
267		400 kV Tie Bay of Bheramara-I And Bus Reactor-2
268		400 kV Main Bay of Bheramara-II
269		400kV Main Bay of Bus Reactor -1 (80 MVAr)
270		400 kV Tie Bay of Bheramara-II And Bus Reactor-1
271		400 kV Main Bay of Bheramara-3
272		400 kV Main Bay of Bheramara-4
273		400kV Main Bay of Future-1
274		400kV Main Bay of Future-2
275		400kV Tie Bay of Bheramara-4 & Future -2
276		400kV Tie Bay of Bheramara-1 & Future -3
277	400/220 kV Binaguri (400 kV Side)	400 kV Main Bay of Alipurduar-4
278		400 kV Main Bay of Alipurduar-3
279		400 kV Tie Bay of Alipurduar-3 & 4
280		400 kV Main Bay of New Purnea-II
281		400 kV Main Bay of Alipurduar-2 with line reactor (80 MVAr)
282		400 kV Tie Bay of New Purnea-II And Alipurduar-II with Line Reactor
283		400 kV Main Bay of New Purnea-I
284		400 kV Main Bay of Alipurduar-I
285		400 kV Tie Bay of New Purnea-I And Alipurduar-I
286		400 kV Main Bay of Kishanganj-II
287		400kV Main Bay of Bus Reactor -2 (125 MVAr)
288		400 kV Tie Bay of Kishanganj-II And Bus Reactor -2

Sl No	Name of Substation	Name of Bay
289		400 kV Main Bay of Kishanganj-I
290		400kV Main Bay of Bus Reactor -1 (125 MVAr)
291		400 kV Tie Bay of Kishanganj-I And Bus Reactor -1
292		400 kV Main Bay of Rangpo-II
293		400 kV Main Bay of Bongaigaon-II
294		400 kV Tie Bay of Rangpo-II & Bongaigaon-II
295		400 kV Main Bay of Rangpo-I
296		400 kV Main Bay of Bongaigaon-I
297		400 kV Tie Bay of Rangpo-I & Bongaigaon-I
298		400 kV Main Bay of Tala-I with Line Reactor (63 MVAr)
299		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
300		400 kV Tie Bay of Tala-I & ICT-I
301		400 kV Main Bay of Tala-II with Line Reactor-2(63 MVAr)
302		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
303		400 kV Tie Bay of Tala-II & ICT-II
304		400 kV Main Bay of Tala-IV with Line Reactor-2(63 MVAr)
305		400 kV Main Bay of Malbase
306		400 kV Tie Bay of Tala-IV & Malbase
307		400 kV Main Bay of Future for ICT 3
308	400/220 kV Gokarno (400 kV Side)	400 kV Main Bay of New Purnea
309		400 kV Main Bay of Rajarhat
310		400 kV Main Bay of Sagardighi-I
311		400 kV Main Bay of Sagardighi-II
312		400 kV Main Bay of Chanditala-I
313		400 kV Main Bay of Chanditala-II

Sl No	Name of Substation	Name of Bay
314		400 kV Main Bay of Bus Reactor -1 (80 MVAr)
315		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
316		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
317		400 kV Main Bay of ICT-3 (400/220 KV, 315 MVA)
318		400kV Main Bay of Future-1
319		400kV Main Bay of Future-2
320		400kV Main Bay of Future-3
321		400kV Main Bay of Future-4
322		400 kV Bus Coupler Bay
323		400 kV Transfer Bus Coupler Bay
324	400/220 kV Maithon (400 kV Side)	400 kV Main Bay of Kahalgaon-I with Line Reactor (50 MVAr)
325		400 kV Main Bay of Maithon RB-II (MPL2)
326		400 kV Tie Bay of Kahalgaon-I And Maithon RB-II
327		400 kV Main Bay of Majia B TPP-III
328		400 kV Main Bay of Raghunathpur TPS
329		400 kV Tie Bay of Mejia B TPP-III And Gaya-2
330		400 kV Main Bay of Maithon RB-I (MPL-1)
331		400 kV Main Bay of Durgapur-I
332		400 kV Tie Bay of Maithon RB-I And Durgapur-I
333		400 kV Main Bay of Ranchi -1
334		400 kV Main Bay of Durgapur-II
335		400 kV Tie Bay of Ranchi-1 And Durgapur-II
336		400 kV Bus Sectionalizer Bay Between Bus1 And Bus3
337		400 kV Bus Sectionalizer Bay Between Bus2 And Bus4
338		400 kV Main Bay of ICT-2 (400/220 KV, 500 MVA)

Sl No	Name of Substation	Name of Bay
339		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
340		400 kV Tie Bay of 400/220 kV ICT-II And 125 MVAr B/R-I
341		400 kV Main Bay of ICT-3 (400/220 KV, 500 MVA)
342		400 kV Main Bay of Gaya-II with Line Reactor (50 MVAr)
343		400 kV Tie Bay of ICT-III And Gaya-II
344		400 kV Main Bay of ICT-1 (400/220 KV, 500 MVA)
345		400 kV Main Bay of Majia B TPP-II
346		400 kV Tie Bay of ICT-I And Majia B TPP-II
347		400 kV Main Bay of Gaya-I with Line Reactor (50 MVAr)
348		400 kV Main Bay of Kahalgaon-II with Line Reactor (50 MVAr)
349		400 kV Tie Bay of Gaya-I And Kahalgaon-II
350		400 kV Main Bay of Majia B TPP-I
351		400 kV Main Bay of Jamshedpur
352		400 kV Tie Bay of Majia B TPP-I And Jamshedpur
353		400 kV Main Bay of Future-1
354		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
355		400 kV Tie Bay of Future -1 And Bus Reactor -2
356	400/220 kV Malda (400 kV Side)	400 kV Main Bay of Farakka STPP-I
357		400 kV Main Bay of Farakka STPP-II
358		400 kV Main Bay of New Purnea-I
359		400 kV Main Bay of New Purnea-II
360		400 kV Main Bay of ICT-3 (400/220 KV, 315 MVA)
361		400 kV Main Bay of ICT-5 (400/220 KV, 315 MVA)
362		400 kV Transfer Bus Coupler
363		400 kV Bus Coupler Bay

Sl No	Name of Substation	Name of Bay
364	400 kV New PPSP	400 kV Main Bay of Ranchi-II
365		400 kV Main Bay of Arambag-I
366		400 kV Tie Bay of Ranchi-II And Arambag-I
367		400 kV Main Bay of Ranchi-I
368		400 kV Main Bay of Arambag-II
369		400 kV Tie Bay of Ranchi-I And Arambag-II
370		400 kV Main Bay of Spare
371		400 kV Main Bay of PPSP-II
372		400 kV Tie Bay of Spare And PPSP-II
373		400 kV Main Bay of Bus Reactor -1 (80 MVAr)
374		400 kV Main Bay of PPSP-I
375		400 kV Tie Bay of Bus Reactor -1 And PPSP-I
376		400kV Main Bay of Future-1
377		400kV Main Bay of Future-2
378		400kV Main Bay of Future-3
379		400kV Main Bay of Future-4
380		400 kV Tie Bay of Future-1 And Future-2
381		400 kV Tie Bay of Future-3 And Future-4
382	400/220 kV Rajarhat (400 kV Side)	400 kV Main Bay of Gokarno with Line Reactor (80 MVAr)
383		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
384		400 kV Tie Bay of Gokarno And Bus Reactor -2
385		400 kV Main Bay of Jeerat
386		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
387		400 kV Tie Bay of Jeerat And Bus Reactor-1
388		400 kV Main Bay of Farakka with Line Reactor (80 MVAr)

Sl No	Name of Substation	Name of Bay
389		400 kV Main Bay of ICT-2 (400/220 KV, 500 MVA)
390		400 kV Tie Bay of Farakka And ICT-2
391		400 kV Main Bay of Subhasgram
392		400 kV Main Bay of ICT-1 (400/220 KV, 500 MVA)
393		400 kV Tie Bay of Subhasgram And ICT-1
394		400 kV Main Bay of future for ICT-3
395		400kV Main Bay of Future-1
396		400 kV Tie Bay of Future-1 And ICT-3
397		400kV Main Bay of Future-2
398		400kV Main Bay of Future-3 (for New Chanditala)
399		400 kV Tie Bay of Future-2 And Future-3
400		400kV Main Bay of Future-5 (for New Chanditala)
401		400 kV Tie Bay of Future-4 And Future-5
402	400/220 kV Subhasgram (400 kV Side)	400 kV Main Bay of Haldia-I
403		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
404		400 kV Tie Bay of Haldia-I And 125 MVAr B/R
405		400 kV Main Bay of Haldia-II
406		400 kV Main Bay of ICT-5 (400/220 KV, 500 MVA)
407		400 kV Tie Bay of Haldia-I And ICT-5
408		400 kV Main Bay of ICT-4 (400/220 KV, 315 MVA)
409		400 kV Main Bay of ICT-3 (400/220 KV, 315 MVA)
410		400 kV Main Bay of Rajarhat
411		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
412		400 kV Tie Bay of Rajarhat And ICT-2
413		400 kV Main Bay of Sagardighi

Sl No	Name of Substation	Name of Bay
414		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
415		400 kV Tie Bay of Sagardighi with Line Reactor And ICT-1
416		400 kV Main Bay of New Jeerat-1
417		400 kV Main Bay of New Jeerat-2
418		400 kV Tie Bay of New Jeerat-1 And ICT-4
419		400 kV Tie Bay of New Jeerat-2 And ICT-3
420	400 kV GMR	400 kV Main Bay of Angul-1
421		400 kV Tie Bay of Angul-1 And Unit-1
422		400 kV Main Bay of Unit-1
423		400 kV Main Bay of Angul-2
424		400 kV Tie Bay of Angul-2 And Unit-2
425		400 kV Main Bay of Unit-2
426		400 kV Bus Sectionalizer Bay Between Bus1 And Bus3
427		400 kV Bus Sectionalizer Bay Between Bus2 And Bus4
428		400 kV Main Bay of Meramundali
429		400 kV Tie Bay of Meramundali And Unit-3
430		400 kV Main Bay of Unit-3
431		400 kV Main Bay of Bus Reactor (Future-1)
432		400 kV Main Bay of Bus Reactor (Future-2)
433		400 kV Tie Bay of Future-1 And Future-2
434		400 kV Main Bay of Line (Future-3)
435		400 kV Main Bay of Unit 4 (Future-4)
436		400 kV Tie Bay of Future-3 And Future-4
437	400 kV JITPL	400 kV Main Bay of Angul 1
438		400 kV Tie Bay of Angul 1 And Unit 1

Sl No	Name of Substation	Name of Bay
439		400 kV Main Bay of Unit 1
440		400 kV Main Bay of Angul 2
441		400 kV Tie Bay Angul 2 And 50 MVAr Bus Reactor 2
442		400 kV Main Bay of Bus Reactor -1 (50 MVAr)
443		400 kV Main Bay of Bus Reactor -2 (50 MVAr)
444		400 kV Tie Bay of Bus Reactor 1
445		400 kV Main Bay of Unit 2
446		400 kV Tie Bay of Unit 2
447		400 kV Main Bay of Future-1 (for line)
448		400 kV Main Bay of Future-2 (for line)
449	400 kV Adhunik	400 kV Main Bay of Jamsedpur 1
450		400 kV Tie Bay of Jamsedpur1 And Jamsedpur-2
451		400 kV Main Bay of Jamsedpur 2
452		400 kV Main Bay of Unit -1
453		400 kV Tie Bay of Unit -1 and Unit-2
454		400 kV Main Bay of Unit -2
455	400/220 kV Arambag (400 kV Side)	400 kV Main Bay of ICT-4 (400/220 KV, 315 MVA)
456		400 kV Main Bay of New Chanditala
457		400 kV Main Bay of Kolaghat
458		400 kV Transfer Bus Coupler
459		400 kV Main Bay of ICT-3 (400/220 KV, 315 MVA)
460		400 kV Main Bay of Bus Reactor -1 (50 MVAr)
461		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
462		400 kV Bus Coupler Bay
463		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)

Sl No	Name of Substation	Name of Bay
464		400 kV Main Bay New PPSP-1
465		400 kV Main Bay New PPSP-2
466		400 kV Main Bay of Bakreswar TPS
467	765/400 kV Jharsuguda (400 kV Side)	400 kV Main Bay of Raigarh-II
468		400 kV Tie Bay of Raigarh-II and ICT-I
469		400 kV Main Bay of ICT-I (765/400 kV 1500MVA)
470		400 kV Main Bay of Rourkela-II
471		400 kV Tie Bay of Rourkela-II and Future -II
472		400 kV Main Bay of ICT-II (765/400 kV 1500MVA)
473		400 kV Main Bay of Raigarh-I
474		400 kV Tie Bay of Raigarh-I and ICT-II
475		400 kV Main Bay of Rourkela-I
476		400 kV Tie Bay of Rourkela-I and Future-I
477		400 kV Main Bay of Future-I
478		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
479		400 kV Tie Bay of Bus Reactor-1 and Sterlite-I
480		400 kV Main Bay of Sterlite-I
481		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
482		400 kV Tie Bay of Bus Reactor -II and Sterlite-II
483		400 kV Main Bay of Sterlite-II
484		400 kV Main Bay of Sterlite-III
485		400 kV Tie Bay of Sterlite-III and IBEUL-I
486		400 kV Main Bay of IBEUL-I
487		400 kV Main Bay of Sterlite-IV
488		400 kV Tie Bay of Sterlite-IV and IBEUL-II

Sl No	Name of Substation	Name of Bay
489		400 kV Main Bay of IBEUL-II
490		400 kV Bus-sectionalizer Bay of Bus-I and Bus-III
491		400 kV Bus-sectionalizer Bay of Bus-II and Bus-IV
492		400 kV Main Bay of Rourkela-IV
493		400 kV Tie Bay of Rourkela-IV and Raigarh-IV
494		400 kV Main Bay of Raigarh-IV
495		400 kV Main Bay of Rourkela-III
496		400 kV Tie Bay of Rourkela-III and Raigarh-III
497		400 kV Main Bay of Raigarh-III
498		400 kV Main Bay of OPGC-I
499		400 kV Tie Bay of OPGC-I and ICT-IV
500		400 kV Main Bay of ICT-III (765/400 kV 1500MVA)
501		400 kV Main Bay of ICT-IV (765/400 kV 1500MVA)
502		400 kV Tie Bay of OPGC-II and ICT-III
503		400 kV Main Bay of OPGC-II
504	400/220 kV Jamsedpur (400 kV Side)	400 kV Main Bay of Durgapur
505		400 kV Main Bay of Mejia B
506		400 kV Tie Bay of Durgapur and Mejia B
507		400 kV Main Bay of Maithon B
508		400 kV Main Bay of Chaibasa-1
509		400 kV Tie Bay of Mainthon B and Chaibasa 1
510		400 kV Main Bay of Chaibasa 2
511		400 kV Main Bay of DSTPS 1
512		400 kV Tie Bay of Chaibasa 2 and DSTPS 1
513		400 kV Main Bay of DSTPS 2

Sl No	Name of Substation	Name of Bay
514		400 kV Main Bay of Baripada
515		400 kV Tie Bay of DSTPS 2 and Baripada
516		400 kV Main Bay of TISCO
517		400 kV Tie of TISCO and Future - IV
518		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
519		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
520		400 kV Tie Bay ICT-2 and Bus Reactor-2
521		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
522		400 kV Main Bay of Bus Reactor -1 and 3 (50 + 125 MVAr)
523		400 kV Tie Bay ICT-1 and Bus Reactor -1 and 3
524		400 kV Main Bay of APNRL 1
525		400 kV Tie of APNRL 1 and Future-2
526		400 kV Main Bay of APNRL 2
527		400 kV Tie of APNRL 2 and Future-3
528		400 kV Main Bay of ICT-3 (400/220 KV, 315 MVA)
529		400 kV Tie Bay of ICT-3 and Future-III
530		400 kV Main Bay of Future-1
531		400 kV Main Bay of Future-2
532		400 kV Main Bay of Future-3
533		400 kV Main Bay of Future-4
534	400/220 kV Daltonganj (400 kV Side)	400 kV Main Bay of Sasaram 1 with Line Reactor (50 MVAr)
535		400 kV Tie Bay of Sasaram 1 with line reactor and ICT-1
536		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
537		400 kV Main Bay of Sasaram 2
538		400 kV Tie Bay of Sasaram 2 and Bus Reactor

Sl No	Name of Substation	Name of Bay
539		400 kV Main Bay of Bus Reactor -1 (80 MVAr)
540		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
541		400 kV Tie Bay of ICT-2 and Future-4
542		400 kV Main Bay of Future-13
543		400 kV Main Bay of Future-1
544		400 kV Main Bay of Future-3 for ICT-3
545		400 kV Main Bay of Future-4
546		400 kV Main Bay of Future-16
547		400 kV Main Bay of Future-19
548		400 kV Main Bay of Future-22
549		400 kV Main Bay of Future-25
550		400 kV Main Bay of Future-28
551		400 kV Main Bay of Future-15
552		400 kV Main Bay of Future-18
553		400 kV Main Bay of Future-21
554		400 kV Main Bay of Future-24
555		400 kV Main Bay of Future-27
556		400 kV Main Bay of Future-30
557		400 kV Tie Bay of Future-13 and Future-15
558		400 kV Tie Bay of Future-16 and Future-18
559		400 kV Tie Bay of Future-19 and Future-21
560		400 kV Tie Bay of Future-22 and Future-24
561		400 kV Tie Bay of Future-25 and Future-27
562		400 kV Tie Bay of Future-28 and Future-30
563	400/220 kV Koderma	400 kV 400kV Main Bay of Unit-1

Sl No	Name of Substation	Name of Bay
564	(400 kV Side)	400kV Main Bay of Station Transformer -1 (90 MVA, 400/11.5 kV)
565		400kV Main Bay of Station Transformer -2 (90 MVA, 400/11.5 kV)
566		400kV Main Bay of Unit-2
567		400kV Main Bay of Future -2 for ST-3
568		400kV Main Bay of Future-1 for Unit-3
569		400kV Main Bay of Future-4 for ST-4
570		400kV Main Bay of Future-3 for Unit-4
571		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
572		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
573		400 kV Main Bay of Bus Reactor -1 (50 MVAr)
574		400kV Main Bay of Gaya -1
575		400kV Main Bay of Gaya -2
576		400kV Main Bay of Biharsarrif -1
577		400kV Main Bay of Biharsarrif -2
578		400kV Main Bay of Bokaro-1
579		400kV Main Bay of Bokaro-2
580		400 kV Main Bay of Bus Reactor -2 (50 MVAr)
581		400kV Tie Bay of Unit-1 & Station Tranformer-1
582		400kV Tie Bay of Unit-2 & Station Tranformer-2
583		400kV Tie Bay of Unit-3 & Station Tranformer-3
584		400kV Tie Bay of Unit-4 & Station Tranformer-4
585		400kV Tie Bay of ICT-1 & ICT-2
586		400kV Tie Bay of Bus Reactor-1 & Gaya PG-1
587	400/220 kV Ranchi (400 kV Side)	400 kV Main Bay of New Ranchi-1
588		400 kV Main Bay of New Ranchi-2

Sl No	Name of Substation	Name of Bay
589		400 kV Main Bay of New Ranchi-3
590		400 kV Main Bay of New Ranchi-4
591		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
592		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
593		400 kV Main Bay of Raghunathpur-1
594		400 kV Main Bay of Raghunathpur-2
595		400 kV Main Bay of Raghunathpur-3
596		400 kV Main Bay of MPL-1 with line reactor (50 MVAr)
597		400 kV Main Bay of MPL-2 with line reactor (50 MVAr)
598		400 kV Main Bay of Maithon-1
599		400 kV Main Bay of Sipat-1 with line reactor (80 MVAr) and FSC
600		400 kV Main Bay of Sipat-2 with line reactor (80 MVAr) and FSC
601		400 kV Main Bay of Rourkela-1
602		400 kV Main Bay of Rourkela-2
603		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
604		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
605		400 kV Main Bay of Future-1
606		400 kV Main Bay of Future-2 (for Chitrapur-I)
607		400 kV Main Bay of Future-3 (for Chitrapur-2)
608		400 kV Main Bay of Future-6 for ICT
609		400 kV Main Bay of Future-4 for Tenughat-1
610		400 kV Main Bay of Future-5 for Tenughat-1
611		400 kV Tie Bay of New Ranchi-1 and Future-1
612		400 kV Tie Bay of New Ranchi-3 and Bus Reactor-1
613		400 kV Tie Bay of New Ranchi-2 and Future-2

Sl No	Name of Substation	Name of Bay
614		400 kV Tie Bay of New Ranchi-1 and Future-1
615		400 kV Tie Bay of Sipat-2 and Future-4
616		400 kV Tie Bay of Sipat-1 and Future-5
617		400 kV Tie Bay of Raghunathpur-3 and Bus Reactor-2
618		400 kV Tie Bay of Raghunathpur-2 and Rourkela-1
619		400 kV Tie Bay of MPL-2 and Rourkela-2
620		400 kV Tie Bay of MPL-1 and ICT-3
621		400 kV Tie Bay of Raghunathpur-1 and ICT-2
622		400 kV Tie Bay of Maihton-1 and ICT-1
623	400/220 kV Bidhannagar (400 kV Side)	400 kV Main Bay of Chanditala S/C
624		400 kV Main Bay of PPSP I
625		400 kV Main Bay of PPSP II
626		400 kV Main Bay of Durhapur I
627		400 kV Main Bay of Durhapur II
628		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
629		400 kV Main Bay of Bus Reactor -1 (50 MVAr)
630		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
631		400 kV Bus Couplar Bay
632		400 kV Transfer Bus Couplar Bay
633	400/220 kV DSTPS (400 kV Side)	400 kV Main Bay of Raghunathpur TPP-I
634		400 kV Main Bay of Raghunathpur TPP-II
635		400 kV Main Bay of Jamshedpur I
636		400 kV Main Bay of Jamshedpur II
637		400 kV Tie Bay of Raghunathpur I and Raghunathpur II
638		400 kV Tie Bay of Jamshedpur I and Jamshedpur II

Sl No	Name of Substation	Name of Bay
639		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
640		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
641		400 kV Tie Bay of ICT-1 And ICT-2
642		400 kV Main Bay of Unit-1
643		400 kV Main Bay of Unit-2
644		400kV Main Bay of Station Transformer -1 (90 MVA, 400/11.5 kV)
645		400kV Main Bay of Station Transformer -2 (90 MVA, 400/11.5 kV)
646		400 kV Tie Bay of Unit-1 and Station Transformer-1
647		400 kV Tie Bay of Unit-2 and Station Transformer-2
648	400 kV Maithon Right Bank (400 kV Side)	400 kV Main Bay of Maihton-2
649		400 kV Main Bay of Ranchi-2 with Line Reactor (50 MVAr)
650		400 kV Main Bay of Ranchi-1 with Line Reactor (50 MVAr)
651		400 kV Main Bay of Maihton-1
652		400 kV Main Bay of Station Transformer -2(80 MVA)
653		400 kV Main Bay of Unit-2
654		400 kV Main Bay of Station Transformer -1(80 MVA)
655		400 kV Main Bay of Unit-1
656		400 kV Main Bay of Bus Reactor-2 (50 MVAr)
657		400 kV Main Bay of Bus Reactor-1 (50 MVAr)
658		400kV Tie Bay of Station Transformer -2 and Ranchi-2
659		400kV Tie Bay of Unit-2 and Ranchi-1
660		400kV Tie Bay of Maithon-2 AND Station Transformer -1
661		400kV Tie Bay of Unit-1 AND Maithon-I
662		400kV Tie Bay of Bus Reactor-2 and Bus Reactor-1
663	400/220 kV	400 kV Main Bay of Future-11 for filter Bank

Sl No	Name of Substation	Name of Bay
664	Alipurdwar(400 kV Side)	400 kV Main Bay of Bus Reactor-1 (125 MVAr)
665		400 kV Main Bay of Filter 3
666		400 kV Main Bay of Bus Reactor-2 (125 MVAr)
667		400 kV Main Bay of Filter 1
668		400 kV Main Bay of Filter 2
669		400 kV Main Bay of Punatsangchu 1
670		400 kV Main Bay of Punatsangchu 2
671		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
672		400 kV Main Bay of Future-1 for ICT
673		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
674		400 kV Main Bay of Binaguri-3
675		400 kV Main Bay of Binaguri-4
676		400 kV Main Bay of Jigmeling-1
677		400 kV Main Bay of Binaguri-1
678		400 kV Main Bay of Future-2
679		400 kV Main Bay of Binaguri-2
680		400 kV Main Bay of Bongaigaon-2
681		400 kV Main Bay of Bongaigaon-1
682		400 kV Main Bay of Future-3
683		400 kV Bus 2A and Bus 2B Coupler
684		400 kV Bus 1A and Bus 1B Coupler
685		400 kV Tie Bay of Future-19 and Bus Reactor-1
686		400 kV Tie Bay of Filter 3 and Bus Reactor-2
687		400 kV Tie Bay of Filter 1 and Filter 2
688		400 kV Tie Bay of Punastsangchu 1 & Punastsangchu 2

Sl No	Name of Substation	Name of Bay
689		400 kV Tie Bay of ICT-2 and Future-1
690		400 kV Tie Bay of ICT-1 and Binaguri-3
691		400 kV Tie Bay of Binaguri-4 and Jigmiling-1
692		400 kV Tie Bay of Future-2 and Jigmiling-2
693		400 kV Tie Bay of Binaguri-2 and Bongaigaon-2
694		400 kV Tie Bay of Bongaigaon-1 and Future-4
695		400 kV Main Bay of Jigmeling-2
696		400 kV Main Bay of Future-4
697		400 kV Main Bay of Future-5
698		400 kV Main Bay of Future-6
699		400 kV Main Bay of Future-7
700		400 kV Main Bay of Future-8
701		400 kV Main Bay of Future-9
702		400 kV Main Bay of Future-10
703		400 kV Main Bay of Future-13
704		400 kV Main Bay of Future-15
705		400 kV Main Bay of Future-18
706		400 kV Main Bay of Future-16
707		400 kV Main Bay of Future-12 for Filter Bank
708		400 kV Main Bay of Future-14 for Converter Transformer
709		400 kV Main Bay of Converter Transformer-2
710		400 kV Main Bay of Converter Transformer-1
711		400 kV Main Bay of Future-17 for Converter Transformer
712		400 kV Main Bay of Future-19 for Filter Bank
713		400 kV Main Bay of Future-21 for Filter Bank

Sl No	Name of Substation	Name of Bay
714		400 kV Tie Bay of Future-3 and Binaguri-1
715		400 kV Tie Bay of Future-5 and Future-6
716		400 kV Tie Bay of Future-7 and Future-8
717		400 kV Tie Bay of Future-9 and Future-10
718		400 kV Tie Bay of Future-11 and Future-12
719		400 kV Tie Bay of Future-13 and Future-14
720		400 kV Tie Bay of Future-15 and Converter Transformer-2
721		400 kV Tie Bay of Future-6 and Converter Transformer-1
722		400 kV Tie Bay of Future-17 and Future-18
723	400/132 kV Banka (400 kV Side)	400 kV Main Bay of Biharshariff-1
724		400 kV Main Bay of Biharshariff-2
725		400 kV Main Bay of Kahalgaon STPP-1
726		400 kV Main Bay of Kahalgaon STPP-2
727		400 kV Main Bay of Future -1
728		400 kV Main Bay of ICT-1 (400/132 KV, 200 MVA)
729		400 kV Main Bay of ICT-2 (400/132 KV, 200 MVA)
730		400 kV Main Bay of Bus Reactor -1 (80 MVAr)
731		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
732		400 kV Main Bay of ICT-3 (400/132 KV, 315 MVA)
733		400 kV Tie Bay of Biharshariff-1 and ICT-1
734		400 kV Tie Bay of Biharshariff-2 and ICT-2
735		400 kV Tie Bay of Bus Reactor-1 and Kahalgaon STPP-1
736		400 kV Tie Bay of Bus Reactor-2 and Kahalgaon STPP-2
737		400 kV Tie Bay of Future-I and ICT-3
738	400/132 kV Barh (	400 kV Main Bay of ICT-3 (400/132 KV, 200 MVA)

Sl No	Name of Substation	Name of Bay
739	400 kV Side)	400 kV Main Bay of Patna-3
740		400 kV Main Bay of Patna-4
741		400 kV Main Bay of Bus-1 and Bus-3 Coupler
742		400 kV Main Bay of Bus-2 and Bus-4 Coupler
743		400 kV Main Bay of Motihari-1 with Line Reactor (63 MVAr)
744		400 kV Main Bay of Motihari-2 with Line Reactor (63 MVAr)
745		400 kV Main Bay of Kahalgaon STPP-2
746		400 kV Main Bay of Kahalgaon STPP-1
747		400 kV Main Bay of Patna-1
748		400 kV Main Bay of Patna-2
749		400 kV Main Bay of ICT-1 (400/132 KV, 200 MVA)
750		400 kV Main Bay of Unit-1
751		400 kV Main Bay of Bus Reactor -1 (80 MVAr)
752		400 kV Main Bay of Unit-2
753		400 kV Main Bay of ICT-2 (400/132 KV, 200 MVA)
754		400 kV Main Bay of Unit-3
755		400 kV Main Bay of Unit-4
756		400 kV Main Bay of Unit-5
757		400 kV Tie Bay of ICT-3 & Future-1
758		400 kV Tie Bay of Patna-3 & Future-7
759		400 kV Tie Bay of Patna-4 & Futuer-6
760		400 kV Tie Bay of Motihari-1 with Line Rector and Future-5
761		400 kV Tie Bay of Motihari-2 with Line Reactor and Kahalgaon STPP-2
762		400 kV Tie Bay of Kahalgaon STPP-1 and Patna-1
763		400 kV Tie Bay of Patna-2

Sl No	Name of Substation	Name of Bay
764		400 kV Tie Bay of ICT-1 and Unit-1
765		400 kV Tie Bay of Bus Reacor -1 and Unit-2
766		400 kV Tie Bay of ICT-2 and Unit-3
767		400 kV Tie Bay of Unit-5 and Future-2
768		400 kV Tie Bay of Unit-4 and Future-3
769		400 kV Main Bay of Future-1
770		400 kV Main Bay of Future-2
771		400 kV Main Bay of Future-3
772		400 kV Main Bay of Future-4
773		400 kV Main Bay of Future-5
774		400 kV Main Bay of Future-6
775		400 kV Main Bay of Future-7
776	400/220 kV Biharsariff (400 kV Side)	400 kV Main Bay of Future-1
777		400 kV Main Bay of Varanasi-1 with Line Reactor(50 MVAr)
778		400 kV Main Bay of Varanasi-2 with Line Reactor(50 MVAr)
779		400 kV Main Bay of Future -2
780		400 kV Main Bay of Banka-II
781		400 kV Main Bay of Banka-I
782		400 kV Main Bay of Bus Reactor-1 & Bus Reactor 4 (50MVAr + 125 MVAr)
783		400 kV Main Bay of Sasaram-1 with Line Reactor(50 MVAr)
784		400 kV Main Bay of Lakhisarai-2 with Line Reactor (50 MVAr)
785		400 kV Main Bay of Future-III for Tenughat
786		400 kV Main Bay of Sasaram-2
787		400 kV Main Bay of Balia-2
788		400 kV Main Bay of Balia-1

Sl No	Name of Substation	Name of Bay
789		400 kV Main Bay of Purnea-2 with line reactor (80 MVAr)
790		400 kV Main Bay of Purnea-1 with line reactor (80 MVAr)
791		400 kV Main Bay of Future - 4
792		400 kV Bus-3 and Bus-1 Coupler Bay
793		400 kV Bus-4 and Bus-2 Coupler Bay
794		400 kV Main Bay of Future - 5
795		400 kV Main Bay of Koderma-1
796		400 kV Main Bay of Koderma-2
797		400 kV Main Bay of ICT-4 (400/132 KV, 500 MVA)
798		400 kV Main Bay of Bus Reactor -3 (125 MVAr)
799		400 kV Main Bay of ICT-2 (400/132 KV, 315 MVA)
800		400 kV Main Bay of ICT-1 (400/132 KV, 315 MVA)
801		400 kV Main Bay of Lakhisarai-1
802		400 kV Main Bay of Bus Reactor -2 (80 MVAr)
803		400 kV Main Bay of ICT-3 (400/132 KV, 315 MVA)
804		400 kV Main Bay of Muzaffarpur-2
805		400 kV Main Bay of Muzaffarpur-1
806		400 kV Tie Bay of Future and Varanasi-1 with Line Reactor
807		400 kV Tie Bay of Varansai-2 and Future-2
808		400 kV Tie Bay of Banka-2 and Banka-1
809		400 kV Tie Bay of Bus Reactor-1&4 and Sasaram-1
810		400 kV Tie Bay of Lakhisarai-2 with line reactor and Future-3
811		400 kV Tie Bay of Sasaram-2 and Balia-2
812		400 kV Tie Bay of Balia-1 and Purnea-2 with Line Reactor-
813		400 kV Tie Bay of Purnea-1 with Line Reactor and Future - 4

Sl No	Name of Substation	Name of Bay
814		400 kV Tie Bay of Future-4 and Koderma-1
815		400 kV Tie Bay of Koderma-2 and ICT-4
816		400 kV Tie Bay of Bus Reactor-3 and ICT-2
817		400 kV Tie Bay of ICT-1 and Lakhisarai-1
818		400 kV Tie Bay of Bus Reactor-2 and ICT-3
819		400 kV Tie Bay of Muzaffarpur-2 and Muzaffarpur-1
820	400/220 kV Darbhanga (400 kV Side)	400 kV Main Bay of ICT-1 (400/220 KV, 500 MVA)
821		400 kV Main Bay of Muzaffarpur-1
822		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
823		400 kV Main Bay of Muzaffarpur-2
824		400 kV Main Bay of ICT-1 (400/220 KV, 500 MVA)
825		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
826		400 kV Main Bay of Kishanganj-1
827		400 kV Main Bay of Kishanganj-2
828		400 kV Tie Bay of ICT-1 and Muzaffarpur-1
829		400 kV Tie Bay of Bus Reactor-1 and Muzaffarpur-2
830		400 kV Tie Bay of ICT-2 and Bus Reactor-2
831		400 kV Tie Bay of Kishanganj-1 and Kishanganj-2
832		400 kV Main Bay of Future-2 for ICT-1
833		400 kV Main Bay of Future-1
834		400 kV Main Bay of Bus Reactor -4 (80 MVAr)
835		400 kV Main Bay of Bus Reactor -3 (80 MVAr)
836		400 kV Tie Bay of Bus Reactor-3 and Bus Reactor-4
837		400 kV Main Bay of Sitamarhi-1
838		400 kV Main Bay of Sitamarhi-2

Sl No	Name of Substation	Name of Bay
839		400 kV Tie Bay of Sitamarhi-1 and Sitamarhi-2
840		400 kV Tie Bay of Future-7 and Future-1
841	400/220 kV Durgapur (400 kV Side)	400 kV Main Bay of Bus Reactor -3 (125 MVAr)
842		400 kV Main Bay of Future-1
843		400 kV Main Bay of Future-2
844		400 kV Main Bay of Maithon-2
845		400 kV Main Bay of Maithon-1
846		400 kV Main Bay of Farakka STPP-2
847		400 kV Main Bay of Farakka STPP-1
848		400 kV Main Bay of Sagardighi TPP-2
849		400 kV Main Bay of Sagardighi TPP-1
850		400 kV Main Bay of Future-3
851		400 kV Bus-3 and Bus-1 Coupler Bay
852		400 kV Bus-4 and Bus-2 Coupler Bay
853		400 kV Main Bay of ICT-3 (400/220 KV, 315 MVA)
854		400 kV Main Bay of Bus Reactor -1 and Bus Reactor-2 (50 MVAr+125MVAr)
855		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
856		400 kV Main Bay of Future-4
857		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
858		400 kV Main Bay of Bidhannagar-1
859		400 kV Main Bay of Bus Reactor -4 (125 MVAr)
860		400 kV Main Bay of Bidhannagar-2
861		400 kV Main Bay of Jamsedpur-1
862		400 kV Main Bay of Future-5
863		400 kV Tie Bay of Bus Reactor - 3 and Future-1

Sl No	Name of Substation	Name of Bay
864		400 kV Tie Bay of Future-2 and Maithon-2
865		400 kV Tie Bay of Maithon-1 and Farakka STPP-2
866		400 kV Tie Bay of Farakka STPP-1 and Sagardighi TPP-2
867		400 kV Tie Bay of Sagardighi TPP-1 and Future-3
868		400 kV Tie Bay of ICT-3 and Bus Reactor -4
869		400 kV Tie Bay of ICT-2 and Future-5
870		400 kV Tie Bay of ICT-1 and Bidhannagar-1
871		400 kV Tie Bay of Bus Reactor-1& Bus Reactor-2 and Bidhannagar-2
872		400 kV Tie Bay of Jamsedpur-1 and Future-4
873	400/220 kV Farakka (400 kV Side)	400 kV Main Bay of Purnea
874		400 kV Main Bay of Rajarhat with Line Reactor(80 MVAr)
875		400 kV Main Bay of Kahalgaon STPP-4 (Bus-1)
876		400 kV Main Bay of Kahalgaon STPP-3
877		400 kV Main Bay of Behrampur-1
878		400 kV Main Bay of Behrampur-2 with Liner Reactor(50 MVAr)
879		400 kV Main Bay of Kahalgaon STPP-1
880		400 kV Main Bay of Kahalgaon STPP-2
881		400 kV Main Bay of Durgapur-2
882		400 kV Main Bay of Durgapur-1
883		400 kV Main Bay of Sagardighi TPP-2
884		400 kV Main Bay of Sagardighi TPP-1
885		400 kV Main Bay of Future-1
886		400 kV Main Bay of ICT-1 (400/220 KV, 315 MVA)
887		400 kV Main Bay of Malda-1
888		400 kV Main Bay of Malda-2 (Bus-2)

Sl No	Name of Substation	Name of Bay
889		400 kV Main Bay of Malda-2 (Bus-1)
890		400 kV Main Bay of Unit-6 (Bus-1)
891		400 kV Main Bay of Unit-5
892		400 kV Main Bay of Tic Transformer-3(100MVA)
893		400 kV Main Bay of Unit-4 (Bus-2)
894		400 kV Main Bay of Unit-4 (Bus-1)
895		400 kV Main Bay of Tic Transformer-1(100MVA)
896		400 kV Main Bay of Unit-1
897		400 kV Main Bay of Tic Transformer-2(100MVA)
898		400 kV Main Bay of Unit-2
899		400 kV Main Bay of Unit-3
900		400 kV Main Bay of Bus Reactor -1 (50 MVAr)
901		400 kV Tie Bay of Purnea and Rajarhat with Line Reactor
902		400 kV Main Bay of Kahalgaon STPP-4 (Bus-2)
903		400 kV Tie Bay of Kahalgaon STPP-3 and Behrampur-1
904		400 kV Tie Bay of Behrampur-2 and Kahalgon STPP-1
905		400 kV Tie Bay of Kahalgaon STPP-2 and Durgapur-2
906		400 kV Tie Bay of Durgapur-1 with Line Reactor and Sagardighi TPP-2
907		400 kV Tie Bay of Sagardighi TPP-1 and Future -1
908		400 kV Tie Bay of ICT-1 and Malda-1
909		400 kV Main Bay of Unit-6 (Bus-2)
910		400 kV Tie Bay of Unit-5 and Tic Transformer-3
911		400 kV Tie Bay of Tic Transformer-1 and Unit-1
912		400 kV Tie Bay of Tic Transformer-2 and Unit-2
913		400 kV Tie Bay of Unit-3 and Bus Reactor-1

Sl No	Name of Substation	Name of Bay
914		400 kV Tie Bay of Unit-6 and Future-4
915	765/400/220 kV Gaya (400 kV Side)	400 kV Main Bay of ICT-3 (400/220 KV, 500 MVA)
916		400 kV Main Bay of ICT-2 (400/220 KV, 315 MVA)
917		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
918		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
919		400 kV Main Bay of ICT-1 (400/220 KV, 500 MVA)
920		400 kV Main Bay of ICT-4 (765/400 KV, 1500 MVA)
921		400 kV Main Bay of ICT-3 (765/400 KV, 1500 MVA)
922		400 kV Main Bay of ICT-2 (765/400 KV, 1500 MVA)
923		400 kV Main Bay of ICT-1 (765/400 KV, 1500 MVA)
924		400 kV Main Bay of Future-1 for North Karanpura -2
925		400 kV Main Bay of Future-2 for North Karanpura -1
926		400 kV Main Bay of Chandauti-1
927		400 kV Main Bay of Chandauti-2
928		400 kV Main Bay of Chandawa-2
929		400 kV Main Bay of Chandawa-1
930		400 kV Main Bay of Maithon-2 with Line Reactor (50 MVAr)
931		400 kV Main Bay of Maithon-1 with Line Reactor (50 MVAr)
932		400 kV Main Bay of Koderma-1
933		400 kV Main Bay of Koderma-2
934		400 kV Tie Bay of Koderma-2 and 765 kV ICT-1
935		400 kV Tie Bay of Koderma-1 and 765 kV ICT-2
936		400 kV Tie Bay of Maithon-1 and 765 kV ICT-3
937		400 kV Tie Bay of Maithon-2 and 765 kV ICT-4
938		400 kV Tie Bay of Chandawa-1 and Future -1

Sl No	Name of Substation	Name of Bay
939		400 kV Tie Bay of Chandawa-2 and ICT-1
940		400 kV Tie Bay of Chandauti-2 and Bus Reactor-1
941		400 kV Tie Bay of Chandauti-1 and Bus Reactor-2
942		400 kV Tie Bay of Future-2 and ICT-2
943		400 kV Tie Bay of Future-1 and ICT-3
944	400/132 kV Kahalgaon (400 kV Side)	400 kV Main Bay of ICT-1 (400/132 kV 200 MVA)
945		400 kV Main Bay of Unit-1
946		400 kV Main Bay of Bus Reactor-1 (50 MVAr)
947		400 kV Main Bay of Unit-2
948		400 kV Main Bay of Unit-3
949		400 kV Main Bay of Unit-4 (Bus-1)
950		400 kV Main Bay of Unit-4 (Bus-2)
951		400 kV Main Bay of Unit-5 (Bus-3)
952		400 kV Main Bay of Unit-5 (Bus-4)
953		400 kV Main Bay of Unit-6 (Bus-3)
954		400 kV Main Bay of Unit-6 (Bus-4)
955		400 kV Main Bay of Bus Reactor-2 (50 MVAr)
956		400 kV Main Bay of Unit-7
957		400 kV Main Bay of ICT-3 (Bus -3) (400/132 kV 200 MVA)
958		400 kV Main Bay of ICT-3 (Bus -4) (400/132 kV 200 MVA)
959		400 kV Main Bay of ICT-4 (Bus -3) (400/132 kV 200 MVA)
960		400 kV Main Bay of ICT-4 (Bus -4) (400/132 kV 200 MVA)
961		400 kV Main Bay of ICT-2 (400/132 kV 200 MVA)
962		400 kV Main Bay of Lakhisarai-1
963		400 kV Main Bay of Lakhisarai-2

Sl No	Name of Substation	Name of Bay
964		400 kV Main Bay of Maithon-2
965		400 kV Main Bay of Maithon-1
966		400 kV Main Bay of Farakka STPP-2
967		400 kV Main Bay of Farakka STPP-1
968		400 kV Main Bay of Barh STPP-1
969		400 kV Main Bay of Barh STPP-2
970		400 kV Main Bay of Banka-1
971		400 kV Main Bay of Banka-2
972		400 kV Main Bay of Future-1
973		400 kV Bus-1 and Bus-3 Coupler
974		400 kV Bus-2 and Bus-4 Coupler
975		400 kV Tie Bay of ICT-1 and Unit-1
976		400 kV Tie Bay of ICT-2 and Lakhisarai-1
977		400 kV Tie Bay of Lakhisarai-2 and Future
978		400 kV Tie Bay of Banka-2 and Future-2
979		400 kV Tie Bay of Maithon-1 and Farakka STPP-2
980		400 kV Tie Bay of Farakka STPP-1 and Barh STPP-1
981		400 kV Tie Bay of Barh STPP-2 and Banka-1
982		400 kV Tie Bay of Banka-2 and Future-2
983		400 kV Tie Bay of Unit-7 and Bus Reactor-2
984		400 kV Tie Bay of Unit-3 and Future-3
985		400 kV Tie Bay of Unit-2 and Bus Reactor-1
986		400 kV Main Bay of Future-2
987		400 kV Main Bay of Future-3
988		400 kV Main Bay of Future-4

Sl No	Name of Substation	Name of Bay
989		400 kV Main Bay of Farakka STPP-3
990		400 kV Main Bay of Farakka STPP-4
991		400 kV Tie Bay of Farakka STPP-4 and Maithon-2
992	400/220 kV Bokaro A (400 kV Side)	400 kV Main Bay of Koderma-1
993		400 kV Main Bay of Koderma-2
994		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
995		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
996		400 kV Main Bay of Station Service Transformer-1 (400/11 kV 70 MVA)
997		400 kV Main Bay of Station Service Transformer-2 (400/11 kV 70 MVA)
998		400 kV Main Bay of Unit-1
999		400 kV Spare Bay of Unit-1
1000		400 kV Bus 1 and Bus 2 Coupler
1001		400 kV Main Bay of Future-1
1002	400kV BRBCL	400 kV Main Bay of Bus Reactor-1 (50 MVAr)
1003		400 kV Main Bay of Sasaram-1
1004		400 kV Main Bay of Sasaram-2
1005		400 kV Main Bay of Future-1 for NPGC
1006		400 kV Main Bay of Future-2 for NPGC
1007		400 kV Main Bay of Future-3 for ICT
1008		400 kV Main Bay of Unit-1
1009		400 kV Main Bay of Unit-2
1010		400 kV Main Bay of Unit-3
1011		400 kV Main Bay of Unit-4
1012		400 kV Main Bay of ICT-1 (400/132 kV 200 MVA)
1013		400 kV Main Bay of ICT-2 (400/132 kV 200 MVA)

Sl No	Name of Substation	Name of Bay
1014		400 kV Tie Bay of Bus Reactor-1 and Sasaram-1
1015		400 kV Tie Bay of Future-1 and Sasarm-2
1016		400 kV Tie Bay of Future-2 and Future-3
1017		400 kV Tie Bay of Unit-4 and Unit-3
1018		400 kV Tie Bay of Unit-2 and ICT-2
1019		400 kV Tie Bay of Unit-1 and ICT-1
1020	400kV Dikchu	400 kV Main Bay of Teesta III
1021		400 kV Main Bay of Rangpo
1022		400 kV Main Bay of ICT-1 (Bus -1) (400/132 kV 200 MVA)
1023		400 kV Main Bay of ICT-1 (Bus -2) (400/132 kV 200 MVA)
1024		400 kV Tie Bay of Teesta III and Rangpo
1025	400 kV Haldia	400 kV Main Bay of Subhasgram-1
1026		400 kV Main Bay of Subhasgram-2
1027		400 kV Main Bay of Station Transformer-1
1028		400 kV Main Bay of Station Transformer-2
1029		400 kV Main Bay of Unit-1
1030		400 kV Main Bay of Unit-2
1031		400 kV Bus 1 and Bus 2 Coupler
1032		400 kV Transfer Bus Coupler
1033	400 kV IB TPS Stage-2	400 kV Main Bay of Lapanga-1
1034		400 kV Main Bay of Lapanga-2
1035		400 kV Main Bay of Jharsuguda-1
1036		400 kV Main Bay of Jharsuguda-2
1037		400 kV Main Bay of Unit-3 (Bus 1A) (400/21 KV)
1038		400 kV Main Bay of Unit-4 (400/21 KV)

Sl No	Name of Substation	Name of Bay
1039		400 kV Main Bay of Auxillary Transformer-1(RAT)(50 MVA)
1040		400 kV Bus 1A and Bus 1B Coupler
1041		400 kV Bus 2A and Bus 2B Coupler
1042		400 kV Tie Bay of Lapanga-1 and Lapanga-2
1043		400 kV Main Bay of Unit-3 (Bus 1B) (400/21 KV)
1044		400 kV Tie Bay of Jharsuguda-1 and Jharsuguda-2
1045		400 kV Tie Bay of Unit-4 and RAT
1046	400/220 kV Indravati (400 kV Side)	400 kV Main Bay of ICT-1
1047		400 kV Tie Bay of ICT-1 and ICT-2
1048		400 kV Main Bay of ICT-2
1049		400 kV Main Bay of Indravati(PG)
1050		400 kV Tie Bay of Indravati(PG)
1051	400/220 kV Jeerat (400 kV Side)	400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1052		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1053		400 kV Main Bay of ICT-3 (400/220 kV 315 MVA)
1054		400 kV Main Bay of ICT-4 (400/220 kV 315 MVA)
1055		400 kV Main Bay of Rajarhat
1056		400 kV Main Bay of New Chanditala
1057		400 kV Main Bay of Bakreswar with Line Reactor(50 MVAr)
1058		400 kV Main Bay of Sagardighi TPP-1
1059		400 kV Main Bay of New Jeerat-1
1060		400 kV Main Bay of New Jeerat-2
1061		400 kV Bus-1 and Bus-2 Coupler
1062		400 kV Transfer Bus Coupler
1063		400 kV Main Bay of Bus Reactor-1 (50 MVAr) and Bus Reactor -2 (50 MVAr)

Sl No	Name of Substation	Name of Bay
1064		400 kV Main Bay of Subhasgram
1065		400 kv Main Bay of Sagardighi TPP-II
1066	400/220 kV JSPL	400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1067		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1068		400 kV Main Bay of ICT-3 (400/220 kV 315 MVA)
1069		400 kV Main Bay of ICT-4 (400/220 kV 315 MVA)
1070		400 kV Main Bay of Power Transformer -1
1071		400 kV Main Bay of Power Transformer -2
1072		400 kV Main Bay of Meramandali-1
1073		400 kV Main Bay of Meramandali-2
1074		400 kV Tie Bay of Meramandal-1 and Meramandali-2
1075		400 kV Tie Bay of ICT-1 and ICT-2
1076		400 kV Tie Bay of ICT-3 and ICT-4
1077		400 kV Tie Bay of Power Transformer -1 and Power Transformer -2
1078	400/220 kV Kharagpur (400 kV Side)	400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1079		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1080		400 kV Main Bay of ICT-3 (400/220 kV 315 MVA)
1081		400 kV Main Bay of Chaibasa-1
1082		400 kV Main Bay of Chaibasa-2
1083		400 kV Main Bay of Kolaghat TPP-1
1084		400 kV Main Bay of Kolaghat TPP-2
1085		400 kV Main Bay of Mednipur-1
1086		400 kV Main Bay of Mednipur-2
1087		400 kV Main Bay of Baripada
1088		400 kV Bus-1 and Bus-2 Coupler

Sl No	Name of Substation	Name of Bay
1089		400 kV Transfer Bus Coupler
1090		400 kV Main Bay of Bus Reactor-1 (80 MVAr)
1091	400/220 kV Kishanganj (400 kV Side)	400 kV Main Bay of Futuer-1
1092		400 kV Main Bay of Futuer-2
1093		400 kV Main Bay of Darbhanga-1 with Line Reactor (80 MVAr)
1094		400 kV Main Bay of Darbhanga-2 with Line Reactor (80 MVAr)
1095		400 kV Main Bay of Binaguri-1
1096		400 kV Main Bay of Binaguri-2
1097		400 kV Main Bay of Purnea-1
1098		400 kV Main Bay of Purnea-2
1099		400 kV Main Bay of Patna-1 with Line Reactor (80 MVAr)
1100		400 kV Main Bay of Patna-2 with Line Reactor (80 MVAr)
1101		400 kV Main Bay of Teesta III with Line Reactor (63 MVAr)
1102		400 kV Main Bay of Rangpo with Line Reactor (63 MVAr)
1103		400 kV Main Bay of STATCOM-1 (400/28 kV, 2 x 100 MVAR VSC, 2 x 125 MVAr MSR)
1104		400 kV Main Bay of Bus Reactor-1 (125 MVAr)
1105		400 kV Main Bay of Bus Reactor-2 (125 MVAr)
1106		400 kV Main Bay of ICT-1 (400/220 kV 500 MVA)
1107		400 kV Main Bay of ICT-2 (400/220 kV 500 MVA)
1108		400 kV Main Bay of Future-3 for ICT
1109		400 kV Tie Bay of Bus Reactor-1 and ICT-1
1110		400 kV Tie Bay of Rangpo and ICT-2
1111		400 kV Tie Bay of Patna-1 and Future-3
1112		400 kV Tie Bay of STATCOM and Teesta III with Line Reactor
1113		400 kV Tie Bay of Bus Reactor-2 and Patna-2

Sl No	Name of Substation	Name of Bay
1114		400 kV Tie Bay of Purnea-2 and Purnea-1
1115		400 kV Tie Bay of Binaguri-1 and Binaguri-2
1116		400 kV Tie Bay of Future-1 and Darbhanga-1 with Line Reactor
1117		400 kV Tie Bay of Future-2 and Darbhanga-2 with Line Reactor
1118	400/220 kV Kolaghat(400 kV side)	400 kV Main Bay of Unit-4
1119		400 kV Main Bay of Unit-5
1120		400 kV Main Bay of Unit-6
1121		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1122		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1123		400 kV Main Bay of Kharagpur-1
1124		400 kV Main Bay of Kharagpur-2
1125		400 kV Main Bay of New Chanditala
1126		400 kV Main Bay of Arambag
1127		400 kV Bus-1 and Bus-2 Coupler
1128		400 kV Transfer Bus Coupler
1129	400/132 kV Lakhisarai (400 kV Side)	400 kV Main Bay of Kahalgaon STPP-1
1130		400 kV Main Bay of Kahalgaon STPP-2
1131		400 kV Main Bay of Bihar Shariff-1
1132		400 kV Main Bay of Bihar Shariff-2
1133		400 kV Main Bay of ICT-1 (400/132 kV 200 MVA)
1134		400 kV Main Bay of ICT-2 (400/132 kV 200 MVA)
1135		400 kV Main Bay of ICT-3 (400/132 kV 315 MVA)
1136		400 kV Main Bay of Bus Reactor-1 (80 MVAr)
1137		400 kV Main Bay of Bus Reactor-2 (125 MVAr)
1138		400 kV Tie Bay of ICT-3 and Kahalgaon STPP-2

Sl No	Name of Substation	Name of Bay
1139		400 kV Tie Bay of Bus Reactor-1 and Kahalgaon STPP-1
1140		400 kV Tie Bay of Bihar Shariff-1 and ICT-1
1141		400 kV Tie Bay of Bihar Shariff-2 and ICT-2
1142		400 kV Tie Bay of Bus Reactor-2 and Future-6
1143		400 kV Main Bay of Future-1
1144		400 kV Main Bay of Future-2
1145		400 kV Main Bay of Future-3
1146		400 kV Main Bay of Future-4
1147		400 kV Main Bay of Future-5
1148		400 kV Main Bay of Future-6
1149		400 kV Main Bay of Future-7
1150		400 kV Main Bay of Future-8
1151		400 kV Main Bay of Future-9
1152		400 kV Main Bay of Future-10
1153		400 kV Main Bay of Future-11
1154		400 kV Main Bay of Future-9
1155		400 kV Tie Bay of Future-1 And Future-7
1156		400 kV Tie Bay of Future-2 And Future-8
1157		400 kV Tie Bay of Future-3 And Future-9
1158		400 kV Tie Bay of Future-4 And Future-10
1159		400 kV Tie Bay of Future-5 And Future-11
1160		400 kV Tie Bay of Future-1 And Future-7
1161	400 kV Mejia B TPS	400 kV Main Bay of Maithon-1
1162		400 kV Main Bay of Maithon-2
1163		400 kV Main Bay of Maithon-3

Sl No	Name of Substation	Name of Bay
1164		400 kV Main Bay of Jamsedpur
1165		400 kV Main Bay of Unit-7
1166		400 kV Main Bay of Unit-8
1167		400 kV Main Bay of Station Transformer-1 (400/11 kV 90 MVA)
1168		400 kV Main Bay of Station Transformer-2 (400/11 kV 90 MVA)
1169		400 kV Bus-1 and Bus-2 Coupler
1170		400 kV Transfer Bus Coupler
1171	400/220 kV Mendasal (400 kV side)	400 kV Main Bay of Meramandali-1
1172		400 kV Main Bay of Meramandali-2
1173		400 kV Main Bay of Pandiabili-1
1174		400 kV Main Bay of Pandiabili-2
1175		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1176		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1177		400 kV Main Bay of ICT-3 (400/220 kV 315 MVA)
1178		400 kV Main Bay of Future-8
1179		400 kV Tie Bay of Meramandali-1 and ICT-1
1180		400 kV Tie Bay of Meramandali-2 and ICT-2
1181		400 kV Tie Bay of Pandaiabili-1 and Pandiabili-2
1182		400 kV Tie Bay of Future-7 and ICT-3
1183		400 kV Main Bay of Future-1
1184		400 kV Main Bay of Future-2
1185		400 kV Main Bay of Future-3
1186		400 kV Main Bay of Future-4
1187		400 kV Main Bay of Future-5
1188		400 kV Main Bay of Future-6

Sl No	Name of Substation	Name of Bay
1189		400 kV Tie Bay of Future-1 And Future-2
1190		400 kV Tie Bay of Future-3 And Future-4
1191		400 kV Tie Bay of Future-5 And Future-6
1192	400/220 kV Meramandali (400 kV Side)	400 kV Main Bay of Mendhasal-1
1193		400 kV Main Bay of Mendhasal-2
1194		400 kV Main Bay of Talcher STPP-1
1195		400 kV Main Bay of Talcher STPP-2
1196		400 kV Main Bay of New Duburi-1 (Bus-1)
1197		400 kV Main Bay of New Duburi-2
1198		400 kV Main Bay of JSPL-1
1199		400 kV Main Bay of JSPL-2
1200		400 kV Main Bay of Lapanga-1 with Line Reactor (50 MVAr)
1201		400 kV Main Bay of Lapanga-2 with Line Reactor (50 MVAr)
1202		400 kV Main Bay of Bolangir with Line Reactor (80 MVAr) LILO at Angul
1203		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1204		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1205		400 kV Main Bay of GMR
1206		400 kV Tie Bay of New Duburi-1 and Mendasal-2
1207		400 kV Tie Bay of New Duburi-2 and Mendasal-1
1208		400 kV Tie Bay of ICT-1 & Future-1
1209		400 kV Tie Bay of ICT-2 & Future-2
1210		400 kV Tie Bay of Talcher STPP-1 and JSPL-1
1211		400 kV Tie Bay of GMR and JSPL-2
1212		400 kV Tie Bay of Talcher STPP-2 and Lapanga-1
1213		400 kV Tie Bay of Bolangir and Lapanga-2

Sl No	Name of Substation	Name of Bay
1214	400/132 kV Motihari (400 kV Side)	400 kV Main Bay of Barh-1 with Line Reactor (80 MVAr)
1215		400 kV Main Bay of Barh-2 with Line Reactor (80 MVAr)
1216		400 kV Main Bay of Gorakhpur-1 with Line Reactor (50 MVAr)
1217		400 kV Main Bay of Gorakhpur-2 with Line Reactor (50 MVAr)
1218		400 kV Main Bay of ICT-1 (400/132 kV 200 MVA)
1219		400 kV Main Bay of ICT-2 (400/132 kV 200 MVA)
1220		400 kV Main Bay of ICT-3 (400/132 kV 315 MVA)
1221		400 kV Main Bay of Bus Reactor-1 (125 MVAr)
1222		400 kV Main Bay of Bus Reactor-2 (125 MVAr)
1223		400 kV Tie Bay of Barh-1 and Bus Reactor-2
1224		400 kV Tie Bay of Barh-2 and Bus Reactor-1
1225		400 kV Tie Bay of Gorakhpur-1 and ICT-1
1226		400 kV Tie Bay of Gorakhpur-2 and ICT-2
1227		400 kV Tie Bay of Sitamarhi-2 and Future-3
1228		400 kV Tie Bay of Sitamarhi-1 and Future-4
1229		400 kV Main Bay of Sitamarhi-I
1230		400 kV Main Bay of Sitamarhi-II
1231		400 kV Main Bay of Future-4
1232		400 kV Main Bay of Future-5 (for ICT)
1233		400 kV Main Bay of Future-3 (Bus-1)
1234		400 kV Main Bay of Future-3 (Bus-2)
1235	400/220 kV Muzaffarpur (400 kV Side)	400 kV Main Bay of Gorakhpur-1 with Line Reactor (63 MVAr)
1236		400 kV Main Bay of Gorakhpur-2 with Line Reactor (50 MVAr)
1237		400 kV Main Bay of Biharshariff-1
1238		400 kV Main Bay of Biharshariff-2

Sl No	Name of Substation	Name of Bay
1239		400 kV Main Bay of Dhalkebar-1
1240		400 kV Main Bay of Dhalkebar-2
1241		400 kV Main Bay of New Purnea-1 with Line Reactor (63 MVAr)
1242		400 kV Main Bay of New Purnea-2 with Line Reactor (63 MVAr)
1243		400 kV Main Bay of Darbhanga-1
1244		400 kV Main Bay of Darbhanga-2
1245		400 kV Main Bay of Bus Reactor-1 (125 MVAr)
1246		400 kV Main Bay of Bus Reactor-2 (125 MVAr)
1247		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1248		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1249		400 kV Main Bay of ICT-3 (400/220 kV 500 MVA)
1250		400 kV Tie Bay of Bus Reactor-1 and ICT-1
1251		400 kV Tie Bay of Dhalkebar-2 and ICT-2
1252		400 kV Tie Bay of Dhalkebar-1 and ICT-3
1253		400 kV Tie Bay of Gorakhpur-1 and New Purnea-1
1254		400 kV Tie Bay of Gorakhpur-2 and New Purnea-2
1255		400 kV Tie Bay of Biharshariff-1 and Future-2
1256		400 kV Tie Bay of Biharshariff-2 and Future-1
1257		400 kV Tie Bay of Darbhanga-2 and Bus Reactor-2
1258		400 kV Tie Bay of Darbhanga-1 and Future-3
1259		400 kV Main Bay of Future-1 for Gorakhpur
1260		400 kV Main Bay of Future-2 for Gorakhpur
1261		400 kV Main Bay of Future-3
1262		400 kV Main Bay of Future-4
1263		400 kV Main Bay of Future-5

Sl No	Name of Substation	Name of Bay
1264		400 kV Tie Bay of Future-4 and Future-5
1265	400 kV Nabinagar STPS (NPGC)	400 kV Main Bay of Transformer-I (400/132 kV, 200 MVA)
1266		400 kV Main Bay of Transformer-2 (400/132 kV, 200 MVA)
1267		400 kV Main Bay of Unit-1 (660 MW)
1268		400 kV Main Bay of Unit-2
1269		400 kV Main Bay of Unit-3
1270		400 kV Main Bay of Chandauti-1
1271		400 kV Main Bay of Chandauti-2
1272		400 kV Main Bay of Patna-1
1273		400 kV Main Bay of Patna-2 (Bus-1)
1274		400 kV Main Bay of BRBCL-1 (Bus-1)
1275		400 kV Main Bay of BRBCL-2 (Bus-1)
1276		400 kV Tie Bay of Unit-1 and Chandauti-2
1277		400 kV Tie Bay of Unit-2 and Bus Reactor-1
1278		400 kV Tie Bay of Unit-3 and Transformer-1
1279		400 kV Tie Bay of Transformer-2 and Future-3
1280		400 kV Main Bay of Future-4 for ICT
1281		400 kV Main Bay of Patna-2 (Bus-2)
1282		400 kV Main Bay of BRBCL-1 (Bus-2)
1283		400 kV Main Bay of BRBCL-2 (Bus-2)
1284		400 kV Main Bay of Future-1
1285		400 kV Main Bay of Future-2
1286		400 kV Tie Bay of Future-1 and Future-2
1287		400 kV Tie Bay of Patna-1 and Chandauti-2
1288		400 kV Tie Bay of Future-3

Sl No	Name of Substation	Name of Bay
1289	400/220 kV New Chanditala(400 kV Side)	400 kV Main Bay of Mednipore-1
1290		400 kV Main Bay of Mednipore-2
1291		400 kV Main Bay of Kolaghat TPS
1292		400 kV Main Bay of Arambag
1293		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1294		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1295		400 kV Main Bay of ICT-3 (400/220 kV 315 MVA)
1296		400 kV Main Bay of Gokarno-1
1297		400 kV Main Bay of Gokarno-2
1298		400 kV Main Bay of Bidhannagar
1299		400 kV Main Bay of Jeerat
1300		400 kV Main Bay of Bus Reactor (80 MVAr)
1301		400 kV Bus-1 and Bus-2 Coupler
1302		400 kV Transfer Bus Coupler
1303		400 kV Main Bay of Future-1
1304		400 kV Main Bay of Future-2
1305		400 kV Main Bay of Future-3
1306		400 kV Main Bay of Future-4
1307	400/220 kV New Duburi (400 kV Side)	400 kV Main Bay of Meramandali-1
1308		400 kV Main Bay of Meramandali-2
1309		400 kV Main Bay of Pandiabili
1310		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1311		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1312		400 kV Main Bay of Tata Power-1 (Kalinganagar)
1313		400 kV Main Bay of Tata Power-2 (Kalinganagar)

Sl No	Name of Substation	Name of Bay
1314		400 kV Main Bay of Baripada (Kuchie)
1315		400 kV Main Bay of Bus Reactor-1 (80 MVAr)
1316		400 kV Tie Bay of Pandiabili and Future-1
1317		400 kV Tie Bay of Bus Reactor-1 and Baripada
1318		400 kV Tie Bay of Meramandali-1 and ICT-1
1319		400 kV Tie Bay of Meramandali-2 and ICT-2
1320		400 kV Tie Bay of Tata Power-1 and Tata Power-2
1321		400 kV Main Bay of Future-1
1322	400/220 kV New Purnea(400 kV Side)	400 kV Main Bay of Binaguri-1 with Line Reactor (63 MVAr)
1323		400 kV Main Bay of Binaguri-2
1324		400 kV Main Bay of Muzaffarpur-1 with Line Reactor (63 MVAr)
1325		400 kV Main Bay of Muzaffarpur-2 with Line Reactor (63 MVAr)
1326		400 kV Main Bay of Biharshariff-1
1327		400 kV Main Bay of Biharshariff-2
1328		400 kV Main Bay of Malda-1
1329		400 kV Main Bay of Malda-2
1330		400 kV Main Bay of Bus Reactor-1 (125 MVAr)
1331		400 kV Main Bay of Bus Reactor-2 (125 MVAr)
1332		400 kV Main Bay of ICT-1 (400/220 kV 500 MVA)
1333		400 kV Main Bay of ICT-2 (400/220 kV 500 MVA)
1334		400 kV Main Bay of Kishanganj-1 with Line Reactor (63 MVAr)
1335		400 kV Main Bay of Kishanganj-2
1336		400 kV Main Bay of Farakka with Line Reactor (80 MVAr)
1337		400 kV Main Bay of Gokarno with Line Reactor (80 MVAr)
1338		400 kV Tie Bay of Binaguri-1 and ICT-2

Sl No	Name of Substation	Name of Bay
1339		400 kV Tie Bay of Binaguri-2 and ICT-1
1340		400 kV Tie Bay of Kishanganj-1 and Muzaffarpur-2
1341		400 kV Tie Bay of Kishanganj-2 and Muzaffarpur-1
1342		400 kV Tie Bay of Malda-1 and Bus Reactor-2
1343		400 kV Tie Bay of Malda-2 and Bus Reactor-1
1344		400 kV Tie Bay of Farakka and Biharshariff-2
1345		400 kV Tie Bay of Gokarno and Biharshariff-1
1346	400/220 kV Patna (400 kV Side)	400 kV Main Bay of Balia-1
1347		400 kV Main Bay of Balia-2
1348		400 kV Main Bay of Balia-3
1349		400 kV Main Bay of Balia-4
1350		400 kV Main Bay of Barh-1 with Line Reactor (80 MVAr)
1351		400 kV Main Bay of Barh-2 with Line Reactor (80 MVAr)
1352		400 kV Main Bay of Barh-3
1353		400 kV Main Bay of Barh-4
1354		400 kV Main Bay of Kishanganj-1 with Line Reactor (63 MVAr)
1355		400 kV Main Bay of Kishanganj-2 with Line Reactor (63 MVAr)
1356		400 kV Main Bay of NPGC-1 with Line Reactor (80 MVAr)
1357		400 kV Main Bay of NPGC-2 with Line Reactor (80 MVAr)
1358		400 kV Main Bay of ICT-1 (400/220 kV 500 MVA)
1359		400 kV Main Bay of ICT-2 (400/220 kV 500 MVA)
1360		400 kV Main Bay of ICT-3 (400/220 kV 500 MVA)
1361		400 kV Tie Bay of Barh-2 and Balia-1
1362		400 kV Tie Bay of Barh-1 and Balia-2
1363		400 kV Tie Bay of Barh-3 and Balia-3

Sl No	Name of Substation	Name of Bay
1364		400 kV Tie Bay of Barh-4 and Balia-4
1365		400 kV Tie Bay of NPGC-1 and ICT-1
1366		400 kV Tie Bay of NPGC-2 and ICT-2
1367		400 kV Tie Bay of Kishanganj-2 and Bus Reactor-2
1368		400 kV Tie Bay of Kishanganj-1 and ICT-3
1369	400 kV PPSP	400 kV Main Bay of Unit-1
1370		400 kV Main Bay of Unit-2
1371		400 kV Main Bay of Unit-3
1372		400 kV Main Bay of Unit-4
1373		400 kV Main Bay of Bidhannagar-1 (Durgapur WB)
1374		400 kV Main Bay of Bidhannagar-2 (Durgapur WB)
1375		400 kV Main Bay of New PPSP-1
1376		400 kV Main Bay of New PPSP-2
1377		400 kV Bus-1 and Bus-2 Coupler
1378	400 kV Raghunathpur	400 kV Main Bay of Ranchi-1
1379		400 kV Main Bay of Ranchi-2 with Line Reactor (50 MVAr)
1380		400 kV Main Bay of Ranchi-3 with Line Reactor (50 MVAr)
1381		400 kV Main Bay of DSTPS-1
1382		400 kV Main Bay of DSTPS-2
1383		400 kV Main Bay of Maithon
1384		400 kV Main Bay of Unit-1
1385		400 kV Main Bay of Unit-2
1386		400 kV Main Bay of Station Transformer-1 (400/11 kV 90 MVA)
1387		400 kV Main Bay of Station Transformer-2 (400/11 kV 90 MVA)
1388		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)

Sl No	Name of Substation	Name of Bay
1389		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1390		400 kV Main Bay of Bus Reactor-1 (50 MVAr)
1391		400 kV Main Bay of Bus Reactor-2 (50 MVAr)
1392		400 kV Tie Bay of Maithon and Ranchi-1
1393		400 kV Tie Bay of Ranchi-2 and Ranchi-3
1394		400 kV Tie Bay of DSTPS-1 and DSTPS-2
1395		400 kV Tie Bay of ICT-1 and ICT-2
1396		400 kV Tie Bay of Unit-1 and Bus Reactor -2
1397		400 kV Tie Bay of Station Transformer-1 and Station Transformer-2
1398		400 kV Main Bay of Future-1
1399		400 kV Main Bay of Future-2
1400		400 kV Main Bay of Future-3
1401		400 kV Main Bay of Future-4
1402		400 kV Tie Bay of Future-1 And Future-2
1403		400 kV Tie Bay of Future-3 And Future-4
1406	400/220 kV Rangpo (400 kV Side)	400 kV Main Bay of Binaguri-1
1407		400 kV Main Bay of Binaguri-2
1408		400 kV Main Bay of Teesta V -1
1409		400 kV Main Bay of Teesta V -2
1410		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1411		400 kV Main Bay of ICT-2 (400/220 kV 315 MVA)
1412		400 kV Main Bay of ICT-3 (400/220 kV 315 MVA)
1413		400 kV Main Bay of ICT-4 (400/220 kV 315 MVA)
1414		400 kV Main Bay of ICT-5 (400/220 kV 315 MVA)
1415		400 kV Main Bay of Dikchu

Sl No	Name of Substation	Name of Bay
1416		400 kV Main Bay of Kishanganj -1
1417		400 kV Main Bay of Bus Reactor -1 (80 MVAr)
1418		400 kV Main Bay of Bus Reactor -2 (80 MVAr)
1419		400 kV Bus-1 and Bus-2 Coupler
1420		400 kV Main Bay of Future for Teesta-III -1
1421		400 kV Main Bay of Future for Kishanganj -1
1422	400/220 kV Sagardighi TPS (400 kV Side)	400 kV Main Bay of Unit-1 (300 MW)
1423		400 kV Main Bay of Unit-2 (300 MW)
1424		400 kV Main Bay of Unit-3 (500 MW)
1425		400 kV Main Bay of Unit-4 (500 MW)
1426		400 kV Main Bay of Gokarno-1
1427		400 kV Main Bay of Gokarno-2
1428		400 kV Main Bay of Behrampur-1
1429		400 kV Main Bay of Behrampur-2
1430		400 kV Main Bay of Durgapur-1
1431		400 kV Main Bay of Durgapur-2
1432		400 kV Main Bay of Jeerat
1433		400 kV Main Bay of Subhasgram
1434		400 kV Main Bay of ICT-1 (400/220 kV 315 MVA)
1435		400 kV Main Bay of Future-3 for ICT-2
1436		400 kV Main Bay of Station Transformer-3 (400/11 kV 80 MVA)
1437		400 kV Main Bay of Station Transformer-4 (400/11 kV 80 MVA)
1438		400 kV Main Bay of Future-2
1439		400 kV Main Bay of Farakka-1
1440		400 kV Main Bay of Farakka-2

Sl No	Name of Substation	Name of Bay
1441		400 kV Tie Bay of Future-1 and Jeerat
1442		400 kV Tie Bay of Farakka-2 and Behrampur-1
1443		400 kV Tie Bay of Gokarno-1 and Behrampur-2
1444		400 kV Tie Bay of Gokarno-2 and Durgapur-1
1445		400 kV Tie Bay of Future-2 and Durgapur-2
1446		400 kV Tie Bay of Subhasgram and Farakka-1
1447		400 kV Tie Bay of ICT-1 and Future-3
1448		400 kV Tie Bay of Unit-1 and Unit-2
1449		400 kV Tie Bay of Unit-4 and Station Transformer-4
1450		400 kV Tie Bay of Unit-3 and Station Transformer-3
1451		400 kV Main Bay of Future-1
1452		400 kV Main Bay of Future-4 for Unit
1453		400 kV Main Bay of Future-5 for Station Transformer
1454		400 kV Main Bay of Future-6
1455		400 kV Main Bay of Future-7
1456		400 kV Main Bay of Future-8
1457		400 kV Main Bay of Future-9
1458		400 kV Tie Bay of Future-4 and Future-5
1459		400 kV Tie Bay of Future-6 and Future-7
1460		400 kV Tie Bay of Future-8 and Future-9
1461	400 kV Talcher HVDC Sustation AC Side	400 kV Main Bay of Pole I
1462		400 kV Tie Bay of Pole I & AC filter Bank II
1463		400 kV Main Bay of AC Filter Bank II
1464		400 kV Main Bay of Pole II (Converter Transformer-II)
1465		400 kV Tie Bay of Pole II & AC Fileter Bank III

Sl No	Name of Substation	Name of Bay
1466		400 kV Main Bay of AC Filter Bank III
1467		400 kV Main Bay of AC Filter Bank I (Bus I)
1468		400 kV Main Bay of AC Filter Bank I (Bus II)
1469		400 kV Bus-1 and Bus-3 Coupler
1470		400 kV Bus-2 and Bus-4 Coupler
1471		400 kV Main Bay of Talcher STPS-1
1472		400 kV Main Bay of Talcher STPS-2
1473		400 kV Main Bay of Talcher STPS-3
1474		400 kV Main Bay of Talcher STPS-4
1475	765/400/220 kV Sasaram (400 kV Side)	400 kV Main Bay of ICT-1 (765/400 kV 1500 MVA)
1476		400 kV Main Bay of Daltonganj-1
1477		400 kV Main Bay of Daltonganj-2
1478		400 kV Main Bay of Biharshariff-1 with Line Reactor (50 MVAr)
1479		400 kV Main Bay of Biharshariff-2 with Line Reactor (50 MVAr)
1480		400 kV Main Bay of BRBCL-1
1481		400 kV Main Bay of BRBCL-2
1482		400 kV Main Bay of Varanasi North Bus with Line Reactor (63 MVAr) (Bus-II)
1483		400 kV Main Bay of Allahabad North Bus with Line Reactor (63 MVAr) (Bus-II)
1484		400 kV AC bypass of North Bus-1 and East Bus-1
1485		
1486		400 kV Main Bay of HVDC Pole (Converter Transformer)
1487		400 kV Main Bay of Fiter Bank East Bus
1488		400 kV Main Bay of Fiter Bank North Bus
1489		400 kV Main Bay of Varanasi North Bus with Line Reactor (63 MVAr) (Bus-I)
1490		400 kV Main Bay of Allahabad North Bus with Line Reactor (63 MVAr) (Bus-I)

Sl No	Name of Substation	Name of Bay
1491		400 kV Main Bay of ICT-1 (400/220 kV 500 MVA)
1492		400 kV Main Bay of ICT-2 (400/220 kV 500 MVA)
1493		400 kV Main Bay of Bus Reactor-1 (125 MVAr)
1494		400 kV Main Bay of Bus Reactor-2 (125 MVAr)
1495		400 kV Main Bay of Future-1
1496		400 kV Main Bay of Future-2
1497		400 kV Tie Bay of Daltonganj-1 and ICT-1
1498		400 kV Tie Bay of Biharshariff-1 and ICT-2
1499		400 kV Tie Bay of Biharshariff-2 and Bus Reactor-1
1500		400 kV Tie Bay of Future-1 and Bus Reactor-2
1501		400 kV Tie Bay of Future-2 and BRBCL-1
1502		400 kV Tie Bay of Daltonganj-2 and BRBCL-2
1503	400/132 kV TISCO (400 kV Side)	400 kV Main Bay of Baripada
1504		400 kV Main Bay of ICT-1 (400/132 kV 500 MVA)
1505		400 kV Main Bay of ICT-2 (400/132 kV 500 MVA)
1506		400 kV Main Bay of Jamsedpur
1507		400 kV Tie Bay of Baripada and ICT-1
1508		400 kV Tie Bay of Jamsedpur and ICT-2
1509	400 kV Teesta-III	400 kV Main Bay of Unit-1
1510		400 kV Main Bay of Unit-2
1511		400 kV Main Bay of Unit-3
1512		400 kV Main Bay of Unit-4
1513		400 kV Main Bay of Unit-5
1514		400 kV Main Bay of Unit-6
1515		400 kV Bus 1 and Bus 2 Coupler

Sl No	Name of Substation	Name of Bay
1516		400 kV Main Bay of Dikchu (Line-2)
1517		400 kV Main Bay of Kishanganj (Line-1)
1518	400 kV Teesta-V	400 kV Main Bay of Unit-1
1519		400 kV Main Bay of Unit-2
1520		400 kV Main Bay of Unit-3
1521		400 kV Bus 1 and Bus 2 Coupler
1522		400 kV Main Bay of Rangpo-1 (Line-2)
1523		400 kV Main Bay of Rangpo-2 (Line-1)
1524	400/220 kV Sterlite (400 kV Side)	400 kV Main Bay of Jharsuguda-1
1525		400 kV Main Bay of Jharsuguda-2
1526		400 kV Main Bay of Lapanga-1
1527		400 kV Main Bay of Lapanga-2
1528		400 kV Main Bay of Unit-1
1529		400 kV Main Bay of Unit-2
1530		400 kV Main Bay of Unit-3
1531		400 kV Main Bay of Unit-4
1532		400 kV Main Bay of Smelter-1
1533		400 kV Main Bay of Smelter-2
1534		400 kV Main Bay of Smelter-3
1535		400 kV Main Bay of ICT-1 (400/132 kV 315 MVA)
1536		400 kV Main Bay of ICT-2 (400/132 kV 315 MVA)
1537		400 kV Main Bay of Station Transformer-1(400/11 kV)
1538		400 kV Main Bay of Station Transformer-2(400/11 kV)
1539		400 kV Tie Bay of Jharsuguda-1 and Jharsuguda-2
1540		400 kV Tie Bay of Lapanga-1 and Lapanga-2

Sl No	Name of Substation	Name of Bay
1541		400 kV Bus 1 and Bus 3 Coupler (Bus Sectionalizer)
1542		400 kV Bus 2 and Bus 4 Coupler (Bus Sectionalizer)
1543		400 kV Tie Bay of Unit-4 and Smelter-3
1544		400 kV Tie Bay of Unit-3 and Smelter-2
1545		400 kV Tie Bay of Station Transformer-1 and Station Transformer-2
1546		400 kV Main Bay of Line-1
1547		400 kV Main Bay of Line-2
1548		400 kV Main Bay of Line-4
1549		400 kV Main Bay of Line-5
1550		400 kV Main Bay of Line-6
1551		400 kV Tie Bay of Unit-3 and Line-5
1552		400 kV Tie Bay of Unit-4 and Line-6
1553	400/220 kV Talcher St-1 (400 kV Side)	400 kV Main Bay of Rourkela-1
1554		400 kV Main Bay of Rourkela-2
1555		400 kV Main Bay of Rengali-1
1556		400 kV Main Bay of Rengali-2
1557		400 kV Main Bay of Meramandali-1
1558		400 kV Main Bay of Meramandali-2 (Bus-1)
1559		400 kV Main Bay of ICT-1 (400/132 kV 315 MVA)
1560		400 kV Main Bay of ICT-2 (400/132 kV 315 MVA)
1561		400 kV Main Bay of Unit-1 (Bus-I)
1562		400 kV Main Bay of Unit-2(Bus-I)
1563		400 kV Main Bay of Unit-2(Bus-II)
1564		400 kV Bus-1 and Bus-3 Coupler (Bus Sectionalizer) (Between St-I and St-II)
1565		400 kV Bus-2 and Bus-4 Coupler (Bus Sectionalizer) (Between St-I and St-II)

Sl No	Name of Substation	Name of Bay
1566		400 kV Tie Bay of ICT-2 and Rourkela-1
1567		400 kV Tie Bay of ICT-1 and Future-1
1568		400 kV Tie Bay of Rourkela-2 and Rengali-1
1569		400 kV Main Bay of Unit-1 (Bus-II)
1570		400 kV Tie Bay of Rengali-2 and Meramandali-1
1571		400 kV Main Bay of Meramandali-2 (Bus-II)
1572	400/220 kV Talcher St-2	400 kV Bus-1 and Bus-3 Coupler (Bus Sectionalizer) (Between St-I and St-II)
1573		400 kV Bus-2 and Bus-4 Coupler (Bus Sectionalizer) (Between St-I and St-II)
1574		400 kV Main Bay of Unit-3
1575		400 kV Main Bay of Unit-4 (Bus-III)
1576		400 kV Main Bay of Unit-4 (Bus-IV)
1577		400 kV Main Bay of Unit-5 (Bus-V)
1578		400 kV Main Bay of Unit-5 (Bus-VI)
1579		400 kV Main Bay of Unit-6
1580		400 kV Main Bay of Talcher HVDC-1
1581		400 kV Main Bay of Talcher HVDC-2
1582		400 kV Main Bay of Talcher HVDC-3
1583		400 kV Main Bay of Talcher HVDC-4
1584		400 kV Bus 3 and Bus 5 Coupler (Bus Sectionalizer)
1585		400 kV Bus 4 and Bus 6 Coupler (Bus Sectionalizer)
1586		400 kV Main Bay of Station Transformer-2 (400/11.5 kV)
1587		400 kV Main Bay of Station Transformer-3 (400/11.5 kV)
1588		400 kV Tie Bay of Unit-4 and Station Transformer-2
1589		400 kV Tie Bay of Unit-6 and Station Transformer-3
1590	400/220 kV Sitamarhi	400 kV Main Bay of Motihari-1

Sl No	Name of Substation	Name of Bay
1591	400 kV Side	400 kV Main Bay of Motihari-2
1592		400 kV Main Bay of Darbhanga-1
1593		400 kV Main Bay of Darbhanga-2
1594		400 kV Main Bay of ICT-1 (400/220 kV 500 MVA)
1595		400 kV Main Bay of ICT-2 (400/220 kV 500 MVA)
1596		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
1597		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
1598		400 kV Tie Bay of Darbhanga-1 and Bus Reactor-1
1599		400 kV Tie Bay of Darbhanga-2 and ICT-2
1600		400 kV Tie Bay of Motihari-1 and Bus Reactor-2
1601		400 kV Tie Bay of Motihari-2 and Bus Reactor-1
1602	765/400 kV Mednipur (400 kV Side)	400 kV Main Bay of New Chanditala-1
1603		400 kV Main Bay of New Chanditala-2
1604		400 kV Main Bay of Kharagpur-1
1605		400 kV Main Bay of Kharagpur-2
1606		400 kV Main Bay of ICT-1 (765/400 kV 1500 MVA)
1607		400 kV Main Bay of ICT-2 (765/400 kV 1500 MVA)
1608		400 kV Main Bay of Bus Reactor -1 (125 MVAr)
1609		400 kV Main Bay of Bus Reactor -2 (125 MVAr)
1610		400 kV Tie Bay of Kharagpur-1 and Bus Reactor-2
1611		400 kV Tie Bay of New Chanditala-2 and Bus Reactor-1
1612		400 kV Tie Bay of New Chanditala-1 and ICT-2
1613		400 kV Tie Bay of Kharagpur-2 and ICT-1

11.3 220 kV bays

Sl No	Name of Substation	Name of Bay
1	400/220 kV Kishanganj (220 kV Side)	220 kV Main Bay of Kishangnaj Bihar - 1
2		220 kV Main Bay of Kishangnaj Bihar - 2
3		220 kV Main Bay of Kishangnaj Bihar - 3
4		220 kV Main Bay of Kishangnaj Bihar - 4
5		220 kV Main Bay of NJP - 1
6		220 kV Main Bay of NJP - 2
7		220 kV Main Bay of Dalkola - 1
8		220 kV Main Bay of Dalkola - 2
9		220 kV Main Bay of Kishanganj 400/220 kV ICT - 1
10		220 kV Main Bay of Kishanganj 400/220 kV ICT - 2
11		220 kV Transfer Bus Coupler Bay
12		220 kV Bus Coupler Bay
13	400/220 kV Patna (220 kV Side)	220 kV Main Bay of Khagual - 1
14		220 kV Main Bay of Khagual - 2
15		220 kV Main Bay of Khagual - 3
16		220 kV Main Bay of Sipara - 1
17		220 kV Main Bay of Sipara - 2
18		220 kV Main Bay of Sipara - 3
19		220 kV Main Bay of Patna - 1
20		220 kV Main Bay of Patna 400/220 kV ICT - 1
21		220 kV Main Bay of Patna 400/220 kV ICT - 2
22		220 kV Main Bay of Patna 400/220 kV ICT - 3
23		220 kV Bus Coupler Bay
24		220 kV Transfer Bus Coupler Bay
25	220/132 kV Purnea (220 kV Side)	220 kV Main Bay of Dalkola - 1
26		220 kV Main Bay of Dalkola - 2
27		220 kV Main Bay of Purnea - 1
28		220 kV Main Bay of Purnea - 2
29		220 kV Main Bay of Purnea 220/132 kV ATR - 1
30		220 kV Bus Coupler Bay
31		220 kV Transfer Bus Coupler Bay
32		220 kV Main Bay of Purnea 220/132 kV ATR - 2
33		220 kV Main Bay of Purnea 220/132 kV ATR - 3
34	400/220 kV Ranchi (220 kV Side)	220 kV Main Bay of Ranchi - 1
35		220 kV Main Bay of Ranchi - 1
36		220 kV Main Bay of Ranchi - 2
37		220 kV Main Bay of Ranchi - 3
38		220 kV Main Bay of Ranchi 400/220 kV ICT - 1
39		220 kV Bus Coupler Bay
40		220 kV Transfer Bus Coupler Bay
41		220 kV Main Bay of Ranchi 400/220 kV ICT - 2
42	400/220 kV Alipudwar	220 kV Main Bay of Salakatia - 1
43		220 kV Main Bay of Salakatia - 2

Sl No	Name of Substation	Name of Bay
44		220 kV Main Bay of Alipurdwar WB - 1
45		221 kV Main Bay of Alipurdwar WB - 1
46		220 kV Main Bay of Alipurdwar - 1
47		220 kV Main Bay of Alipurdwar - 2
48		220 kV Main Bay of Alipudwar 400/220 kV ICT - 1
49		220 kV Transfer Bus Coupler Bay
50		220 kV Bus Coupler Bay
51		220 kV Main Bay of Alipudwar 400/220 kV ICT - 2
52	220/132 Alipudwar WB (220 kV Side)	220 kV Main Bay of Alipurdwar - 1
53		220 kV Bus Coupler Bay
54		220 kV Main Bay of Alipurdwar - 2
55	220/132 kV Arah (220 kV Side)	220 kV Main Bay of Khagual - 1
56		220 kV Main Bay of Khagual - 2
57		220 kV Main Bay of Pusauli - 1
58		220 kV Main Bay of Pusauli - 2
59		220 kV Main Bay of Arah 220/132 kV ATR - 1
60		220 kV Main Bay of Arah 220/132 kV ATR - 2
61		220 kV Bus Coupler Bay
62		220 kV Transfer Bus Coupler Bay
63		220 kV Main Bay of Arah 220/132 kV ATR - 3
64	220/132 kV Atri (220 kV Side)	220 kV Bus Coupler Bay
65		220 kV Transfer Bus Coupler Bay
66		220 kV Main Bay of Atri - 1
67		220 kV Main Bay of Atri - 2
68	220/132 kV Balasore(220kV Side)	220 kV Bus Coupler Bay
69		220 kV Transfer Bus Coupler Bay
70		220 kV Main Bay of Baripada - 1
71		220 kV Main Bay of Baripada - 2
72	400/220 kV Baripada (220 kV Side)	220 kV Bus Coupler Bay
73		220 kV Transfer Bus Coupler Bay
74		220 kV Main Bay of Balasore - 1
75		220 kV Main Bay of Balasore - 2
76		220 kV Main Bay of Baripada 220/132 kV ATR - 1
77		220 kV Main Bay of Baripada 220/132 kV ATR - 2
78		220 kV Main Bay of Baripada 400/220 kV ICT - 1
79		220 kV Main Bay of Baripada 400/220 kV ICT - 2
80		220 kV Main Bay of Baripada 400/220 kV ICT - 3
81	220/132 kV Begusarai	220 kV Bus Coupler Bay
82		220 kV Transfer Bus Coupler Bay
83		220 kV Main Bay of New Purnea - 1
84		220 kV Main Bay of New Purnea - 2
85	400/220 kV Binaguri (220 kV Side)	220 kV Bus Coupler Bay
86		220 kV Transfer Bus Coupler Bay
87		220 kV Main Bay of Birpara - 1
88		220 kV Main Bay of Birpara - 2

Sl No	Name of Substation	Name of Bay
89		220 kV Main Bay of Siliguri - 1
90		220 kV Main Bay of Siliguri - 2
91		220 kV Main Bay of NJP(WB) Bus - 1 extension
92		220 kV Main Bay of NJP(WB) Bus - 2 extension
93		220 kV Main Bay of Binaguri 400/220 kV ICT - 1
94		220 kV Main Bay of Binaguri 400/220 kV ICT - 2
95	220/132 kV Birpara (220 kV Side)	220 kV Bus Coupler Bay
96		220 kV Transfer Bus Coupler Bay
97		220 kV Main Bay of Binaguri - 1
98		220 kV Main Bay of Binaguri - 2
99		220 kV Main Bay of Alipurdwar - 1
100		220 kV Main Bay of Alipurdwar - 2
101		220 kV Main Bay of Chukhan - 1
102		220 kV Main Bay of Chukhan - 2
103		220 kV Main Bay of Malabase - 1
104		220 kV Main Bay of Birpara 220/132 kV ATR - 1
105		220 kV Main Bay of Birpara 220/132 kV ATR - 2
106	220/132 kV Bodhgaya (220 kV Side)	220 kV Bus Coupler Bay
107		220 kV Transfer Bus Coupler Bay
108		220 kV Main Bay of Gaya - 1
109		220 kV Main Bay of Gaya - 2
110	400/220 kV Bolangir (220 kV Side)	220 kV Bus Coupler Bay
111		220 kV Transfer Bus Coupler Bay
112		220 kV Main Bay of New Bolangir - 1
113		220 kV Main Bay of New Bolangir - 2
114		220 kV Main Bay of Bolangir - 1
115		220 kV Main Bay of Bolangir 400/220 kV ICT - 1
116		220 kV Main Bay of Bolangir 400/220 kV ICT - 2
117	400/220 kV Chaibasa (220 kV Side)	220 kV Bus Coupler Bay
118		220 kV Transfer Bus Coupler Bay
119		220 kV Main Bay of New Chaibasa Jharkahnd - 1
120		220 kV Main Bay of New Chaibasa Jharkahnd - 2
121		220 kV Bus Coupler Bay
122		220 kV Transfer Bus Coupler Bay
123		220 kV Main Bay of Chaibasa 400/220 kV ICT - 1
124		220 kV Main Bay of Chaibasa 400/220 kV ICT - 2
125	220/132 kV Chaibasa New (220 kV Side)	220 kV Main Bay of Chaibasa - 1
126		220 kV Bus Coupler Bay
127		220 kV Transfer Bus Coupler Bay
128		220 kV Main Bay of Chaibasa - 2
129	220/132 kV Chandil (220 kV Side)	220 kV Main Bay of Ranchi - 1
130	220 kV Chukha	220 kV Main Bay of Birpara - 1
131		220 kV Main Bay of Birpara - 2
132		220 kV Bus Coupler Bay

Sl No	Name of Substation	Name of Bay
133		220 kV Transfer Bus Coupler Bay
134	220/132 kV Dalkola WB (220 kV Side)	220 kV Main Bay of Dalkola - 1
135		220 kV Bus Coupler Bay
136		220 kV Transfer Bus Coupler Bay
137		220 kV Main Bay of Dalkola - 2
138	220 kV Dalkola	220 kV Main Bay of Dalkola WB - 1
139		220 kV Main Bay of Dalkola WB- 1
140		220 kV Main Bay of Kishanganj - 1
141		220 kV Main Bay of Kishanganj - 1
142		220 kV Main Bay of Purnea-1
143		220 kV Main Bay of Purnea-2
144		220 kV Transfer Bus Bay
145		220 kV Bus Coupler Bay
146		220 kV Main Bay of Gazol-1
147		220 kV Main Bay of Gazol-2
148		220 kV Bus Coupler Bay
149		220 kV Transfer Bus Coupler Bay
150	400/220 kV Daltonganj (220 kV Side)	220 kV Main Bay of New Garhwa - 1
151		220 kV Bus Coupler Bay
152		220 kV Transfer Bus Coupler Bay
153		220 kV Main Bay of New Garhwa - 2
154		220 kV Main Bay of Daltonganj 220/132 kV ATR - 1
155		220 kV Main Bay of Daltonganj 220/132 kV ATR - 2
156		220 kV Main Bay of Daltangnj 400/220 kV ICT - 1
157		220 kV Main Bay of Daltangnj 400/220 kV ICT - 2
158	220/132 kV Dehri (220 kV Side)	220 kV Main Bay of Sasaram - 1
159		220 kV Bus Coupler Bay
160		220 kV Transfer Bus Coupler Bay
161		220 kV Main Bay of Gaya - 1
162		220 kV Main Bay of Gaya - 2
163	220 kV Dhanbad	220 kV Main Bay of Maithon - 1
164		220 kV Bus Coupler Bay
165		220 kV Transfer Bus Coupler Bay
166		220 kV Main bay of Giridih - 1
167		220 kV Main bay of Giridih - 2
168		220 kV Main bay of Ctps A - 1
169		220 kV Main bay of Ctps B - 2
170		220 kV Main Bay of Maithon - 2
171	220/132 kV Dumka (220 kV Side)	220 kV Main Bay of Maithon - 1
172		220 kV Bus Coupler Bay
173		220 kV Main bay of Govindpur - 1
174		220 kV Main bay of Govindpur - 2
175		220 kV Transfer Bus Coupler Bay
176		220 kV Main Bay of Maithon - 2
177	220 kV EMSS	220 kV Bus Coupler Bay

Sl No	Name of Substation	Name of Bay
178		220 kV Transfer Bus Coupler Bay
179		220 kV Main Bay of Subhasgram - 1
180		220 kV Main Bay of Subhasgram - 2
181	400/220 kV Farakka (220 kV Side)	220 kV Bus Coupler Bay
182		220 kV Transfer Bus Coupler Bay
183		220 kV Main Bay of Farakka - 1
184		220 kV Main Bay of Farakka 400/220 kV ICT - 1
185	220/132 kV Fatuah (220 kV Side)	220 kV Bus Coupler Bay
186		220 kV Transfer Bus Coupler Bay
187		220 kV Main bay of Biharshariff - 1
188		220 kV Main bay of Biharshariff - 2
189		220 kV Main Bay of Patna - 1
190	765/400/220 kV Gaya (220 kV Side)	220 kV Main Bay of Sonenagar - 1
191		220 kV Main Bay of Sonenagar - 2
192		220 kV Main Bay of Khizirsarai - 1
193		220 kV Main Bay of Khizirsarai - 2
194		220 kV Main Bay of Dehri - 1
195		220 kV Main Bay of Dehri - 2
196		220 kV Main Bay of BodhGaya - 1
197		220 kV Main Bay of BodhGaya - 2
198		220 kV Bus Coupler Bay
199		220 kV Transfer Bus Coupler Bay
200		220 kV Main Bay of Gaya 400/220 kV ICT - 1
201		220 kV Main Bay of Gaya 400/220 kV ICT - 2
202		220 kV Main Bay of Gaya 400/220 kV ICT - 3
203	220/132 kV Gazol (220 kV Side)	220 kV Main Bay of Malda - 1
204		220 kV Bus Coupler Bay
205		220 kV Transfer Bus Coupler Bay
206		220 kV Main Bay of Malda - 2
207		220 kV Main Bay of Dalkola - 1
208		220 kV Main Bay of Dalkola - 2
209	220/132 kV Kizirsarai (220 kV Side)	220 kV Main Bay of Gaya - 1
210		220 kV Bus Coupler Bay
211		220 kV Main Bay of Gaya - 2
212	220/132 kV Hatia (220 kV Side)	220 kV Main Bay of Ranchi - 1
213		220 kV Bus Coupler Bay
214		220 kV Transfer Bus Coupler Bay
215		220 kV Main bay of Patratu TPS - 1
216		220 kV Main bay of Patratu TPS - 2
217		220 kV Main Bay of Ranchi - 2
218		220 kV Main Bay of Ranchi - 3
219	220/132 kV Hazipur (220 kV Side)	220 kV Main Bay of Muzaffarpur - 1
220		220 kV Bus Coupler Bay
221		220 kV Transfer Bus Coupler Bay
222		220 kV Main Bay of Muzaffarpur - 2

Sl No	Name of Substation	Name of Bay
223	400/220 kV Jeerat (220 kV Side)	220 kV Main Bay of Rajarhat - 1
224		220 kV Bus Coupler Bay
225		220 kV Transfer Bus Coupler Bay
226		220 kV Main Bay of Jeerat 400/220 kV ICT - 1
227		220 kV Main Bay of Jeerat 400/220 kV ICT - 2
228		220 kV Main Bay of Jeerat 400/220 kV ICT - 3
229		220 kV Main Bay of Jeerat 400/220 kV ICT - 4
230		220 kV Main bay of Dharampur - 1
231		220 kV Main bay of Dharampur - 2
232		220 kV Main bay of Barasat - 1
233		220 kV Main bay of Barasat - 2
234		220 kV Main bay of Newtown - 1
235		220 kV Main bay of Newtown - 2
236		220 kV Main Bay of Rajarhat - 2
237	220/132 kV Jeynagar(220 kV Side)	220 kV Main Bay of Jeypur - 1
238		220 kV Bus Coupler Bay
239		220 kV Transfer Bus Coupler Bay
240		220 kV Main Bay of Jeypur - 2
241	400/220 kV Jeypore (220 kV Side)	220 kV Main Bay of Jeynagar - 1
242		220 kV Main Bay of Jeynagar - 2
243		220 kV Bus Coupler Bay
244		220 kV Transfer Bus Coupler Bay
245		220 kV Main Bay of Jeypore 400/220 kV ICT - 1
246		220 kV Main Bay of Jeypore 400/220 kV ICT - 2
247	220 kV Jorthang	220 kV Main Bay of Jorthang - 1
248		220 kV Main Bay of Jorthang - 2
249		220 kV Bus Coupler Bay
250	400/220 kV Keonjhar (220 kV Side)	220 kV Main Bay of Keonjhar Odisha - 1
251		220 kV Main Bay of Keonjhar Odisha - 2
252		220 kV Transfer Bus Coupler Bay
253		220 kV Main Bay of Bolangir - 1
254		220 kV Main Bay of Keonjhar 400/220 kV ICT - 1
255		220 kV Main Bay of Keonjhar 400/220 kV ICT - 2
256	220/132 kV Keonjhar (220 kV Side)	220 kV Main Bay of Keonjhar - 1
257		220 kV Bus Coupler Bay
258		220 kV Transfer Bus Coupler Bay
259		220 kV Main Bay of Keonjhar - 2
260	220/132 kV Katapalli	220 kV Main Bay of Bolangir - 1
261		220 kV Bus Coupler Bay
262		220 kV Transfer Bus Coupler Bay
263		220 kV Main Bay of Bolangir - 1
264		220 kV Main Bay of Bolangir - 1
265	220/132 kV New Khagaria (220 kV Side)	220 kV Transfer Bus Coupler Bay
266		220 kV Main Bay of Bolangir - 1
267		220 kV Main Bay of New Khagaria - 1

Sl No	Name of Substation	Name of Bay
268	220/131 kV Khagaul (220 kV Side)	220 kV Main Bay of Arah - 1
269		220 kV Main Bay of Arah - 2
270		220 kV Main Bay of Patna - 1
271		220 kV Main Bay of Patna - 2
272		220 kV Bus Coupler Bay
273		220 kV Transfer Bus Coupler Bay
274		220 kV Main Bay of Patna - 3
275	220/132 kV Kishanganj Bihar(220 kV Side)	220 kV Main Bay of Kishangnaj Bihar - 1
276		220 kV Main Bay of Kishangnaj Bihar - 2
277		220 kV Main Bay of Kishangnaj Bihar - 3
278		220 kV Bus Coupler Bay
279		220 kV Main Bay of Kishangnaj Bihar - 4
280	220/132 kV Kalyaneswari (220 kV Side)	220 kV Main Bay of Maithon - 1
281		220 kV Bus Coupler Bay
282		220 kV Transfer Bus Coupler Bay
283		220 kV Main Bay of Maithon - 2
284	220/132 kV Lalmatia (220 kV Side)	220 kV Bus Coupler Bay
285		220 kV Transfer Bus Coupler Bay
286		220 kV Main Bay of Farakka - 1
287	220/132 kV Madehpura (220 kV Side)	220 kV Main Bay of Purnea - 1
288		220 kV Bus Coupler Bay
289		220 kV Transfer Bus Coupler Bay
290		220 kV Main Bay of Purnea - 2
291	400/220 kV Maithon (220 kV Side)	220 kV Main Bay of Kalyaneswari - 1
292		220 kV Bus Coupler Bay
293		220 kV Transfer Bus Coupler Bay
294		220 kV Main Bay of Kalyaneswari - 2
295		220 kV Main Bay of Dhanbad - 1
296		220 kV Main Bay of Dhanbad - 2
297		220 kV Main Bay of Dumka - 1
298		220 kV Main Bay of Dumka - 2
299		220 kV Main Bay of Maithon 400/220 kV ICT - 1
300		220 kV Main Bay of Maithon 400/220 kV ICT - 2
301		220 kV Main Bay of Maithon 400/220 kV ICT - 3
302	400/220 kV Malabase (220 kV Side)	220 kV Bus Coupler Bay
303		220 kV Transfer Bus Coupler Bay
304		220 kV Main Bay of Malabase - 1
305	400/220 kV Malda (220 kV Side)	220 kV Main Bay of Gazole - 1
306		220 kV Bus Coupler Bay
307		220 kV Transfer Bus Coupler Bay
308		220 kV Main Bay of Gazole - 2
309		220 kV Main Bay of Malda 220/132 kV ATR - 1
310		220 kV Main Bay of Malda 220/132 kV ATR - 2
311		220 kV Main Bay of Malda 220/132 kV ATR - 3
312		220 kV Main Bay of Malda 400/220 kV ICT - 1

Sl No	Name of Substation	Name of Bay
313		220 kV Main Bay of Malda 400/220 kV ICT - 2
314	400/220 kV Meramandali (220 kV Side)	220 kV Main Bay of Talcher Super - 1
315		220 kV Main Bay of Talcher Super - 2
316	400/220 kV Muzzafarpur (220 kV Side)	220 kV Main Bay of Hazipur - 1
317		220 kV Bus Coupler Bay
318		220 kV Transfer Bus Coupler Bay
319		220 kV Main Bay of Hazipur - 2
320		220 kV Main Bay of KBUNL - 1
321		220 kV Main Bay of KBUNL - 2
322		220 kV Main Bay of Spare - 1
323		220 kV Main Bay of Spare - 2
324		220 kV Main Bay of Muzzafarpur 400/220 kV ICT - 1
325		220 kV Main Bay of Muzzafarpur 400/220 kV ICT - 2
326		220 kV Main Bay of Muzzafarpur 400/220 kV ICT - 3
327	400/220 kV New Purnea (220 kV Side)	220 kV Main Bay of Purnea - 1
328		220 kV Main Bay of Purnea - 2
329		220 kV Main Bay of Madehpura - 1
330		220 kV Main Bay of Madehpura - 2
331		220 kV Main Bay of New Khagaria - 1
332		220 kV Bus Coupler Bay
333		220 kV Transfer Bus Coupler Bay
334		220 kV Main Bay of Begusarai - 1
335		220 kV Main Bay of New Purnea 400/220 kV ICT - 1
336		220 kV Main Bay of New Purnea 400/220 kV ICT - 2
337	220/132 kV New town (220 kV Side)	220 kV Main Bay of Rajarhat - 1
338		220 kV Bus Coupler Bay
339		220 kV Transfer Bus Coupler Bay
340		220 kV Main Bay of Rajarhat - 2
341	220 kV New Melli	220 kV Main Bay of Jorthang - 1
342		220 kV Main Bay of Jorthang - 2
343		220 kV Main Bay of Taseding - 1
344		220 kV Main Bay of Rangpo - 1
345	220/132 kV Siliguri (220 kV Side)	220 kV Main Bay of Binaguri - 1
346		220 kV Bus Coupler Bay
347		220 kV Transfer Bus Coupler Bay
348		220 kV Main Bay of Binaguri - 2
349		220 kV Main Bay of Kishanganj - 1
350		220 kV Main Bay of Kishanganj - 2
351		220 kV Main Bay of NJP 220/132 kV ATR - 1
352		220 kV Main Bay of NJP 220/132 kV ATR - 2
353	220/132 kV NJP WB (220 kV Side)	220 kV Main Bay of Binaguri Bus - 1 Extension
354		220 kV Bus Coupler Bay
355		220 kV Transfer Bus Coupler Bay
356		220 kV Main Bay of Binaguri Bus - 2 Extension
357	400/220 kV Pandiabilli	220 kV Main Bay of Atri - 1

Sl No	Name of Substation	Name of Bay
358	(220 kV Side)	220 kV Main Bay of Atri - 2
359		220 kV Main Bay of Puri - 1
360		220 kV Main Bay of Puri - 2
361		220 kV Bus Coupler Bay
362		220 kV Transfer Bus Coupler Bay
363		220 kV Main Bay of Pandiabili 400/220 kV ICT - 1
364		220 kV Main Bay of Pandiabili 400/220 kV ICT - 2
365	220/132 kV Parulia DVC (220 kV Side)	220 kV Main Bay of Durgapur - 1
366		220 kV Main Bay of Durgapur - 2
367	400/220 kV Durgapur (220 kV Side)	220 kV Main Bay of Parulia - 1
368		220 kV Main Bay of Parulia - 2
369		220 kV Bus Coupler Bay
370		220 kV Transfer Bus Coupler Bay
371		220 kV Main Bay of Durgapur 400/220 kV ICT - 1
372		220 kV Main Bay of Durgapur 400/220 kV ICT - 2
373		220 kV Main Bay of Durgapur 400/220 kV ICT - 3
374	220/132 kV Puri (220 kV Side)	220 kV Bus Coupler Bay
375		220 kV Transfer Bus Coupler Bay
376		220 kV Main Bay of Pandiabilli - 1
377		220 kV Main Bay of Pandiabilli - 2
378	220/132 kV Nadokar (220 kV Side)	220 kV Main Bay of Sasaram - 1
379		220 kV Bus Coupler Bay
380		220 kV Transfer Bus Coupler Bay
381		220 kV Main Bay of Sasaram - 2
382		220 kV Main Bay of Arah - 1
383		220 kV Main Bay of Arah - 2
384	400/220 kV Sasaram (220 kV Side)	220 kV Main Bay of Nadokar - 1
385		220 kV Bus Coupler Bay
386		220 kV Transfer Bus Coupler Bay
387		220 kV Main Bay of Nadokar - 2
388		220 kV Main Bay of Sahapuri - 1
389		220 kV Main Bay of Dehri - 1
390		220 kV Main Bay of Sasaram 400/220 kV ICT - 1
391		220 kV Main Bay of Sasaram 400/220 kV ICT - 2
392	400/220 kV Rajarhat (220 kV Side)	220 kV Main Bay of New Town AA-III - 1
393		220 kV Main Bay of New Town AA-III - 2
394		220 kV Main Bay of Jeerat - 1
395		220 kV Bus Coupler Bay
396		220 kV Main Bay of Jeerat - 2
397		220 kV Main Bay of Rajarhat 400/220 kV ICT - 1
398		220 kV Main Bay of Rajarhat 400/220 kV ICT - 3
399	220/132 kV Ramchandrapur (220 kV Side)	220 kV Main Bay of Jamsedpur 400/220 kV ICT - 1
400		220 kV Main Bay of Jamsedpur 400/220 kV ICT - 2
401		220 kV Bus Coupler Bay
402		220 kV Transfer Bus Coupler Bay

Sl No	Name of Substation	Name of Bay
403		220 kV Main Bay of Jamsedpur 400/220 kV ICT - 3
404		220 kV Main Bay of Joda - 1
405	400/220 kV Rangpo (220 kV Side)	220 kV Main Bay of New Melli - 1
406		220 kV Main Bay of Taseding - 1
407		220 kV Main Bay of Rangpo 220/132 kV ATR - 1
408		220 kV Main Bay of Rangpo 220/132 kV ATR - 2
409		220 kV Main Bay of Rangpo 220/132 kV ATR - 3
410		220 kV Main Bay of Rangpo 400/220 kV ICT - 1
411		220 kV Main Bay of Rangpo 400/220 kV ICT - 2
412		220 kV Main Bay of Rangpo 400/220 kV ICT - 3
413		220 kV Main Bay of Rangpo 400/220 kV ICT - 4
414		220 kV Main Bay of Rangpo 400/220 kV ICT - 5
415	220 kV Rengali Odisha	220 kV Main Bay of Rengali - 1
416		220 kV Bus Coupler Bay
417		220 kV Transfer Bus Coupler Bay
418		220 kV Main Bay of Rengali - 2
419	400/220 kV Rengali (220 kV Side)	220 kV Main Bay of Rengali Odisha - 1
420		220 kV Bus Coupler Bay
421		220 kV Transfer Bus Coupler Bay
422		220 kV Main Bay of Rengali Odisha - 2
423		220 kV Main Bay of Rengali 400/220 kV ICT - 1
424		220 kV Main Bay of Rengali 400/220 kV ICT - 2
425	220 kV Rengali Power House	220 kV Bus Coupler Bay
426		220 kV Transfer Bus Coupler Bay
427		220 kV Main Bay of Talcher Super - 1
428	400/220 kV Rourkela (220 kV Side)	220 kV Main Bay of Tarkera - 1
429		220 kV Main Bay of Tarkera - 2
430		220 kV Bus Coupler Bay
431		220 kV Transfer Bus Coupler Bay
432		220 kV Main Bay of Rourkela 400/220 kV ICT - 1
433		220 kV Main Bay of Rourkela 400/220 kV ICT - 2
434	220/132 kV Sahapuri (220 kV Side)	220 kV Main Bay of Sasaram - 1
435	220 kV Salakati	220 kV Main Bay of Salakatia - 1
436		220 kV Bus Coupler Bay
437		220 kV Transfer Bus Coupler Bay
438		220 kV Main Bay of Salakatia - 2
439	220/132 kV Sipara (220 kV Side)	220 kV Main Bay of Patna - 1
440		220 kV Bus Coupler Bay
441		220 kV Transfer Bus Coupler Bay
442		220 kV Main Bay of Patna - 2
443		220 kV Main Bay of Patna - 3
444	220/132 kV Sonnegar (220 kV Side)	220 kV Main Bay of Gaya - 1
445		220 kV Bus Coupler Bay
446		220 kV Transfer Bus Coupler Bay

Sl No	Name of Substation	Name of Bay
447		220 kV Main Bay of Gaya - 2
448	220/132 kV Subhasgram WB (220 kV Side)	220 kV Main Bay of Subhasgram - 1
449		220 kV Bus Coupler Bay
450		220 kV Transfer Bus Coupler Bay
451		220 kV Main Bay of Subhasgram - 2
452	400/220 kV Subhasgram (220 kV Side)	220 kV Main Bay of New Town - 1
453		220 kV Main Bay of East Metro Politan - 1
454		220 kV Main Bay of East Metro Politan - 2
455		220 kV Main Bay of Subhasgram WB - 1
456		220 kV Main Bay of Subhasgram WB - 2
457		220 kV Main Bay of Bantala - 1
458		220 kV Main Bay of Subshagram 400/220 kV ICT - 1
459		220 kV Main Bay of Subshagram 400/220 kV ICT - 2
460		220 kV Main Bay of Subshagram 400/220 kV ICT - 3
461		220 kV Bus Coupler Bay
462		220 kV Transfer Bus Coupler Bay
463		220 kV Main Bay of Subshagram 400/220 kV ICT - 4
464		220 kV Main Bay of Subshagram 400/220 kV ICT - 5
465	220/132 kV Tarkera (220 kV Side)	220 kV Main Bay of Rourkela - 1
466		220 kV Bus Coupler Bay
467		220 kV Transfer Bus Coupler Bay
468		220 kV Main Bay of Rourkela - 2
469	220 kV Tasheding	220 kV Main Bay of Rangpo - 1
470		220 kV Main Bay of New Melli - 1
471	400/220 kV Talcher STPS (220 kV Side)	220 kV Main Bay of Meramandali - 1
472		220 kV Bus Coupler Bay
473		220 kV Transfer Bus Coupler Bay
474		220 kV Main Bay of Meramandali - 2
475		220 kV Main Bay of Rengali Power House - 1
476		220 kV Main Bay of Tacher - 2
477		220 kV Main Bay of Talcher STPS 400/220 kV ICT - 1
478		220 kV Main Bay of Talcher STPS 400/220 kV ICT - 2
479	220/132 Talcher TPS (220 kV Side)	220 kV Bus Coupler Bay
480		220 kV Transfer Bus Coupler Bay
481		220 kV Main Bay of Talcher Super - 1
482	220/132 kV Bhanjnagar (220 kV Side)	220 kV Main bay of Meramundali - 1
483		220 kV Main bay of Meramundali - 2
484		220 kV Main bay of Nayagarh - 1
485		220 kV Main bay of Theruvalli - 1
486		220 kV Main bay of Theruvalli - 2
487	220/132 kV Bidanasi (220 kV Side)	220 kV Main bay of Meramundali - 1
488		220 kV Main bay of Meramundali - 2
489	220/132 kV Budhipadar (220 kV Side)	220 kV Main bay of IBTPS - 1
490		220 kV Main bay of IBTPS - 2
491		220 kV Main bay of IBTPS - 3

Sl No	Name of Substation	Name of Bay
492		220 kV Main bay of IBTPS - 4
493		220 kV Main bay of Korba-1
494		220 kV Main bay of Korba-2
495		220 kV Main bay of Raipur
496	220/132 kV Chandaka (220 kV Side)	220 kV Main bay of Mendhasal - 1
497		220 kV Main bay of Mendhasal - 2
498	220/132 kV Dharampur (220 kV Side)	220 kV Main bay of Jeerat - 1
499		220 kV Main bay of Jeerat - 2
500	220/132 kV Domjur (220 kV Side)	220 kV Main bay of Arambagh - 1
501		220 kV Main bay of Arambagh - 2
502	220/132 kV Duburi(old) (220 kV Side)	220 kV Main bay of Meramundali - 1
503		220 kV Main bay of Meramundali - 2
504	220/132 kV Lakhikantpur (220 kV Side)	220 kV Main bay of Subhasgram (WB) - 1
505		220 kV Main bay of Subhasgram (WB) - 2
506	220/132 kV Laxmipur (220 kV Side)	220 kV Main bay of Jayanagar - 1
507		220 kV Main bay of Jayanagar - 2
508		220 kV Main bay of Theruvalli - 1
509		220 kV Main bay of Theruvalli - 2
510	220/132 kV Midnapore (220 kV Side)	220 kV Main bay of Arambagh - 1
511		220 kV Main bay of Arambagh - 2
512		220 kV Main bay of Kharagpur - 1
513		220 kV Main bay of Kharagpur - 2
514	220/132 kV Narendrapur (220 kV Side)	220 kV Main bay of Mendhasal - 1
515		220 kV Main bay of Theruvalli - 1
516		220 kV Main bay of Theruvalli - 2
517	220/132 kV Nayagarh (220 kV Side)	220 kV Main bay of Mendhasal - 1
518	220/132 kV Rishra (220 kV Side)	220 kV Main bay of Arambagh - 1
519		220 kV Main bay of Dharampur - 1
520		220 kV Main bay of Dharampur - 2
521	400/220 kV Arambagh (220 kV Side)	220 kV Main bay of Domjur - 1
522		220 kV Main bay of Domjur - 2
523		220 kV Main bay of Midnapore - 1
524		220 kV Main bay of Midnapore - 2
525		220 kV Main bay of Rishra - 1
526		220 kV Main bay of N.Bishnupur - 1
527		220 kV Main bay of N.Bishnupur - 2
528		220 kV Main Bay of 400/220 kV ICT - 1
529		220 kV Main Bay of 400/220 kV ICT - 2
530		220 kV Main Bay of 400/220 kV ICT - 3
531		220 kV Main Bay of 400/220 kV ICT - 4
532	400/220 kV Bakreswar (220 kV Side)	220 kV Main bay of Sadaipur - 1
533		220 kV Main bay of Sadaipur - 2
534		220 kV Main bay of Bidhannagar - 1
535		220 kV Main bay of Bidhannagar - 2

Sl No	Name of Substation	Name of Bay
536		220 kV Main bay of Satgachia - 1
537		220 kV Main Bay of 400/220 kV ICT - 1
538		220 kV Main Bay of 400/220 kV ICT - 2
539		220 kV Main bay of Satgachia - 2
540	220/132 kV Balimela (220 kV Side)	220 kV Main bay of Jeynagar - 1
541		220 kV Main bay of Jeynagar - 2
542		220 kV Main bay of Jeynagar - 3
543	220/132 kV Barasat (220 kV Side)	220 kV Main bay of Kasba - 1
544		220 kV Main bay of Kasba - 2
545		220 kV Main bay of Jeerat - 1
546		220 kV Main bay of Jeerat - 2
547	220/132 kV Barjora (220 kV Side)	220 kV Main bay of Mejia - 1
548		220 kV Main bay of Mejia - 2
549	220/132 kV Barkot (220 kV Side)	220 kV Main bay of Rengali - 1
550		220 kV Main bay of Tarkera - 1
551	220/132 kV Begusarai (220 kV Side)	220 kV Main bay of Biharshariff - 1
552		220 kV Main bay of Biharshariff - 2
553		220 kV Main bay of MTPS - 1
554		220 kV Main bay of MTPS - 2
555	220/132 kV Bhanjnagar (220 kV Side)	220 kV Main bay of Mendhasal - 1
556	400/220 kV Bidhannagar (220 kV Side)	220 kV Main bay of Bakreswar - 1
557		220 kV Main bay of Bakreswar - 2
558		220 kV Main bay of DPL - 1
559		220 kV Main bay of DPL - 2
560		220 kV Main Bay of 400/220 kV ICT - 1
561		220 kV Main Bay of 400/220 kV ICT - 2
562		220 kV Main bay of Santaldih - 1
563	220/132 kV Biharshariff (220 kV Side)	220 kV Main bay of Begusarai - 1
564		220 kV Main bay of Begusarai - 2
565		220 kV Main bay of Bodhagya - 1
566		220 kV Main bay of Bodhagya - 2
567		220 kV Main bay of Fatuah - 1
568		220 kV Main bay of Fatuah - 2
569	220/132 kV Bishnupur (220 kV Side)	220 kV Main bay of Santaldih - 1
570		220 kV Main bay of Santaldih - 2
571	220/132 kV Bodhagya (220 kV Side)	220 kV Main bay of Biharshariff - 1
572		220 kV Main bay of Biharshariff - 2
573	220/132 kV Bokaro (220 kV Side)	220 kV Main bay of Chandrapura TPS B - 1
574		220 kV Main bay of Chandrapura TPS B - 2
575		220 kV Main bay of Jamshedpur - 1
576		220 kV Main bay of Jamshedpur - 2
577		220 kV Main bay of Ramgarh - 1
578		220 kV Main bay of Ramgarh - 2
579	220/132 kV Budhipadar	220 kV Main bay of Katapalli - 1

Sl No	Name of Substation	Name of Bay
580	(220 kV Side)	220 kV Main bay of Katapalli - 2
581		220 kV Main bay of Tarkera - 1
582		220 kV Main bay of Tarkera - 2
583	220/132 kV Burnpur (220 kV Side)	220 kV Main bay of Mejia - 1
584		220 kV Main bay of Kalyaneshwari - 1
585	220/132 kV Chaibasa New(J) (220 kV Side)	220 kV Main bay of Ramchandrapur - 1
586		220 kV Main bay of Ramchandrapur - 2
587	220/132 kV Chandiposh (220 kV Side)	220 kV Main bay of Rengali - 1
588		220 kV Main bay of Tarkera - 1
589	220/132 kV Chandrapura TPS B (220 kV Side)	220 kV Main bay of Bokaro - 1
590		220 kV Main bay of Bokaro - 2
591	220/132 kV Waria (220 kV Side)	220 kV Main bay of Mejia - 1
592		220 kV Main bay of Mejia - 2
593		220 kV Main bay of Parulia - 1
594		220 kV Main bay of Parulia - 2
595	220/132 kV Uihep (220 kV Side)	220 kV Main bay of Theruvali - 1
596		220 kV Main bay of Theruvali - 2
597		220 kV Main bay of Theruvali - 3
598		220 kV Main bay of Theruvali - 4
599	220/132 kV U. Kolab (220 kV Side)	220 kV Main bay of Jayanagar - 1
600		220 kV Main bay of Jayanagar - 2
601		220 kV Main bay of Theruvali - 1
602		220 kV Main bay of Jeyanagar - 1
603		220 kV Main bay of Jeyanagar - 2
604	220/132 kV Theruvali (220 kV Side)	220 kV Main bay of U. Kolab - 1
605		220 kV Main bay of Uihep - 1
606		220 kV Main bay of Uihep - 2
607		220 kV Main bay of Uihep - 3
608		220 kV Main bay of Uihep - 4
609		220 kV Main bay of Bhanjnagar - 1
610		220 kV Main bay of Bhanjnagar - 2
611		220 kV Main bay of Laxmipur - 1
612		220 kV Main bay of Laxmipur - 2
613		220 kV Main bay of Narendrapur - 1
614		220 kV Main bay of Narendrapur - 2
615	220/132 kV Tarkera (220 kV Side)	220 kV Main bay of Barkot - 1
616		220 kV Main bay of Budhipadar - 1
617		220 kV Main bay of Budhipadar - 2
618		220 kV Main bay of Chandiposh - 1
619	220/132 kV Rengali (220 kV Side)	220 kV Main bay of Barkot - 1
620		220 kV Main bay of Chandiposh - 1
621	220/132 kV Sadaipur (220 kV Side)	220 kV Main bay of Gokarno - 1
622		220 kV Main bay of Gokarno - 2
623		220 kV Main bay of Bakreswar - 1
624		220 kV Main bay of Bakreswar - 2

Sl No	Name of Substation	Name of Bay
625	220/132 kV Sagardighi (220 kV Side)	220 kV Main bay of Gokarno - 1
626		220 kV Main bay of Gokarno - 2
627	220/132 kV Santaldih (220 kV Side)	220 kV Main bay of Bidhannagr - 1
628		220 kV Main bay of Bishnupur - 1
629		220 kV Main bay of Bishnupur - 2
630	220/132 kV Satgachia (220 kV Side)	220 kV Main bay of Bakreswar - 1
631		220 kV Main bay of Bakreswar - 2
632		220 kV Main bay of Krishnanagar - 1
633		220 kV Main bay of Krishnanagar - 2
634	220/132 kV Patratu TPS (220 kV Side)	220 kV Main bay of Hatia - 1
635		220 kV Main bay of Hatia - 2
636		220 kV Main bay of Tenughat - 1
637	220/132 kV Ramgarh (220 kV Side)	220 kV Main bay of Bokaro - 1
638		220 kV Main bay of Bokaro - 2
639	400/220 kV Meramandali (220 kV Side)	220 kV Main bay of NALCO - 1
640		220 kV Main bay of NALCO - 2
641		220 kV Main bay of Talcher - 1
642		220 kV Main bay of Bhanjnagar - 1
643		220 kV Main bay of Bhanjnagar - 2
644		220 kV Main bay of Bidanasi - 1
645		220 kV Main bay of Bidanasi - 2
646		220 kV Main Bay of 400/220 kV ICT - 1
647		220 kV Main Bay of 400/220 kV ICT - 2
648		220 kV Main bay of Duburi(old) - 1
649		220 kV Main bay of Duburi(old) - 2
650	220/132 kV Mejia (220 kV Side)	220 kV Main bay of Barjora - 1
651		220 kV Main bay of Barjora - 2
652		220 kV Main bay of Muchipara - 1
653		220 kV Main bay of Muchipara - 2
654		220 kV Main bay of Burnpur - 1
655		220 kV Main bay of Kalyaneshwari - 1
656		220 kV Main bay of Kalyaneshwari - 2
657		220 kV Main bay of Kalyaneshwari - 3
658		220 kV Main bay of Waria - 1
659		220 kV Main bay of Waria - 2
660	400/220 kV Mendhasal (220 kV Side)	220 kV Main bay of Chandaka - 1
661		220 kV Main bay of Chandaka - 2
662		220 kV Main bay of Narendrapur - 1
663		220 kV Main bay of Nayagarh - 1
664		220 kV Main Bay of 400/220 kV ICT - 1
665		220 kV Main Bay of 400/220 kV ICT - 2
666		220 kV Main bay of Bhanjnagar - 1
667	220/132 kV Kolaghat TPS (220 kV Side)	220 kV Main bay of Howrah - 1
668		220 kV Main bay of Howrah - 2
669	220/132 kV Kasba (220 kV	220 kV Main bay of EM bypass - 1

Sl No	Name of Substation	Name of Bay
670	Side)	220 kV Main bay of Subhasgram(Wb) - 1
671		220 kV Main bay of Subhasgram(Wb) - 2
672		220 kV Main bay of Barasat - 1
673		220 kV Main bay of Barasat - 2
674	220/132 kV Katapalli (220 kV Side)	220 kV Main bay of Budhipadar - 1
675		220 kV Main bay of Budhipadar - 2
676	220/132 kV Kharagpur (220 kV Side)	220 kV Main bay of Midnapore - 1
677		220 kV Main bay of Midnapore - 2
678	220/132 kV Krishnanagar (220 kV Side)	220 kV Main bay of Gokarno - 1
679		220 kV Main bay of Gokarno - 2
680		220 kV Main bay of Satgachia - 1
681		220 kV Main bay of Satgachia - 2
682	220/132 kV Kalyaneshwari (220 kV Side)	220 kV Main bay of Burnpur - 1
683		220 kV Main bay of Mejia - 1
684		220 kV Main bay of Mejia - 2
685		220 kV Main bay of Mejia - 3
686	220/132 kV Gokarno (220 kV Side)	220 kV Main bay of Krishnanagar - 1
687		220 kV Main bay of Krishnanagar - 2
688		220 kV Main bay of Sagardighi - 1
689		220 kV Main bay of Sagardighi - 2
690		220 kV Main bay of Sadaipur - 1
691		220 kV Main bay of Sadaipur - 2
692	220/132 kV Gopalganj (220 kV Side)	220 kV Main bay of MTPS - 1
693		220 kV Main bay of MTPS - 2
694	220/132 kV Govindpur (220 kV Side)	220 kV Main bay of Dumka New - 1
695		220 kV Main bay of Dumka New - 2
696	220/132 kV Bishnupur (220 kV Side)	220 kV Main bay of Santaldih - 1
697		220 kV Main bay of Santaldih - 2
698	220/132 kV Bodhagya (220 kV Side)	220 kV Main bay of Biharshariff - 1
699		220 kV Main bay of Biharshariff - 2
700	220/132 kV Bokaro (220 kV Side)	220 kV Main bay of Chandrapura TPS B - 1
701		220 kV Main bay of Chandrapura TPS B - 2
702		220 kV Main bay of Jamshedpur - 1
703		220 kV Main bay of Jamshedpur - 2
704		220 kV Main bay of Ramgarh - 1
705		220 kV Main bay of Ramgarh - 2
706	220/132 kV Budhipadar (220 kV Side)	220 kV Main bay of Katapalli - 1
707		220 kV Main bay of Katapalli - 2
708		220 kV Main bay of Tarkera - 1
709		220 kV Main bay of Tarkera - 2
710	220/132 kV Burnpur (220 kV Side)	220 kV Main bay of Mejia - 1
711		220 kV Main bay of Kalyaneshwari - 1
712	220 kV IBTPS-1	220 kV Main bay of Budhipadar - 1
713		220 kV Main bay of Budhipadar - 2
714		220 kV Main bay of Budhipadar - 3

Sl No	Name of Substation	Name of Bay
715		220 kV Main bay of Budhipadar - 4
716	220/132 kV Jamshedpur (220 kV Side)	220 kV Main bay of Bokaro - 1
717		220 kV Main bay of Bokaro - 2
718	220/132 kV Jayanagar (220 kV Side)	220 kV Main bay of U. Kolab - 1
719		220 kV Main bay of U. Kolab - 2
720		220 kV Main bay of Laxmipur - 1
721		220 kV Main bay of Laxmipur - 2
722	220/132 kV Giridih (220 kV Side)	220 kV Main bay of Dhanbad - 1
723		220 kV Main bay of Dhanbad - 2
724	220/132 kV Howrah (220 kV Side)	220 kV Main bay of Domjur- 1
725		220 kV Main bay of Domjur- - 2
726	220/132 kV Dharampur (220 kV Side)	220 kV Main bay of Rishra - 1
727		220 kV Main bay of Rishra - 2
728	220/132 kV DPL (220 kV Side)	220 kV Main bay of Bidhannagar - 1
729		220 kV Main bay of Bidhannagar - 2
730	220/132 kV Darbhanga (220 kV Side)	220 kV Main bay of MTPS - 1
731		220 kV Main bay of MTPS - 2
732	220/132 kV Chandiposh (220 kV Side)	220 kV Main bay of Rengali - 1
733		220 kV Main bay of Tarkera - 1
734	220/132 kV Chandrapura TPS B (220 kV Side)	220 kV Main bay of Bokaro - 1
735		220 kV Main bay of Bokaro - 2
736	220/132 kV Ctps A (220 kV Side)	220 kV Main bay of Dhanbad - 1
737		220 kV Main bay of Dhanbad - 2
738	220/132 kV Chaibasa New(J) (220 kV Side)	220 kV Main bay of Ramchandrapur - 1
739		220 kV Main bay of Ramchandrapur - 2
740	400/220/132 kV Sitamarhi (220 kV Side)	220 kV Main Bay of Sitamarhi 400/220 kV ICT - 1
741		220 kV Main Bay of Sitamarhi 400/220 kV ICT - 2
742		220 kV Main Bay of Sitamarhi 220/132 kV ICT - 1
743		220 kV Main Bay of Sitamarhi 220/132 kV ICT - 2
744		220 kV Main Bay of Motipur-1
745		220 kV Main Bay of Motipur-2
746		220 kV Main Bay of Raxaul-1
747		220 kV Main Bay of Raxaul-2
748		220 kV Bus Coupler Bay
749		220 kV Transfer Bus Coupler Bay

11.4 132 kV bays

Sl No	Name of Substation	Name of Bay
1	132 kV Jamaui	132 kV Main Bay of Lakhisarai
2		132 kV Main Bay of Lakhisarai
3	132 kV Melli	132 kV Main Bay of Rangpo
4	132 kV Njp	132 kV Main Bay of Siliguri(Pg)
5	132 kV Rihand	132 kV Main Bay of Sonenagar
6	132 kV Arha	132 kV Main Bay of Jagdishpur
7		132 kV Main Bay of Arrah
8		132 kV Main Bay of Arrah
9		132 kV Main Bay of Dumraon
10	132 kV Bangiriposi	132 kV Main Bay of Baripada
11	132 kV Banka	132 kV Main Bay of Sultangunj
12		132 kV Main Bay of Sultangunj
13		132 kV Main Bay of Sabour
14		132 kV Main Bay of Sabour
15		132 kV Main Bay of Banka
16		132 kV Main Bay of Banka
17		132 kV Main Bay of Banka
18		132 kV Main Bay of Banka
19	132 kV Barhi	132 kV Main Bay of Rajgir
20		132 kV Main Bay of B'Shariff
21	132 kV Baripada	132 kV Main Bay of Bangiriposi
22		132 kV Main Bay of Baripada
23		132 kV Main Bay of Baripada
24		132 kV Main Bay of Bhograi
25		132 kV Main Bay of Jaleswr
26	132 kV Bethia(B)	132 kV Main Bay of Motihari(Dmtcl)
27		132 kV Main Bay of Motihari(Dmtcl)
28	132 kV Bhograi	132 kV Main Bay of Baripda
29	132 kV Birpara(PG)	132 kV Main Bay of Birpara(Wb)
30		132 kV Main Bay of Birpara(Wb)
31	132 kV Birpara(WB)	132 kV Main Bay of Birpara(Pg)
32		132 kV Main Bay of Birpara(Pg)
33	132 kV Chandauli	132 kV Main Bay of Karmanasa
34	132 kV Chandil	132 kV Main Bay of Manique
35		132 kV Main Bay of Manique
36	132 kV Chujachen	132 kV Main Bay of Rangpo
37		132 kV Main Bay of Rangpo
38	132 kV Daltonganj	132 kV Main Bay of Daltonganj (Pg)
39		132 kV Main Bay of Daltonganj (Pg)
40	132 kV Daltonganj (PG)	132 kV Main Bay of Daltonganj

41		132 kV Main Bay of Daltonganj
42	132 kV Dumraon	132 kV Main Bay of Arrah
43	132 kV Gangtok	132 kV Main Bay of Rangpo
44		132 kV Main Bay of Rangpo
45	132 kV Garwa	132 kV Main Bay of Rihand
46	132 kV Jagdishpur	132 kV Main Bay of Arha
47	132 kV Jaleswr	132 kV Main Bay of Baripda
48	132 kV Jamtara	132 kV Main Bay of Maithon
49	132 kV Japla	132 kV Main Bay of Sonenagar
50	132 kV Joda	132 kV Main Bay of Kendposi
51	132 kV Kahalgaon	132 kV Main Bay of Kahalgaon
52		132 kV Main Bay of Sabour
53		132 kV Main Bay of Lalmatia
54		132 kV Main Bay of Kahalgaon
55	132 kV Karmanasa	132 kV Main Bay of Sahupuri
56		132 kV Main Bay of Chandauli
57	132 kV Kendposi	132 kV Main Bay of Joda
58	132 kV Kharagpur(Dvc)	132 kV Main Bay of Kharagpur(Wb)
59	132 kV Kharagpur(WB)	132 kV Main Bay of Kharagpur(Dvc)
60	132 kV Khudra	132 kV Main Bay of Pusuali
61	132 kV Kisanganj	132 kV Main Bay of Purnea(Pg)
62	132 kV Kolaghat(Dvc)	132 kV Main Bay of Kolaghat(Wb)
63	132 kV Kolaghat(WB)	132 kV Main Bay of Kolaghat(Dvc)
64	132 kV Kurseong	132 kV Main Bay of Rangit
65		132 kV Main Bay of Siliguri(PG)
66	132 kV Lakhisarai	132 kV Main Bay of Jamaui
67		132 kV Main Bay of Jamaui
68	132 kV Lalmatia	132 kV Main Bay of Sabour
69		132 kV Main Bay of Kahalgaon
70	132 kV Maithon	132 kV Main Bay of Jamtara
71	132 kV Malda(PG)	132 kV Main Bay of Malda(Wb)
72		132 kV Main Bay of Malda(Wb)
73	132 kV Malda(WB)	132 kV Main Bay of Malda(Pg)
74		132 kV Main Bay of Malda(Pg)
75	132 kV Manique	132 kV Main Bay of Chandil
76	132 kV Manique	132 kV Main Bay of Chandil
77	132 kV Melli	132 kV Main Bay of Siliguri(Pg)
78	132 kV Mohania	132 kV Main Bay of Pusuali
79	132 kV Motihari(B)	132 kV Main Bay of Motihari(Dmtcl)
80	132 kV Motihari(B)	132 kV Main Bay of Motihari(Dmtcl)
81	132 kV Motihari(DMTCL)	132 kV Main Bay of Motihari(B)
82		132 kV Main Bay of Motihari(B)
83		132 kV Main Bay of Bethia(B)
84		132 kV Main Bay of Bethia(B)
85		132 kV Main Bay of Raxaul(B)

86		132 kV Main Bay of Raxaul(B)
87	132 kV Nbu	132 kV Main Bay of Siliguri(Pg)
88	132 kV Pataratu(Dvc)	132 kV Main Bay of Patratu(Jharkahnd)
89		132 kV Main Bay of Patratu(Jharkahnd)
90	132 kV Patratu	132 kV Main Bay of Patratu
91		132 kV Main Bay of Patratu
92	132 kV Patratu(Jharkahnd)	132 kV Main Bay of Pataratu(Dvc)
93		132 kV Main Bay of Pataratu(Dvc)
94	132 kV Purnea	132 kV Main Bay of Purnea(Pg)
95		132 kV Main Bay of Purnea(Pg)
96		132 kV Main Bay of Purnea(Pg)
97	132 kV Purnea(PG)	132 kV Main Bay of Kisanganj
98		132 kV Main Bay of Purnea
99		132 kV Main Bay of Purnea
100		132 kV Main Bay of Purnea
101	132 kV Pusuali	132 kV Main Bay of Khudra
102		132 kV Main Bay of Mohania
103	132 kV Rajgir	132 kV Main Bay of Barhi
104	132 kV Rammam	132 kV Main Bay of Rangit
105	132 kV Rangit	132 kV Main Bay of Rammam
106		132 kV Main Bay of Rangpo
107		132 kV Main Bay of Kurseong
108		132 kV Main Bay of Sagbari
109		132 kV Main Bay of Sagbari
110	132 kV Rangpo	132 kV Main Bay of Chujachen
111		132 kV Main Bay of Chujachen
112		132 kV Main Bay of Melli
113		132 kV Main Bay of Gangtok
114		132 kV Main Bay of Gangtok
115		132 kV Main Bay of Rangit
116	132 kV Raxaul(B)	132 kV Main Bay of Motihari(Dmtcl)
117		132 kV Main Bay of Motihari(Dmtcl)
118	132 kV Rihand	132 kV Main Bay of Garwa
119	132 kV Sabour	132 kV Main Bay of Lalmatia
120		132 kV Main Bay of Kahalgaon
121		132 kV Main Bay of Banka
122		132 kV Main Bay of Banka
123	132 kV Sagbari	132 kV Main Bay of Rangit
124		132 kV Main Bay of Rangit
125	132 kV Sahupuri	132 kV Main Bay of Karmanasa
126	132 kV Siliguri(PG)	132 kV Main Bay of Nbu
127		132 kV Main Bay of Njp
128		132 kV Main Bay of Kurseong
129		132 kV Main Bay of Melli
130	132 kV Sonenagar	132 kV Main Bay of Japla

131		132 kV Main Bay of Rihand
132	132 kV Sultangunj	132 kV Main Bay of Banka
133		132 kV Main Bay of Banka
134	132 kV Sitamarhi	132 kV Main Bay of Pupri-1
135		132 kV Main Bay of Pupri-2
136		132 kV Main Bay of Runnisaidpur-1
137		132 kV Main Bay of Runnisaidpur-2
138		132 kV Main Bay of 220/132 kV ICT-1
139		132 kV Main Bay of 220/132 kV ICT-2
140		132 kV Bus Coupler Bay

Document Management Information:

Document Name	List of Important Grid Elements in Eastern Region		
Document ID	ERLDC/LIMP/2021-22/Rev 1		
Rev No.	1	Date	12th May 2021
Classification	Public		

POWER SYSTEM DEVELOPMENT FUND												
Status of the Projects in Eastern Region												
Sl No	State	Entity	Name of the scheme	Grant Approved	Grant sanctioned on	1st Installment grant released on	Completion Schedule	Completion schedule w.r.t date of 1st instalment	Grant aviled so far	Under process of release	Total awards amount of placed of till date	Latest status
1	Bihar	BSPTCL	Renovation and Upgradation of protection system of substations. (18)	64.22	42135	42506	24	43236	56.04		69.195	90% grant availed on award cost.
2			Installation of Capacitor bank in 20 Nos of Grid Sub Station. (74)	18.882	42618	43550	24	44281	16.99		21.55	
			Total	**83.10**					**73.03**		**90.745**	
5	Jharkhand	JUSNL	Renovation & Upradation of protection system of Jharkhnad. (161)	138.13	15-Nov-17	28-Mar-19	16	28-Jul-20	114.68	1.01	145.674	90% grant availed on award cost. Project closure is expected by Q-2 of 2021-22.
6			Reliable Communication & data acquisition system upto 132kV Substations ER. (177)	22.36	24-May-19		24					Price bid has been opened. Tender on awarding stage.
			Total	**160.49**					**114.68**		**145.674**	
7	Odisha	OPTCL	Renovation and Upgradation of protection system of substaions. (08)	162.50	11-May-15	22-Mar-16	24	22-Mar-18	46.04		63.31	Project Completed on Dec-20. Request for release of final 10 % fund has been placed.
8			Implementation of OPGW based reliable communication at 132 kv and above substations. (128)	25.61	15-Nov-17	29-Mar-19	36	29-Mar-22	23.04		51.22	90% grant availed on award cost.
9			Installation of 125 MVAR Bus Reactor along with construction of associated by each at 400kV Grid S/S of Mendhasal, Meramundali & New Duburi for VAR control & stabilisation of system voltage. (179)	27.23	27-Jul-18	1-Apr-19	18	1-Oct-20	8.17		8.166	30% grant availed
10			Implementation of Automatic Demand Management System (ADMS) in SLDC, Odisha. (196)	2.93	24-May-19	19-Feb-20	10	19-Dec-20	0.29		0.29	10% grant availed
11			Protection Upgradation and installation os Substation Automatic System (SAS) for seven nos of 220/132/33kV Substations (Balasore, Bidanasi, Budhipadar, Katapali, Narendrapur, New-Bolangir & Paradeep). (209)	36.63	24-May-19	13-Feb-20	18	13-Aug-21	8.87		8.87	30% grant availed
12		OHPCL	Renovation and Upgradation of protection and control system of OHPC. (109)	22.35	22-May-17	25-May-18	24	25-May-20	10.96		17.983	90% grant availed on award cost.
			Total	**277.25**					**97.37**		**149.839**	
14		WBSETCL	Installation of switchable reactor & shunt capacitor for voltage improvement. (88)	43.37	22-May-17	22-Jun-18	19	22-Jan-20	33.07		40.83	90% grant availed on award cost.
15			Renovation & Modernisation of Transmission System. (87)	70.13	22-May-17	25-Jun-18	25	25-Jul-20	63.12		96.44	
16			Installation of Bus Reactors at different 400kV Substation within the state of West Bengal for reactive power management of the Grid. (210)	71.74	24-May-19	23-Oct-19	19	23-May-21	39.3		45.62	30% grant availed on award cost.
17			Project for establishment of reliable communication and data acquisition at different substation at WBSWTCL. (222)	31.19	24-May-19	23-Oct-19	25	23-Nov-21	3.12			Expected to be completed by Jul'22.
18			Implementation of Integated system for Scheduling, Accounting, Metering and Settlement of Transactions (SAMAST) system in West Bengal. (197)	10.08	43910		12					10% grant not yet requested
19		WBPDCL	Renovation and Modernization of 220/ 132 kV STPS switch yard and implementation of Substaion Automation System. (72)	23.48	5-Sep-16	18-May-17	18	18-Nov-18	21.13		32.09	Target date for completion of project is Sept., 21 subject to availability of S/D & Covid scenario. Request for release for final 10% grant has been placed.
21			Renovation and Modernization of switchyard and related protection system of different power stations (BTPS, BKTPS and KTPS) of WBPDCL (155)	45.16	27-Jul-18	27-Mar-19	12	27-Mar-20	34.52		41.68	Target date for completion of project is Oct., 21 subject to availability of S/D & Covid scenario. 90% grant availed on award cost.
			Total	**295.15**					**194.26**		**256.661**	

POWER SYSTEM DEVELOPMENT FUND												
Status of the Projects in Eastern Region												
Sl No	State	Entity	Name of the scheme	Grant Approved	Grant sanctioned on	1st Installment grant released on	Completion Schedule	Completion schedule w.r.t date of 1st instalment	Grant aviled so far	Under process of release	Total awards amount of placed of till date	Latest status
22	DVC	DVC	Renovation and Upgradation of the protection and control system of Ramgarh Sub Station. (81)	25.96	2-Jan-17	31-May-17	24	31-May-19	22.95	2.57	28.603	90% grant availed on award cost.
23			Renovation and Modernization of control and protection system and replecement of equipment at Parulia, Durgapur, Kalyanewari, Giridhi Jamsedpur, Barjora, Burnpur, Dhanbad and Bundwan substation. (106)	140.50	16-May-17	14-Dec-17	24	14-Dec-19	102.34	3.29	126.87	
			Total	**166.46**					**125.29**		**155.473**	
24	Sikkim	ENPD, Sikkim	Drawing of optical ground wire (OPGW) cables on existing 132kV & 66kV transmission lines and integration of leftover substations with State Load Despatch Centre, Sikkim. (173)	10.00	24-May-19		18		3.00		20	30% grant availed on award cost
				10.00					**3.00**		**20.00**	
26	ERPC	ERPC	Creation and Maintenance of web based protection database management. (67)	20.00	17-Mar-16	28-Jun-16	18	28-Dec-17	14.83		16.48	Project Completed
27			Study Programme on power trading at NORD POOL Academy for Power System Engineers of Eastern Region. (122)	5.46	27-Jul-18	27-Mar-19	13	27-Apr-20	4.61		5.37	
28			Traning Program for Power system Engineers of various constituents of Eastern Region. (117)	0.61	27-Jul-18	11-Apr-19	24	11-Apr-21	0.54		0.60888	90% grant availed on award cost.
			Total	**26.07**					**19.98**		**22.45888**	
			GrandTotal	**1,018.53**					**627.61**		**840.85**	

Annexure B15.1

Station Name	Unit Number	AVR manufacturer	Transient Data recording facility available (Yes / No)	Activation Status
Farakka	FSTPP #1	BHEL	No	
	FSTPP #2	BHEL	No	
	FSTPP #3	BHEL	No	
	FSTPP #4	Siemens	No	
	FSTPP #5	Siemens	No	
	FSTPP #6	BHEL	No	
Kahalgaon	KhSTPP #1	ABB Unitrol 6800	Yes	Due to space constraint in local ECT same could not be turned on
	KhSTPP #2	ABB Unitrol 6800	Yes	Due to space constraint in local ECT same could not be turned on
	KhSTPP #3	ABB Unitrol 6800	Yes	Due to space constraint in local ECT same could not be turned on
	KhSTPP #4	BHEL	Yes	Due to space constraint in local ECT same could not be turned on
	KhSTPP #5	BHEL	NO	
	KhSTPP #6	BHEL	NO	
	KhSTPP #7	BHEL	NO	
Talcher	TSTPP #1	ANYDRIZ	NO	
	TSTPP #2	ANYDRIZ	NO	
	TSTPP #3	BHEL	NO	
	TSTPP #4	BHEL	NO	
	TSTPP #5	BHEL	NO	
	TSTPP #6	BHEL	NO	
Rangit	Rangit #1			
	Rangit #2			
	Rangit #3			
Teesta V	Teesta V #1	ALSTOM (now GE POWER LTD)	NO	
	Teesta V #2	ALSTOM (now GE POWER LTD)	NO	
	Teesta V #3	ALSTOM (now GE POWER LTD)	NO	
Sterlite	SEL #1			
	SEL #2			
	SEL #3			
	SEL #4			
MPL	MPL #1			
	MPL #2			
Adhunik	APNRL #1	BHEL	NO	
	APNRL #2	BHEL	NO	
Chujachen	Chujachen #1	Alostom	Yes	
	Chujachen #2	Alostom	Yes	
Jorethang	JORETHANG #1	ALTSOM	Yes	Not configured
	JORETHANG #2	ALTSOM	Yes	Not configured
Dikchu	dikchu unit 1	GE Power	Yes	Not configured
	dikchu unit 2	GE Power	Yes	Not configured
Tashiding	tashiding unit 1	M/s ABB	Yes	Activated
	tashiding unit 2	M/s ABB	Yes	Activated
Teesta III	teesta #3 unit 1	Model – THYNE 5 , Make - ELIN	No	
	teesta #3 unit 2	Model – THYNE 5 , Make - ELIN	No	
	teesta #3 unit 3	Model – THYNE 5 , Make - ELIN	No	
	teesta #3 unit 4	Model – THYNE 5 , Make - ELIN	No	
	teesta #3 unit 5	Model – THYNE 5 , Make - ELIN	No	
	teesta #3 unit 6	Model – THYNE 5 , Make - ELIN	No	
Barh	Barh Unit-4			
	Barh Unit-5			
Darlipalli	DARLIPALLI 765.00 T1			
	DARLIPALLI 765.00 T2			
NPGC	NPGC 400.00 T1			
	NPGC 400.00 T2			
BRBCL	BRBCL nabinagar unit 1			
	BRBCL nabinagar unit 2			
	BRBCL nabinagar unit 3			
	BRBCL nabinagar unit 4			
GMR	GMR unit-1	ABB Unitrol 5000	No Transient data recording facility of Active power, Reactive power, Efd, Ifd are not available since Analog Transducers are used and those values are showing in the DCS system with 500mS scan time..	No provision of activation status available in ABB make AVR Unitrol 5000
	GMR unit-2	ABB Unitrol 5000	No Transient data recording facility of Active power, Reactive power, Efd, Ifd are not available since Analog Transducers are used and those values are showing in the DCS system with 500mS scan time..	No provision of activation status available in ABB make AVR Unitrol 5000
	GMR unit-3	ABB Unitrol 5000	No Transient data recording facility of Active power, Reactive power, Efd, Ifd are not available since Analog Transducers are used and those values are showing in the DCS system with 500mS scan time..	No provision of activation status available in ABB make AVR Unitrol 5000
JITPL	JITPL #1			
	JITPL #2			
Bakreswar	BAKARESWARSWAR Unit-1	BHEL, Model: Unitrol	Yes.	But activation with required channel configuration (Active power, Reactive power, Efd, Ifd, PSS output) need to be confirmed from OEM. M/S BHEL EDN will visit BKTPP for PSS tuning soon, during that time status checking of Transient Data recording facility may be done
	BAKARESWARSWAR Unit-2	BHEL make & old Analog system	No	It will be replaced by DAVR of ABB Make, Unitrol 6080 in June-July 2021. Transient Data recording facility activation with required channel configuration may be done during commissioning.
	BAKARESWARSWAR Unit-3	ABB, Model: Unitrol 6080	YES.	DAVR is recently commissioned in November 2020. M/S ABB is scheduled to visit during commissioning of DAVR UNIT#2 in June 2021. During that time Transient Data recording facility activation with required channel configuration may be done.
	BAKARESWARSWAR Unit-4	BHEL Make & Model: Unitrol	No Transient data recording facility of Active power, Reactive power, Efd, Ifd are not available since Analog Transducers are used and those values are showing in the DCS system with 500mS scan time..	
	BAKARESWARSWAR Unit-5	BHEL Make & Model: Unitrol	No Transient data recording facility of Active power, Reactive power, Efd, Ifd are not available since Analog Transducers are used and those values are showing in the DCS system with 500mS scan time..	
Kolagaht	KOLAGHAT TP Unit-1			
	KOLAGHAT TP Unit-2			
	KOLAGHAT TP Unit-3			
	KOLAGHAT TP Unit-4			
	KOLAGHAT TP Unit-5			
	KOLAGHAT TP Unit-6			
Sagardighi	Sagardhighi Unit-1			
	Sagardhighi Unit-2			
	Sagardhighi Unit-3			
	Sagardhighi Unit-4			
Santhaldi	SANTHALDIaldi Unit-5	BHEL	NO Our DVR is old, BHEL Make, Model No. UnitrolNo transient Data recording facility is available.	
	SANTHALDIaldi Unit-6	BHEL	NO Our DVR is old, BHEL Make, Model No. UnitrolNo transient Data recording facility is available.	

Bandel	Bandel Unit-5			
Haldia	HEL 400.00 T1	Make: ABB,Model: UNITROL 5000	No	
	HEL 400.00 T2	Make: ABB,Model: UNITROL 5000	No	
Budge Budge	Budgebudge Unit-1	NEICS Parsons	No	
	Budgebudge Unit-2	NEICS Parsons	No	
	Budgebudge Unit-3	BHEL	No	
Southern	SRS 132.00 T1	BHEL	No	
	SRS 132.00 T2	BHEL	No	
	DPL2 220.00 T7	ABB, Model: Unitrol 5000	No	Activation possible after upgradation of AVR
	DPL2 220.00 T8	BHEL	Yes	But activation with required channel configuration (Active power, Reactive power, Efd, Ifd, PSS output) need to be confirmed from OEM.
TLDP 3	TEESTALD 220.00 H1	Model – THYNE 5 , Make - ELIN (M/s Andritz Hydro Pvt LTd)	NO	
	TEESTALD 220.00 H2	Model – THYNE 5 , Make - ELIN (M/s Andritz Hydro Pvt LTd)	NO	
	TEESTALD 220.00 H3	Model – THYNE 5 , Make - ELIN (M/s Andritz Hydro Pvt LTd)	NO	
	TEESTALD 220.00 H4	Model – THYNE 5 , Make - ELIN (M/s Andritz Hydro Pvt LTd)	NO	
TLDP 4	TLDP4 220.00 H1			
	TLDP4 220.00 H2			
	TLDP4 220.00 H3			
	TLDP4 220.00 H4			
PPSP	PPSP Unit 1			
	PPSP Unit 2			
	PPSP Unit 3			
	PPSP Unit 4			
Hirakud	HIRAKUD1 132.00 H1			
	HIRAKUD1 132.00 H2			
	HIRAKUD1 132.00 H3			
	HIRAKUD1 132.00 H4			
	HIRAKUD1 132.00 H5			
	HIRAKUD1 132.00 H6			
	HIRAKUD1 132.00 H7			
Chiplima	CHIPLIMA 132.00 H3			
Balimela	BALIMELAela unit-1			
	BALIMELAela unit-2			
	BALIMELAela unit-3			
	BALIMELAela unit-4			
	BALIMELAela unit-5			
	BALIMELAela unit-6			
	BALIMELAela unit-7			
	BALIMELAela unit-8			
Upper Kolab	UBKLB unit-1			
	UBKLB unit-2			
	UBKLB unit-3			
	UBKLB unit-4			
Indravati	INDRAVATHI unit-1			
	INDRAVATHI unit-2			
	INDRAVATHI unit-3			
	INDRAVATHI unit-4			
Rengali	RENGALI unit-1			
	RENGALI unit-2			
	RENGALI unit-3			
	RENGALI unit-4			
	RENGALI unit-5			
IBTPS	IBTPS unit-1	BHEL	No, Transient data recording facility of Active power, Reactive power, Efd, Ifd are not available,as Analog Transducers are used and those values are showing in the DCS system with 500ms scan time	
	IBTPS unit-2	BHEL	No, Transient data recording facility of Active power, Reactive power, Efd, Ifd are not available,as Analog Transducers are used and those values are showing in the DCS system with 500ms scan time	
OPGC	OPGC_CTU 400.00 T4	BHEL	No, Transient data recording facility of Active power, Reactive power, Efd, Ifd are not available,as Analog Transducers are used and those values are showing in the DCS system with 500ms scan time	
	OPGC_STU 400.00 T3	BHEL	No, Transient data recording facility of Active power, Reactive power, Efd, Ifd are not available,as Analog Transducers are used and those values are showing in the DCS system with 500ms scan time	
Tenughat	TENUGHAT Unit-1			
	TENUGHAT Unit-2			
Subarnarekha	SRHP SIKIDRI132.00 H1			
	SRHP SIKIDRI132.00 H2			
Bokaro B	Bokara B unit-3			
Andal	DSTPS unit-1			
	DSTPS unit-2			
MTPS	MTPS 2 220.00 T1			
	MTPS 2 220.00 T2			
	KBUNL ST 2 Unit 3			
	KBUNL ST 2 Unit 4			
Barauni	BTPS 132.00 T6			
	BTPS 132.00 T7			
	BTPS(NEW)220220.00 T8			
	BTPS(NEW)220220.00 T9			
Mejia A	MEJIA 2 220.00 T2			
	MEJIA 2 220.00 T3			
	MEJIA 2 220.00 T5			
	MEJIA 2 220.00 T1			
	MEJIA 2 220.00 T4			
	MEJIA 2 220.00 T6			
Waria	WARIA GEN 220.00 T1			
Raghunathpur	RAGHUNAT 400.00 T1			
	RAGHUNAT 400.00 T2			
Mejia B	MEJIA 400.00 T1			
	MEJIA 400.00 T2			
Chandrapura	CHNPUR 2 220.00 T7			
	CHNPUR 2 220.00 T8			
Bokaro A	BOKARO A 400.00 T1			
Koderma	KODERMA4 400.00 T1			
	KODERMA4 400.00 T2			

Annexure-2.1

सत्यमेव जयते

भारत सरकार/Government of India

विद्युत मंत्रालय/ Ministry of Power

केन्द्रीय विद्युत प्राधिकरण/ Central Electricity Authority

राष्ट्रीय विद्युत समिति प्रभाग/ NPC Division

1st Floor, Wing-5, West Block-II, R.K. Puram, New Delhi-66, Mail: cenpc-cea@gov.in

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No. 4/MTGS/NPC/CEA/2020/ 94-104 **Date: 02.12.2020**

To,

As per distribution list

Subject: Constitution of "Joint Committee on Technical Specification (TS) of the 5/15 minute IEMs with AMR, MDP system"-reg.

विषय: AMR, MDP प्रणाली के साथ 5/15 मिनट IEM की "तकनीकी विशिष्टता (टीएस) पर संयुक्त समिति का गठन। " -Reg

A meeting on the issue of Telemetry of Real-time Active Power (MW) data to SLDCs through IEMs was held on 19th November, 2020 chaired by Chairperson, CEA. In this meeting, it was decided that the Technical Specification (TS) of the 5/15 minute Interface Energy Meters (IEMs) with Automatic Meter Reading (AMR) and Meter Data Processing (MDP) for Interstate transmission system may be prepared at PAN India basis.

A joint committee comprising members from each RPCs, CEA, and CTU/PGCIL and POSOCO has been constituted to deliberate and finalise the above Technical Specifications.

The Constitution of the joint committee is as follows

1	Chief Engineer (GM), CEA	Member
2.	Chief Engineer, DP&T, CEA	Member
3	Member Secretary, WRPC	Member
4	Member Secretary, NRPC	Member
5	Member Secretary, ERPC	Member
6	Member Secretary, SRPC	Member
7	Member Secretary, NERPC	Member
8	Representative from PGCIL*(at the level of Sr.GM/GM)	Member
9	Representative from POSOCO**(at the level of Sr. GM/GM)	Member
10	Chief Engineer(NPC), CEA	Member & Convener of the committee

*To be nominated by PGCIL

**To be nominated by POSOCO

In this regard it is requested that PGCIL and POSOCO may send their nominations at the level of Sr.GM/GM.

Terms of Reference of the Committee is to "To prepare the Technical Specification (TS) of the 5/15 minute Interface Energy Meters (IEMs) with Automatic Meter Reading (AMR) and Meter Data Processing (MDP) for Interstate transmission system."

This letter is issued with the approval of the Competent Authority.

Rishika 2/12/2020

(Rishika Sharan)
Chief Engineer (NPC)

Distribution List

1. CMD, PGCIL
2. CMD, POSOCO
3. Chief Engineer (GM), CEA
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5. Member Secretary, WRPC/ NRPC/ ERPC/SRPC/ NERPC

Copy for information to:

1. PS to Chairperson, CEA
2. SA to Member (GO&D)

Technical Specification for Interface Energy Meters, Automated Meter Reading System and Meter Data Processing for Inter State Transmission System

LIST OF TABLES

ABBREVIATIONS

S.No	Acronym	Definition
1	AMR	Automated Meter Reading
2	ATP	Acceptance Test Plan
3	CDCS	Central Data Collection System
4	CMRI	Common Meter Reading Instrument
5	C&R	Control & Relay
6	CTU	Central Transmission Utility
7	DCD	Data Collection Device
8	DCU	Data Concentrator Unit
9	DSM	Deviation Settlement Mechanism
10	EA	Energy Accounting
11	EHV	Extra High Voltage
12	FAT	Factory Acceptance Test
13	FTE	Full Time Equivalent
14	GPRS	General Packet Radio Service
15	GSM	Global System of Mobile
16	HHU	Hand Held Unit
17	IEC	International Electro-technical Commission
18	IEEE	Institute of Electrical and Electronics Engineers
19	IEM	Interface Energy Meter
20	IP	Ingress Protection
21	IS	Indian Standard
22	ISTS	Inter State Transmission System
23	LAN	Local Area Network
24	MDP	Meter Data Processing
25	NMS	Network Management System
26	OEM	Original Equipment Manufacturer
27	PCB	Printed Circuit Board
28	RDBMS	Relational Database Management System
29	RMS	Root Mean Square
30	SAT	Site Acceptance Test
31	SEM	Special Energy Meter
32	SRS	Software Requirements Specification
33	TOC	Taking Over Certificate
34	VPN	Virtual Private Network
35	WAN	Wide Area Network
36	RLDC	Regional Load Despatch Centre

37	RPC	Regional Power Committee
38	IEMDC	Interface Energy Meter Data Centre

I. BACKGROUND

Power system operation in India is under control of hierarchical regulatory system. Commercial settlements of energy generation and consumption are being computed through Availability Based Tariff (ABT) and Deviation Settlement Mechanism (DSM) which are in vogue for energy accounting. Availability Based Tariff was implemented in India in 2002/2003 considering the settlement period as 15-min. The Special Energy Meters (SEM) for Interface points i.e. Interface Energy Meters (IEM) are deployed throughout all the regions of India at identified locations which store electrical parameters having significance in Regional Energy Accounting (REA) and DSM. Suitable storage capacity was provided in meters keeping in view meagre data communication facilities which were available in the country about two decades ago. Block wise Energy data as recorded by the SEMs are down loaded offline monthly/weekly and forwarded (in encrypted format) by email to respective RLDCs for verification/validation. The processed meter data is forwarded by RLDCs to RPC secretariats for preparation of weekly/monthly energy accounts.

A large number of SEMs/IEMs installed at several ISTS points are more than 5 / 10 years old and are due for testing / replacement. Also Government of India (GoI) has set a Renewable Energy (RE) target of 175GW capacity by 2022. The need for implementing a 5-minute scheduling, accounting and settlement at the Inter State level is being felt considering the variability of load and renewables especially considering RE penetration in the coming years.

This issue was discussed in several CCM (Commercial Coordination Meeting) and TCC/RPC meetings and was decided to replace the entire fleet of existing SEMs (15-min Block) with Interface Energy Meters (5-min Block) and implement the Automated Meter Reading and Meter Data Processing System. The above is also in line with the recommendations of the Report on Scheduling, Accounting, Metering and Settlement of Transactions in Electricity (SAMAST) that was endorsed by the Forum of Regulators on 15th July 2016.

Moreover, in view of the new DSM regulation and its amendments, which are more stringent, there is a need to get streaming online instantaneous MW data at a user configurable rate (minimum 1 min) at SLDCs via IEMDCs. The Technical/basic performance of the meter (as envisaged in the CEA metering regulations/standards) should not get affected at any cost because of this streaming online instantaneous MW data functionality. This instantaneous MW data is only for the purpose of taking actions/decisions in real time for grid monitoring & discipline.

II. PROJECT SCOPE

…………….. region comprises of the states of ……….., ………., ………., ………., and ………….. As on …………. there are ……… Special energy meters (SEMs) installed at various interface points in the Inter State Transmission System (ISTS). The existing distribution of energy meters in ………… Region (State wise) is as below:

State	No. of SEMs installed

Table II-1 Distribution of Energy Meters in ………..

The present project envisages to replace the existing fleet of IEM (15 min, ABT meters) in the Inter State Transmission System (ISTS) in the ……… region with Interface Energy Meters (5 min, IEM). The project also envisages to put in place a system of Main & Back-up Central Data Collection System (CDCS) for Automated Meter Reading (AMR)/Meter Data Processing (MDP) along with the associated hardware for meter data collection, validation and processing at Interface Energy Meter Data Centre (IEMDC)/ Regional Load Dispatch Centre (RLDC) before forwarding the meter data to RPC Secretariat for regional energy accounting. The Back-up IEMDC center to be established to take care of disaster management. A conceptual architecture of IEMDCs is shown in Fig.1

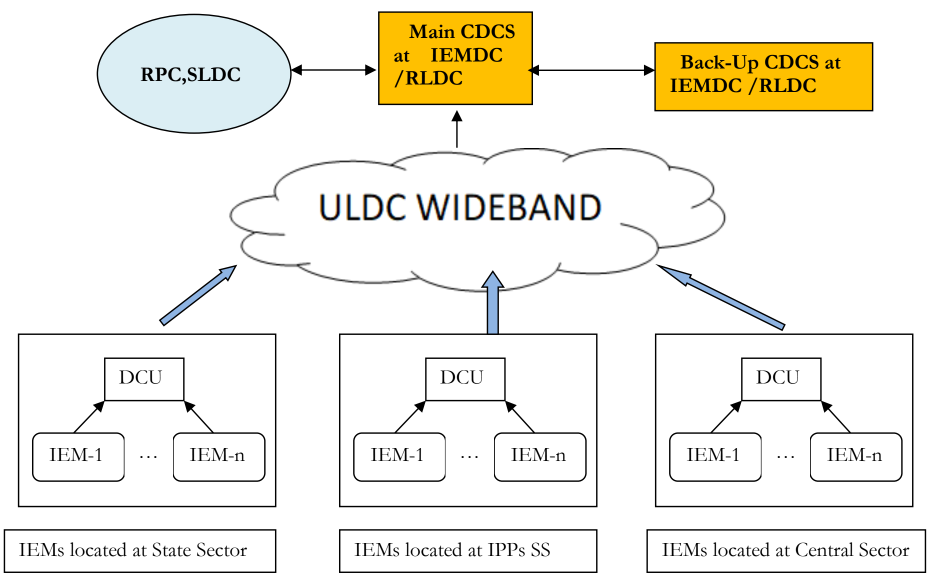


Fig.1

The main and back-up CDCS are to be provided with applications for fetching data from all IEMs via Data Collection Units (DCU), processing, validating meter data using Meter Data Processing (MDP) software, archiving data in appropriate storage, sharing data with

RLDC/RPC through secure web API. The DCU shall communicate with MDP System through CDCS at main and back-up IEMDCs/RLDCs as per the user defined schedule. The servers shall generate all the reports as configured as per defined time schedules and generate defined alarms for operators.

The successful bidders shall be responsible for site survey, planning, designing, engineering, testing, supply, transportation & insurance, delivery at site, storage, installation & commissioning, integration and training of IEM & CDCS system alongwith all hardware and software at respective locations

This project envisages delivering an end to end solution for energy metering at the interstate level. It shall involve capital as well as O&M expenditure by the successful bidder. During the warranty and O&M phase, the bidder shall provide web based system for complaint registration, support and maintenance along with one full time equivalent (FTE) competent resident engineer at IEMDCs/RLDCs to diagnose and address any software related issues in AMR/MDP/reporting system. The O&M/AMC charges payable to the successful bidder shall be calculated based on the CDCS system availability.

The technical specifications are broadly in two parts.

Part-1 - The first part of the specifications covers Interface Energy Meter (IEM) and Data Concentrator Unit (DCU) along with suitable switches for connection in between. The DCU shall be compatible to communicate with CDCS System at main and back-up IEMDCs/RLDCs as per the user defined schedule.

Part-2 -The second part covers CDCS system comprising all associated hardware & software for AMR-MDP system..

The execution of the project shall be planned in such a manner that there is no interruption in the prevailing regional energy accounting system. The IEMs shall record data at user configured time block of 5 minute/15 minute. This data shall be collected and archived atIEMDCs/RLDCs. However the settlement period for data processing and energy accounting shall be defined by the RLDCas per the prevailing CERC regulations. For instance, if the user chooses the settlement period to be 15 min, then the archived data of 5 min interval shall be converted to 15 min interval so as to be compatible with the existing software for meter data processing and energy accounting at RLDC and RPC. The format of the 5-min/15-min processed data reports shall be exactly same as that of the existing 15-min processed data reports in text files for compatibility at RPC end.

The installation of the IEM at the interface points shall involve shutdown of transmission elements. This shall be coordinated through the existing outage coordination procedure approved by the Regional OCC forum. Employer/RLDC shall coordinate the shutdown as per the OCC approved list subject to real time grid conditions.

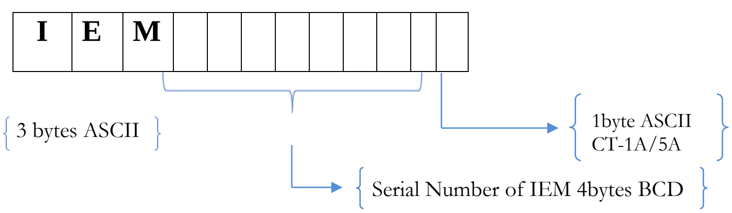
PART-I

III. INTERFACE ENERGY METERS

1. Basic Features of Interface Energy Meters

a. The energy metering system specified herein shall be used for tariff metering for bulk, inter-utility power flows, in different States of India. Projection mounted type, Static composite AC 3-ph 4 wire meter shall be installed at interface points as a self-contained device for measurement of Voltage (V), Frequency (f), Active (Wh) and Reactive (VArh) energy exchanged in each successive user defined (5 min/15 min) time block. Meter time block shall be re-configurable at site for change of time block as specified by the Central Commission. All meters shall be compliant to IS 15959 and its amendments.

b. Each meter shall have a unique identification code, which shall be marked permanently on its front, as well as in its memory. All meters supplied to as per this specification shall have their identification code starting with "IEM", which shall not be used for any other supplies. "IEM" shall be followed by an eight digit running serial number, further followed by a "A" and "B" for the use with CT secondary of 1A and 5A respectively. This shall be mutually agreed between the buyer and the vendor.



c. The meters shall be suitable for communication with external device like modem, DCU, etc. which shall be able to communicate with CDCS for remote data transfer.

d. Auxiliary Supply to IEM- The meters shall normally operate with the power drawn from the VT secondary circuit (line-to line voltage of 110V); provided that there shall be provision to operate the meters from AC and DC (Range 110V to 220V DC) auxiliary power supply.~~The meters shall normally operate with the power drawn from DC auxiliary power supply (Range 110V to 220V DC)to reduce the Voltage Transformer (VT) burden~~. ~~In addition, there shall be provision to operate the meter from the Voltage Transformer (VT) secondary circuit having a rated secondary line-to- line voltage of 110V.~~ Necessary isolation and/or suppression shall also be built-in as per IS 14697 and its amendments, for protecting the meters from surges and voltage spikes from extra high voltage switchyards. The reference frequency shall be 50Hz. Also, the meter shall have suitable of ±15% tolerance for DC supply.

e. **Variation in CT/PT** The meters shall safely withstand the usual fluctuations arising during faults etc. In particular, VT secondary voltages 115% of Vref applied continuously and 190% of Vref for 3.0 seconds, and CT secondary current 150% of Iref applied continuously and 30 times of Iref applied for 0.5 seconds shall not cause any damage to or maloperation of the meters.

f. The meters shall continue to function for the remaining healthy phase(s), in case one or two phases of VT supply fails. In case of a complete VT supply failure, the computation of average values shall be calculated and recorded along with the time only for the period during which the VT supply was available in configured time block. However, the integrated parameters (active/reactive energy) shall not be affected and recorded as actuals

g. The total burden imposed by a meter for measurement and operation shall be defined as per IS 14697 and its amendments. An automatic backup for continued operation of the meter's calendar- clock, and for retaining all data stored in its memory, shall be provided through a long- life battery, which shall be capable of supplying the required power for at least 2 years. The meters shall be supplied duly fitted with the batteries, which shall not require to be changed for at least 10 years, as long as total VT supply interruption does not exceed two years.

h. The meters shall fully comply with all stipulations in IS 14697 and its amendments except those specifically modified by this specification. The reference ambient temperature shall be 27° C.

i. Each meter shall be provided with optical test output device (visual), as per IS 14697 and its amendments for checking the accuracy of active energy (Wh) measurement. The preferred pulsing rate is twenty (20) per Wh for CT sec-1A and four (4) per Wh for CT sec –5A.

j. **Exception Management**- The three line-to-neutral voltage shall be continuously monitored and in case any of these falls below defined threshold (80% of Vref), meter shall have suitable indication on LED/ LCD. The meter shall also have provision for low voltage event logging in meter memory in case of any phase voltage going below a defined threshold. The time blocks in which such a voltage failure occurs/persists shall also be recorded in the meter's memory with a symbol"*" if 3 Phase RMS voltage applied to the IEM is in between 25% to 80% of Vref and if Voltage is less than 25% of Vref, meter should record Zero voltage symbol "Z".

Commented [SS{S1]: To be deliberated in committee meeting

k. **Time Accuracy** - Each meter shall have a built-in calendar and clock, having an accuracy of 10 seconds per month or better. The calendar and clock shall be correctly set at the manufacturer's works. The date (year-month-day) and time (hour-min.-sec.) shall be displayed on the meter front on demand. Meter shall have the intelligence to synchronize the time locally from station control room or remotely from CDCS through software. All clock corrections shall be registered in the meter's memory-and suitably shown in the meter data report.

l. A touch key or push button shall be provided on the meter front for switching on the display and for changing from one indication to the next

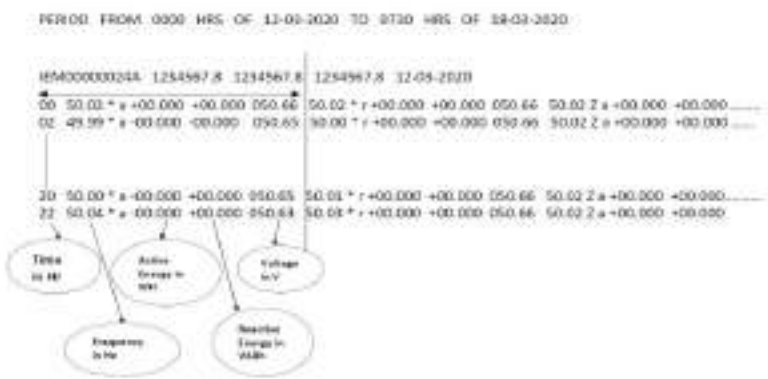


Fig 2 – Standard raw data format for IEM

There are 4 values in one 5 min time block. The first row shall contain the meter data for 2 hours, i.e. 24 time blocks, 00 hrs to 02:00 hrs. Similarly the 2nd row shall contain the data for the next 2 hours and henceforth.

m. Accuracy of IEMs under transients, frequency variations, voltage variations, unbalance, harmonics. Electromechanical influence and reverse phase rotation etc. shall be maintained as per IEC 62053-22 and its amendments.

n. Constructional Features

(i) The meters shall be supplied with compact and sturdy, metallic or moulded cases of non-rusting construction and/or finish. The cases shall be designed for simple mounting on a plane, vertical surface such as a control/relay panel front. Terminals shall have a suitable construction with barriers and cover, to provide a secure and safe connection of CTs and VTs leads through stranded copper conductors of 2.5 sq. mm. size.

(ii) All meters of the same model shall be totally identical in all respects except for their unique identification codes. They shall also be properly sealed and tamper evident, with no possibility of any adjustment at site as per IS 15959 (and its amendments) & CEA (Installation and Operation of meters) Regulations 2006 (and its amendments).

(iii) The meters shall safely withstand, without any damage or mal operation, reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. in accordance with IS-14697(~~-~~and its amendments) & CEA (Installation and Operation of meters) Regulations 2006 (and its amendments).~~.~~

(iv) They shall have at least IP51 category dust tight construction, and shall be capable of satisfactory operation in an indoor, non-air conditioned installation & outdoor installation in a panel

(v) The meters shall have built-in facility (e.g. test links in their terminals) for in-site testing-

(vi) The meter shall be immune to external influences like magnetic induction, vibration, electrostatic discharge, switching transients, surge voltages, oblique suspension and harmonics and necessary tests shall be carried out in accordance with relevant standard.

o. **Data Security**: Data security shall be as per

i. IS 15959 (three layers of security) and its amendments,

ii. Cyber Security guidelines issued by the Central Government, time to time &

iii. The technical standards for communication system in Power Sector laid down by the Authority.

2. Measurement

a. The active energy (Wh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy as per class **0.2S** (IS 14697).

b. The meter shall compute the instantaneous active power (W) sent out from the substation busbars in each successive 1 min block, and store it in its memory up to two decimal place.

c. The meter shall compute the net active energy (Wh) sent out from the substation bus bars during each successive time block, and store it in its memory up to two decimal place. Further Wh data in .NPC/output report shall be rounded upto two decimal.

d. The meter shall count the number of cycles in VT output during each successive time block, and divide the same by time (in sec)to arrive at the average frequency. The least count of the frequency data shall be 0.01 Hz. The frequency data shall be stored in the meter's memory in Hertz up to two decimal. Further Wh data in .NPC/output report shall be rounded upto two decimal.

e. The meter shall continuously compute the average of the RMS values of the three line- to-neutral VT secondary voltages as a percentage of 63.51 V, and display the same on demand. The accuracy of the voltage measurement/computation shall be at least 0.5%,. The voltage data shall be stored in the meter's memory in volts up to second decimal. Further Wh data in .NPC/output report shall be rounded upto two decimal.

f. The Reactive energy (VARh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy of 0.5S as specified in IS 14697 and its amendments. The meter shall compute the net Reactive energy (Net VARh=(VARh Export- VARh Import)) sent out from the substation bus bars during each successive time block, and store it in its memory up to second decimal. It shall also display on demand the net VARh sent out during the previous time block. Further Wh data in .NPC/output report shall be rounded up to second decimal.

g. The meter shall also integrate the reactive energy (VARh) algebraically into two separate registers, one for the period for which the average RMS voltage is above 103.0%, and the other for the period for which the average RMS voltage is below 97.0%. The current reactive power (VAR), and cumulative reactive energy (VARh) readings of the two registers (>103% and <97%) shall be displayed on demand. The readings of the two registers at each midnight shall also be stored in the meter's memory. When reactive power is being sent out from substation bus bars, VAR display shall have a plus sign or no sign and VARh registers shall move forward. When reactive power flow is in the reverse direction, VAR display shall have negative sign and VARh registers shall move backwards. Generally, the standard PT ratios are 132 kV/110 V, 220 kV /110 V, 400 kV /110 V and 765 kV / 110 V. However, at the time of commissioning the vendor may confirm the same from site (authorized sign) and configure the meter accordingly to ensure correct recording of reactive energy.

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h. For reactive power (VAR) and reactive energy (VARh) measurements, IS14697 shall be complied with. The accuracy of measurement of reactive energy shall be as per the standard.
i. Further, the meter shall continuously integrate and display on demand the net cumulative active energy sent out from the substation bus bars up to that time. The cumulative net Wh reading at each midnight shall be stored in the meter's memory. The register shall move backwards when active power flows back to substation bus bars.
j. Errors for different power factors shall be as defined in IS14697 and its amendments.
k. The harmonics shall be filtered out while measuring Wh, V and VARh, and only fundamental frequency quantities shall be measured/computed.

3. Memory/ Storage

a. Each meter shall have a non-volatile memory in which the following shall be automatically stored:

   i. 1 min Instantaneous Active Power in MW up to second decimals.

   ii. Average frequency for each successive time block, in Hertz up to second decimals.

   iii. Net Wh transmittal during each successive time block, up to second decimal, with plus sign for active power sent out from station busbars and minus sign for active power received into the busbars.

   iv. Net VARh transmittal during each successive time block, up to second decimal with plus sign for reactive power sent out from station busbars and minus sign for reactive power received into the busbars.

   v. Cumulative Wh transmittal at each midnight, in eight digits including one decimal.

   vi. Cumulative VARh transmittal for voltage high condition, at each midnight in eight digits including one decimal.

   vii. Cumulative VARh transmittal for voltage low condition, at each midnight, in eight digits including one decimal.

viii. Average RMS voltage for each successive time block.

ix. Date and time blocks of failure of VT supply on any phase, as a star (*)/ (Z) mark.

b. The meters shall store all the above listed data in their memories for a period of minimum fifteen (15) days.

4. Display

Each meter shall have digital display for indication of the following (one at a time), on demand:

i) Meter serial no.: IEM12345678A or IEM12345678B

ii) Date (year month day /yyyy mm dd) : 20160311 d

iii) Time (hour min sec /hh mm ss) : 195527 t

iv) Cumulative Wh reading : 1234567.8 C

v) Average frequency of the previous block : 49.89 F

vi) Net Wh transmittal during the previous block with +/- sign: - 28.75 E

vii) Net VARh transmittal during the previous block with +/- sign : - 18.75 R

viii) Average % Voltage : 99.2 U

ix) Reactive power (VAR) : 106.5 r

x) Voltage - high VARh register reading : 1234567.5 H

xi) Voltage - low VARh registerl reading : 1234567.4 L

xii) Low battery indication

xiii) The three line-to-neutral voltages shall be continuously monitored and in case any of these falls below 80 %, then preferably, the corresponding flashing LED provided on meter's front shall become steady. They all shall go off if all three voltages fall below 80 %. The LED shall automatically resume flashing when all VT secondary voltages are healthy again.

xiv) The two VARh registers (x and xi) shall remain stay-put while VT supply is unhealthy.

Navigation keys to be provided at the meter front plate to navigate the display menu.

5. Communication Port

a. All the meters shall have at least three ports. . One of these ports shall be compatible for Ethernet traffic through which all the data stored in the meter's memory shall be transferred to DCU. The data between Meter and DCU is exchanged using Ethernet standard frame structures defined in IS15959.

The second port shall be front Optical port suitable for admin access / meter configuration/ local data downloading. The admin port is password protected for access and the meter configuration is to be done through admin port using Laptop and optical to USB convertor. Optical to USB convertor cable of suitable length to be supplied at every location. (Third port shall be Rs485 as spare and shall be used for meter data access in case of any eventuality. One number RS485 to USB convertor cable of suitable length to be supplied at every location.

b. The galvanic isolation of these ports is such that no external electrical induction on cable degrades the performance of the meter. Meter data shall be tamper-proof.

c. Data collection on any local laptop/PC shall be possible by installing data collection software. It shall be ensured that data transfer through Optical to USB interface shall be unidirectional only i.e. from Meter to external storage device in an authentication process.

6. Quality Assurance

All equipment, after final assembly and before dispatch from manufacturer's works, shall be duly tested to verify that is suitable for supply to the Owner. Type, Routine & Factory Acceptance Tests (FAT) shall be carried out on the meters in line with relevant standards.

i. Type Test-

b. The meters shall be subjected to the complete range of type tests as per IS14697 and IS15959 and their amendments and other applicable standards, after final assembly. At least three samples shall be offered to employer for choosing any one meter for Type Testing. In case of any failure to pass all specified tests, the bidder shall arrange to carry out the requisite modifications/replacements in the entire lot of meters at his own cost. After any such modifications and final assembly, again three samples shall be offered to employer and two (2) meters selected out of the lot by the Owner's representative shall be subjected to the full range of type tests. The lot shall be accepted by the Owner only after successful type testing.

c. The type tested meters shall not be supplied/installed. The Bidder shall arrange all type testing specified above, and bear all expenses for the same.

d. Type Tests shall be certified or performed by reputed laboratories using data sheets and test procedures that have been approved by the Employer. Type test conducted once shall be valid for 5 years for the same model. Copy of Test certificate shall be submitted to Employer/OWNER

ii. Routine Test-

All Routine Test shall be carried out as per IS 14697 and its amendments.

iii. **FAT-**

During the FAT IEMs after final assembly and before dispatch from Bidder's/Manufacturer's works shall be duly tested to verify that they are suitable for downloading data using meter communication ports shall be subjected to the following acceptance test.

i) Downloading Meter Data from the Meter(s) to PC via admin Optical port.

ii) Downloading meter data to DCU through Ethernet port. IEMs along with convertor, Optical Switch, DCU shall be integrated with the PC for demonstration.

iii) Downloading Meter Data from the Meter(s) to PC via RS 485 port.

iv) Functioning of Time synchronization.

e. A procedure/schedule for the above demonstrations shall be submitted to the employer for approval. Copy of Test certificate shall be submitted to Employer/OWNER

iii. SAT-

Integration of DCU to CDCS shall be demonstrated at site incoordination with IEMDC/RLDC. Employer shall ensure FO connectivity upto IEMDC/RLDC.

7. Installation and Commissioning

The static energy meters specified above shall be installed at various EHV substations owned by the Owner, ISTS licensee, Inter State Generating Stations, DISCOMs and other agencies, throughout India. The tentative list of substations along with the existing number of meters is enclosed as Annex-I. The exact location for installation shall be provided in consultation with site in-charge.. In case of replacement of old meters during the transition, the new meters will be connected in series of the existing meter subject to space availability..

a. The Bidder shall be responsible for total installation and commissioning of the meters (along with test blocks, if supplied separately) as per Owner's advice, including unpacking and inspection on receipt at site, mounting the meters on existing control and relay panels at suggested height, connection of CT and VT circuits including any required rewiring, functional testing, commissioning and handing over. The Bidder's personnel shall procure/carry the necessary tools, equipment, materials and consumables (including insulated wires, lugs, ferrules, hardware etc.)

b. As part of commissioning of DCUs the Bidder shall load the required software in the Laptop/PC at the respective substations, and fully commission the total meter reading scheme.

c. Operating manual (.pdf as well as hard copy) of the meter containing all details of the meter, various data downloading features, etc. shall be made available at site.
d. Following technical information shall be furnished by the Bidders in their offers:
    i) Foreseen dimensions of proposed meter.
    ii) Expected weight of proposed meter.
    iii) Dimensions and weight of the test block, if supplied separately.
e. Every meter installed shall be time synchronized through SNTP server from IEMDCs/RLDC.

8. Training

Hands on training program for personnel at Generating Stations/Transmission substation shall cover the following:

- Features of IEM, DCU, Communication Interface.
- IS/IEC protocols.
- Extension of Auxiliary Supply, CT/PT connection.
- Time synchronization through station GPS, Time correction through software.
- Data downloading from IEM.
- Data uploading through web interface.
- Installation of software in local PC/Laptop.

System Diagnostics Minimum duration of training program is Two Hours.

9. General

a. The IEMs shall be supplied with version of firmware.
b. The meter shall be supplied with software (compatible with old & new meters data download handling).
c. Software for windows/office/antivirus to be supplied for DCUs at substation.. Antivirus should not slow down processes and same will be demonstrated during technical demonstration.
d. .
e. Meter shall be accommodated in existing C&R panel in door closed condition. If required before bidding, bidder may collect necessary data by visiting the site..
f. Step by Step procedure (on screen shot type and desktop video capture) shall be provided for
    i. Installation/Re-installation of Database handling software in to Laptop / PC
    ii. Meter maintenance/site-testing procedure as per relevant IS/IEC standard.
    iii. Procedure for data downloading from Meter by Laptop/Desktop PC.

10. .Dismantling / Buy-Back of Existing IEM

Bidder is responsible for dismantling of old special energy meters and to purchase on buy back basis on successful installation of new IEMs in case of replacement of old meters.

IV. DATA CONCENTRATOR UNIT (DCU) & OPTICAL SWITCH

1. Basic Features of DCU

A Data Concentrator Unit (DCU) installed at each location will act as interface between IEMs and Central Data Collection System (CDCS) at IEMDCs/RLDCs. DCU shall collect data from energy meters (upto 35 IEMs/DCU) and send the same to CDCS at IEMDCs/RLDCs. DCU shall also report diagnostic information of the energy meters to CDCS.

a. Acquiring energy and status data from energy meters

DCUs shall be connected with local energy meters through Ethernet to Optical convertors & Optical Switches in between. Connection to the local energy meters shall be firm and secure from any unintended disconnection. DCU should implement IEM protocols.

b. Providing Energy Data and Status to CDCS

DCU shall accept following commands from CDCS/GPS Clock and shall function as per the command:

- **Energy data collection from energy meters**- . DCUs shall query meter data and transfer the same to CDCS based on the command received from CDCS. Command may be for one time demand of data or it may be on cyclic basis. CDCS takes the updated Database from these DCUs and create suitable Database in its memory. DCU shall be able to query data from all or selected energy meters for the selected period based on the command from CDCS. DCUs shall be able to read meter data from all make of energy meters supplied as per this Technical Specification.

  Each meter has a unique identification number and each meter location has unique identification code. DCU shall collect data from a single or group of meters based on meter number or meter location code. DCUs shall collect data from IEMs and transfer the same to CDCS. As DCU functions on read and forward philosophy for IEM data, no storage is envisaged in the DCUs for meter data.

- **Acquiring status and alarm from energy meters**- DCUs shall acquire connected IEM details like meter identification number, make etc. periodically as well as whenever it's powered on. Any meter change activity like meter number etc. shall be reported to CDCS immediately.

  DCUs shall be self-monitoring for alarm like power failure, communication disconnection, and disconnection from energy meters and report the same to CDCS immediately.

DCUs shall have non-volatile memory for storing status data of IEMs duly time stamped, details of connected meters like make, meter number, status change. Non-volatile memory should be able to store such data for at least one month in round FIFO buffer.

- **IEM clock synchronization with GPS clock-** DCU shall have the intelligence to synchronize the IEM clock time. Input signal to DCU shall be from CDCS (at IEMDC/RLDC) GPS clock. If CDCS clock synch signal is not available to DCU, DCU will get GPS clock reference from station GPS. DCU shall function as SNTP servers to the IEMs and SNTP clients to CDCS SNTP servers.

c. **Providing Energy Data to Local PC/Laptop-**DCU shall provide meter status, alarm etc. and data to local personal computer, if required. Local PC shall be able to query meter data from selected or all IEMs by using basic meter downloading software. All communication with local computer shall be password protected. PC for data downloading at each DCU location shall be arranged by respective site/ utility.

d. **Displays**- Each DCU shall be provided with indicative LEDs for monitoring of- Power supply status, health of DCU, LAN ports for link/activity.

e. The DCU shall be powered from the station battery supply rated at 220V/110V DC supply.

f. DCUs shall accept only digitally signed files for Firmware updates, Package updates, License updates.

g. Only root user shall have rights to modify/delete DCU logs.

h. The data exchange is controlled as per the IS 15959 :2011 standard and its amendments.

i. **Constructional Features**

- DCU shall be a self-contained, stand-alone, tamper proof sealed box with necessary ports for external connection.
- DCU shall not have any removable parts such as a hard disk, to ensure smooth and reliable operation for long term.
- All external connections to DCU should be secure so as to avoid accidental disconnection.
- DCU shall be able to operate in environment with temperature up to 50ºC and humidity up to 90% without any significant effect on its performance.
- The mechanical design and construction of each unit sub-assembly shall be inherently robust and rigid under various conditions of operation, adjustment, replacement, storage and transport.
- DCUs shall also withstand, without any damage or mal-operation, reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. They shall have at least IP-51 category dust-tight construction and shall be capable of satisfactory operation in an indoor, non-air conditioned installation.

j. **Communication Ports**

- 6 Ethernet ports for data communication.
- DCU shall be capable of sending data simultaneously through two discrete ports to Main and Back-up CDCSs through separate physical FO channels.

- DCUs shall be provided with a RS-485 as Spare

Annexure - A

Technical Specification for Interface Energy Meters, Automated Meter Reading System and Meter Data Processing for Inter State Transmission System

……..

ABBREVIATIONS

S.No	Acronym	Definition
1	AMR	Automated Meter Reading
2	ATP	Acceptance Test Plan
3	CDCS	Central Data Collection System
4	CMRI	Common Meter Reading Instrument
5	C&R	Control & Relay
6	CTU	Central Transmission Utility
7	DCD	Data Collection Device
8	DCU	Data Concentrator Unit
9	DSM	Deviation Settlement Mechanism
10	EA	Energy Accounting
11	EHV	Extra High Voltage
12	FAT	Factory Acceptance Test
13	FTE	Full Time Equivalent
14	GPRS	General Packet Radio Service
15	GSM	Global System of Mobile
16	HHU	Hand Held Unit
17	IEC	International Electro-technical Commission
18	IEEE	Institute of Electrical and Electronics Engineers
19	IEM	Interface Energy Meter
20	IP	Ingress Protection
21	IS	Indian Standard
22	ISTS	Inter State Transmission System
23	LAN	Local Area Network
24	MDP	Meter Data Processing
25	NMS	Network Management System
26	OEM	Original Equipment Manufacturer
27	PCB	Printed Circuit Board
28	RDBMS	Relational Database Management System
29	RMS	Root Mean Square
30	SAT	Site Acceptance Test
31	SEM	Special Energy Meter
32	SRS	Software Requirements Specification
33	TOC	Taking Over Certificate
34	VPN	Virtual Private Network
35	WAN	Wide Area Network
36	RLDC	Regional Load Despatch Centre
37	RPC	Regional Power Committee
38	IEMDC	Interface Energy Meter Data Centre

Part-II

I. CENTRAL DATA COLLECTION SYSTEM (CDCS)

1. Intent of CDCS

The intent of CDCS proposed in this document is collection of meter data at a user configurable rate including 1 minute instantaneous MW data from each meter/location to IEMDCs/RLDC followed by validation, processing and generation of customized reports.

The data shall be stored in Standard RDBMS and archived in Historian at CDCS. Finally the processed data shall be integrated to RLDC Energy Accounting software for Deviation Settlement calculation .

2. Basic of Central Data Collection System

CDCS are heart of the system. In this project two CDCS are envisaged one main and other back-up, located at different locations. A Central Data Collecting System provided at IEMDC/RLDC will manage all functionalities of collection of data through DCUs, validation and verification of the data, storage of the data in ORACLE/ Standard RDBMS such as SQL/ORACLE database and management of the complete AMR system.

CDCS at IEMDC/RLDC shall have a scheduler for scheduling the task of collection of data periodically as per the selected time block interval. It has server class machines networked along with Historian. Main IEMDC and Back-up IEMDC shall communicate with each other in ICCP protocol. Both are always engaged in health monitoring of each other. In case main IEMDC fails, failover process brings the backup in less than 1 minute. Firewall must be proposed at all vulnerable points.

Architecture for ISTS Metering with AMR-CDCS system is attached as Appendix-A

The Bidder shall provide the necessary software which would enable CDCS to

i) Have polling feature along with a task scheduler to run the data downloading software at a pre-designated date and time repeatedly or by manually selecting a meter. A detailed activity log shall also be available for each downloading operation.

ii) Fetch the meter data from all metering points and process the same in its server in user defined formats (text, csv, xls, etc.) in a user-defined file name (file name format must be dd-mm-yy substation name-utility name).

iii) Fetch 1 min instantaneous Active Power (MW) data from all connected IEMs

iv) There should be provision to select multiple meter data files based on filename, and convert all selected files with single key-stroke and store the text files in the same location where binary files are stored.

v) Display the collected data on PC's screen in text format, with forward/backward rolling.

vi) Print out in text format the data collected from one or more meters, starting from a certain date and time, as per operator's instructions.

vii) Providing access to RLDC for Energy Accounting software to download all meter related data from CDCS system in standard formats such as .csv, xlsx, text etc. through authenticated login on Web Portal. The CDCS system should provide standard API features (preferably RESTful APIs such JSON etc) to enable data exchange between IEMDC/RLDC and existing Energy Accounting software at RLDCs.

viii) Access to SLDCs to provide user based access to view instantaneous MW data through WEB portal.

The above software shall further ensure that absolutely no tampering (except erasing of complete data with password protection) of the collected metering data is possible during its handling by the PC.

The software shall be suitable for the commonly available PCs, (Windows) and shall be supplied to Employer in a compatible form to enable its easy loading into the PCs available (or to be installed by the Employer) at the various substations.

3. Scope of Work

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This section provides detailed scope of work included in the bidder's scope, and facilities to be provided by station owner/employer.

2.1 Bidder's Scope of Work

The scope of work in complete conformity with subsequent sections of the specification shall include site survey, planning, design, engineering, manufacturing/integration, testing, supply, transportation & insurance, delivery at site, storage, installation, commissioning, demonstration for acceptance, training and documentation of AMR-MDP system including:

a. Design Document for complete AMR -MDP System including software specifications.
b. All hardware including application Servers, Database and RDBMS etc at IEMDCs/RLDC.
c. Making data available up to CDCS system at IEMDCs/RLDC.
d. Standard database (RDBMS) for storage of data at IEMDCs/RLDC.
e. All cabling, wiring, terminations and interconnections of the equipment.
f. Database development, Displays and Reports.
g. Archival and retrieval of data through Standard RDBMS such as SQL/ORACLE database at IEMDC/RLDC
h. Interconnection of main CDCS with Back-up CDCS on ICCP
i. The complete system shall be in line with established cyber security standards.
j. Training of personnel (Substation, SLDC, CTU, RLDC and RPC)

2.2 Exclusions from Bidder's Scope of Work

Followings are not included in the scope of the bidder and shall be provided by local station without any extra cost to bidder:-

a. Space for installation of IEMs, Optical Switches, DCU, CDCS at respective locations

b. Auxiliary Power Supply for IEMs, Optical Switches, DCU at each location and server system at CDCS.

c. Provision of static IP (to be provided by POSOCO) and internet connection at IEMDCs/RLDC

d. Building, air conditioning systems and other infrastructures.

~~e.~~ PC required for data downloading at each location.

f. Facility shall be provided for the RLDCs/NLDC to be able to receive raw data from the IEMDC using Secure File Transfer Protocol (SFTP-SSH protocol) also

g. Integration of CDCS data into Existing Energy Audit software by POSOCO

Any other work which is not identified in 2.1 & 2.2 or in the specification but is required for completion of the project within the intent of this specification shall also be in the scope of the Bidder without any extra cost.

4. General Requirements

3.1 CDCS

- System shall support entry / addition of data manually by an authenticated RLDC user.
- Uploading meter data files manually to the AMR system by an authenticated user shall also be supported.
- Data collection system shall use multi-tier, Purdue Enterprise Reference Architecture having separate tier for DMZ, database, application server and client.
- The Application shall be secured with password-protected access. It shall support multiuser access with role-based security. Access control and account management system shall be deployed to look after account and access control in systems, application and services deployed in AMR-CDCS-MDP systems. Centralized user authentication (e.g. LDAP) and authorization server shall be deployed. All users shall use a unique ID to access AMR systems and applications. Passwords shall be set in accordance with the Password Policy. System and application sessions must automatically lock after 15 minutes of inactivity.

Minimum configuration of servers may be :-

Server : (Minimum Requirement)

- 2 X Intel Xeon E5-2667 v4 3.2 GHz,25M Cache,9.6GT/s QPI,8C/16T (135W) Max Mem 2400MHz Cache 8MB.
- 128GB RDIMM,2400MT/s
- 1TB hot pluggable, RAID 5 for Server Internal HDD
- Remote Management- Shall be able to manage through dedicated 1G remote management port with Remote Access Controller with KVM redirection. Any licenses required for KVM redirection should be included with support for 5 years.
- DVD+/-RW SATA Internal
- Power Supply and Fans-Dual, Hot-plug, Redundant Power Supply(1+1). Redundant hot swap fans.
- USB 3.0 ports-4 nos.(minimum)
- Supported OS as per the requirements and latest technology
- Form Factor -1U Rack with rack mounting kit
- Management Software - Server management software with power management features and 5 years support should be included
- NIC Port - 4 X 1Gbps NIC card
- Office 2019 Business (64 bit) or latest.
- Operation System: latest
- 23" Wide TFT Monitor
- Makes: HP/DELL/Lenovo /equivalent
- CPU should be latest model fully compatible with the application.

Client PC Specification:(Minimum Requirement)

- Processor – 1 x Intel i5 -7300U (3M cache, 2 Cores, 4 Threads 2.60 GHz) CPU
- Memory- 1 x 16GB Dual Rank x8 DDR4-2666 SODIMM (expandable up to 32 GB)
- Hard Drive - Configured with 1 x 1TB SATA 6G Read Intensive M.2 Drive
- Graphics: Intel Integrated Graphics or Higher
- Ports- One SD Card slot,1 GbE management Port, 2 1GbE port,2 USB 2.0 port, 2 USB 3.0 and 1 HDMI Port
- Integrated sound controller; Gigabit Ethernet controller; DVD writer dual layer ; 104 Keys OEM Keyboard and OEM Optical Mouse; all necessary Plug-ins/utilities and driver software, bundled in CD/DVD Media
- 4 USB Port
- 23 " TFT Monitor
- Windows 10 Professional or latest, MS office 2019 or latest

External & Internal Firewall :(Minimum Requirement)

All firewalls shall be hardware box firewall and shall be complied with the operational requirements of the project. The firewalls shall meet the following requirements:

- The Firewall proposed family should attain Common Criteria EAL4+

- Firewall shall belong to product family which minimally attains Internet Computer Security Association (ICSA) firewall Product Criteria 4.1 Certification
- The proposed system shall comply/support industry standards, supports without additional external solution, hardware or modules: IPSEC VPN, PPTP VPN, L2TP VPN, and SSL VPN
- Firewall should support profile base login account administration, offering gradual access control such as only to Policy Configuration & Log Data Access
- The system shall be able to provide outbound Wan link load-balancing capabilities
- Shall support assigning of zones to virtual and physical interfaces and assigning of firewall policies between zones, physical interfaces and virtual interfaces
- Port Forwarding
- IEC 61850-3 compliance or better
- NERC-CIP Compliance
- IP20 rating

1. Routing requirements in FW:

- Sufficient number (considering future requirements as envisaged in the project) of Ethernet interfaces 100Mbps/1Gbps routable ports.
- Hot standby operation with a similar router and fail-over to backup router on wan link failure, Pre-empt mode.
- IEEE 802.3u: Auto-negotiation
- IEEE 802.3x, 802.1p: flow control and prioritization,
- IEEE 802.1Q: VLANs tagging, maximum 255 VLANs,
- IEEE 8021.1d, 802.1w: Spanning Tree
- IEEE 802.3ad-Link Aggregation
- Firewall should have integrated quality of service (802.1p) and Traffic Shaping functionality including these features:
- capable of enable and disable traffic shaping per firewall policy
- capable of setting guarantee bandwidth per firewall policy
- capable of setting maximum bandwidth allocated per firewall policy
- capable of setting minimally 3 levels of prioritization
- ability to pass Differentiated Service tagging
- Shall support simultaneous operation with both IPv4 and IPv6 traffic
- Dynamic IP Routing - OSPF, OSPF with authentication (MD5), RIP v2, & BGP
- Shall support unicast as well as multicast IP Routing (IGMP)
- OSPF Route filtering
- The system shall be able to operate as a Protocol Independent Multicast (PIM) version 2 routers.
- Shall support NAT (Network Address Translation) including dynamic and static NAT translations.

2. Management & monitoring Features

- Firewall appliance should be 1U/2U size and rack mountable and have redundant power supply arrangements
- LEDs for indication of Port activity as well as presentation of major alarms
- Shall have System Management interface using Web UI (https) and Command Line Interface (console/telnet/SSH).
- SNMPv3 for monitoring from Network Management system, The device shall log events send SNMP traps, send alert email when fail-over occurs
- Diagnostics with logging and alarms
- SNTP/NTP based clock synchronization
- Different privileges for different users. Administrator authentication to be facilitated by local database, PKI & remote services such as Radius, LDAP and TACACS+ with option of 2 factor authentication
- Memory for Storage of logs for at least 1 week
- Shall support events logging/monitoring features using syslog, email, and VPN Tunnel Monitor.
- Shall have definition updates for virus/signatures/engine upgrade/software patches for the complete AMC period.
- Shall operate in Active/Passive with State Synch and Active-Active complete UTM features with High Availability features like Load balancing, failover for Firewall and IPsec VPN. Any other operations mode, which does not result in loss of session (including IPsec VPN sessions), is also acceptable.
- Firewall should have integrated SSL VPN gateway functionality and should support 10000 concurrent SSL users
- Firewall should support 200000 New sessions per second
- Firewall should support 500000 Million concurrent sessions

3. Security Features in Firewall:

- Shall have provision to configure multiple IP Sec VPNs, at least 500 (?) nos., (one-to-many or many-to-one). Shall support redundant operation with a similar router after creation of all the IP Sec VPN.
- IPSec VPN (Virtual Private Networking) support ESP protocol with encryption 3DES (168 bits), AES 128-, 192-, 256- bit and hashing algorithm like MD5 , SHA-1, IKE, PKI (X.509) and IKEv2 with EAP.
- Firewall should have at least 1 (?) Gbps of IPSEC VPN throughput and 500 (?) Mbps of SSL VPN throughput.
- Stateful packet inspection with NAT and filter Protocols such as FTP, SMTP, HTTP, HTTPS, SNMP, UDP, ICMP, RPC, DNS, DHCP, ARP, TCP, POP3, XML, and content filter for JAVA & ActiveX blocking.
- IP firewall features – address filtering, port inspection & filtering. Shall filter packets (both incoming and outgoing) based on Source address, Destination address, Protocol type, User, Port number, URL, applications, etc.
- Shall have to provision to define application control list based on selectable application group and/or list and its corresponding actions

- The solution should be able to enable or disable Web Filtering per firewall policy or based on firewall authenticated user groups for both HTTP and HTTPS traffic
- Shall have Denial of service (DoS) & Distributed Denial of Service (DDoS) prevention. DOS and DDOS protection should be applied and attacks stopped before firewall policy look-ups, AV scan.
- Shall have network IPS as an integral part or have tight integration with the Network Intrusion Prevention System (NIPS)
- IPS solution should have capability to protect against Denial of Service (DOS) and DDOS attacks.
- Enable/disable ports, MAC based port security. VLAN (802.1Q) to segregate and secure network traffic, VLAN - port based support.
- Firewall rules should be applicable to normal traffic and IPsec VPN traffic.
- IPS and application control–support for industrial provision and offline signature/patch update. Firewall IPS throughput of at least 1(?) Gbps
- Shall support IPv6 features like DoS attack detection, SIP, RTSP, RPC, RIPng, BGP4, DHCPv6 Relay, IPv4 to IPv6 translations & encapsulations, etc.
- SNMPv3 encrypted authentication and access security
- Shall have protection against Antivirus, anti-worm, anti-spam and anti-spyware as applicable.
- The system should be able to block, allow or monitor only using AV signatures and file blocking based on per firewall policy based or based on firewall authenticated user groups with configurable selection.
- Firewall antivirus throughput of at least 1 Gbps (Flow Based)
- Shall have provision for Zone based IP Spoofing
- Shall have protection against malformed packet
- Shall have DNS attack prevention features
- Shall have Brute force attack mitigation
- Shall support DLP capability. It shall be configured by creating individual rules for the following protocol & activities such as AIM, ICQ, MSN, Yahoo!, HTTP/HTTPS POST, HTTP/HTTPS GET FTP PUT, GET, SMTP, IMAP, POP3, SMTPS, IMAPS, POP3S, and NNTP.
- Shall have deep packet inspection capability and it shall have the ability to intercept and inspect content of SSL encrypted traffic

<u>LAN Switch :(Minimum Requirement)</u>

- ISO8802 or IEEE 802 Series Standards
- LAN switch shall be a rack-mountable with 1U form factor.
- The switch should have hot-swappable and field-replaceable internal redundant power supply and fan from day one.
- Layer-3 switching & VLAN
- Minimum 8- 1 Gbps Ethernet ports (However, the no. of ports in a LAN switch shall be as per the network architecture. Vendor has to provide required no. of switch as per

the requirement of technical specification)

- The switch should have 1x USB Console Port, 1x OOB management port, and 1x serial console port.
- Flash Memory- 128 MB or more and DRAM 512MB or more.
- Cat 6 or higher bandwidth cable
- The switch should support hardware-based ACL with support for VLAN, Port, MAC, and IP based ACLs.
- The switch should support SNMPv1, SNMPv2c, and SNMPv3.
- The Switch should be manageable through SSHv2, SSL, and/or SNMPv3 etc.
- All Functionalities of Switch shall be IPv6 compliant and it should work on IPv6 Platform without any additional hardware/software.

GPS based time facility :(Minimum Requirement)

- Minimum 2ppm time stability of internal time base
- Feature of Propagation delay compensation .
- Feature includes an offset to permit correction to local time
- Feature of reverting to internal time base upon loss of signal from UTC source
- Resynchronization delay should not be more than 5 minutes
- Accuracy of synchronization must be less than 1.5 micro Sec
- Minimum port details: 2 no Ethernet ports, 2 IGIG-B port

SAN Storage :(Minimum Requirement)

- Minimum 10 TB capacity. Min 50% expandable including slots with storage enclosure.
- 1 number spare HDD
- RAID level-5
- 16 Gbps FC interface port
- Snapshot features with license
- Hard Drives speed-10000

The above-mentioned hardware specification is minimum requirement, if the vendor ABT application requires higher configuration than vendor has to quote for the same. After supply of material during commissioning or during observation period if any server hardware/software up gradation required than it shall be in vendor scope. The contractor shall ensure that at the time of final approval all the hardware must be as per latest technology and industry standard.

5. Functional Requirements

4.1 Central Data Collection System (CDCS)

A central data collection system (CDCS) shall be provided at IEMDCs for collection and processing of data from DCUs installed at remote locations. The software provided at IEMDCs will manage all functionalities of collection of data through DCUs, validate the data, store the data in a database, and manage the complete system. Software will also have a scheduler for scheduling the task of collection of data periodically. The periodicity of data collection shall be user defined.

CDCS shall perform following functions:-

- Communication with DCUs.
- Collection of energy data from DCUs.
- Collection of status/alarm data form DCUs
- Remote Configuration of DCUs
- Time synchronization of DCUs/IEMs
- Processing of meter data.
- Storing of data.
- Providing data to energy accounting software.
- Reporting functions.
- Monitoring and Alarm generation.
- Audit trail and logging.
- Meter management.
- Shall have user Interface for
- CDCS shall include a web based application for utilities/stations to manually upload the data in case of AMR communication system failure due to any reasons. The following shall be taken care of in this regard:

    - The web application link shall be made accessible to all stations through RLDC website.
    - The downloaded data shall be in encrypted format.
    - Each utility shall be given User name and Password for login the web application.

    - Browser shall have the list of all Utilities and its station names.
    - Each station shall upload the encrypted data by selecting their Utility name and Station name.
    - Web Application shall generate the confirmation message to the station on successful uploading of data.
    - Web application shall generate the popup message at CDCS with Utility name and Station name on receipt of data.
    - All the encrypted data received at CDCS via web application shall be stored in predefined path.
    - CDCS shall have the provision to decrypt the data and store in the database for the further processing.

4.1.1 Processing of energy data

Collected energy meter data shall be provided to the data processing module. The time block period of the raw output from CDCS shall be used defined (5-min/15-min). This module shall check the data for completeness, error etc. and if any error is found, the same shall be displayed as an alarm.

4.1.2 Storing of data

If collected data is error free, it shall be provided to a data storage module. Data storage module shall load the collected energy data in to the database as per its structure. Archival of data shall be through Standard RDBMS such as SQL/ORACLE data base.

4.1.3 Providing data to energy accounting software

CDCS should have software module for providing energy meter data from the database to the energy accounting software. The data output shall be in the form of text file (as per RLDC standard text file format) or as query based output.

4.1.4 Reporting

CDCS shall have data reporting capability implemented through a separate dedicated module. Reporting module should be able to give report output on screen, in pdf or in XLS/csv form.

4.1.5 Monitoring and Alarm

CDCS shall generate an alarm whenever "data not received" occurs for one or more times for one or more DCU/IEM data. The alarm shall indicate which DCU/IEM has the problem.

All Alarms (such as loss of supply to IEM, DCU failure, Communication failure, AMR failure etc.) to be generated in CDCS within 5 min. of the event.

4.1.6 Performance levels for AMR and CDCS

Data from all the installed IEMs shall be received at CDCS within 8 hours after the scheduled hour. Report for missing data if any shall be generated instantly on demand.

Issues observed in data collection, processing, report generation etc. shall be flagged by RLDC to the vendor for redressal in line with the Emergency Support Response/Resolution time as per table XI-4.

4.1.7 Audit trail and logging

CDCS should have audit and logging function for each and every activities either completed successfully or failed.

The system shall provide audit trail of user and system activities that enables data changes to be tracked and reported, including changes made by the system administrator.

For editing of energy meter data, the system shall record the following information in a log and store it for a minimum of 12 months:

- User ID
- Date and Time of Change

User shall be prompted to input a reason for editing using either a standard reason code or a freeform text field. In addition to data stored in the edit log, each interval containing edited data shall be marked with a status to indicate that the data has been edited. The pre-edited value shall be stored in the database as a previous version, which can be retrieved using "as- off" date functionality.

Changes to configuration data by users shall be logged by date, time, and user ID and such logs shall be stored for a minimum of 12 months.

Critical changes relating to measuring parameters (pulse multipliers, transformer ratios, etc.) and formulae change shall be stored indefinitely as a previous version. The database for these is to be maintained in CDCS.

For regular system tasks, such as meter communication, task processing, validation, etc. the information will be kept for minimum one month.

It should have provision of full data and system audit ability such as version controls and data retrieval according to the date and time. Additionally, all versions of meter data shall be stored such that they may be retrieved by "as-off" date for user to inspect.

6. System Sizing and Performance Requirements

AMR System shall meet the following system sizing and performance requirements. The system sizing and performance requirements are specified for main subsystem. Back-up/Standby subsystem shall have the same sizing and performance requirements. The Acceptance of the product shall be based on the Employer/RLDC approved test protocols/ schedules to be submitted in advance by the successful Bidder ahead of factory/site inspection.

5.1 System Sizing

The system sizing for CDCS System is only specified for initial sizing. The delivered system shall be expandable as the input and output requirements grow. Vendor is required to demonstrate their system's expandability in FAT(Factory Acceptance Test).

5.1.1 CDCS

CDCS shall meet following sizing requirements:

5.1.1.1 Population of Energy Meters

CDCS shall be capable to receive data from a minimum 500 DCUs, which is collecting up to 35 energy meters connected per DCU, at the minimum data collection interval. However, CDCS shall have provision to collect and handle data from up to 1000 DCUs and up to 5000 energy meters without any significant degradation of performance. The Server size shall be enough to accommodate additional meters in future .

5.1.1.2 Data Storage-

After processing and validation, the meter data is archived every week in respective IEMDC/RLDC .For metering entity, the four weeks data should be available in respective RLDC/ SLDC website. The archived data is maintained at IEMDC/RLDC for last five years in their historical database, beyond the above mentioned time frame automatically last data shall be removed from database in FIFO mode. For instantaneous MW data, the 4 weeks data should be available to view by respective SLDCs.

5.1.1.3 Clients

CDCS shall be capable of supporting minimum 100 clients for providing collected data. Each client output shall be individually configurable by users.

Commented [HSK{क2]: Defination!

5.1.2 DCU

The number of meters at site may vary. Bidder shall decide the DCU requirement accordingly with sufficient future expansion capability. The detailed list of meters installed at substations as on date …………. is attached in Annex-1.

5.2 Data Handling Performance Requirements

CDCS shall meet the following performance requirements for data collection and data processing.

5.2.1 Performance requirements for CDCS

CDCS shall receive process and archive the complete data from all DCUs within specified time as guaranteed by the vendor excluding the waiting time for data arrival. This performance requirement shall be met under the maximum number of input DCUs and maximum number of SEMs with the maximum number of data points as specified for the delivered as-build or expanded system.

5.3 System Availability Requirements

After commissioning of the project, service level agreement shall come into effect. Bidder shall quote the monthly charges for 5 years which shall be based on the availability calculations in line with the scope defined in the Technical Specification.

AMR system and its subsystems and system components shall meet the following availability requirements.

The CDCS shall have a measured availability of 99.9% or better during the availability test. The CDCS software shall be considered available when all of the functions described in this specification are operating as specified at their scheduled periodicity and within the execution time parameters and at the same time all hardware is available as specified.

The CDCS shall continue to operate without interruption under any single point of failure condition. That is, there shall be no hardware or software element whose failure renders the CDCS unavailable. This requirement shall specifically include all hardware, the interconnections among hardware, power supplies, and enclosures of the OP or PT subsystems.

II. METER DATA PROCESSING AND REPORTING

Commented [HSK{क3]: Given by Posoco

This section describes the envisaged system architecture of Meter Data Processing (MDP) and Reporting in Host Region.

Intent of MDP and Reporting

The intent is to provide the requirement details of Standard RDBMS such as SQL/ORACLE Database oriented Meter Data Processing Software having compatibility to exchange and share data / information with similar Database systems that may be used by other RLDC / NLDC with a view to meet requirements of Data Warehousing and Business Intelligence systems etc. The Client Interface shall be Browser/console based and report formats shall be in user defined multiple formats like PDF, Standard Spreadsheet, CSV, Text file etc. The software is intended to meet the regional energy accounting requirements for the commercial mechanism adopted in respect of bulk power supplies and inter-State exchanges within and across a Region. The software shall also have a module for importing the interchange schedule of regional entities from an external system and computing the deviation by any regional entity from its interchange schedule. Further the software shall have a module to compute the deviation charges as per the prevailing DSM mechanism approved by CERC. This document describes the details of various functions like meter data - collection, formatting /conversion and facilities of existing software (which is to be replaced with the new proposed Standard RDBMS such as SQL/ORACLE database oriented software) and proposed solution for meter data processing.

1. General Requirements:

- The end-to-end metering system shall be supplied by the successful bidder and all meters' data shall be available at CDCS through AMR system. Database creation in MDP software shall be done by designing a suitable interface between MDP and CDCS at IEMDC.

- RLDC after receiving the meter data from different locations in encrypted form convert the same into readable format through suitable software.

IEMs Details (Master file) in MDP:

- MDP shall keep database (Meter No., Location ID, Utility Name, Station Name, Description, Meter Type, HV Voltage, LV Voltage, HV Current, LV Current etc.) of all IEMs used in accounting.
- One of the inputs required for computation of energy from raw data is a Master file containing details (CT/PT ratio, location, etc.) of all the available IEM's in the region.
- There shall be provision for updation of existing IEMs database and to add new IEMs to MDP database
- Whenever master file shall be modified, the old version of the master file shall be stored in database with date stamping. When computation of raw data for old dates is required, the S/W shall fetch the meter details (Meter ID, HV Voltage, LV

Voltage, HV Current, LV Current etc.), for the mentioned period, from the required version of the Master file.

- Meter associated with a particular location ID during particular period may need to have be associated with another location ID. MDP shall be able to handle this relocation.

- The MDP Master File format shall be as mentioned below.

Utility Name	Station Name	Location	Description	Element Type	Meter No	Local Meter	HV Voltage	LV Voltage	HV current	LV current	
						ID	(kV)	(V)	(A)	(A)	

Table V-1 - Master file format

- Activities to be carried out by the software can be broadly classified as follows:
  a. Uploading Meter Data in database
  b. Validation of Meter Data
  c. Computation of net injection, drawal and transmission loss
  d. Accounting
  e. Reporting

  After receipt of energy meter data from all metering locations, RLDCs are responsible for meter data processing, validation and computation.

a. Uploading Meter data in Database:

The process shall be through 'Database Interface Menu driven'. The Menu shall enable creation, uploading, validation, processing, modification, computation and retrieval of Meter data from Database.

File Upload Menu: The user shall be asked to enter / select from a calendar the "Start Date" and the "End Date" for the period for which the Meter data file shall be uploaded to the system. On entry the user shall be able to upload the file by browsing the computer or directly from database.

On successful upload, same shall be mentioned on the screen along with "Error Description" if any.

Data Availability Menu The availability of all data (i.e. data received /not received/partially received) w.r.t. individual meters can be checked through this menu. The user is required to select the dates (start date / end date) pertaining to the period concerned and select the location code against which the availability of data is required to be checked. The Menu shall also display a description of the location in brief.

On selection of the appropriate location(s), the status of availability shall be mentioned and in case of availability, the date-wise availability of data w.r.t. the concerned meter(s), for the subject location(s), shall be displayed under each location through an expandable drop down menu. The time-block-wise details regarding Frequency, WH data, Raw Data, Date of Receipt etc. shall also be displayed as shown below:

	Location	Location Description.	Date	Availability		
+	AB-01	ABC END OF XYZ-1 FDR	DD/MM/YYYY	YES / NO		
	In case of YES:					
	Time	**Meter**	**Frequency**	**WH Data**	**Raw Data****	**Received On**
	00:00	NP-0001-A	50.01	14.66	50.01 + 14.66	DD/MM/YYYY
	00:05	NP-0001-A	49.99	13.92	49.99 + 13.92	DD/MM/YYYY

	23:55	NP-0001-A	49	13.65	49 + 13.65	DD/MM/YYYY

** Raw Data is the combination of the frequency (Hz) and WH data.

Table V-2 - Data Availability Report

Further, the data regarding availability/ partial availability shall also be downloadable in consolidated format in a text file format (file extension as per IEEE standard/.txt) exportable to ISO/IEC 26300:2006/Amd 1:2012 or ISO/IEC-29500:2012 compatible Spreadsheet format. For partial availability of data for particular time blocks only, the same shall also be displayed/ reported.

All Checks Menu: Through the All Checks Menu the User shall be able to check the existence of any problems related to the various measurable parameters recorded by the meters viz. Voltage, Time Correction, Frequency, Watt Hr, any Algebraic sum problems etc. The user shall be able to select the start date and the end date, station type (Generator/ Inter Regional/ State/ Transmission Utility) and Location(s) for which the information is required. The same shall also be downloadable as "Details File" & "Summary File". The various checks to be performed along with sample format of reports are defined as follows:

(i) **Voltage Check**: If during any time block, voltage in any of the phases fall below 80% of rated voltage, this would be flagged and reported.

Location	Date	Time	Meter	Problem	WH Data	Raw Data
NG-13	03/03/2018	00:30	NP-6889-A	Voltage Supply Failure	-4.54	50 * -04.54
NG-13	03/03/2018	02:30	NP-6889-A	Voltage Supply Failure	-3.37	48 * -03.37
NG-13	03/03/2018	05:15	NP-6889-A	Voltage Supply Failure	-3.15	49 * -03.15
NG-13	03/03/2018	07:15	NP-6889-A	Voltage Supply Failure	-11.71	50 * -11.71

Table V-3 – Voltage Check Report

(ii) **Time Correction Check**: In case of time drift in the meter, time correction command can be provided through DCU; which would be logged and stamped in meter data file. This check would list out such time correction commands.

Location	Date	Time	Meter	Problem	WH Data	Raw Data
AG-01	01/03/2018	13:45	NP-9081-A	Time Correction Retard	6.16	49 rr+06.16
AG-01	01/03/2018	14:00	NP-9081-A	Time Correction Retard	6.32	46 rr+06.32
AG-01	01/03/2018	14:15	NP-9081-A	Time Correction Retard	6.26	40 rr+06.26
AG-01	01/03/2018	14:30	NP-9081-A	Time Correction Retard	6.19	45 rr+06.19

Table V-4 – Time Correction Check Report

(iii) **Frequency Check**: A meter is defined in Meter database as Master frequency meter and frequency as recorded by Master frequency meter is used for all computations. This check lists all meters with frequency difference of more than a set tolerance value with reference to Master Frequency Meter. User shall be allowed to select the Master Frequency Meter from a list of defined Master Frequency Meters.

Location	Date	Time	Meter	Frequency	Master Frequency	Variance
ZZ-07	01/01/2018	00:00	NP-5285-A	51	48	3
ZZ-07	01/01/2018	00:15	NP-5285-A	47	50	3
ZZ-07	01/01/2018	00:45	NP-5285-A	51	47	4
ZZ-07	01/01/2018	01:00	NP-5285-A	48	50	2
ZZ-07	01/01/2018	01:45	NP-5285-A	51	55	4

Table V-5 – Frequency Check Report

(iv) **Watt Hr. Check**: This check is used to lists out any 'zero value' Wh reading (i.e. if the flow is '0') or any Wh reading which is greater than 2 digit (99.99) value i.e. beyond permitted range in any time block; and it is reported as 'no flow' and 'invalid reading' respectively. If there is a no flow condition, it is to be checked for non-availability or open/ floating condition of line/ ICT/ Generator or any other reason.

Location	Date	Time	Meter	Problem	WH Data	Raw Data
AG-01	05/02/2018	00:00	NP-9081-A	No Flow	0	00 * +00.00
AG-01	05/02/2018	00:15	NP-9081-A	No Flow	0	00 * +00.00
AG-01	05/02/2018	00:30	NP-9081-A	No Flow	0	00 * +00.00
AG-01	05/02/2018	00:45	NP-9081-A	No Flow	0	00 * +00.00
AG-01	05/02/2018	01:00	NP-9081-A	No Flow	0	00 * +00.00

Table V-6 – Frequency Check Report

(v) **Algebraic Problem:** In a meter, sum of Wh readings of all time blocks in a day should be equal to the Wh reading of whole day (difference between cumulative reading of 0000 Hrs and 2345 Hrs). This check flags if there is any discrepancy in this algebraic sum during the period.

ocation	Date	Problem	Cumulative Diff.	Algebraic Sum	Error
AX-02	01/01/2018	Algebraic sum	1,196.050000	1,196.100000	-0.050000
AX-03	01/01/2018	Algebraic sum	979.600000	979.560000	0.040000
AX-04	01/01/2018	Algebraic sum	1,346.900000	1,346.890000	0.010000
AX-05	01/01/2018	Algebraic sum	1,331.600000	1,331.580000	0.020000

Table V-7 – Algebraic Problem Report

View Menu: The View Menu shall enable the users to view and download all data pertaining to the following:

i. (M)WH Data

ii. (M)WH Daily Data

i. **(M)WH Data**: The following details shall be displayed on selection of start date, end date and location(s) / utility / station etc., for the selected locations for all available time blocks:

Time	Meter	CTR	PTR	WH Data	MWH Data*	Received On
00:00	NP-0001-A	800	1200	6.77	6.4992	DD/MM/YYYY
00:05	NP-0001-A	800	1200	7.08	6.7968	DD/MM/YYYY

23:55	NP-0001-A	800	1200	7.04	6.7584	DD/MM/YYYY

**MWH = WH x CTR X PTR*

Table V-8 – Algebraic Problem Report

The detailed files shall also be downloadable in pre-approved formats as shown in **Annexure-B**.

ii. **(M)WH Daily Data**: This option shall enable the user to view & download the details regarding daily total energy flow for all the selected locations for the selected period, for all the dates. The following shall be displayed and shall be downloadable in pre-approved format as shown in **Annexure-C.**

Location	Location Desc	Date	Total Energy
XY-01	ABC END OF XYZ-1 FDR	DD/MM/YYYY	532.7904
XY-02	ABC END OF XYZ-2 FDR	DD/MM/YYYY	399.4368
XY-03	ABC END OF XYZ-3 FDR	DD/MM/YYYY	399.4368

Table V-9 – (M)WH Daily Data

- The Computation (Multiplication of raw data with CT/PT Ratios to arrive at actual values) of meter data in MDP shall be done automatically after activating the import option for data fetching from CDCS.

b. Validation of Meter Data:

Real and Virtual/Fictitous Meters can be classified into three types viz., Main Meters, Check Meters and Standby Meters. For accuracy of Energy Accounting it is essential to carry out validation of meter data. Validation of Main Meters (both real and virtual meters) is done by pair checking of Main Meter readings with that of Check and Standby Meters (real and virtual/fictitous meters) data for every block. The pairs shall be configurable as per change of network configuration under Configuration Menu as mentioned in subsequent paragraphs.

Provision of "High Correlation Comparison" facility shall also be made available.

Validation Menu: The validation menu shall have two options:

A.Pair Check: The mismatch (difference) between the readings of the real or virtual meters of identified pairs is checked and listed as shown below:
The pair check menu shall display a list showing the following:
(i) meter pairs: Meter IDs for End-1 and End-2,
(ii) Station Names for End-1 & End-2,
(iii) pair relation (M – C, M – S, C – S),
(iv) the mismatch tolerance limit in MWH (the limit is set as
0.5/1/1.5 MWH for 132/220/400kV voltage level respectively),
(v) Name of Feeder/ Element Details
(vi) And there shall also be an option to "include Meter Replace Value Tolerance %"; which can be entered by the user; and which shall overrule the set tolerance limits and display the readings against those meters only and for those time blocks for which the value is beyond this user-specified limit.
(vii) Option to select the time period (i.e. Start & End dates)
The following list shall be displayed and upon selection of the required pair(s), the time block wise details and total mismatch for each day for the selected period will be displayed and can be downloaded.

End-1 Station Name	End-2 Station Name	MAIN Meter No./ ID	CHECK/ ST.BY Meter No./ ID	Pair Relation	MWH limit X	MWH limit Y	Element Name
ABC	XYZ	AG-01	TR-01	M - S	0.5	0.5	400KV ABC - XYZ-1
ABC	XYZ	AG-02	TR-02	M - S	0.5	0.5	400KV ABC - XYZ-2
ABC	PQR	AM-01	AM-02	M - S	1.5	1.5	400KV ABC - PQR-1
ABC	PQR	AM-03	ME-14	M - S	1.5	1.5	400KV ABC - PQR-2

Table V-10 – Validation (Pair-check) Report-1

detailed meter reading mismatch values shall be displayed for the whole day and for those blocks for which the value exceeds the tolerance limits:

Date	End-1	End-2	End-1 MWH	End-2 MWH	Diff MWH	% Diff.
05/03/2018	AM-19	AS-45	3371.7090	-3437.5272	-65.8181	1.95
		Time	**End-1 MWH**	**End-2 MWH**	**Difference**	**% Diff.**
		00:00	31.2727	-38.3272	-7.0545	22.56
		00:05	30.2545	-33.9636	-3.7090	12.26
06/03/2018	AM-19	AS-45	2822.6909	-2846.0727	-23.3818	0.83
		Time	**End-1 MWH**	**End-2 MWH**	**Difference**	**% Diff.**
		01:30	25.7454	-22.4727	3.2727	12.71
		01:45	30.4727	-23.6727	6.8000	22.32
		17:00	38.1090	-29.7090	8.4000	22.04

Table V-11 – Validation (Pair-check) Report-2

The results of the above pair checking shall be downloadable in .xlsx file formats; samples of which are given under **Annexures-D (I) & D (II).**

For calculation of MWH & percentage differences, the following shall be the consideration:
1.The polarity of Main & Check shall be same and that of Main & Standby meters shall be opposite.
2.For working out the percentage differences, the reference energy value shall be the Main Meter energy data.
Further, there shall be a provision for Graphical representation of Pair Checks in Excel as per samples shown below:

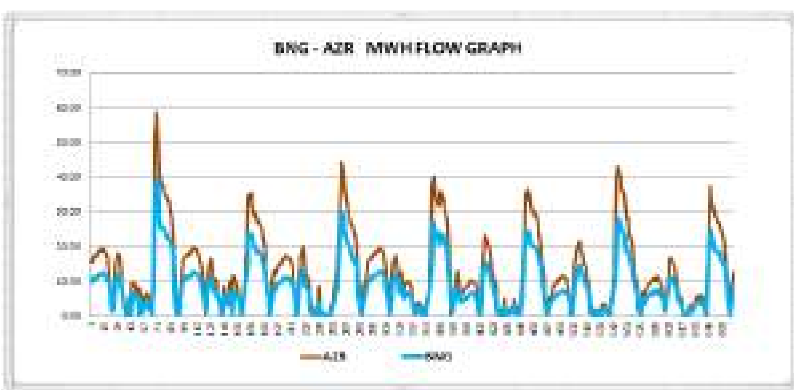


Fig:1 BNG-AZR MWH graph

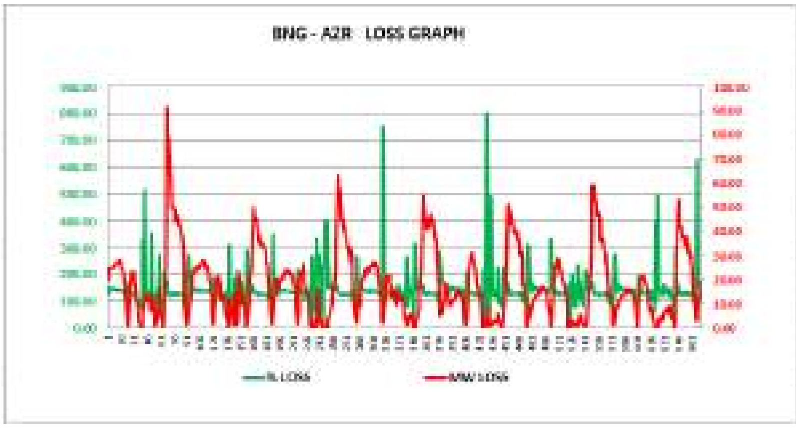


Fig:2 BNG-AZR loss graph

Further, the software shall provide other facilities like loss analysis trends and measurements of other statistical parameters like standard deviations etc. wherever possible.

B.Net Bus Check: In any bus bar of substation or generating station, total energy incoming in any time block should be equal to total outgoing energy. This is checked in all identified buses and the result is listed. Mismatch beyond tolerance is flagged.

The net bus check menu shall display a list of "Net Bus Virtual Meters" and there shall also be an option for applying a Tolerance % limit. On selection of the desired meters and the range of dates for which the net bus checking is required to be carried out, the MDP software shall generate a list of the values for every time block for all the selected dates and the same shall be displayed as shown below. On entering the tolerance limit, only those time blocks for which the values of the net bus % mismatch is exceeding the set limit shall be displayed.

For example:

The Net Bus Virtual/Fictitious Meter for a generating station is the difference between the combinations of all the outgoing Main Meters at the outgoing feeders and the sum of the Standby Meters at HT of the Generator and the station transformer.

For calculating the % Mismatch, the difference is divided by that virtual meter value which is calculated out of the main meter readings.

NetBus tolerance value:				
Location	**Location Desc.**	**Station Name**	**NetBus***	**Date**
AG-91	NET BUS AT AGTPP	RC NAGAR (RCN)	-834.372600	01/12/2017
Time	**Formula**	**Expression**	**NetBus**	**% Mismatch**
00:00	+(AG-81) -(AG-71)	' +(9.0522) -(17.964)'	-8.911800	49.61%
00:05	+(AG-81) -(AG-71)	' +(8.5272) -(17.3664)'	-8.839200	50.90%
00:10	+(AG-81) -(AG-71)	' +(8.4768) -(17.064)'	-8.587200	50.32%

23:50	+(AG-81) -(AG-71)	' +(8.4168) -(16.9416)'	-8.524800	50.32%
23:55	+(AG-81) -(AG-71)	' +(8.3706) -(16.9272)'	-8.556600	50.55%

Table V-12 – Validation (Net Bus) Report

c. Computation of Injection/Drawal Of Utilities:

- The user shall have the option to convert any 15 min meter reading data into 5 min data and vice versa. For conversion of 15 min block length data into 5 min blocks, the MWH readings of each 15 min blocks shall be equally divided against three 5 min blocks, the total remaining same; and the frequency for each 5 min block being same as that of the 15 min block. Similarly, for conversion of 5 min reading to 15 min, the MWH value shall be the algebraic sum of three consecutive 5 min block readings and frequency shall be the average of the three 5 min readings.
- Energy data of IEMs shall be used for Computation of Injection/Drawal of utilities, which shall include application of algebraic functions on a set of predefined IEMs. Such injection/drawal of utilities may itself be treated as a fictitious meter data, which can be calculated through application of algebraic functions on real meter data.
- Addition and deletion of new utility shall be user defined. There shall also be provision to update the file with date stamp.
- There shall be two types of database for Fictitious IEMs. One for Fictitious ID details with description and other is for formulae set. All the data formats shall be user configurable.
- The format of Fictitious IEMs shall be as below:

FICTITIOUS ID	FICTITIOUS ID TYPE	DESCRIPTION
KO-901	Main	Korba Stage-1 Injection
KO-902	Check	Korba Stage-1 Injection
KO-902	Standby	Korba Stage-1 Injection
LK-901	Main	Lanco Stage-1 Injection
LK-902	Check	Lanco Stage-1 Injection
LK-902	Standby	Lanco Stage-1 Injection

Table V-13 Fictitious meter Description file format

FICTITIOUS ID	FICTITIOUS ID TYPE	FORMULA
KO-901	Main	(KO-01)+(KO-02)-(KO-03)*98/100
KO-902	Check	(KO-04)+(KO-05)-(KO-06)*98/100
KO-902	Standby	(KO-05)+(KO-06)+(KO-07)
LK-901	Main	(LK-01)+(LK-02)-(LK-03)
LK-902	Check	(LK-04)+(LK-05)-(LK-06)
LK-902	Standby	(LK-05)+(LK-06)+(LK-07)
IN-901	Main	(KO-901)+(LK-901)

Table V-14 Fictitious meter Formulae File Format

- Computation formula of a fictitious meter may involve other fictitious meters in its formula. Therefore, the software shall have the capability to compute the same. The fictitious meters used in the formula have to be computed first before they are used in other formulae.
- S/W shall have the capability to replace any meter used in fictitious formulae with its Check/Standby meter with application of transmission loss in case of non-

availability/discrepancy of main meter data. The replacement can be for a block/day/week. The percentage of loss to be applied shall be defined by user in configuration file base on the type and voltage rating. The configuration file format shall be as below.

Type of Element	Voltage Level KV	% of Loss to be applied
Line	765	1.5
Line	765	2
Line	220 and Below	4
ICT	-	0

Table V-15 – Loss configuration file

- All changes in fictitious meter in block wise shall be stored in database for future requirements.
- MDP shall be able to store the formula of Fictious meters with time stamp. During the computation of Fictious meter data, MDP shall fetch the formula as per the time stamp and compute the result.
- MDP shall be capable of fetching computed IEM data and fictitious meter data of required date and time block through query.
- MDP shall also store name associated with Location IDs with time stamp, to handle change in names after LILO of lines.
- If, while computing fictitious formula, any meter data is found missing/invalid, the same shall be shown in an error dialogue box with an option to bypass the same or not.
- MDP shall compute Injection/Drawal of Utilities while incorporating all the changes made in fictitious meter configuration files viz. replacement of main meters with Check/Standby meters due to non-availability/ discrepancy of main meter data.
- Report of all replacements and adjustments done shall be provided/available and downloadable.
- Meter associated with a particular location ID during particular period may need to have be associated with another location ID. MDP shall be able to handle this relocation.
- After uploading meter data into the database and validating the data, the user shall be able to carry out computation of the various parameters such as net injection, drawal and transmission loss etc.

  On clicking the "Compute" option, computation shall be carried out by the software and the following data shall be generated and stored in the database

  a)Virtual/Fictitious Meter Data
  b)Out MWH Data
  c)Out MVAR Data
  d)Loss Computation
  e)Pair check results.

After executing the above computations, the following information shall be viewable under the 'View Menu':

(i) Virtual/Fictitious Meter Data
(ii) Virtual/Fictitious Meter Daily Data
(iii) Reverse Flow Virtua/Fictitious Meter Data
(iv) Reverse Flow Virtual/fictitious Meter Data Summary

(i) **<u>Virtual/Fictitious Meter MWH Data</u>**: The user shall be required to select the date range and the Virtual meter(s) against which the MWH details are to be viewed. On selection, the following details shall be displayed showing the date-wise total MWH against each Virtual meter, expandable on the same screen to display the time-block-wise details (for the entire 96 or 288 blocks, as applicable), as shown below:

	Virtual Meter No.	Description	Station / State Name	MWH	Date	
⊟	AB-71	INJECTION BY ABC GEN. STN. (LINES)	ABC	---- (upto 2 decimal places)	01/01/2018	
Date	**Time**	**Formula$**	**Expression$**	**MWH**	**MW**	**Error$$**
01/01/2018	00:00	+(AB-01) +(AB-02) +(AB-03)	+(0) +(11.28) +(8.2224)	19.5024	78.0096	
	00:05	+(AB-01) +(AB-02) +(AB-03)	+(0) +(11.0304) +(8.2872)	19.3176	77.2704	
	--- *upto*					
	23:55	+(AB-01) +(AB-02) +(AB-03)	+(0) +(13.5648) +(6.7968)	20.3616	81.4464	

Table V-16– Virtual/Fictitious Meter MWH Data

$ *Formula refers to the various meters combining to form the Virtual* /Fictitious- *meter and Expression refers to the MWH flow for each meter.*

$$ *Error - an error message shall be displayed in case of non-availability of data of any of the meters, from the combination of meters, as per the formula; or any other problem with meter data.*

The above details shall be downloadable in .xlsx file format as shown in the sample placed at **Annexure-F (I).**

(ii) **<u>Virtual/Fictitious Meter MWH Daily Data:</u>** This menu shall enable the user to view and download (in .xlsx format) the overall total daily MWH energy flow for every Virtual meter for each day for the range to dates selected by the user and for the selected Virtual meter(s) as shown below:

Virtual/Fictitious Meter No.	Description	Station / State Name	Total MWH	Date
AG-71	INJECTION BY RC NAGAR (LINES)	RC NAGAR (RCN)	1526.9808	05/03/2018
AG-71	INJECTION BY RC NAGAR (LINES)	RC NAGAR (RCN)	1229.7696	06/03/2018
AG-91	NET BUS AT AGTPP	RC NAGAR (RCN)	-511.8900	05/03/2018
AG-91	NET BUS AT AGTPP	RC NAGAR (RCN)	-415.6944	06/03/2018
AS-51	TOTAL DRAWAL OF ASEB	ASSAM	18783.4893	05/03/2018
AS-51	TOTAL DRAWAL OF ASEB	ASSAM	17049.7198	06/03/2018

Table V-17 --Virtual Meter MWH Daily Data

The sample downloadable format is also attached in **Annexure–F (II)**.

(iii) **Reverse Flow Virtual/Fictitious Meter Daily Data**: The user shall be able to download and view the details regarding reverse flow (drawal by a generator and injection by a drawing entity is treated as reverse flow) of energy for the selected Virtual/Fictitious meter(s) for the selected days for all the time blocks for which reverse energy flow has occurred.
For the selected virtual/fictitious meter(s), the "formula" of meter combination and the "expression" showing the individual meter readings shall also be displayed. The following details shall be displayed and downloadable in .xlsx files for each selected meter as shown below (format placed at **Annexure-G (I)):**

Date	Time	Location	Station Name	Formula	Expression	MWH
DD/MM/YYYY	00:00	XY-71	XXYYZZ (XYZ)	+(XY-01) +(XY-02) -(XY-03) +(XY-04)	'+(0.6444) +(0.6444) -(-1.0584) +(-2.4156)'	-0.068400
01/01/2018	00:05	DY-71	DOYANG (DOY)	+(DY-01) +(DY-02) – (DY-03) +(DY-04)	'+(0.63) +(0.6408) -(-1.0332) +(-2.3616)'	-0.057600
01/01/2018	00:15	DY-71	DOYANG (DOY)	+(DY-01) +(DY-02) – (DY-03) +(DY-04)	'+(0.6624) +(0.6624) -(-1.0044) +(-2.394)'	-0.064800
01/01/2018	02:00	DY-71	DOYANG (DOY)	+(DY-01) +(DY-02) – (DY-03) +(DY-04)	'+(0.6948) +(0.702) -(-0.9792) +(-2.412)'	-0.036000

Table V-18 --Reverse Flow Virtual/Fictitious Meter MWH Data

(iv) **<u>Reverse Flow Virtual/Fictitious Meter Data Summary</u>**: The summary of the details regarding reverse flow of energy w.r.t. the selected meters for the selected days i.e. the total number of time blocks for which reverse flow has occurred and the total reverse flow MWh for the selected dates shall be viewable and downloadable as shown below (format at **Annexure-G(II)):**

Virtual/Fictitious Meter No.	Station Name	Date	Total Blocks	Energy MWh
XY-71	XXYYZZ (XYZ)	DD/MM/YYYY	73	-6.894000
DY-71	DOYANG (DOY)	01/01/2018	70	-5.130000
DY-71	DOYANG (DOY)	02/01/2018	68	-5.691600
DY-71	DOYANG (DOY)	03/01/2018	72	-6.048000
DY-71	DOYANG (DOY)	04/01/2018	73	-6.451200

Table V-19 Reverse Flow Virtual/Fictitious Meter MWH Data Summary

d. Accounting:

Account/accounting Menu: After computation. The account Menu enables a user to retrieve the energy accounting records of the IEM (both in 5 minutes and 15 minutes) pertaining to the following:

(i) MWH output
(ii) MVAR output
(iii) Load Curve
(iv) Lord Duration Curve
(v) Loss Computation

(i) <u>MWH output:</u> Through this option the user can compute the drawal / export by every entity, injection by the generators, MWH loss in the lines and Net Bus Check for Bus at the Substation End.

Time	Freq.	Line-1	Line-2	---Line-N	Total (MWH)
00:00	45	+0.401000	-0.471600	---	+154.436853
00:05	46	+0.390000	-0.612000	---	+151.328018

23:55	44	+0.382200	-0.748800		+139.487827
TOTAL		+38.732400	-34.53000		+16957.979817

The above details shall be downloadable in .xlsx / .txt file formats as shown in the examples below:

Examples:

(1) MWH Drawal Accounting for the State of A:

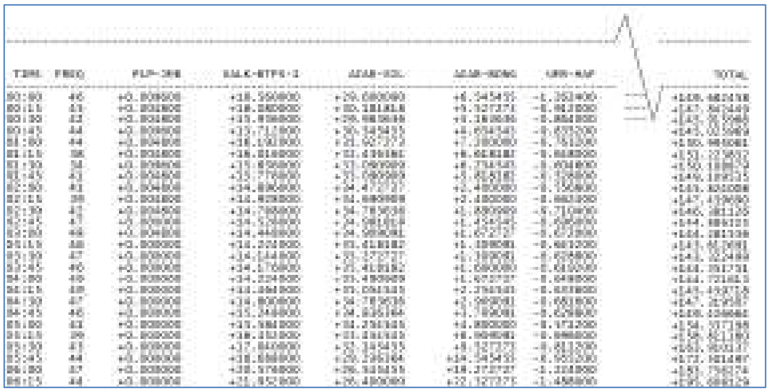


Table V-20: MWH drawal Accounting

(2) Net Bus Check for 'M' S/S (at 220kV bus):

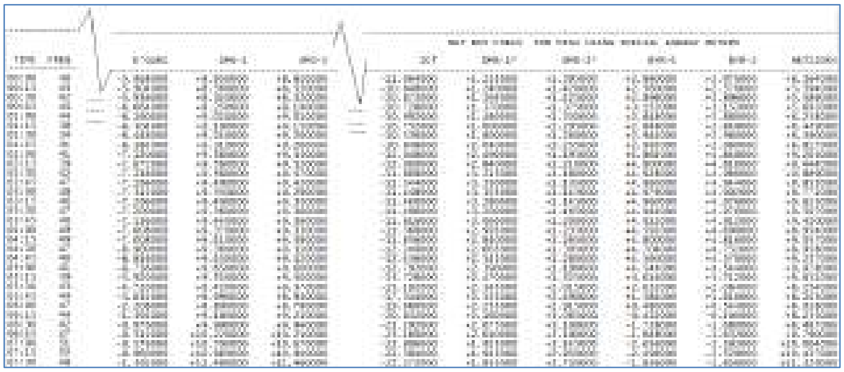
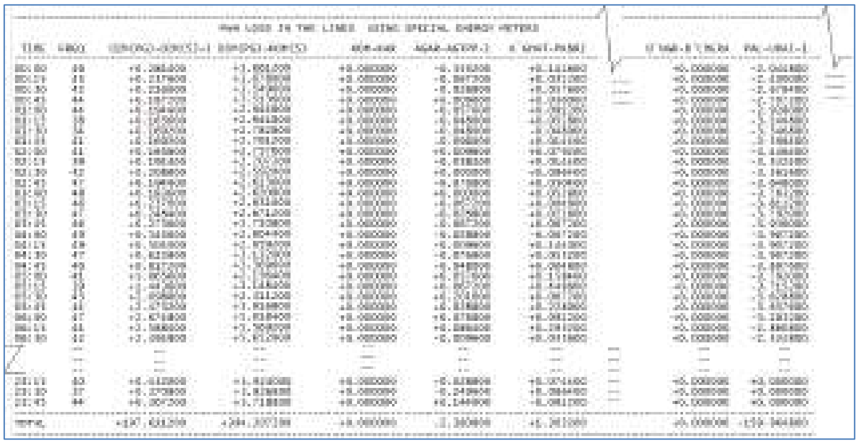


Table V-20: MWH drawal Accounting

3: Net Bus Check for ‘M’ S/S (at 220kV bus):

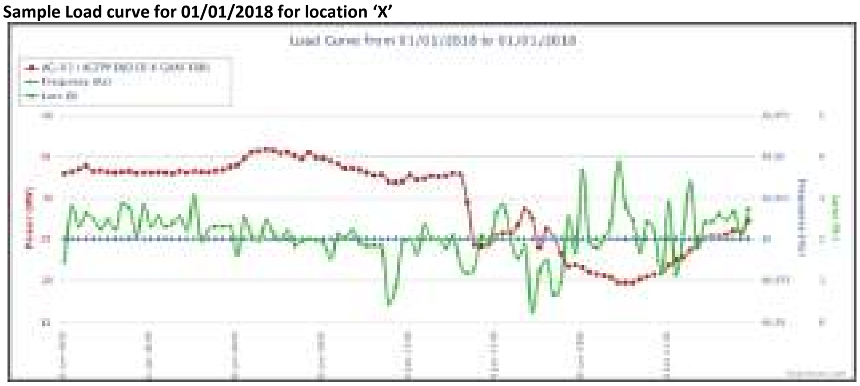
4: MWH Loss in the Lines:



(ii) **MVARH output:** This option enables a user to compute the reactive energy accounting of all States.

(iii) **Load Curve:** Through this option , the user can be obtain a graphical representation of the power flow, frequency and percentage loss pertaining to all the locations for the selected time periods **.**

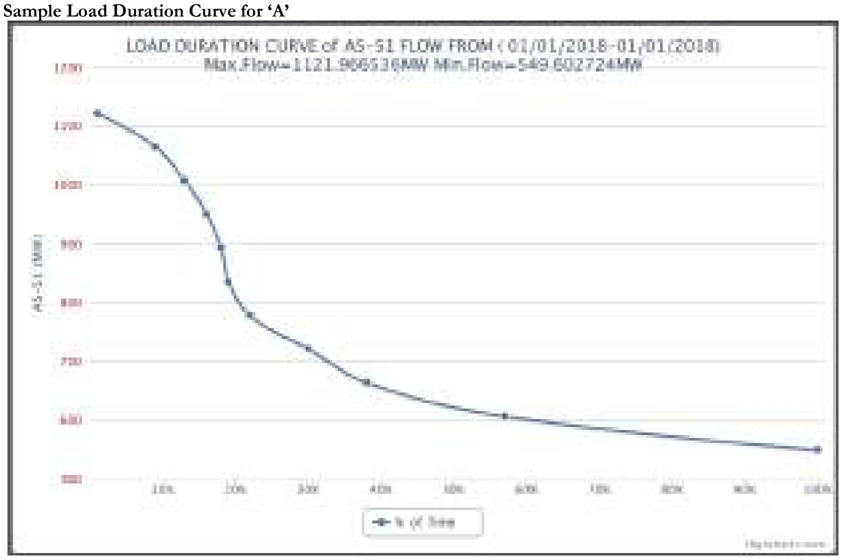
Sample Load curve for 01/01/2018 for location 'X'



The above graph shall be downloadable in .pdf file format.

(iv) **Load Duration Curve:** This option enables the user to view and download a graphical representation of the MW load flow vs time duration (in percentage) for which the load flow was below/above a particular maximum or minimum load.

Sample Load Duration Curve for 'A'



The above curve shall be downloadable in .pdf, .jpeg, .png & SVG Vector Image file format.

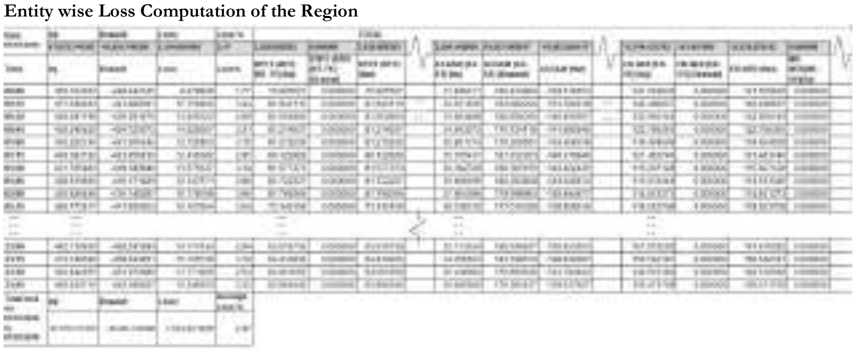
(v) <u>Loss Computation:</u> Regional pool loss for each time block for a selected time period can be computed and also represented and also represented graphically.

As per Procedure for Sharing of Inter-State Transmission System Losses, actual Regional transmission loss is computed as below:
Actual Transmission losses (in MWh) in Regional ISTS, L =
(ΣInjection of Regional Entities, G + ΣInterregional injection, I) - (ΣRegional Entity drawals + Σ Inter-regional drawals)

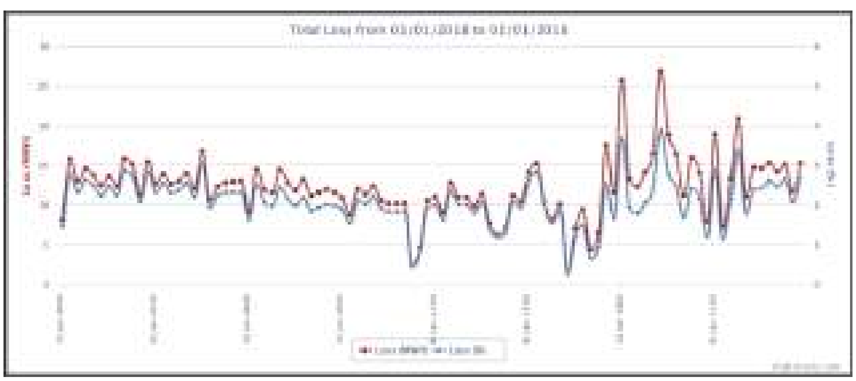
Actual Percentage Regional losses, LPA = L / (G+I) *100

Total injection or drawal by any Regional entity in a time block is considered to arrive at Regional injection or drawal.

Entity wise Loss Computation of the Region



Sample Total Loss Graph



The Loss Graph shall be downloadable in .pdf, .jpeg, .png & SVG Vector Image file format.

Format of loss output file shall be as below:

Name	Date	Time Blk	Injection(A)	Drawl(B)	Loss(A-B) (MWH)	Loss (MW)	Region Loss (%)
	27-03-2017	1	6084.85	5837.30	247.54	990.16	4.07
	27-03-2017	2	6071.78	5845.74	226.03	904.12	3.72
	27-03-2017	3	6075.19	5837.96	237.24	948.96	3.91
	-	-	-	-	-	-	-
	02-04-2017	96	5669.85	5449.95	219.90	879.6	3.88
	02-04-2017	97	5748.77	5520.88	227.90	911.6	3.96
	02-04-2017	96	5780.30	5560.22	220.08	880.32	3.81
			∑ (A)	∑ (B)	∑ (loss MWH)	∑ (loss MW)	

Table V-22 – Loss output file

S/W shall have the feature to generate loss output files for required period (From "Date and Time block" & To "Date and Time block") through user query.

- **Line Wise Transmission Loss Computation:** Configuration file for line wise transmission computation shall be as below:

Meter ID (A)	Meter ID (B)	Loss (MWH) (C)	Loss (%)
KO-001	KO-005	If A is +ve "A-B" or else "B-A"	If A if +ve "(C/A)*100)" or else "(C/B)*100)"
KO-007	KO-009	"	"
-	-	"	"
-	-	"	"
TR-001	TR-005	"	"
BL-007	BL-009	"	"

Table V-23 – Line wise Transmission loss configuration file

- Format of line wise transmission loss output file shall be as below:

Date	Time Blk	"KO-001"-"KO-005"		-	-	-	"LA-001"-"LA-005"	
		Loss (MWH)	Loss (%)	-	-	-	Loss(MWH)	Loss (%)
27-03-2017	1	-1.12	-3.18	-	-	-	-2.12	-3.18
27-03-2017	2	-0.27	-1.16	-	-	-	-3.27	-1.16
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
02-04-2017	95	-0.27	-1.00	-	-	-	-1.27	-3.00
02-04-2017	96	-0.40	-1.56	-	-	-	-3.40	-3.56

Table V-24- Line wise transmission loss output file

- S/W shall have the feature of browsing the line wise loss configuration files with respect to utility/Station/Voltage level etc. so that the required pair can be easily computed.
- Software shall also have the provision to compute loss for a user specified no. of time blocks for any entity.

- **ICT loss computation** configuration file and their output file formats shall be same as that of the line wise loss formats.

- **Bus loss Computation:** The bus loss configuration shall be user defined.

Configuration file for bus loss computation shall be as below:

BUS ID	Bus Description	Bus Section Formulae (L)	Bus Section Loss (MWH)	Bus Section Loss (%)
KO-025	KSTPS-400KV	L=(KO-001)+(KO-002) - (KO-003)	L	{L/sum of injection into the bus (negative energy recordings)}
-	-	-	-	-

Table V-25- Bus loss configuration file format

Format of bus wise transmission loss output file shall be as below:

Bus ID	Bus Description	Bus Section Loss (MWH)	Bus Section Loss (%)
KO-025	KSTPS-400KV	10.2	1.2
-	-	-	-
-	-	-	-

Table V-26 – Bus loss output file format

e. Configuration Management: This menu enables the user to configure the following information in the System or database:

(i) Location/ Meter data: Through this option a user shall be able to create, enter, update, delete or modify details pertaining to Real Meters or Virtual/Fictitious Meters, into the system database, as per requirement from time to time.

Utility Name	Station Name	Location	Description	Meter No	Meter Type	Voltage Label	HV Current	LV Current	EHV Voltage	LV Voltage
		AB-01	AB END OF AB-CD-1 FDR	NP-9081-A	Main	132	600	1	132	110
		AB-04	ABC GT-1	NP-6857-A	Stand by	132	250	1	132	110
		XY-05	X END OF XY FDR	NP-6887-A	Line meter	132	400	1	132	110
		EF-24	EF END OF EFGH-1 FDR (CHECK METER)	NP-9458-A	Check	220	500	1	220	110

Table V-27 – Location Data

(ii)Find & Replace: This option enables a user to find real meters or Virtual/Fictitious meters and replace them with their compatible pairs or otherwise modify the formula as applicable.

This option can be used in case the data pertaining to a meter is missing due to any reason.

Once location id of the meter to be replaced is entered in "Find", software will suggest other end meter from "Pairs" or net-bus of other end as probable replacement. User can accept suggestion or use own meter location-id / formula and specify from - to date and time for replacement in all formulae (except validation checks).

Against every transmission line and the replaceable meter pairs, the software shall maintain records of previous 2 (two) months loss history in the form of "Export Loss" & "Import Loss". Thus, in case of replacement of any end meter with its pair, a multiplying factor shall be applied by the software in order to account for the line loss; for which the software shall check the direction of flow of energy and follow proper sign convention as defined in the preceding paragraphs under validation menu and apply the multiplying factor accordingly considering either import loss or export loss as applicable for that time block. The following shall be the consideration for applying the multiplying factor:

(1) In case of (+)ve reading in the available end meter, the applicable multiplying factor for replacing the missing meter reading shall be (1 - % previous 2 mths. Avg. Import Loss)

(2) In case of (-)ve reading in the available end meter, the applicable multiplying factor shall be 1/(1 - %previous 2 mths. Avg. Export Loss)

(a) <u>OUT MWH Configuration</u>: This function is used to configure the formulae for obtaining the desired active MWH power output of an entity. The MWH output is calculated based on real meter MWH output and Virtual meter MWH output, which can be modified as required. The software should be able to handle computation of virtual meter within a Virtual meter.

(b) **<u>OUT MVAR Configuration</u>**: This function is used to configure the formulae for obtaining the desired reactive MVARH power output of the States. The reactive MVARH output is calculated based on real meter reactive MVARH power output and Virtual/Fictitious meter reactive MVARH power output. This is similar to OUT MWH.

(c) **<u>Master Frequency:</u>** Master frequency meter is a IEM whose recorded frequency code is considered as standard freq. code by all synchronously inter-connected electrical regions, viz., NR, ER, WR, SR and NER for any calculation such as DSM etc. within the above mentioned Region.
Through this option, Master frequency meters can be defined. There shall be option to define multiple Master Frequency Meters in order to enable validation check with reference to any frequency.

(d) **<u>Pair Configuration:</u>** Through this menu the user shall be able to define and edit the pairs of real meters and also enter new pairs or delete obsolete ones. The list of pairs and their details such as errors, feeder name etc. are displayed; and the pairs can be selected from a scrolling menu for changing them, if required; and each of the other details can also be modified once the option to 'edit' is clicked against a selected pair.

(e) **<u>User Information:</u>** It is list of authorized users who can access the Meter data processing software.

(f) **<u>Location/ Meter Master Data:</u>** Through this menu, a user shall be able to update the list of various Utilities – Generation/ Transmission Utilities, States, Regions, Regional Boundaries etc. involved in the Regional / State power flow.

f. Historical Record:

The History of each connected real meter right from the beginning of operation of the meter, changes in CT or PT ratio, meter no., replacement of the meter etc. shall be maintained in the database for viewing or downloading as stated below:

(i) Location/ Real Meter Data History
(ii) Change in CTR, PTR, Meter No & Replacement

(i) **<u>Location/ Real Meter Data History</u>**: This option shall enable the user to view and download the details regarding history of the meter(s); which includes start date & time and end date & time of the meters, installation date, testing date, Make etc.. A sample downloadable file is placed at **Annexure-H(I)**.

(ii) **Change in CTR, PTR, Meter No. & Replacement during the period:** Through this menu, **the user can view and download the details regarding the changes in CT & PT Ratios of the** meters, change in meter number, as well as details regarding the history of the meter such as start date & time and end date & time and details regarding replacement of the meter by another meter, if any. The following details are mentioned

Utility Name	Station Name	Loc	Meter Name	Start Date	Start Time	End Date	End Time	HV Current	LV Current	EHV Voltage	LV Voltage	Nature of Change
ABC	XYZ	XY-01	NP-1001-A	05/06/2017	00:00	12/11/2017	23:45	400	1	132	110	
ABC	XYZ	XY-01	NP-1001-A	13/11/2017	00:00			300	1	132	110	CT ratio/ PT ratio

Table V-28 – Table of Historical Records (Change in CTR/PTR/Meter no.

Meter Replacements:

Further, the following record is downloadable regarding meter replacements history

Utility Name	Station Name	Location	Meter No	Start Date	Start Time	End Date	End Time	Meter Replaced With
ABC	XYZ	XY-01	XY-1001-A	01/01/2016	00:00	01/01/2018	23:55	-(XY-11)

Table V-29 – Table of Historical Records -Meter Replacement Menu

g. Reports:

S/W shall provide two options to generate reports in 5/15 min depending upon the user requirement.. The reports (5/15 min) shall be in pre-defined Text file, PDF, ISO/IEC 26300:2006/Amd 1:2012 or ISO/IEC-29500:2012 compatible Spreadsheet and CSV formats. The format of the 5-min processed data reports shall be exactly same as that of the existing

15-min processed data reports for compatibility with the existing system.

The report configuration files shall be user configurable. There shall be provision for addition of new columns in the report to incorporate new elements and there shall also be a provision to configure new report to incorporate new utility.

Different types of Reports to be prepared are as below.

a. Active Energy Reports

i. S/W shall have the capability to prepare the day wise active energy reports (in 5/15 min blocks data) of Utilities for submission to RPC.
ii. These reports shall be prepared for each utility. The formats shall be user configurable.
iii. The Active energy report shall consist of computed data of all elements which shall be used for computation of drawal/injection of utilities and total value.
iv. These configuration files shall be user configurable. There shall be suitable provisions for addition of new columns in the report to incorporate new element and there shall also be provision for configuration of new reports to incorporate new utility.
v. Typical Active energy output file format (5/15 min) shall be as below:

Active Energy(MWH) Accounting of "Utility Name" for 31-03-17								
Date	**Time**	**Time Blk**	**Meter ID-1**	**Meter ID-2**	**-**	**-**	**-**	**Total**
31/03/2017	00:00	1	33.163635	33.054546	-	-	-	100.036362
31/03/2017	00:15	2	32.072727	32.072727	-	-	-	100.690903
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
31/03/2017	23:30	95	36.545452	36.436363	-	-	-	100.254555
31/03/2017	23:45	96	36.327271	36.327271	-	-	-	100.254539

Table V-30- Active Energy Output file format

b. Reactive Energy Reports

i. Reactive Energy Settlement at ISTS level is being done day wise for Low Voltage (<97% of Rated Voltage) and High Voltage (>103% of Rated Voltage) conditions.
ii. S/W shall have the capability to prepare the weekly reactive energy reports of
iii. Utilities for submission to RPC.
iv. These reports shall be prepared for each utility. The Reactive energy report shall consist of Cumulative reactive data (LV & HV registers) of all elements which shall be used for computation of drawal/injection of utilities. However, there shall be an option to provide reactive energy reports similar to active energy report with block-wise details of reactive energy consumption/injection.
v. Typical block wise Reactive energy output file format shall be as below:

Reactive Energy (MVARh) Accounting of "Utility Name" for 31-03-17								
Date	**Time**	**Time Blk**	**Meter ID-1**	**Meter ID-2**	**-**	**-**	**-**	**Meter ID-n**
31/03/2017	00:00	1	11.163635	12.054546	-	-	-	100.036362
31/03/2017	00:15	2	12.072727	12.072727	-	-	-	100.690903
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
31/03/2017	23:30	95	16.545442	16.436347	-	-	-	100.254555
31/03/2017	23:45	96	16.327261	16.327252	-	-	-	100.254539

Table V-31– Reactive energy output file (block wise)

vi. Along with block wise reactive report for High voltage /Low voltage conditions, a report mentioning net VAR exchange in each TB may be added.

vii. Day wise Reactive energy output file format shall be as below:

Reactive Energy(MVArh) Accounting of "Utility Name" for 31-03-17									
Date	**Meter ID-1**		**Meter ID-2**		**-**	**-**	**-**	**Total Reactive Energy Drawl**	
	LV	**HV**	**LV**	**HV**	**-**	**-**	**-**	**LV**	**HV**
01/02/2016	2346.20	0.00	2324.70	0.00	-	-	-	6584.25	0.00
02/02/2016	2356.00	0.00	2334.50	0.00	-	-	-	7524.25	125.25
-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	
06/02/2016	1142.90	0.00	2195.60	0.00	-	-	-	7558.39	25.30
07/02/2016	1718.60	0.00	2339.30	0.00	-	-	-	6548.35	365.20

Table V-32 - Reactive energy output file (day wise)

c. Voltage Reports:

i. S/W shall have the option for preparation of Voltage reports (5/15 min block wise) for required meters. The configuration files shall be user configurable.

ii. The format of 5/15 min block wise Voltage reports are same as that of active energy reports.

iii. S/W shall have the option for preparation of Low Voltage Logging report (5/15 min block wise).

iv. The S/W shall fetch the details of meter IDs which have recorded the Low Voltage using low voltage logging symbols “*” and “Z”.

v. The output format of Low Voltage reports shall be as below:

Meter ID	Low Voltage(*) Logging report for the period "31-03-17" to "02-04-17"										
	Total No. of Blocks (LV Logging)	**31-03-2017**			**01-04-2017**			**-**	**02-04-2017**		
		Blk-1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**96**
KO-001	12 5	*	*	-	-	-	-	-	-	-	*
LA-028	18		*	-	-	-	-	-	-	-	
KS-012	7	*		-	-	-	-	-	-	-	*
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
MB-005	8	*	*	-	-	-	-	-	-	-	-

Table V-33 – Low voltage Log file

Meter ID	Low Voltage(Z) Logging report for the period "31-03-17" to "02-04-17"										
	Total No. of Blocks(LV Logging)	**31-03-2017**			**01-04-2017**			**-**	**02-04-2017**		
		Blk-1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**96**
KO-001	2	Z	Z	-	-	-	-	-	-	-	Z
LA-028	5		Z	-	-	-	-	-	-	-	
KS-012	6	Z		-	-	-	-	-	-	-	Z
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
MB-005	0			-	-	-	-	-	-	-	

Table V-34 – Zero voltage log file

d. Frequency Reports:

i. Frequency data of reference IEM (user defined) shall be used for DSM Accounting. If main reference meter data is not available, first standby meter (user defined) frequency data shall be used for accounting. If both main and first standby meter frequency data are not available for a particular period, second standby meter (user defined) frequency data shall be used for these periods.

ii. The S/W shall have a user frequency configuration file for selection of any of the reference IEMs.

iii. The output file format of reference IEM frequency data to submit to RPC for DSM accounting shall be as below:

Date	Time	Time Block	Frequency of Main IEM	Frequency of First Standby IEM	Frequency of Second Standby IEM
31-03-2017	00:00	1	49.97		
31-03-2017	00:15	2	49.88		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
31-03-2017	23:30	95	50.03		
31-03-2017	23:45	96	50.01		

Table V-35 – Frequency report output file format

iv. S/W shall have the module to compare the frequency data recorded by all IEMs with reference IEM frequency data and to generate the report/trend for any required period (Date and Time) through query. The module shall also have the option to define frequency tolerance value. If difference in the frequency data is greater than the tolerance then report shall show the same. The output file format as below:

Frequency Comparison Report for the Period "30/03/17" to "31/03/17"							
Date	**Time**	**Blk No**	**Meter ID-1**	**Meter ID-2**	**-**	**-**	**Meter ID-n**
31-03-2017	00:00	1	0.02	0	-	-	0.02
31-03-2017	00:15	2	0.01	0.01	-	-	0.01
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
06-04-2017	23:30	95	0.06	0	-	-	0.02
06-04-2017	23:45	96	0.01	0	-	-	0.03

Table V-36 – Frequency Comparison Report

2. Other Requirements:

(i) The software should be expandable to include databases of up to 5000 Meters without compromising performance and speed. Load test shall be carried out to verify the performance of the software. For computations of any Fictitious meter or creation of any OUT.MWH files maximum time taken should be less than 5 min.

(ii) In case Regional pool loss in any time block during a day is outside the tolerance range as specified by the user, all such time blocks will be flagged. The software will provide suggested rectification for the flagged time blocks based on Validation checks.

(iii) The system should facilitate concurrent login of multiple users after proper authentication and verification.

(iv) The computed Virtual meter data and OUT MWH files shall be stored in the database.

(v) The software shall be able to provide diagrammatical representation (GUI based) in the form of circuit diagram, single line diagram etc. expandable (on clicking) to provide more detailed descriptions such as information regarding connected meters, power flow etc. of each of the grid connected elements viz. transmission lines, substations, generating stations etc. The diagrams shall be modified automatically in case of addition or deletion of any element or modification of data by the user so as to match with the existing updated system.

(vi) "High Co-relation comparison" features should be available to evaluate the main meter missing/wrong/zero measurement data.

(vii) Provision to modify in MDP menu/Report formats/ addition of reports must be possible.

3. Transition Requirements

Presently the time period for Scheduling and Settlement at ISTS level is 15-min. Special Energy Meters data is used for computation of injection/drawal of all entities, which are under the jurisdiction of RLDC. Injection/Drawal computed from SEMs data is used as input data for preparation of following regional accounts.

- Deviation Settlement (Weekly)
- Reactive Energy (Weekly)
- Congestion (Weekly)
- Ancillary Services (Weekly)
- Regional Energy Account (Monthly)
- Transmission Deviation Account (Monthly)

Bidders are encouraged to refer the appropriate regulation to understand the settlement system. They are also encouraged to check the following links on RLDC website to understand the format of existing output reports.

- Active Energy Reports- http://RLDC.org/dropdown_semdata.aspx
- Reactive Energy Reports- http://RLDC.org/semdata_reactive.aspx

Until the amendments for 5-min Settlement in the appropriate regulations come, the settlement at the interstate level shall continue to be done at 15-min interval. Hence, the data of 5-min interval received from the IEMs shall be converted to 15-min interval at CDCS, so that it is compatible with the existing software for energy accounting at RLDC and RPC. After the entire infrastructure envisaged under this project is in place, the output files generated for energy accounting shall be compatible with the existing software. In a nutshell, the execution of work shall be planned in such a manner that there is no interruption in the existing regional energy accounting system.

Shutdown Coordination for meter installation

The successful bidder shall prepare and submit a schedule for replacement/testing of meters to Employer and RLDC. If the meter installation requires shutdown of transmission elements, the indent for the same shall be forwarded to RPC through the respective utilities/Employer 45 days in advance for the approval of the regional Operation Coordination Committee. Employer shall coordinate for gate pass and other administrative approvals from the utility in whose premises the IEM/DCU have to be installed. RLDC shall coordinate the shutdown as per the OCC approved list subject to real time grid conditions. The bidder shall keep suitable margins for grid related uncertainties while formulating the meter installation plan.

For smooth handling of transition phase, following issues are to be well addressed in AMR and new MDP software.

Compatibility of raw data (text file) with existing software

AMR system shall have the options to generate raw text files of IEMs in 5/15min at CDCS. Format of the raw text file (*.npc) in 15-min shall be exactly same as that of the existing format (Existing format is given in example).

In existing 15-min raw text file, frequency is stored in terms of codes from 00 to 99. This can be addressed in new AMR system by converting frequency to codes at RLDC end (CDCS) for compatibility with existing MDP S/W (Detailed explanation is given in example-1.

Existing SEMs have 7 character unique serial number where as new IEMs shall have 12 character serial number. This can also be addressed by mapping old meter SEM IDs to IEM IDs in CDCS data base at RLDC so that new IEMs raw data could be extracted with old SEM IDs for compatibility with existing software.

Example

The format of the decoded file (text file) of our existing SEM meter is shown in Fig.3.

Where the first two digit (for e.g. "00","04", etc.) denotes the starting hour i.e. 00 hrs, 04:00 hrs, etc., the next two digits denotes the frequency code for the current block (Freq. = 49.5 + (freq. code)/100) and the next digits denote the active energy measurement (in MWH) of the current time block.

The decoded file of the IEM (with 5 min accounting) is shown in Fig. 4.

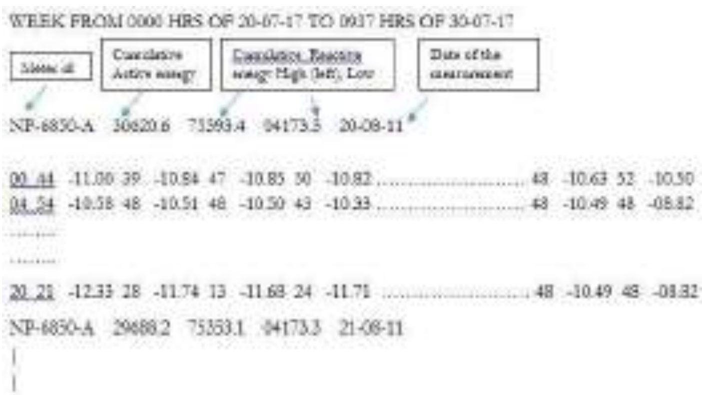


Figure 3 – Standard raw data format for SEM

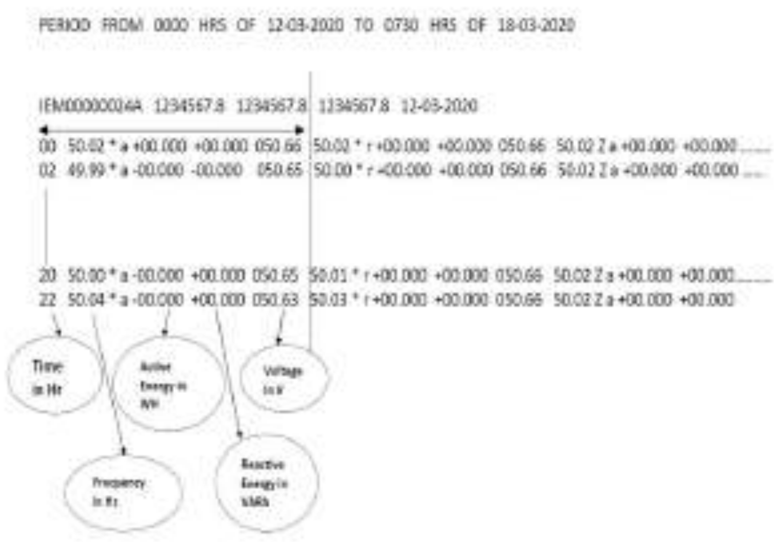


Figure 4 – Standard raw data format for IEM

In the transition phase, above 5 min data shall be converted into 15 min data in the existing format as defined in Fig. 3. For conversion of 5 min data into 15 min data, active energy and frequency data in three consecutive time blocks (5 min.) starting from 00 hrs shall be averaged to arrive at 15 min active energy and frequency data.

For e.g. in Figure-4, the active energy in the first three time blocks (5 min) are +14.72, -77.25 and -77.20. The frequency in the same consecutive time blocks are 49.99, 50.79 and 50.78.

When this file will be converted to the existing format (15 min), the 15 min active energy data (00 hrs) will be calculated as the average of the +14.72,-77.25 and -77.20, i.e. -46.58.

Similarly, the frequency code data will be calculated as = 100*[{Average of (49.99, 50.06, 50.07)} - 49.5]

= 100*[50.04 – 49.5]

= 100*[0.54] = 54

'Average current value' and 'Process Status Word' to be included in the above mentioned format after Voltage value. As per the clause 'III.1.m'.

4. Deviation and Other Reports

This module shall compute deviation of regional entity by comparing the actual injection/drawal with its interchange schedule. It shall also compute the applicable deviation charges and generate the reports that include time block wise normal deviation charges, additional deviation charges, capped deviation charges, aggregate deviation charges.

The module shall be capable of importing the interchange schedules in .xls/.csv format from the external system. The user shall be able to define the applicable deviation rates (in paisa per unit) in line with the formula notified in the appropriate CERC regulations. There shall be adequate flexibility for the user to configure the methodology for computation of deviation/ deviation charges in line with the prevailing CERC regulations and/or as per the decisions of the regional power committees.

As on date of delivery, the supplied S/W shall comply with all statutory regulation as required under CERC/IEGC as applicable and the same should be declared by the vendor during delivery along with warranty certificate.

The module shall provide interface for generating user defined reports using arithmetic, logical and statistical functions.

5. Graphs/Trends

- S/W shall have the option to display the graphs/trends in user defined standard chart type such as line scatter plot, bar chart etc. of different electrical quantities (Energy, Voltage, Frequency etc.) already stored in database for the required period (Date and Time) through query.

- There shall also be a provision to display the Actual vs Schedule graphs of utilities for user defined period. S/W shall have the provision to upload standard CSV 5/15 min schedule data.
- There shall be provision to download the Graphs/Trends in required formats (JPEG, PDF etc.)
- The X and Y axis parameters of the graphs are user definable.

III. GENERAL SOFTWARE REQUIREMENTS

AMR System and MDP software shall meet the following general software requirements.

1. Upgradability

All software kernel/OS and application programs supplied shall be fully upgradable through firmware upgrade and/or other software upgrade methods. The firmware/software upgrade may include

- General software upgrade such as kernel/OS upgrade
- Adding new features and functionalities, such as supporting new data format and communication protocols
- Fixing bugs and deficiencies

The Vendor shall keep RLDC and Employer informed of the latest software updates of revisions available after the system is shipped.

Users shall be able to perform the necessary software upgrade in the field.

2. Software Security Requirements at Delivery

The development of the software for AMR and MDP system shall be done in consultation with RLDC/Employer. Software at delivery shall meet following requirements in accordance with general software security assurance practices.

2.1 Security Tested and Configured

All software and associated application software modules shall be the most secure version of the software available at the time of start of the Factory Acceptance Test. The delivered software shall to be tested to ensure the followings:

- Free of computer viruses, worms, Trojan horses, and other software contaminants
- Unused services are disabled/removed, this includes device drivers for devices not included in the hardware.
- Unused networking protocols.

- Unused administrative utilities, diagnostics, network management, or system management functions.
- Administrative utilities, diagnostics, network management, or system management functions or workstations unused by administrators.
- Backups of files, databases, and programs, used during system installation/upgrade but not needed in the operational system
- Accounts that are not End-User Administrator shall be removed, this include any guest accounts (with and without passwords) or default administrator or maintenance accounts other than the initial system administrator account for Procurement Entity or any guest accounts or default administrator or maintenance accounts for any third party software.

2.2 Maximum Initial Security Settings

The software shall be shipped with all security settings at their maximum setting. All software shall be delivered with all the latest relevant patches installed.

All security-related parameters and options shall be placed at their most restrictive settings at the delivery, i.e. affording the access and execution privileges to the smallest class of users consistent with meeting the functional specifications, and restricting their rights to the narrowest range of privileges.

2.3 No Automatic Downloading and Execution of Executable Code

All active content activated through any link or script into the CDCS or DCU must be disabled in the browser using script blockers such as No Script add-on for Mozilla based Browsers implementing pre-blocking any ActiveX, JavaScript or its derivatives of any description, Java servlets, binary executables etc. preventing any cross-scripting or clickjacking incident.

2.4 File Access Control

The CDCS and DCU software shall support controlled access privileges for files, including at least access, read, write, execute and combinations of these. The access privileges for each user can only be assigned by system administrator of CDCS or DCU as the case may be, and shall be assigned on an individual user account basis.

The default access privileges for each new user account shall be no access to any file on the system at all.

No user, including system administrator, shall be given the privilege of modifying operating system files and other files that are never supposed to change while the system is running.

2.5 Free of "Electronic Self-Help" Enabled Software

It shall be strictly prohibited for delivered software to contain embedded faults or back-door mechanisms that allow the software manufacturer to remotely disable some or all of the functions of the software, or affect their performance, or in any way degrade its operation. The software shall not contain any mechanism that automatically disables some of all of its functions or degrades their operation on a certain date or upon the occurrence of a specific event.

2.6. Requirement for Backup server, Software agent, Backup Hard disk Servers:

a. All data and software essential to continue the operation of AMR as well as all configuration files shall be backed up.

b. System shall be configured for primary and secondary back up.

c. All backup data preferably shall be stored in an encrypted manner.

d. Backup copies preferably shall be stored in an environmentally protected and access controlled secure offsite location.

e. Stored copies shall be made available upon authorized request.

2.7. Disaster Recovery Requirements:

AMR and MDP project should have disaster recovery plan (DRP) for handling the any disaster. A DRP should be in place as a complete set of procedures to reduce downtime by focusing on the most effective way to recover. Sufficient capacity will be maintained for AMR system, network and communications to recover from the loss/disaster within target timescales.

a. Individual recovery procedures will be developed and maintained to restore each service in line with its required reinstatement time line.

b. A detailed step by step overall DR plan will be maintained and (periodically) tested of how recovery will be enacted using the individual recovery procedures including:

i. Switching to dedicated fall back equipment/systems deployed in different site.

ii. The re-assignment and reconfiguration of development systems to support production systems for which resilient hardware does not exist .

iii. Procurement arrangements for equipment, software or contract services to recover less critical systems.

3. Application Software Modification

Modifications in application software to comply with the prevailing CERC regulations for energy accounting and/or to implement the decisions at the RPC level shall be in the scope of the vendor. These modifications shall be considered as a part of O&M/AMC expenses. The modification shall be done in consultation with RLDC.

4. Source Code

After completion of the project, the final implemented source code shall be handed over to Employer and RLDC.

OR

The source code shall be kept in the escrow account.

OR

All source code developed under the project shall be under an appropriate Open Source License, to allow dispute free access to Source Code. Linking of such source code to a proprietary binary product shall be permissible, provided that it be documented along with applicable license restrictions of the named binary product. Vendor, must periodically update the owner on any vulnerabilities of the named binary product and provide patches to the owner without any additional cost implication.

5. Cyber Security Compliance

i. The Project shall adhere to all provisions of IS:16335 for cybersecurity process. ~~3~~IS/IEC/ISO:27001 2016 shall be the management standard for implementing applicable risk controls. IEC/ISO27701:2019 shall be the governing standard to implement Privacy requirements for sensitive personal data.

ii. The MDP should not have any provision to correct the IEMs raw data in database or replacement of the old data.

iii. Cyber security requirements for End to End Data Exchange communication between IEM (client) ,CDCS server and MDP application at RLDCs must conform to IS: 15959 2011/ IEC 62056 in general. The internals of Encryption Key generation and key distribution implementation according to DLMS/COSEM, must be in accordance to DLMS User Association Green Book v9 or later. The details of digital certificates, Certifying Authority and the PKI deployed must be clearly documented. The root CA must be an Indian Entity, recognized by Controller of Certifying Authorities, India, complying to provisions and Rules framed under Information Technology Act, 2000.

iv. All IEMs are to be tempered proof or there shall be a provision in all IEMs to implement an Intrusion detector system with appropriate data logs to facilitate audits to identify and isolate any fraudulent activity.

v. Details of any Optical and Wi-Fi sensors used and any Microcontrollers employed in the solution shall be provided.

vi. Wherever applicable and possible devices featured remote firmware upgrade/update, should have the facility of firmware integrity verification and checking. Firmware upgrade/update of exceptional items shall be done on need basis in consultation with the acquirer.

vii. All software developed and databases employed must meet applicable Open Web Application Security Project (OWASP) Security Guidelines. All applications and infrastructure hosted on public IP shall be audited by CERT-in empaneled agency by conducting Vulnerability Assessment and Penetration Testing and certificate for satisfactory closure of all observations made by the agency must be obtained.. Every year re-certification is to be obtained during maintenance period. Vulnerability assessment of other software applications hosted on the protected internal network and systems, shall be in the scope of vendor and the owner must assess the status every quarter.

viii. Suitable technical/management measures to be taken by service provider to minimize the impact of any loss of privacy to any Data Principal as detailed in ISO/IEC 27701:2019.

ix. The following things must be ensured for GSM based data communications using

4G/3G/2G/SMS:

a. Identity authentication shall be configured in IEM and associated GPRS component.
b. Identity confidentiality must be implemented and maintained.
c. Data and signaling protection: GPRS encryption algorithm (GEA4) must be configured for data and signal for communications.
d. Integrity protection and non-repudiation mechanisms shall be ensured.
e. The communication between the IEM/GPRS core networks and the CDCS needs to be protected, either by using an IPSec VPN solution or by implementing additional security measures.

x. DAM (Database Activity Monitoring) system should have the minimum features as below:

a. DAM should independently monitor and audit all database activity, including administrator activity and query transactions. Tools should record all database transactions without performance degradation.
b. DAM should have the ability to monitor attacks and back-doors on real time.
c. There should be a feature to store audit logs securely in a central logs server (may be syslog server) outside the audited database. Central logs server shall keep the logs for at least for 1 year.
d. DAM should ensure that a service account only accesses a database from a defined source IP, and only runs a narrow group of authorized queries. This can alert in case of compromises of a service account either from the system that normally uses it, or if the account credentials show up in a connection from an unexpected system.
e. DAM should enforce separation of duties (implementation of role base access control), by monitoring and logging database administrator activities.
f. DAM should generate alerts for rule-based or heuristic-based policy violations. For example, an alert to be generated based on a created rule such that each time a privileged user performs a query that returns more than a defined threshold (may be 5) of the outcome
g. DAM should offer closed-loop integration with external change management tools (if using any one) to track approved database changes implemented in database. Other tools can then track administrator activity and provide change management reports for manual reconciliation.
h. Utility level data anonymization which, based on the relative and subjective concept of anonymity executes a process of data de-personalization before they leave the user-level.
i. Vendor shall offer any data traffic analysis tools to detect anomalous communication patterns compatible with the Cyber Kill Chain (CKC) attack (in Central Security Agent)
j. Smart meters with the (remote) load flow control functionality fall into the wider category of ICS. Tool may also detect false data injections.

xi. System Hardening guidelines:

a. All systems shall be hardened.
b. USB port of all systems and devices shall be disabled.
c. CD/DVD Rom access in all system shall be disabled.

d. All unused ports of all systems shall be disabled.
e. Unused ports of the firewall, router and switches should be disabled.
f. All Unnecessary services and protocols should be disabled.
g. Unused software, applications and services shall be disabled.
h. Software shall run with least necessary privileges, taking account of both security and functionality.
i. All unnecessary accounts and privilege accesses shall be eliminated.
j. All systems shall be hardened by doing the whitelisting of applications and services.

xii. Vendor shall notify the all the software/firmware vulnerabilities which come to its knowledge. Vendor has to approve and install all patches/ settings to resolve vulnerabilities as notified by respective OEMs on the fly (suddenly/informal way). In case any patch is not installed, technical reason has to be provided. A suitable time period as shall be agreed between solution provider and owner to permit solution provider to test stability of the notified patch and integration efforts, if any.

xiii. Intrusion Detection and Prevention System, Web Application Firewall, Network Firewalls, Central Syslog Server, Endpoint protection, Centralised Software patch and configuration solution etc to be considered as below:

a. Malicious code detection, antimalware and intrusion detection shall be installed in all possible systems.
b. Intrusion prevention system must be facilitated for signature-based, behavioural, and protocol anomaly detection in firewall.
c. Firewall should have integrated web application and content filtering features without external solution, devices or hardware modules.
d. Firewall should be able to support of user authentication and authorization (such as LDAP/local/AD).
e. Firewall should support industry standards IPSEC, and SSL VPN.
f. Firewall should have the ability to prevent data loss/leakage
g. Firewall should provide protection against viruses, worms or any other malicious content in traffic.
h. Firewall should have log storing facility on a local disk or on to a remote system. Logs stored on the local disk must be transferable over network (scheduled) to a remote system and must be in a generic format.
i. Centralized patch management system shall be deployed following network architecture design for efficient distribution of patches and software updates. Patches are to be managed/fixed in every three months (quarterly basis).
j. There shall be centralized logs server to collect and store logs from all the system of network. This server should have the capability to provide sufficient and necessary resources to study, analysis and correlate logs for deriving readable logs.
k. Centralized configuration management system may be considered proper system configuration and change management.

xiv. Vendor shall offer any data traffic analysis tools to detect anomalous communication patterns compatible with the Cyber Kill Chain (CKC) attack (in Central Security Agent) Smart meters with the (remote) load flow control functionality fall into the wider category of ICS. Tool may also detect false data injections.

VII. DOCUMENTATION REQUIREMENTS

Details of services to be provided by the solution provider during and up to the end of warranty period must be catalogued along with a committed response and resolution time, through an appropriate Service Level Agreement (SLA). Documentation of AMR system and MDP shall meet following requirements. All documents shall be supplied in hard copies as well as computer readable soft version:-

1. Design Documents

Before starting the manufacturing of the AMR system components, a design document shall be submitted. The design document must essentially (but not limited to) included:-

- System Overview
- Functional diagram
- Flow diagram
- Functions of each major component
- Physical details of each major component
- Overall networking scheme
- System configurations
- Cyber Security Provisions

Similarly the design document for MDP shall also include (not limited to) the above sections.

2. Software Requirement Specifications Document

After approval of Design document software requirements specifications (SRS) document for the application software for CDCS and DCU should be prepared and submitted for approval. This SRS should be prepared as per IEC/ISO/IEEE 29148: 2018. Software should be designed as per approved SRS.

3. User Manuals

Following user manuals shall be prepared and supplied for the system:-

3.1 User Manual for central site

User manual for central site i.e. location where CDCS shall be installed and where all data collection activities shall be taken up, should contains all user instructions, block diagrams, user screens etc. in order to make itself contain complete document required for operation of complete AMR and MDP system including each and every component of the metering system.

3.2 User Manual for DCU site

Separate user manual shall be provided which shall be used by the users located at DCUs site. This user manual shall contain details of IEMs, external connections to DCU, communication system, block diagram of system at DCU site, instructions of using DCU system, trouble shooting of DCU system etc. This user manual should be self-contained and shall not require any external reference document in order to use and trouble shoot DCU system.

3.3 Training Documents

Training document to be used during training of site personals shall contain major functional details of the overall metering system, its features and major instructions for understanding the overall working of the system.

3.4 Testing Documents

Testing documents shall be prepared and submitted as per Testing Requirements clause of this specification.

3.5 Documents providing software details

Documentation of all software used in solution providing details of Name of Software Used, Version No (as on date of FAT/SAT), License Type (Third party Commercial/ Proprietary of Solution provider/ Open Source) with validity duration (Perpetual/ Term based) shall be prepared and submitted. All software requiring upgradation/ service support, based on any renewal subscription, should be separately listed.

VIII. TESTING REQUIREMENTS

All equipment, materials and software for AMR and MDP System shall be subject to both Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT). The purpose of Acceptance Testing is to determine compliance to this specification in every respect in regard to the delivered and installed system.

1. Acceptance Test Plans and Procedures

The Vendor shall develop and document proposed Test Procedures and Test Plans for Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) of the delivered and commissioned system and its components. Vendor shall finalize the proposed FAT and SAT acceptance test plans and procedures. The final Test Procedures and Test Plans shall be subject to review and approval prior to testing.

The Acceptance Test Plans (ATP) shall enable Employer to verify the ability of the delivered and commissioned system and its components to individually and simultaneously fulfil all functional and performance requirements of the system set forth in the contract through a series of mutually agreed to structured tests.

All system documentations shall be completed, reviewed and approved by Employer in consultation with RLDC before any testing.

The ATP shall include, but not be limited to, functional tests that demonstrate compliance of

the functional, performance, software, hardware, communication, interface, and operational aspects of the delivered and installed system.

2. Factory Acceptance Test (FAT)

The Vendor shall perform a preliminary FAT (Pre-FAT) prior to the FAT. The pre-FAT shall be a complete dry run of the FAT, following the test plans and procedures. The intent is for the Vendor to detect and correct most design, integration, and database, display, and performance problems prior to the FAT. The representatives of Employer shall have the right to witness all or parts of pre-FAT for which vendor shall intimate Employer in sufficient advance.

Test results (including documentations and certifications) for tests conducted by Vendor or third parties that are not included in the FAT test plan and procedures shall be furnished to Employer prior to FAT for review and evaluation. Vendor and/or third parties conducted tests deemed inadequate shall be repeated until accepted by Employer .

Vendor's project manager shall sign off each test of Pre-FAT. The completed test results shall be sent to Employer for review before their representative's travel to the Vendor facilities for the FAT. All tests shall be conducted using the contract-specified databases unless Employer authorizes the Vendor to use a test database.

The FAT shall be conducted according to the FAT Test Plan and Test Procedure documents approved by Employer in consultation with RLDC shall cover, as a minimum:

- Visual Inspection – To verify that the system to be delivered has all required components and is properly configured. Visual inspection shall verify acceptable workmanship and that all equipment, including cables and connectors, are appropriately labelled
- Hardware Diagnostic Test – Individual tests of all system hardware. These tests shall consist of running standard hardware diagnostic programs, plus all special diagnostic programs used by the Vendor.
- Communications and Interfacing Test – Verify that all interconnected system components, such as data acquisition, control, monitoring, and data management functions are operating properly when correctly connected.
- Software Development Tools – Verify that all required software development tools, utilities, software diagnostics, and debugging tools for the system, including the UI and database, are included in the system and are functioning correctly.
- Functionality verification – Verify that all system functions are working normally as set

forth in the contract.

- Performance Testing – Verify that the system throughput, timing and response time requirements are satisfied. Tests shall include verification of:

    - ❖ Data exchange times
    - ❖ Local and remote request response times
    - ❖ Communication latency
    - ❖ User Interface function response time

- Security Testing – Verify that the system meet the software at delivery security requirements and other aspects of secure operation and system access including:

    - ❖ Communication error detection capabilities
    - ❖ Correct operation of system configuration, control, maintenance, and management procedures
    - ❖ Safe system recovery with no erroneous data or control operation generation after system restarts
    - ❖ Protection against unauthorized access to the system and control functions

- Environmental Testing – Verify that

    - ❖ All system functions shall operate correctly over the specified temperature range
    - ❖ The accuracy of the inputs and outputs remain valid over the specified temperature range.

The test schedule shall allow sufficient time for verification and/or additional unstructured testing by the RLDC/Employer's representative, who shall be able to schedule unstructured testing at any time, including during structured tests.

3. Site Acceptance Test (SAT)

The SAT will be conducted by the OWNER with support as required from the vendor after the system has been installed and commissioned. The system will be subjected to a subset of the functional and performance tests. The SAT will also include any type of testing that could not be performed in the factory. Unstructured tests will be employed by the Employer/RLDC's representative, as necessary, to verify overall system operation under field conditions. Any defects or design errors discovered during the SAT shall be corrected by the Vendor. The SAT includes the commissioning test, the functional and performance test, and the cyber security audit after the installation of the delivered system.

3.1 Commissioning Test

The commissioning tests shall be conducted by the vendor and include:

- The same visual inspection and verification as in FAT

- Loading of the software and starting the system. At the option of the Employer, all software shall be recompiled from the source or distribution media.
- Interface of the AMR and MDP System to communications facilities for all data sources and other systems that interface with the AMR System.
- Initialization and preliminary tuning of application software as needed.

3.2 Site Functional and Performance Test

The site functional and performance test ("site test") shall be comprised of a subset of the functional and performance tests conducted in FAT. The tests to be performed shall be proposed by the Contractor and approved by Employer in consultation with RLDC. These tests shall be extended as necessary to test functions simulated during the FAT, such as communications with all field devices and all other systems that interface with the CDCS.

3.3 Site Cyber Security Audit

The site cyber security audit shall repeat the audit performed during factory testing in every year during Annual maintenance.

3.4 Test Approval

The Vendor shall maintain a complete computer record of all test results with variance reporting and processing procedures for approval by Employer and RLDC. In the event that the AMR/MDP system does not successfully pass any portion of the Acceptance Testing, the Vendor shall notify the Employer and RLDC of the specific deficiency. The Vendor shall promptly correct the specified deficiency, which will then be re-tested until successful.

IX. TRAINING REQUIREMENTS

Comprehensive training programs shall be provided to enable the efficient and effective use and operation of the deployed system by users of the system, and to develop a self-sufficient hardware and software support team within CTU, RLDC, SLDCs and the registered users of RLDC.

Training shall include, where appropriate, a combination of formal training classes, workshops, as well as continuous (informal) knowledge transfer from the Vendor's technical specialists to the personnel of RLDC and its constituents during the deployment process and after the commissioning of the AMR and MDP system. In-person training sessions could be offered at Vendor's location or at the CTU/RLDC/Employer own facilities or any other locations of choice by both parties.

1. Training for personnel at Generating/Transmission substation where IEM is installed

Hands on training program for personnel at Generating Stations/Transmission substation shall cover the following:

- Features of IEM, DCU, Communication Interface.
- IS/IEC protocols.
- Extension of Auxiliary Supply, CT/PT connection.
- Time synchronization through station GPS, Time correction through software.
- Data downloading from IEM.
- Data uploading through web interface.
- Installation of software in local PC/Laptop.
- System Diagnostics.

Minimum duration of training session shall be 3 hours.

Soft and hard copy of the training manual shall contain Step by Step procedure (on screen shot type and desktop video capture) for

- Installation/Re-installation of software in to Laptop / PC.
- Meter maintenance/site-testing procedure as per relevant IS/IEC standard.
- Procedure for data downloading from Meter by Laptop/Desktop PC.

2. Training programs for system users

Training program for system users shall include but not restricted to the following:

- System overview including system functionalities and features.
- System configuration and operations oriented training.
- System alarms handling.
- Local/Remote configuration procedures.
- Engineering oriented training for development/testing.
- Minimum classroom training for a group of system users shall be 18 hours (6 hours x 3 days). Minimum hands-on training for a team of system users shall be 48 hours (6 hours x 8 days). The group shall comprise of representatives from RLDCs, SLDCs, RPC, NLDC, CTU, Registered Users of RLDC etc.

3. Training program for system hardware and software support team

Training program for hardware and software support team shall include but not restricted to the following:

- System overview including system design and detailed as-built system configuration information
- System software maintenance
- System hardware maintenance
- Engineering oriented training for development/testing
- System diagnostics and troubleshooting oriented training for engineers and technicians
- Minimum training for hardware and software support team shall be 18 hours (6 hours x 3 days). The software support team shall comprise of representatives from RLDC.

The bidder shall prepare and provide a description of the proposed training programs with course content, and technical level of the instruction for review and approval by the Employer and RLDC at the beginning of the deployment, and shall work with the RLDC to schedule, organize and execute the approved training programs.

Two hard copies and one soft copy of operating manual of the meter and DCU/AMR/MDP containing all details shall be made available to Employer and RLDC each.

X. SUPPORT AND MAINTENANCE REQUIREMENTS

Vendor shall provide onsite as well as remote support in order to keep system operational with system functionalities and performance in accordance with the specifications.

1. Scope of Warranty/O&M/AMC

During warranty/O&M/AMC period, vendor would be responsible for repair/ replacement/ modification/ rectification of software, hardware either manufactured or bought out, updation of software used in AMR and MDP scheme all times without any extra charges to Employer/RLDC.

2. On-Site Support and Maintenance

Vendor shall maintain a team of skilled personals having sufficient knowledge of the system in order to diagnose and set right any problem in AMR and MDP system in minimum time. Since, the locations of DCUs under this AMR system is geographically spread across entire Region, the vendor shall locate its supporting personals so as any problem may be attended within next working day of reporting.

Vendor shall maintain an online web based help desk system on its own website for logging complaints and checking the resolution status round the clock on all days of the year. Web based help desk shall be accessible to the user through browser via Internet. Separate username and password shall be provided with separate privileges for users of central site as well as DCUs site.

Vendor shall post one Full Time Equivalent (FTE) resident engineer to central site (RLDC) throughout the warranty/O&M/ AMC period in order to diagnose and set right any problem in AMR/MDP/reporting system in minimum time. He/she shall coordinate with the substation personnel and the back end team of the vendor for complaint resolution. Resident engineer shall be provided with mobile phone for communication for escalation of complaint. Vendor shall maintain this mobile phone live and shall maintain same number throughout the contract period.

3. Remote Support and Maintenance

No remote login shall be permitted.

4. Upgradation and Patches

Vendor shall keep updated all supplied software kernel/OS and application software with all latest patch and upgrade. There shall be no separate liability for License renewable on the system user.

5. Maintenance and Support Of Brought Out Items

Vendor shall take back-to-back support from manufactures of bought out items like servers, printers and like items. However, vendor shall be responsible for all coordination work from OEM for all types of support and maintenance.

6. Maintenance and Support for Communication Channels

Vendor shall be responsible for all coordination with communication channel service provider like availability of channels, utilization, data volume certification etc. Bidder shall provide web based access to Network Management System and make it to RLDC and POWERGRID. Billing and payment of monthly and/or yearly bills will also be settled by the vendor to communication services provider. Channel utilization charges and rental charges of communication channels as billed by communication service provider shall be reimbursable to the vendor by POWERGRID against original documents. Bidder should estimate the optimum plan of service provider for each location & submit to POWERGRID before taking any connection.

7. Charges for support services

All recurring expenditure for support services shall be borne by the vendor.

8. Problem/Defect Escalation Order

The successful bidder shall submit their organization's escalation order for this project in the following format:

Vendor Executive Details	Description	Escalation Order
Name Designation Email ID Mobile number	Overall accountability	4th level
Name Designation Email ID Mobile number	RLDC Department head to interact if there is any change in business requirement or some change request need to be implemented within the existing contract or any other issue that need to have a mutual consent to move forward and if the problem/defect in the existing software is not resolved within the specified resolution time.	3rd level
Name Designation Email ID Mobile number	RLDC Team Lead to report if any concerns and some items within the scope need to be fixed in priority	2nd level
Name Designation Email ID Mobile number	Interaction with RLDC Team, to provide support, resolve the defects and work together for seamless operation.	1st level

Table XI-1- Escalation Matrix

9. System Availability and Recovery of Charges

The nature of maintenance support required for systems and components are described in the Table XI-2 below:

Sl. no.	System	Scope	System Availability
1	AMR system (Data collection and storage in database)	Hardware and software	99.9 %
2	Meter Data Processing, Energy Accounting and DSM accounting software	Hardware and software	99.9 %

Table XI-2- System availability requirement

Bidder shall be responsible for coordination with the OEM for all matter related to that equipment. The bidder shall also be responsible for meeting the overall response times and availability requirements as specified in the specification.

The maintenance of the System shall be comprehensive and shall comprise of the following category of works which is further elaborated for each of the different subsystems:

(a) Preventive Maintenance Activity (performance monitoring, system backup, patch management, updates, emergency response and troubleshooting)

(b) Maintaining a minimum no. of specified spares.

(c) Integration of new module etc.

9.1 Preventive Maintenance Activity

The preventive maintenance activity to be performed by the Vendor to keep the system running at optimum level by diagnosis and rectification of all hardware and software failures would broadly include:

- Repair / replacement of defective equipment -The bidder shall be responsible for repair/replacement of all the hardware including consumables required for the various systems.
- Monitoring of the performance of the system and doing necessary tuning for optimum performance to accommodate any changes such as addition of new components.
- Providing all necessary assistance to Owner for addition and modification of database, Database sizing activities including Backup and restore of the system.
- Restoration of the systems upon its failure and to restore the functioning of the various systems.

9.2 Hours of Cover

The vendor shall provide engineers who have an experience and skill to maintain the AMR/MDP system to the desired level of availability. The vendor's on-site support for Control centre shall be standard hours of service i.e. Monday to Friday- 9:00 am to 5:30 pm local time (IST) throughout a year.

One expert Engineer on FTE basis having expertise in metering system shall be available during the standard hours of service at RLDC. The timings for Emergency Support shall be 24 hours a day, 7 days a week throughout the year.

Vendor and its personal have to follow all rules and regulations of owner's office premises in view of owner's certifications of ISO-9001, ISO-14001, OHSAS-18001 and ISO-27001 including any other future certification.

9.3 Problem/Defect Reporting

The bidder shall submit an appropriate problem/defect reporting procedure to meet the requirement of all severity level cases to get the approval of the same from Employer/RLDC

The problems will be categorized as follows:

Severity 4 – Emergency	Complete system failure, severe system instability, loss or failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability. For e.g. system crash/both servers are not working.
Severity 3 – Serious	Degradation of services or critical functions such as to negatively impact system operation. Failure of any redundant system component such that the normal redundancy is lost. For e.g. meter data of a whole station is not available/both main & standby meter data not available/Main server not working, system shifted on standby server.
Severity 2 – Minor	Any other system defect, failure, or unexpected operation. For e.g. Main meter data is not available, however standby/check meter data is available.
Severity 1 – General	Request for information, technical configuration assistance, "how to" guidance, and enhancement requests.

Table XI-3- Severity Levels

9.4 Response and Resolution Time

This section describes the target times within which the bidder shall respond to support requests for each category of severity. The Initial Response Time is defined as the period from the initial receipt of the support request (email/telephone/fax or any other communication channels) and the acknowledgment of the vendor subject to the Maximum time defined in Table XI-4. The Action Resolution Time shall be computed after the expiry of the ideal initial response time subject to the Maximum time defined in Table XI-4.

This period includes investigation time and consideration of alternative courses of action to remedy the situation. The Action is defined as a direct solution or a workaround.

Except for Severity Level 4 all response and resolution times (hours and days) specified below are working hours only:

Severity	Ideal Initial Response	Action Resolution Time(Max.) (to be commenced after	Action

	Time	end of ideal initial response time)	
4	1 hour	6 hours	An urgent or emergency situation requiring continuous attention from necessary support staff until system operation is restored – may be by workaround.
3	3 Hours	12 Hours	Attempt to find a solution acceptable to Owner (dependent on reproducibility) as quickly as practical.
2	8 hours	2 days	Evaluation and action plan. Resolution time is dependent on reproducibility, ability to gather data, and Owner's prioritization. Resolution may be by workaround.
1	1 day	4 days	Report on the problem/query is to be furnished.

Table XI-4 - Emergency Support Response/Resolution Time

The bidder shall submit the detailed format and procedure for all the activities such as Reporting time, Resolution time, Downtime etc. along with the bid proposal.

9.5 Availability and Payment charges Calculation

It is the endeavor of both the bidder and owner to maximize system availability to the extent possible. The bidder shall provide guaranteed availability for various types of Systems as specified in Table XI-2. The non-availability hours for availability calculation shall be counted from the end of the allowed Action Resolution time. The web based help desk software application shall have features for complaint reporting, severity level assignment, initial response time stamping, remarks of the resident engineer regarding actions taken, complaint resolution time stamp and statistics for computing duration of system outage under different severity level categories. There shall be separate login for RLDC/Employer for certification of the complaint resolution time. The complaint resolution time stamp shall be generated only after endorsement/acknowledgement by RLDC engineer in-charge.

Duration of outages over and above the Action Resolution time, as defined in Table XI-4 in each of the Severity levels shall be counted for the non- availability computation and shall be clearly brought out in the web based help desk. The resolution may be accomplished by a work around, and such solution shall mark the end of non-availability.

In the event of frequent failures at a site, due to a common cause, the first FPR (Field Problem

Report) logged shall be used for the purpose of availability calculation. However, simultaneous multiple outages due to unrelated cause would be counted separately.

9.6 Availability computation for AMR/MDP System

System availability is envisaged for overall data availability at RLDC whether by AMR or manually.99.9% data availability is to be ensured with the help of AMR and manual data.

Availability shall be computed on weekly basis. The formula to be used for availability computation would be as under:

Availability per week = {THQ- (S4 + S3 + S2 + S1)} x 100%

Where THQ is total hours in the week

S1 is the total non-available hours in Severity Level-1 in the week. S2 is the total non-available hours in Severity Level-2 in the week. S3 is the total non-available hours in Severity Level -3 in the week. S4 is the total non-available hours in Severity Level -4 in the week. The target availability would be 99.9 % or better.

9.7 Payment of maintenance charges (based on the total System availability)

In the event of availability below a certain level, the maintenance charges would be proportionately reduced as follows:

Availability of the system per week	Deduction in the AMC/O&M charges for the week
More than or equal to 99.9%	NIL
Less than 99.9%	Deduction of 1% of the apportioned weekly AMC/O&M charges for every 0.1 % or part there of decrease in data availability from Target Availability subject to maximum deduction of 20%

Table XI-5- Deduction against less availability

The computation of Availability / Non-availability would be rounded up to 2 decimal places at Control Centre on weekly basis and any deduction in the maintenance charges thereof would be calculated as stated above on pro-rata basis.

9.8 Reliability Indices

The following reliability indices shall also be automatically generated on weekly basis from CDCS and archived for download on demand.

9.8.1 System Average Interruption Duration Index

The System Average Interruption Duration Index (SAIDI) shall measure the average duration for which the meter data was unavailable during a week. An Interruption shall be defined as the non-availability of meter data at RLDC end at the scheduled hour (for e.g. at 09:00 hrs everyday)

To calculate SAIDI, each interruption during a week shall be multiplied by the duration of the interruption to find the interruption time during which meter data was not available at RLDC. The time duration of all such interruptions would then be summed up to determine the total unavailability minutes. To find the SAIDI value, the total unavailability minutes would be divided by the total no. of meters. The formula is

SAIDI = Σ(ri * Ni) / NT

Where,

SAIDI = System Average Interruption Duration Index in minutes. Σ = Summation function.

ri = Restoration time in minutes.

Ni = Total number of meters interrupted.

NT = Total number of meters in the system.

For example the SAIDI for a sample week having three cases of interruptions is computed in the table below. It is assumed that the interruption and restoration in each case occurred simultaneously. It is further assumed that the system has a total of 1,500 meters.

Date of Interruption	No. of meters whose data was unavailable at RLDC	Interruption Duration (minutes)	Unavailability minutes
Date-1	50	120	6000
Date-2	25	240	6000
Date-3	100	30	3000
Total			**15000**

Table XI-6 – Calculation of unavailability minutes

The SAIDI for the above case would be

SAIDI = 15000/1500 = 10 minutes.

This implies that on an average, each meter was out for 10 minutes in the above week.

9.8.2 Average Service Availability Index (ASAI)

The Average Service Availability Index (ASAI) would be the ratio of the total number of minutes that meter data was available during a week to the total minutes in the week (7 x 24 x 60 = 10080). This is sometimes called the service reliability index. The ASAI shall be computed as

ASAI = [1 – (Σ (ri * Ni) / (NT * T))] * 100

Where,

ASAI = Average System Availability Index, percent. Σ = Summation function.

T = Time period under study in minutes.
ri = Restoration time in minutes.

Ni = Total number of meter data interrupted.

NT = Total number of meters installed in the system.

The ASAI value for the sample week based on the interruption data reported in Table XI-2 would be as under

The meter data unavailability minutes = 15000.

Study period = 7 x 24 x 60 = 10080

ASAI = [1 – (15000 / (1500 x 10080)] * 100

ASAI = 99.90%

XI. WARRANTY

Part-A (Meter)

a. The IEM shall be under warranty for 60 months from the date of installation. The bidder shall be responsible for meter testing as per CEA metering regulations. Support and maintenance during 5 years extended period after expiry of warranty period.

b. The warranty would include repair, replacement, part material replacement cost and both way transportation cost (including insurance of transit).

c. Meter software, if upgraded by OEM should be supplied free of cost with initiation taken from party. Remote service person name to be indicated during bidding.

d. Meters which are found defective/inoperative at the time of installation or become inoperative/defective within the warranty period, these defective/inoperative meters shall be replaced within one week of receipt of report for such defective/inoperative meters.

e. Copy of warranty certificate shall be submitted to owner.

Part-B (AMR +MDP System)

a. The AMR system and MDP software shall be under warranty for a period of 5 years from the date of successful commissioning.
b. The warranty shall include repair, replacement, part material replacement and both way transportation cost (including transit insurance) of the hardware items in the AMR system and MDP software.
c. The software developed shall be kept under warranty for a period of 5 years from completion of SAT (site acceptance test) and issuance of TOC. Necessary support towards un-interrupted operation of the software along with support for integration with third party software shall be ensured during warranty period. For the warranty period, bidder shall provide on-site, web and telephonic support for application support, as & when required, on all days of the week. In case site visit is necessary for the software system restoration/ upgradation, all such required visits shall be free and without any additional financial implication.
d. During the warranty period, the bidder shall implement the modifications in the software to implement amendment in CERC Regulations regarding metering and energy accounting.

XII. ANNUAL MAINTENANCE CONTRACT

After successful completion of warranty period Employer/RLDC, at their sole discretion, may decide to avail annual maintenance service from the successful bidder for providing technical/hardware support for the AMR system and the software system under the Annual Maintenance Contract (AMC). In such event, RLDC shall issue separate award of contract for the AMC.

XIII. SPARES/FUTURE REQUIREMENT

Bidder shall maintain sufficient number of IEMs as spares/future requirement at each substation/Generating station.

XIV. REFERENCES

a. CEA (Installation & Operation of Meters) Regulations 2006 available at http://www.cea.nic.in/meteringreg.html
b. Functional Requirement of AMI – CEA report available at http://www.cea.nic.in/reports/others/god/dpd/ami_func_req.pdf
c. CERC Regulations on IEGC, DSM, Congestion Alleviation, Ancillary Services, Sharing of Transmission Charges as available at http://www.cercind.gov.in/updated_consolidated_reg1.html
d. Report on Scheduling, Accounting, Metering and Settlement of Transactions in Electricity "SAMAST", http://www.forumofregulators.gov.in/Data/WhatsNew/SAMAST.pdf

Annexure-2.3

Email **N. S. Mondal**

Draft Technical specifications (TS) of 5/15 minutes IEM with AMR, MDP system-reg

---

From : N. S. Mondal <mserpc-power@nic.in> Thu, Feb 04, 2021 06:37 PM

Subject : Draft Technical specifications (TS) of 5/15 minutes IEM with AMR, MDP system-reg 2 attachments

To : Gridco <sgm.pp@gridco.co.in>, SLDC Patna <sldc.bseb@gmail.com>, SLDC DVC <dvcsldc@gmail.com>, JSEB Ranchi SLDC <sldcranchi@gmail.com>, SLDC GRIDCO <sldcgridco@yahoo.com>, SIKKIM SLDC <sikkim.sldc@gmail.com>, chiefengineercr@gmail.com, secypower sikkim <secypower.sikkim@gmail.com>, acepowersikkim@gmail.com, srgmppgridco@yahoo.com, subrata ghosal <subrata_ghosal@dvcindia.org>, rekolbsphcl@gmail.com, cetransom bsptcl <cetransom.bsptcl@gmail.com>, ceptp wbsedcl <ceptp.wbsedcl@gmail.com>, SLDC WB <wbsldc.enac@gmail.com>, jseb commercial (coml.rev@rediffmail.com) <coml.rev@rediffmail.com>

Cc : nsmondalcea <nsmondalcea@yahoo.com>, SHYAM KEJRIWAL <shyam.ies11@gmail.com>, Shishir Pradhan <shishir.1505@gmail.com>

Sir,

As per NPC, CEA letter dated 02.12.2020, a Joint Committee comprising of members from RPCs, CEA, PGCIL/CTU & POSOCO has been constituted to finalize the Technical Specification (TS) of the 5/15 minute IEMs (Interface Energy Meters) with AMR, MDP system. Subsequently, NPC, vide email dated 28.01.2021, has circulated a **draft Technical specification (TS) in two parts**.

In this matter, the constituents of Eastern Region are requested to go through both the parts of draft Technical Specifications and furnish your views/comments to ERPC Secretariat (at mserpc-power@nic.in) and NPC Division, CEA (at cenpccea@gmail.com) within a week.

Regards,

Office of Member Secretary,
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata- 700033
Telephone: 033-24239651/50
Fax: 033-24239652/53

TS part 2.docx
926 KB

TS part 1.docx
184 KB

Power System Operation Corporation Ltd.

179th OCC Meeting

At ERPC, Kolkata

21st May, 2021

ER Grid Performances

Highlights for the month of April-2021

Frequency Profile

Average Freq:- 50.0 Hz

Avg FVI: - 0.041

Lowest FVI:- 0.021

Max- 50.29 Hz on 04th April'21

Min- 49.69 Hz on 11th April'21

75.06 % of the time frequency was with in IEGC Band

Peak Demand*

ER: 24656 MW on 27th April 2021 at 22:50 hrs

% Growth in Average Demand Met w.r.t. last year: (+)52.3%

BSPHCL : 6097 MW ; ON 29/04/21

JUVNL: 1701 MW; ON 13/04/21

DVC: 3411 MW; ON 08/04/21

GRIDCO: 5656 MW; ON 29/04/21

WB: 9316 MW; ON 27/04/21

SIKKIM: 80 MW; ON 07/04/21

Energy met

Max. 525 MU on 28th Apr' *2021*

%Growth w.r.t. last year on Max energy : 38.66%

Avg. 492 MU in Apr' *2021*

%Growth w.r.t. last year on Avg. energy : 53.41%

New Unit

NIL

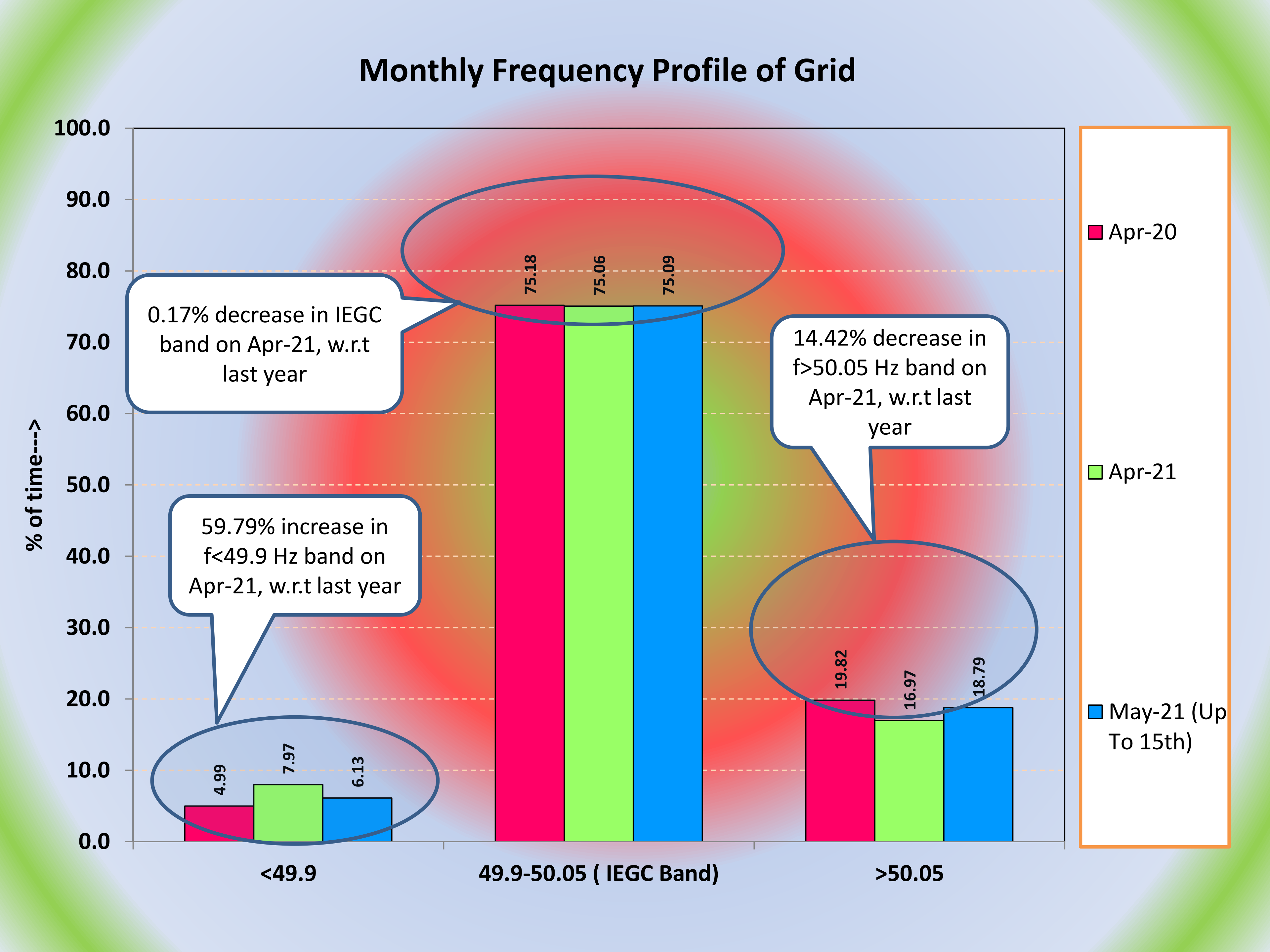
Open Access

STOA transactions approved : 852 nos.

Energy Approved- 1321.35 MUs

New Element addition during the month:

SL No.	Element Name	Owner	Charging Date	Charging Time	Remarks
1	220KV/132KV 100 MVA ICT 4 AT RANGPO	PGCIL	01-Apr-21	17:39	
2	400KV-SITAMARHI-MOTIHARI-2	PMTL	02-Apr-21	14:22	
3	400KV-SITAMARHI-DARBHANGA (DMTCL)-2	PMTL	02-Apr-21	15:29	
4	400KV-SITAMARHI-MOTIHARI-1	PMTL	03-Apr-21	17:51	
5	125MVAR 400KV B/R-1 AT SITAMARHI	PMTL	04-Apr-21	16:34	
6	220KV-DARBHANGA(DMTCL)-LAUKAHI-2	BSPTCL	06-Apr-21	13:43	
7	400KV/220KV 500 MVA ICT 2 AT SITAMARHI	PMTL	08-Apr-21	18:25	
8	400KV/220KV 500 MVA ICT 1 AT SITAMARHI	PMTL	08-Apr-21	17:25	
9	220KV/132KV 200 MVA ICT 2 AT SITAMARHI	PMTL	09-Apr-21	18:01	
10	220KV/132KV 200 MVA ICT 1 AT SITAMARHI	PMTL	10-Apr-21	17:15	
11	220KV-SITAMARHI-MOTIPUR-2	BSPTCL	12-Apr-21	17:01	
12	400KV/220KV 315 MVA ICT 3 AT JEYPORE	PGCIL	16-Apr-21	16:55	
13	765KV 262 MVAR BR 1 AT DARLIPALI (DSTPS) ALONG WITH BAYS	NTPC Darlipali	22-Apr-21	10:28	
14	400KV/220KV 315 MVA ICT 1 AT DSTPS(ANDAL)	DVC	23-Apr-21	17:58	Idle charged from 400kV Side
15	33KV/0.415KV 0.630 MVA ICT 2 AT ROURKELA	PGCIL	28-Apr-21	12:14	Tertiary transformer of 400/220 kV ICT 2 at Rourkela



Monthly Frequency Profile of Grid
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
% of time--->
4.99
7.97
6.13
75.18
75.06
75.09
19.82
16.97
18.79
<49.9
49.9-50.05 (IEGC Band)
>50.05
0.17% decrease in IEGC band on Apr-21, w.r.t last year
59.79% increase in f<49.9 Hz band on Apr-21, w.r.t last year
14.42% decrease in f>50.05 Hz band on Apr-21, w.r.t last year
Apr-20
Apr-21
May-21 (Up To 15th)

So Far Highest Demand (* As on 15th-May-21)

Constitute	Demand (in MW)	Date	Time	Demand met (MW) on 27th April'21 (Max. demand met day)	
				MW	Time
Bihar	6123	03-Aug-20	20:07	5720	20:39
DVC	3543	21-Dec-19	18:06	3168	19:22
Jharkhand	1701	13-Apr-21	21:06	1652	20:42
Odisha	5656	29-Apr-21	22:44	5461	22:47
Sikkim	155	11-Jan-20	19:22	69	18:21
W. Bengal	9546	27-May-19	23:31	9316	23:14
ER	24656	27-Apr-21	22:50	24656	22:50

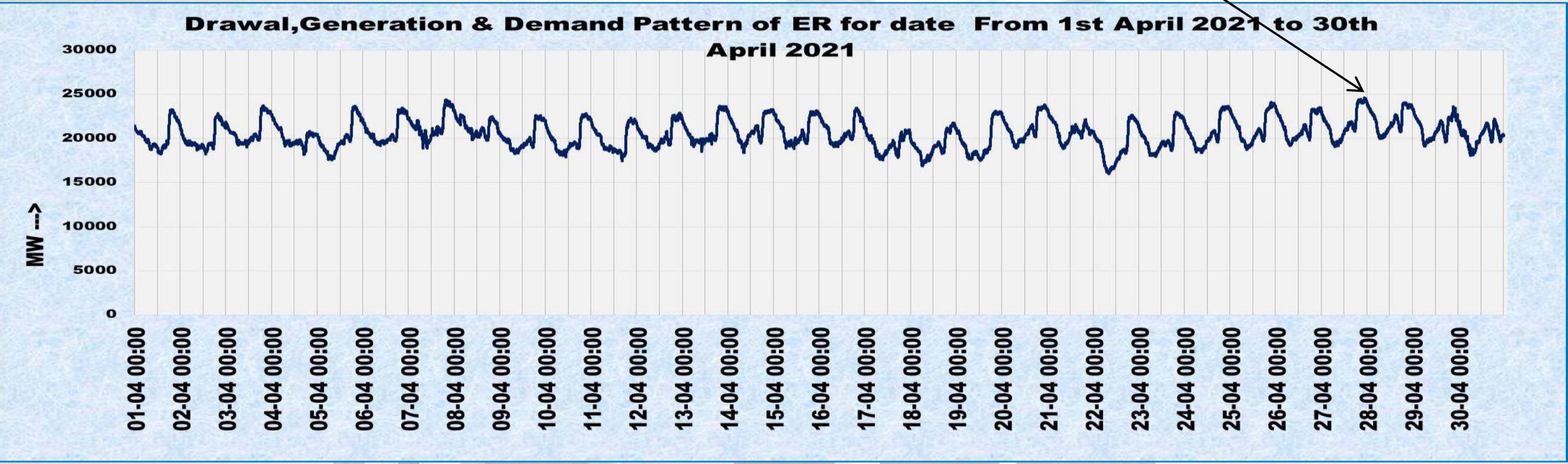
So Far Highest Energy Consumption

Constitute	Energy consumption (in MUs)	Date	Energy met on 27th April'21 (Max. demand met day)
Bihar	121.4	02-Sep-19	116.4
DVC	75.8	12-Jul-18	67.6
Jharkhand	31.1	28-Apr-21	30.1
Odisha	123.5	02-Oct-18	108.0
Sikkim	2.5	28-Jan-20	1.02
W. Bengal	199.9	28-May-19	190.9
ER	525.3	28-Apr-21	514.0

3D VIEW OF ER DEMAND PATTERN

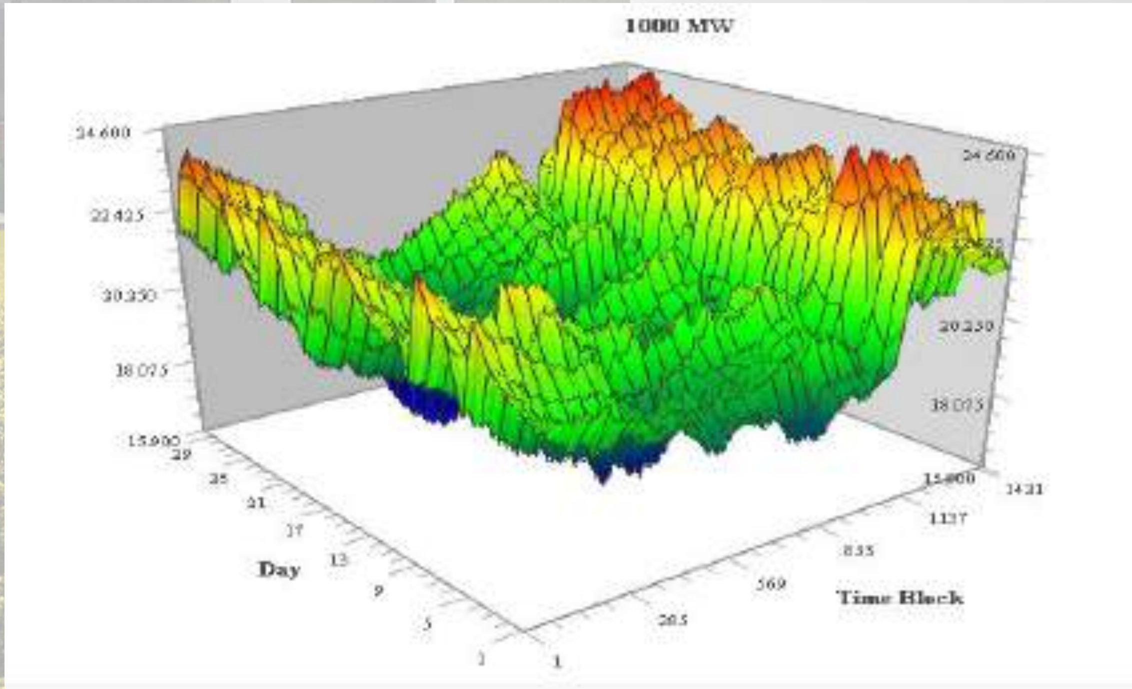
ER Demand Pattern in Apr-21

Maximum Demand on 27th Apr-21 : 24656 MW



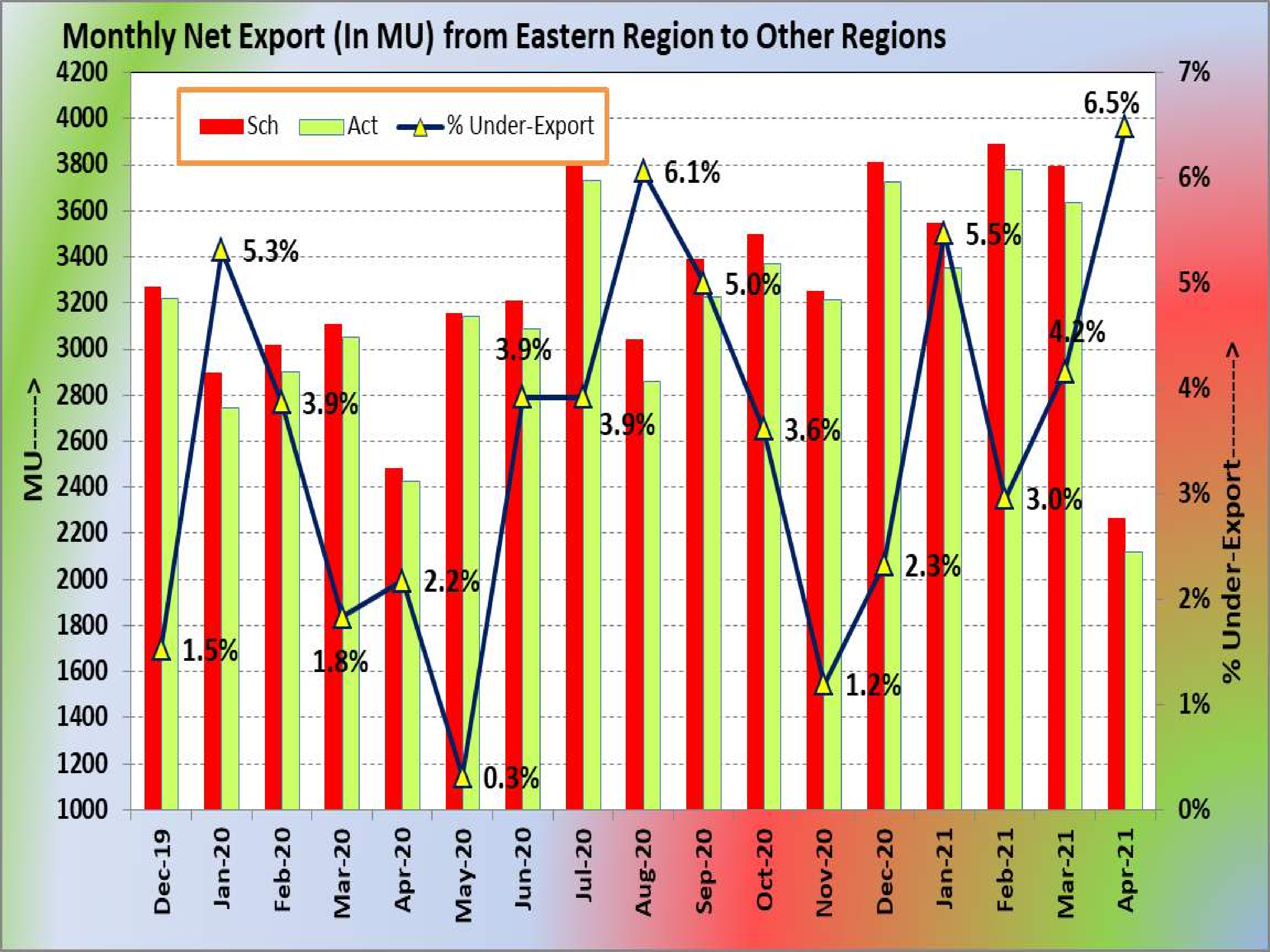
EASTERN REGION DEMAND

3D CURVES (Apr'21)



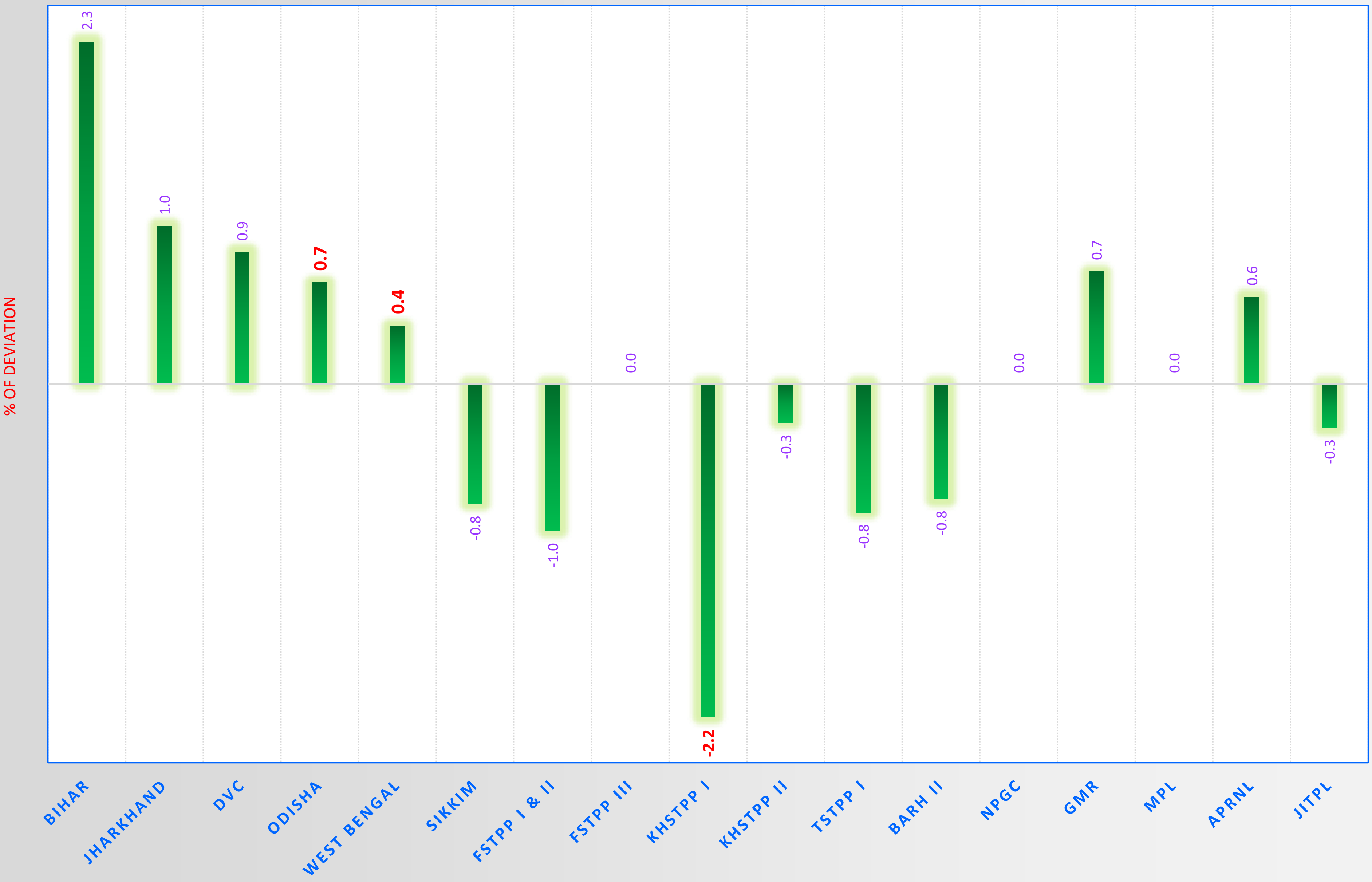
Over Drawl / Under Injection by ER Entities

Non-compliance of direction issued by SLDC



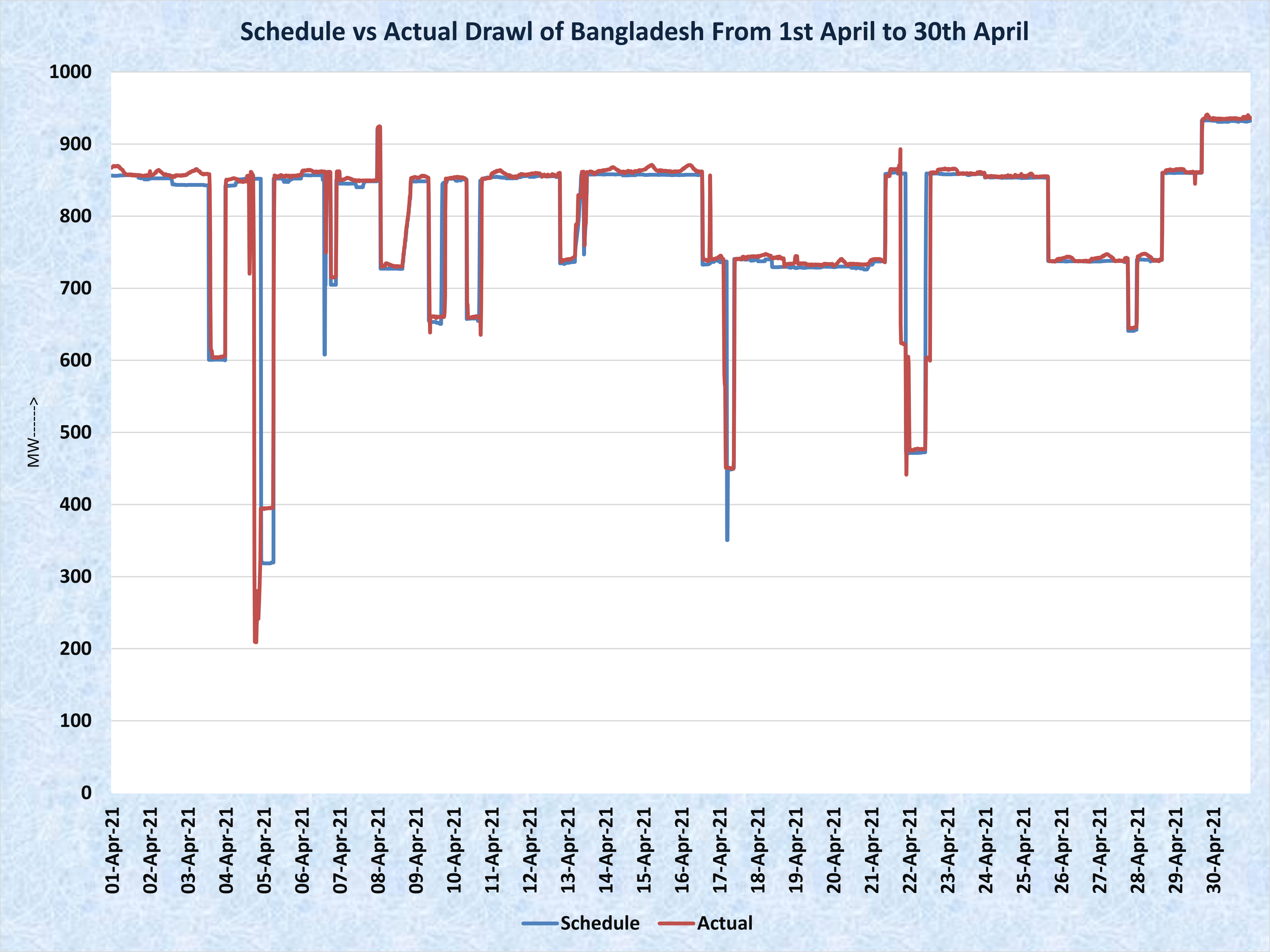
Monthly Net Export (In MU) from Eastern Region to Other Regions
Sch
Act
% Under-Export
MU------>
% Under-Export-------->
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
7%
6%
5%
4%
3%
2%
1%
0%
1.5%
5.3%
3.9%
1.8%
2.2%
0.3%
3.9%
3.9%
6.1%
5.0%
3.6%
1.2%
2.3%
5.5%
3.0%
4.2%
6.5%
Dec-19
Jan-20
Feb-20
Mar-20
Apr-20
May-20
Jun-20
Jul-20
Aug-20
Sep-20
Oct-20
Nov-20
Dec-20
Jan-21
Feb-21
Mar-21
Apr-21

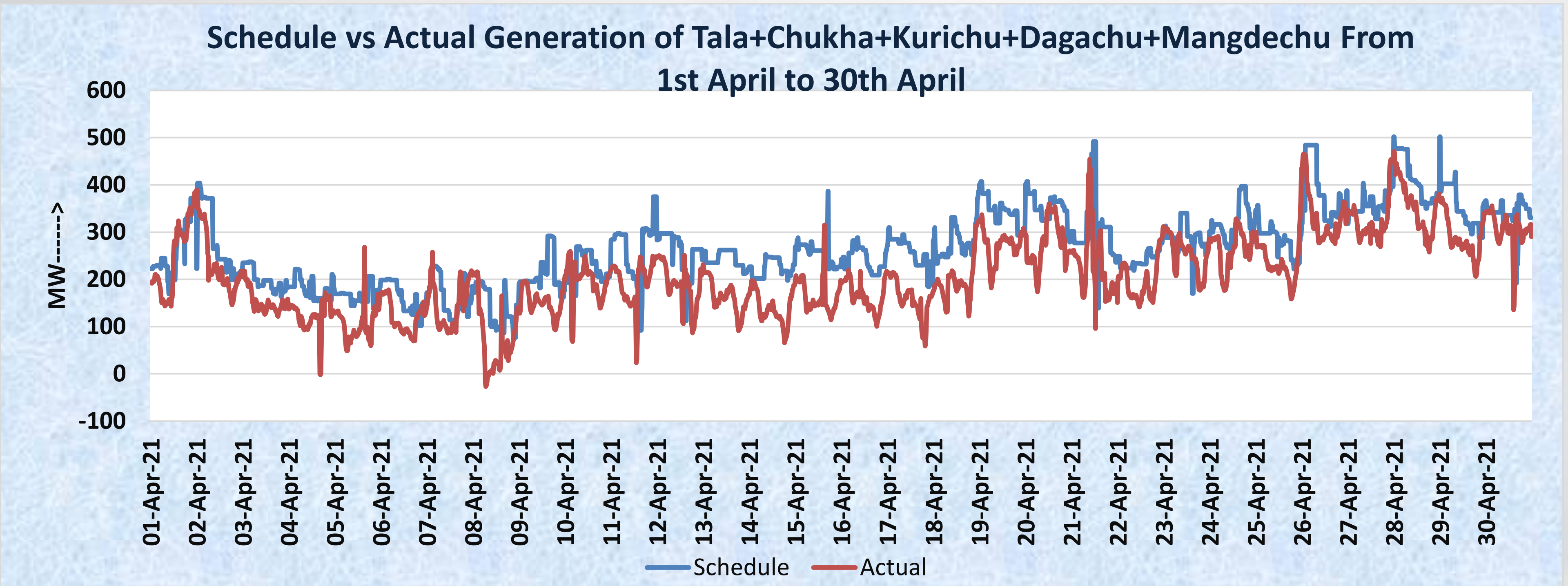
% DEVIATION APRIL 2021

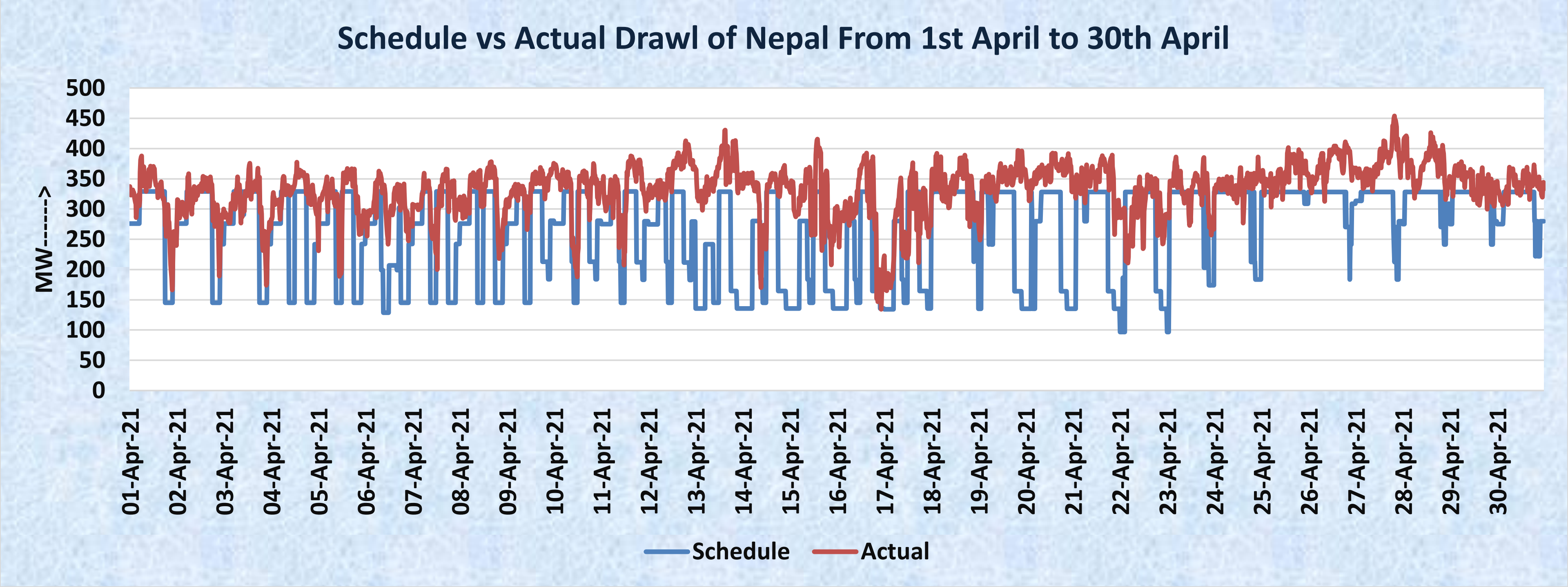


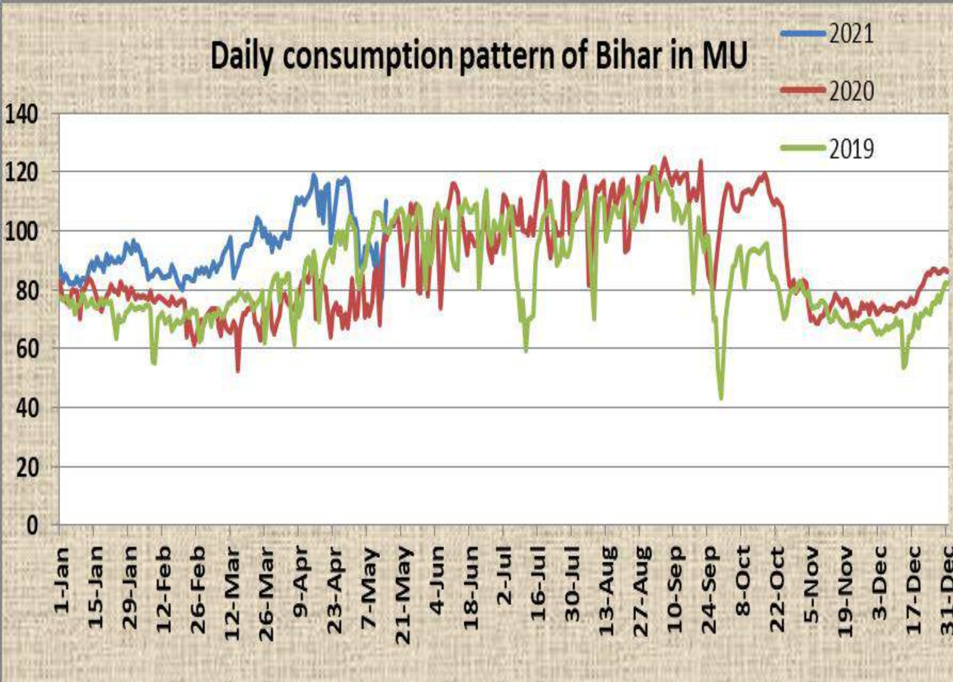
April 2021 Schedule vs Actual Status

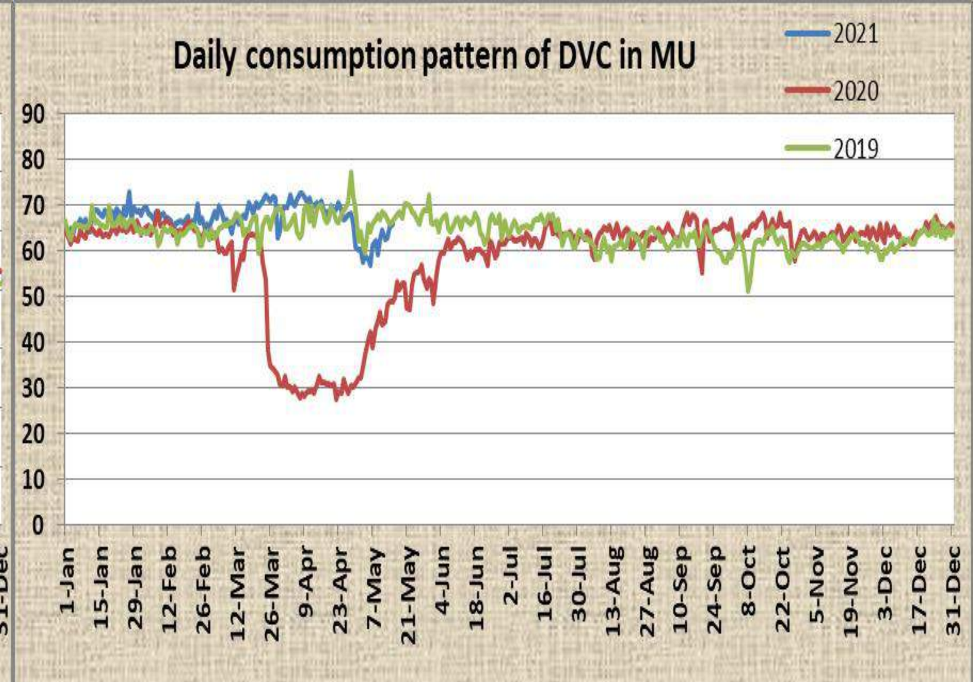
	Schedule (MU)	Actual (MU)	OD (MU)	Daily Avg OD (MU)	% Deviation
Bihar	2928	2995	66	2.1	2.3
Jharkhand	698	705	7	0.2	1.0
DVC	-1448	-1435	13	0.4	0.9
Odisha	1276	1284	9	0.3	**0.7**
West Bengal	1257	1262	5	0.2	**0.4**
Sikkim	45	45	0	0.0	-0.8
FSTPP I & II	616	610	-6	-0.2	-1.0
FSTPP III	309	303	-6	-0.2	0.0
KHSTPP I	535	523	-12	-0.4	**-2.2**
KHSTPP II	998	996	-3	-0.1	-0.3
TSTPP I	446	442	-4	-0.1	-0.8
BARH II	790	784	-6	-0.2	-0.8
NPGC	400	400	0	0.0	0.0
GMR	403	406	3	0.1	0.7
MPL	678	678	0	0.0	0.0
APRNL	348	350	2	0.1	0.6
JITPL	695	693	-2	-0.1	-0.3

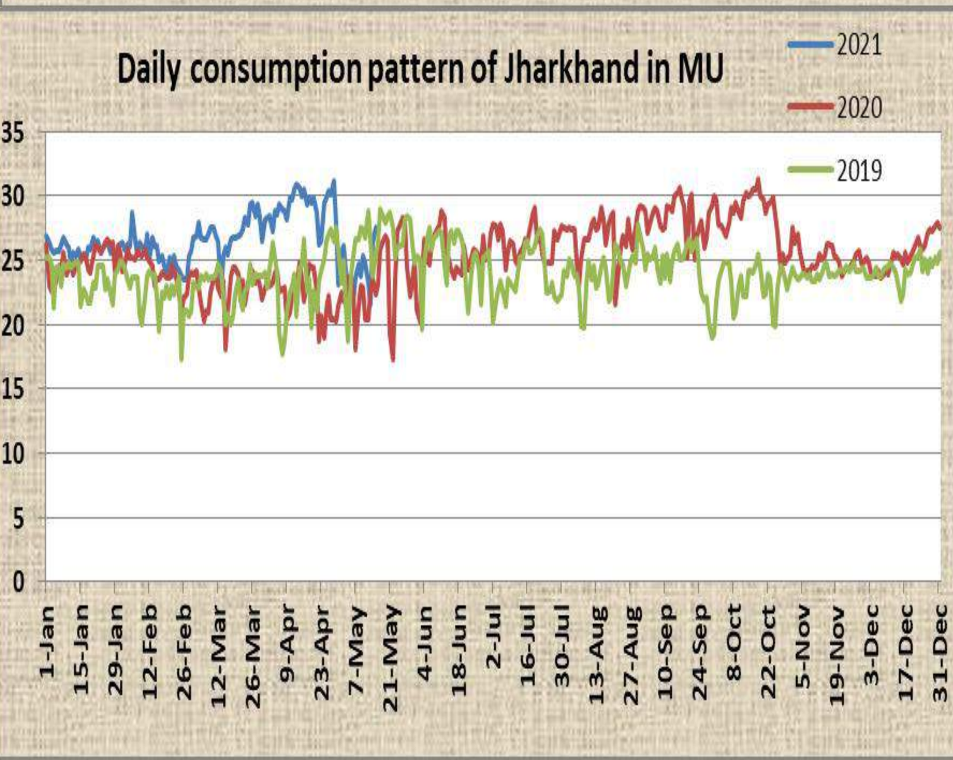

Schedule vs Actual Drawl of Bangladesh From 1st April to 30th April
1000
900
800
700
600
500
400
300
200
100
0
MW------>
01-Apr-21
02-Apr-21
03-Apr-21
04-Apr-21
05-Apr-21
06-Apr-21
07-Apr-21
08-Apr-21
09-Apr-21
10-Apr-21
11-Apr-21
12-Apr-21
13-Apr-21
14-Apr-21
15-Apr-21
16-Apr-21
17-Apr-21
18-Apr-21
19-Apr-21
20-Apr-21
21-Apr-21
22-Apr-21
23-Apr-21
24-Apr-21
25-Apr-21
26-Apr-21
27-Apr-21
28-Apr-21
29-Apr-21
30-Apr-21
Schedule
Actual

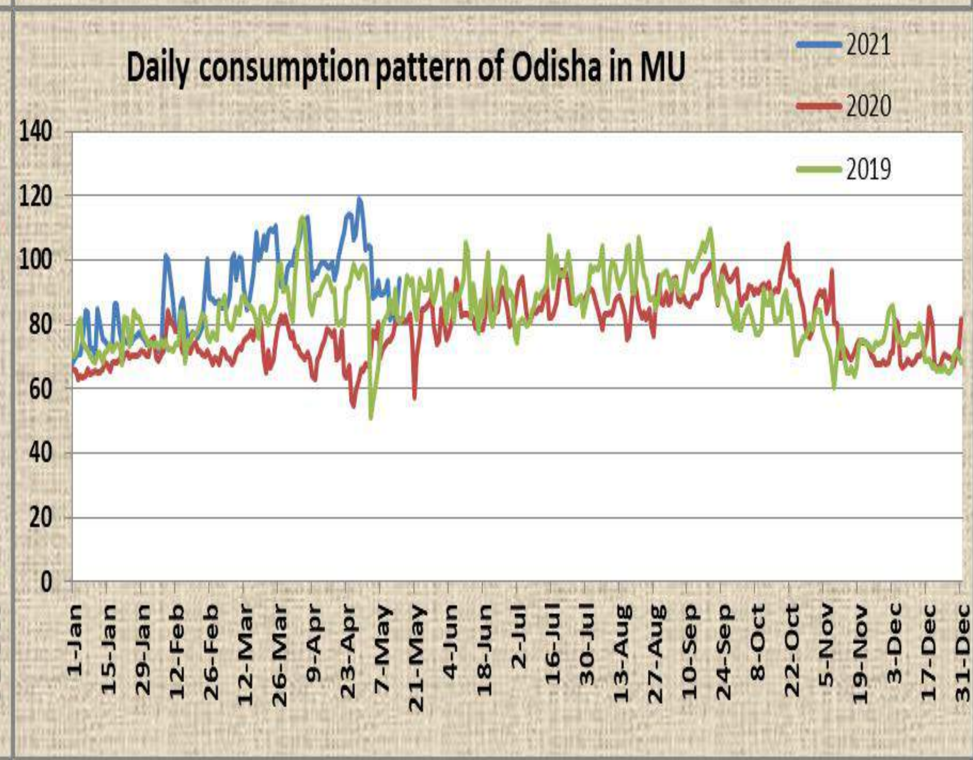

Schedule vs Actual Generation of Tala+Chukha+Kurichu+Dagachu+Mangdechu From 1st April to 30th April
600
500
400
300
200
100
0
-100
MW------>
01-Apr-21
02-Apr-21
03-Apr-21
04-Apr-21
05-Apr-21
06-Apr-21
07-Apr-21
08-Apr-21
09-Apr-21
10-Apr-21
11-Apr-21
12-Apr-21
13-Apr-21
14-Apr-21
15-Apr-21
16-Apr-21
17-Apr-21
18-Apr-21
19-Apr-21
20-Apr-21
21-Apr-21
22-Apr-21
23-Apr-21
24-Apr-21
25-Apr-21
26-Apr-21
27-Apr-21
28-Apr-21
29-Apr-21
30-Apr-21
Schedule
Actual

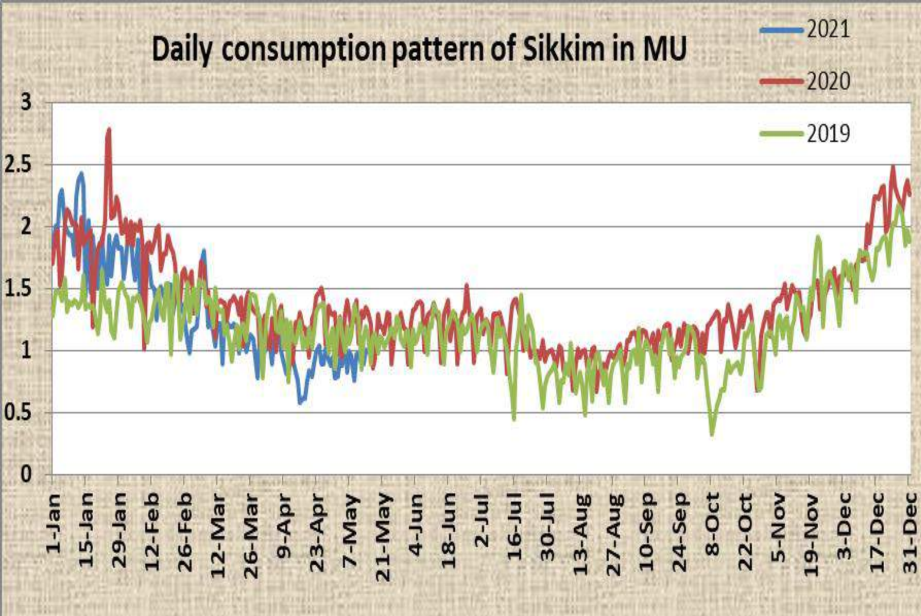

Schedule vs Actual Drawl of Nepal From 1st April to 30th April
500
450
400
350
300
250
200
150
100
50
0
MW------>
01-Apr-21
02-Apr-21
03-Apr-21
04-Apr-21
05-Apr-21
06-Apr-21
07-Apr-21
08-Apr-21
09-Apr-21
10-Apr-21
11-Apr-21
12-Apr-21
13-Apr-21
14-Apr-21
15-Apr-21
16-Apr-21
17-Apr-21
18-Apr-21
19-Apr-21
20-Apr-21
21-Apr-21
22-Apr-21
23-Apr-21
24-Apr-21
25-Apr-21
26-Apr-21
27-Apr-21
28-Apr-21
29-Apr-21
30-Apr-21
Schedule
Actual

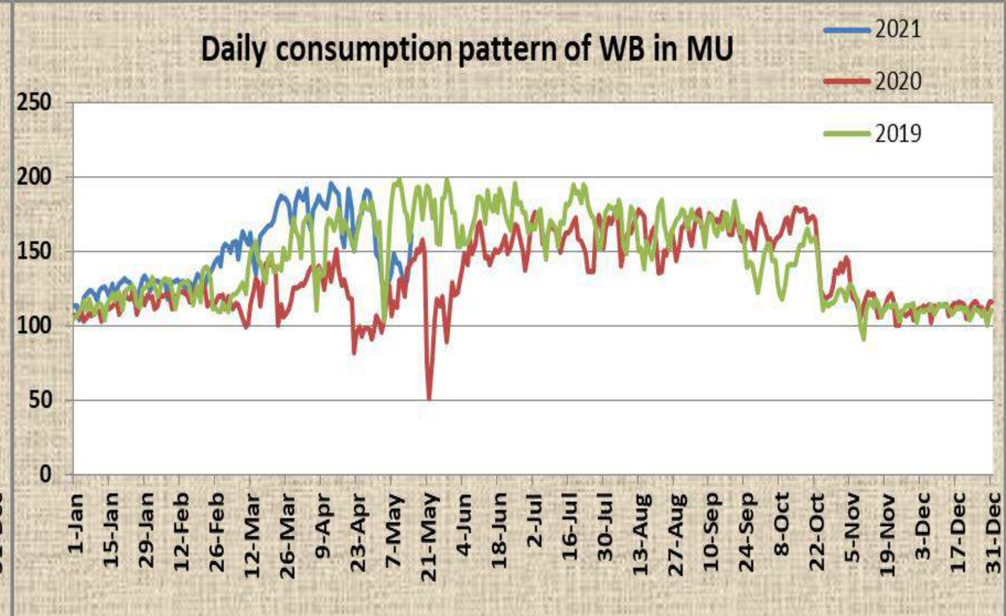

Daily consumption pattern of Bihar in MU
2021
2020
2019
0
20
40
60
80
100
120
140
1-Jan
15-Jan
29-Jan
12-Feb
26-Feb
12-Mar
26-Mar
9-Apr
23-Apr
7-May
21-May
4-Jun
18-Jun
2-Jul
16-Jul
30-Jul
13-Aug
27-Aug
10-Sep
24-Sep
8-Oct
22-Oct
5-Nov
19-Nov
3-Dec
17-Dec
31-Dec

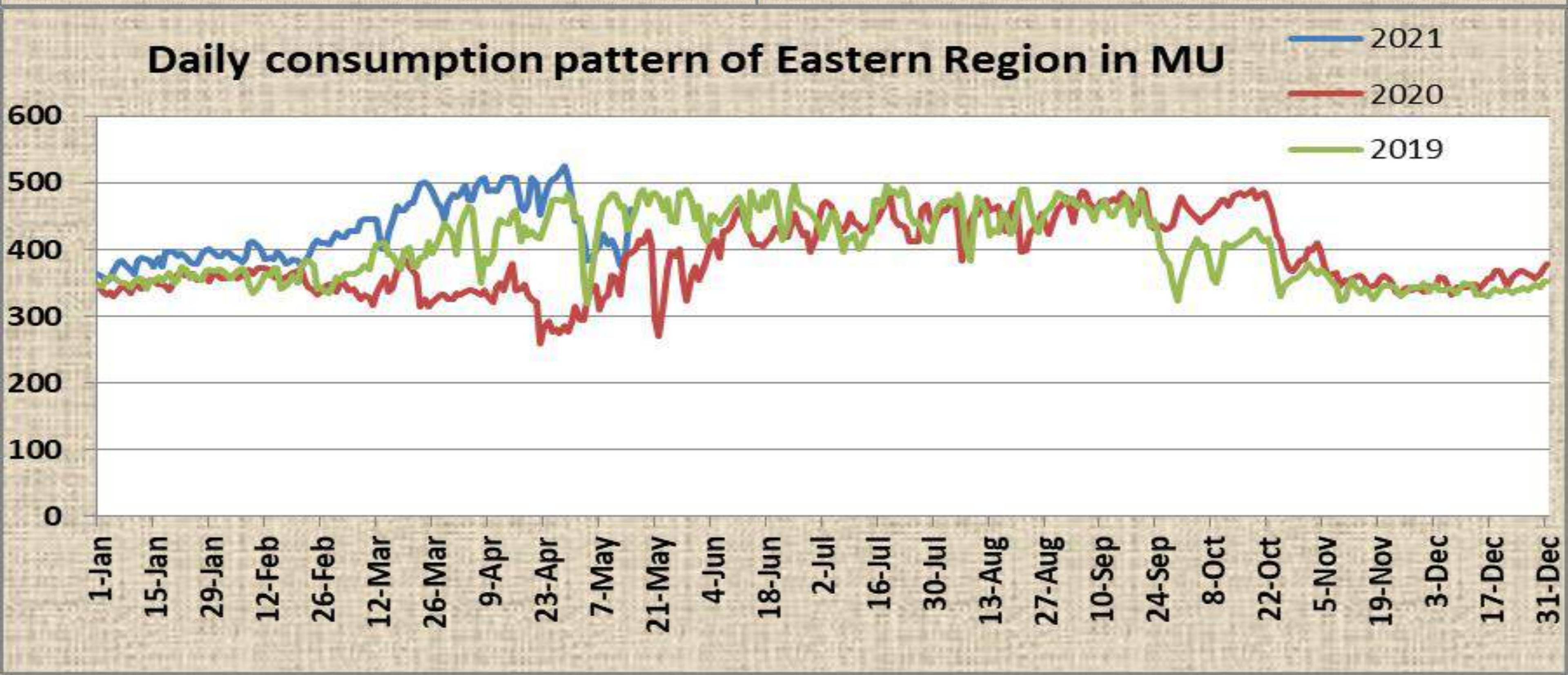

Daily consumption pattern of DVC in MU
2021
2020
2019
0
10
20
30
40
50
60
70
80
90
1-Jan
15-Jan
29-Jan
12-Feb
26-Feb
12-Mar
26-Mar
9-Apr
23-Apr
7-May
21-May
4-Jun
18-Jun
2-Jul
16-Jul
30-Jul
13-Aug
27-Aug
10-Sep
24-Sep
8-Oct
22-Oct
5-Nov
19-Nov
3-Dec
17-Dec
31-Dec


Daily consumption pattern of Jharkhand in MU
2021
2020
2019
0
5
10
15
20
25
30
35
1-Jan
15-Jan
29-Jan
12-Feb
26-Feb
12-Mar
26-Mar
9-Apr
23-Apr
7-May
21-May
4-Jun
18-Jun
2-Jul
16-Jul
30-Jul
13-Aug
27-Aug
10-Sep
24-Sep
8-Oct
22-Oct
5-Nov
19-Nov
3-Dec
17-Dec
31-Dec

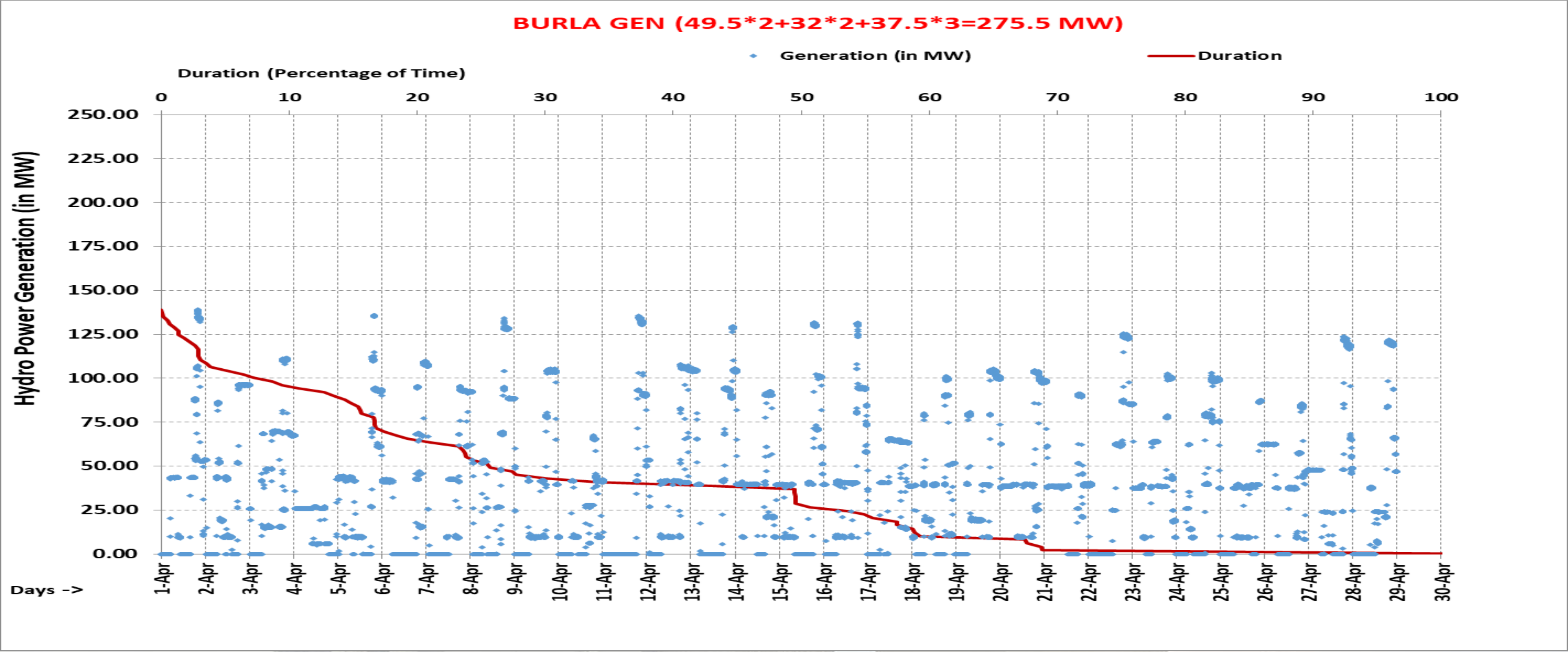

Daily consumption pattern of Odisha in MU
2021
2020
2019
0
20
40
60
80
100
120
140
1-Jan
15-Jan
29-Jan
12-Feb
26-Feb
12-Mar
26-Mar
9-Apr
23-Apr
7-May
21-May
4-Jun
18-Jun
2-Jul
16-Jul
30-Jul
13-Aug
27-Aug
10-Sep
24-Sep
8-Oct
22-Oct
5-Nov
19-Nov
3-Dec
17-Dec
31-Dec

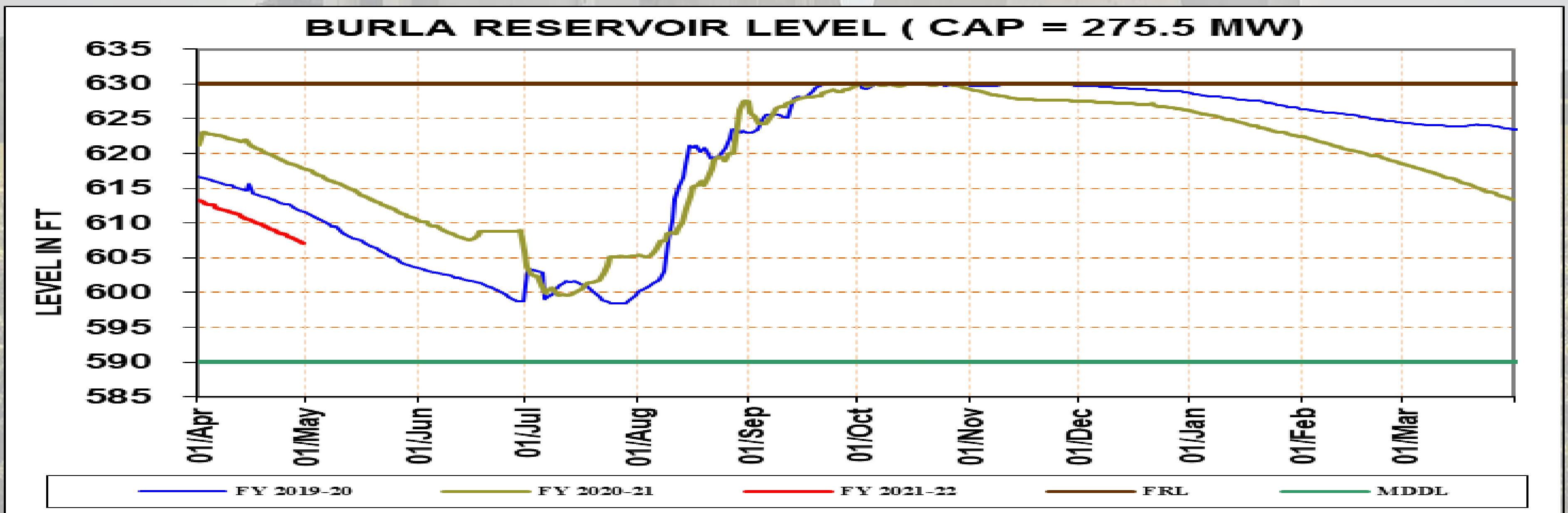

Daily consumption pattern of Sikkim in MU
2021
2020
2019
3
2.5
2
1.5
1
0.5
0
1-Jan
15-Jan
29-Jan
12-Feb
26-Feb
12-Mar
26-Mar
9-Apr
23-Apr
7-May
21-May
4-Jun
18-Jun
2-Jul
16-Jul
30-Jul
13-Aug
27-Aug
10-Sep
24-Sep
8-Oct
22-Oct
5-Nov
19-Nov
3-Dec
17-Dec
31-Dec

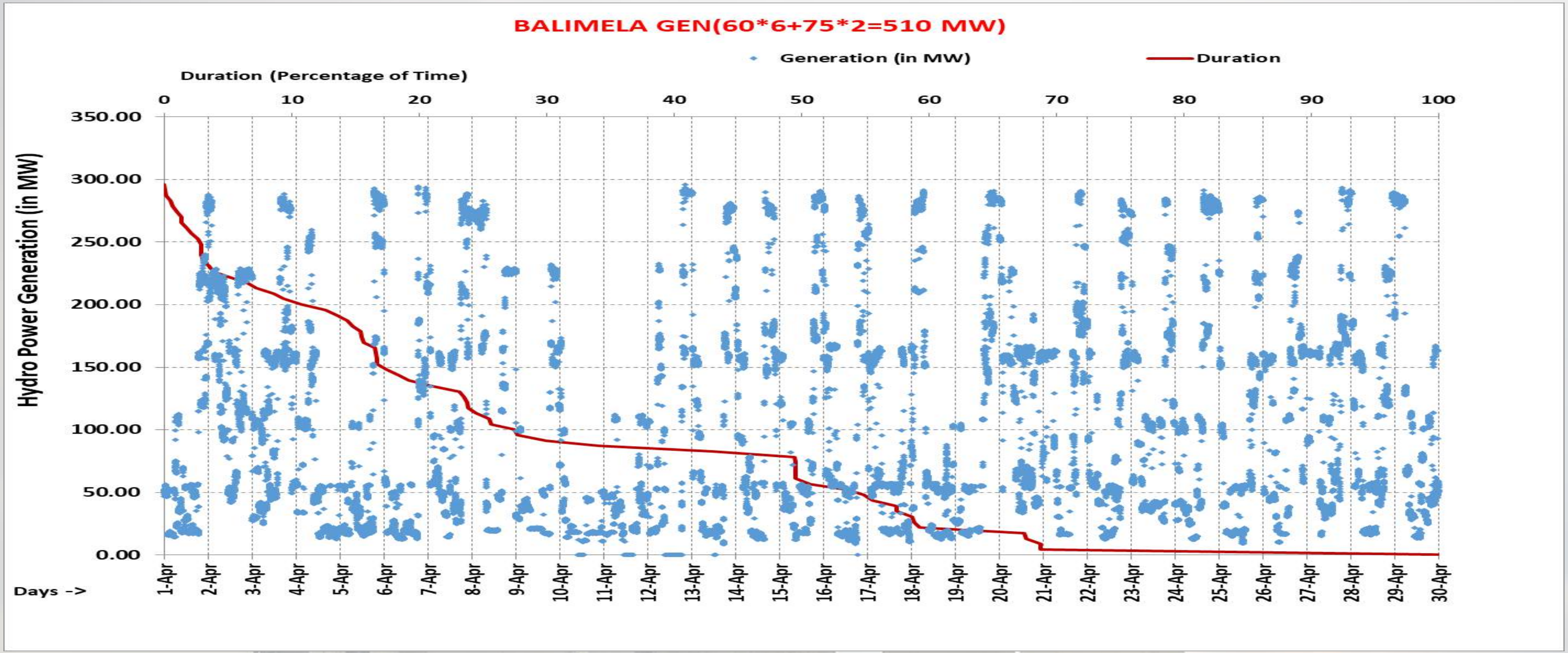

Daily consumption pattern of WB in MU
2021
2020
2019
250
200
150
100
50
0
1-Jan
15-Jan
29-Jan
12-Feb
26-Feb
12-Mar
26-Mar
9-Apr
23-Apr
7-May
21-May
4-Jun
18-Jun
2-Jul
16-Jul
30-Jul
13-Aug
27-Aug
10-Sep
24-Sep
8-Oct
22-Oct
5-Nov
19-Nov
3-Dec
17-Dec
31-Dec

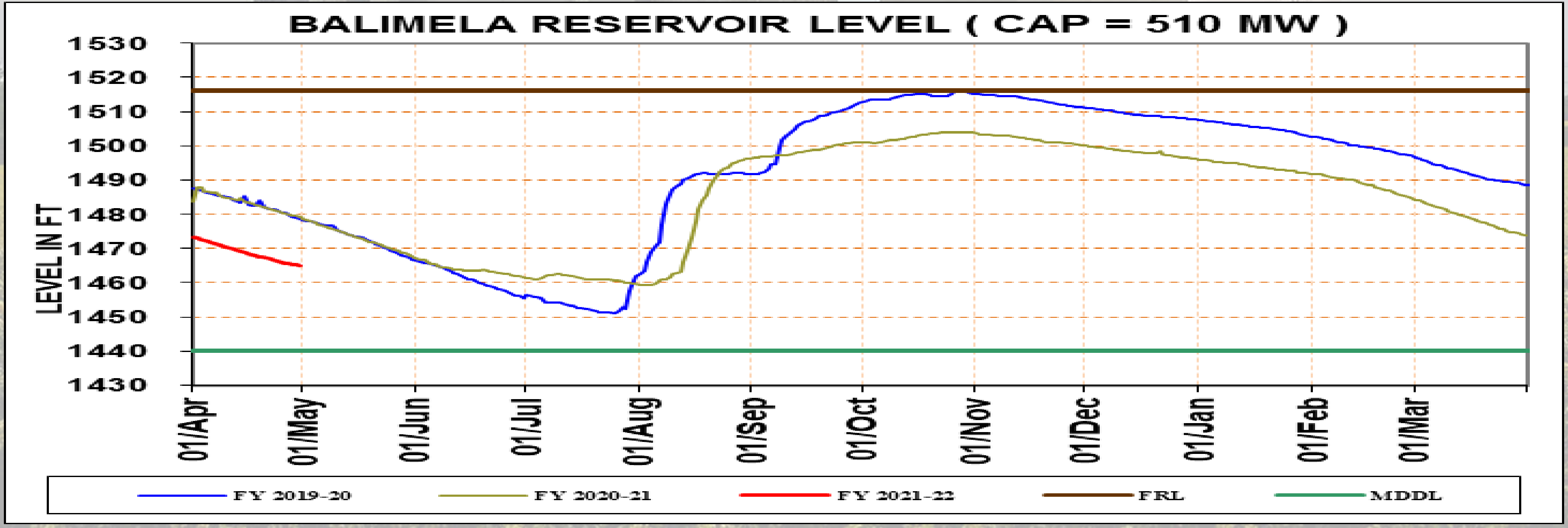

Daily consumption pattern of Eastern Region in MU
2021
2020
2019
600
500
400
300
200
100
0
1-Jan
15-Jan
29-Jan
12-Feb
26-Feb
12-Mar
26-Mar
9-Apr
23-Apr
7-May
21-May
4-Jun
18-Jun
2-Jul
16-Jul
30-Jul
13-Aug
27-Aug
10-Sep
24-Sep
8-Oct
22-Oct
5-Nov
19-Nov
3-Dec
17-Dec
31-Dec

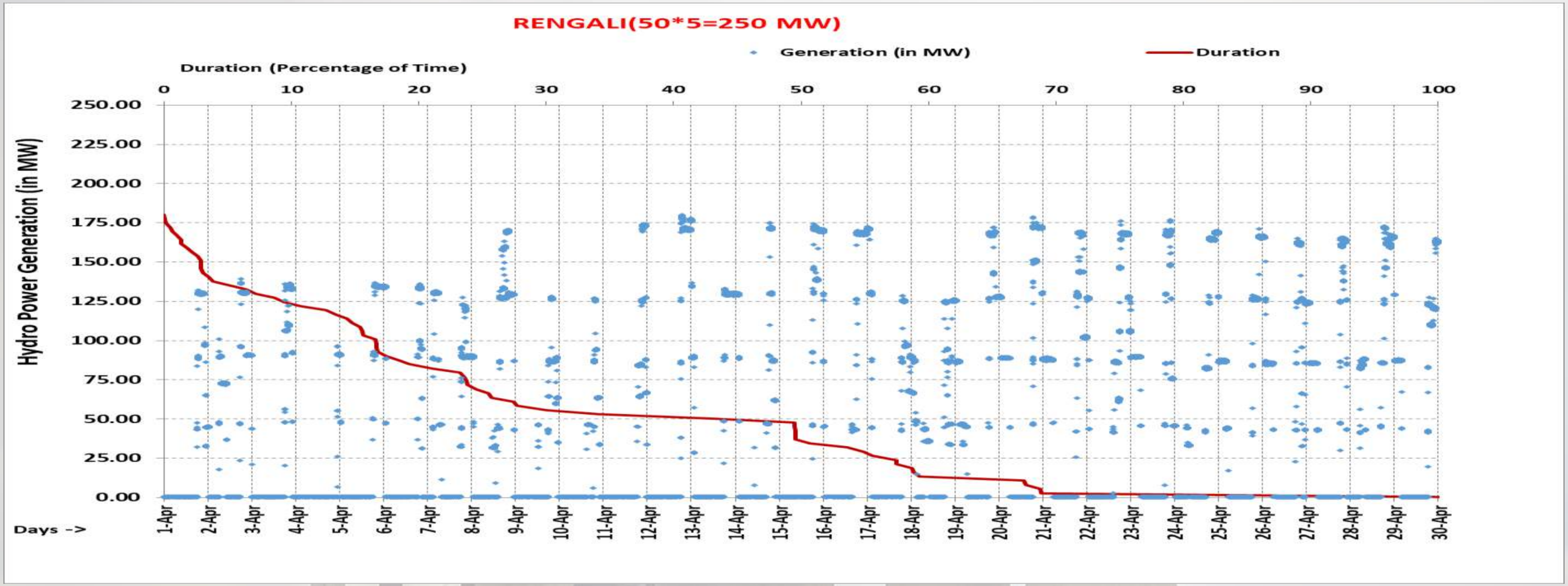
State Hydro Generators Performance


BURLA GEN (49.5*2+32*2+37.5*3=275.5 MW)
Generation (in MW)
Duration
Duration (Percentage of Time)
Hydro Power Generation (in MW)
Days ->

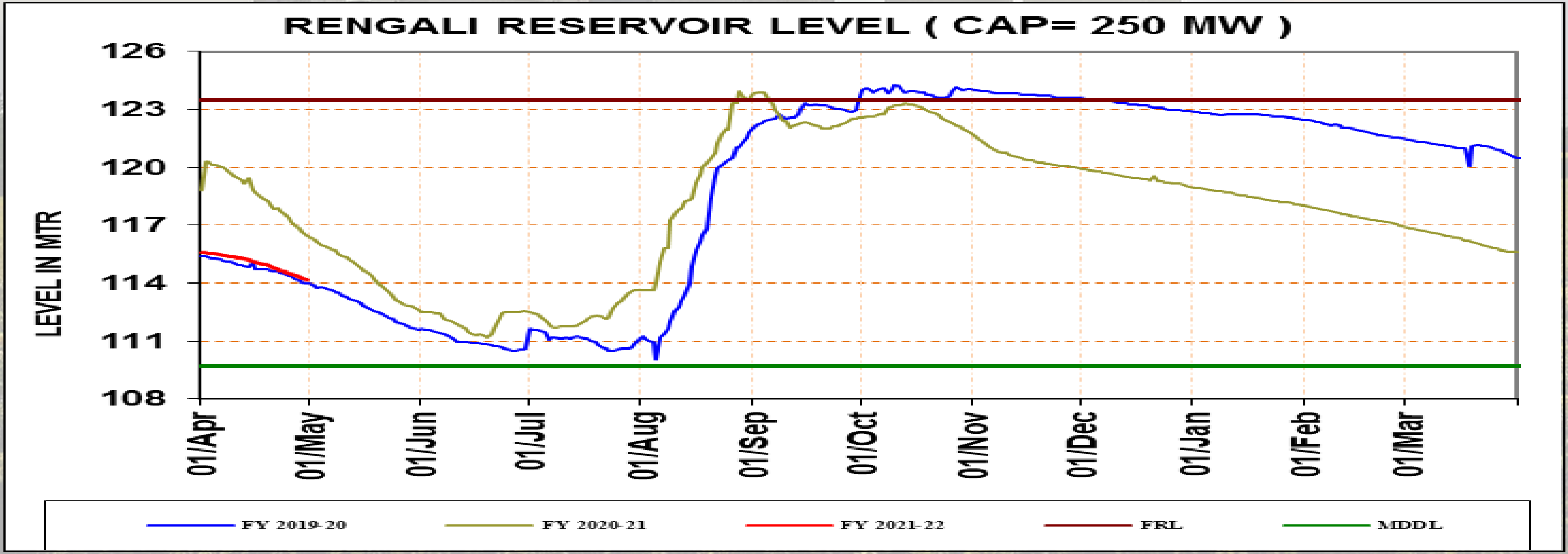

BURLA RESERVOIR LEVEL (CAP = 275.5 MW)
LEVEL IN FT
FY 2019-20
FY 2020-21
FY 2021-22
FRL
MDDL


BALIMELA GEN(60*6+75*2=510 MW)
Generation (in MW)
Duration
Duration (Percentage of Time)
0
10
20
30
40
50
60
70
80
90
100
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Hydro Power Generation (in MW)
Days ->
1-Apr
2-Apr
3-Apr
4-Apr
5-Apr
6-Apr
7-Apr
8-Apr
9-Apr
10-Apr
11-Apr
12-Apr
13-Apr
14-Apr
15-Apr
16-Apr
17-Apr
18-Apr
19-Apr
20-Apr
21-Apr
22-Apr
23-Apr
24-Apr
25-Apr
26-Apr
27-Apr
28-Apr
29-Apr
30-Apr

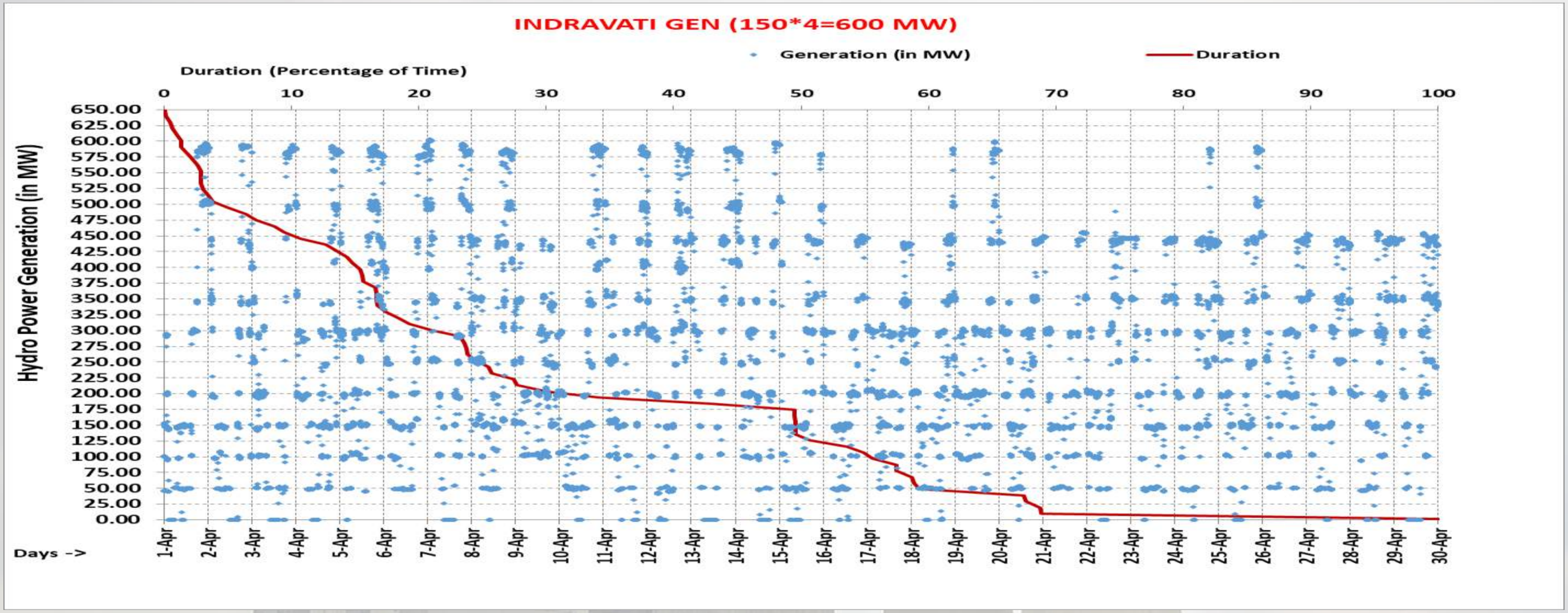

BALIMELA RESERVOIR LEVEL (CAP = 510 MW)
1530
1520
1510
1500
1490
1480
1470
1460
1450
1440
1430
LEVEL IN FT
01/Apr
01/May
01/Jun
01/Jul
01/Aug
01/Sep
01/Oct
01/Nov
01/Dec
01/Jan
01/Feb
01/Mar
FY 2019-20
FY 2020-21
FY 2021-22
FRL
MDDL

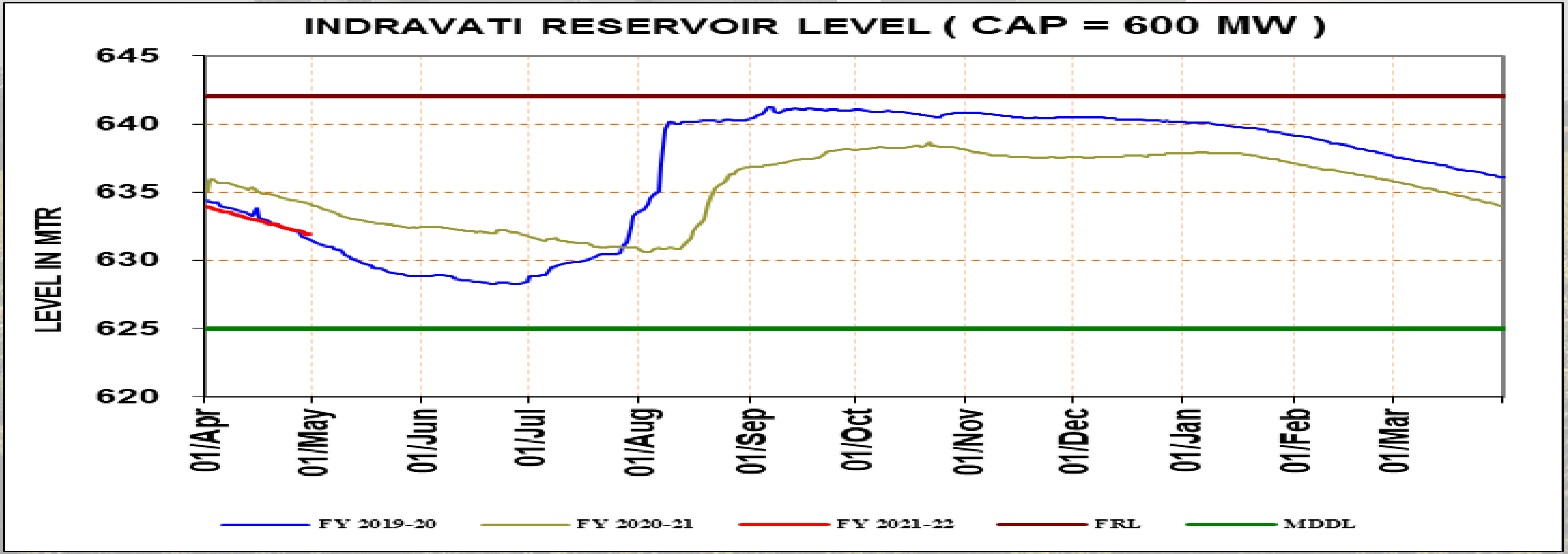


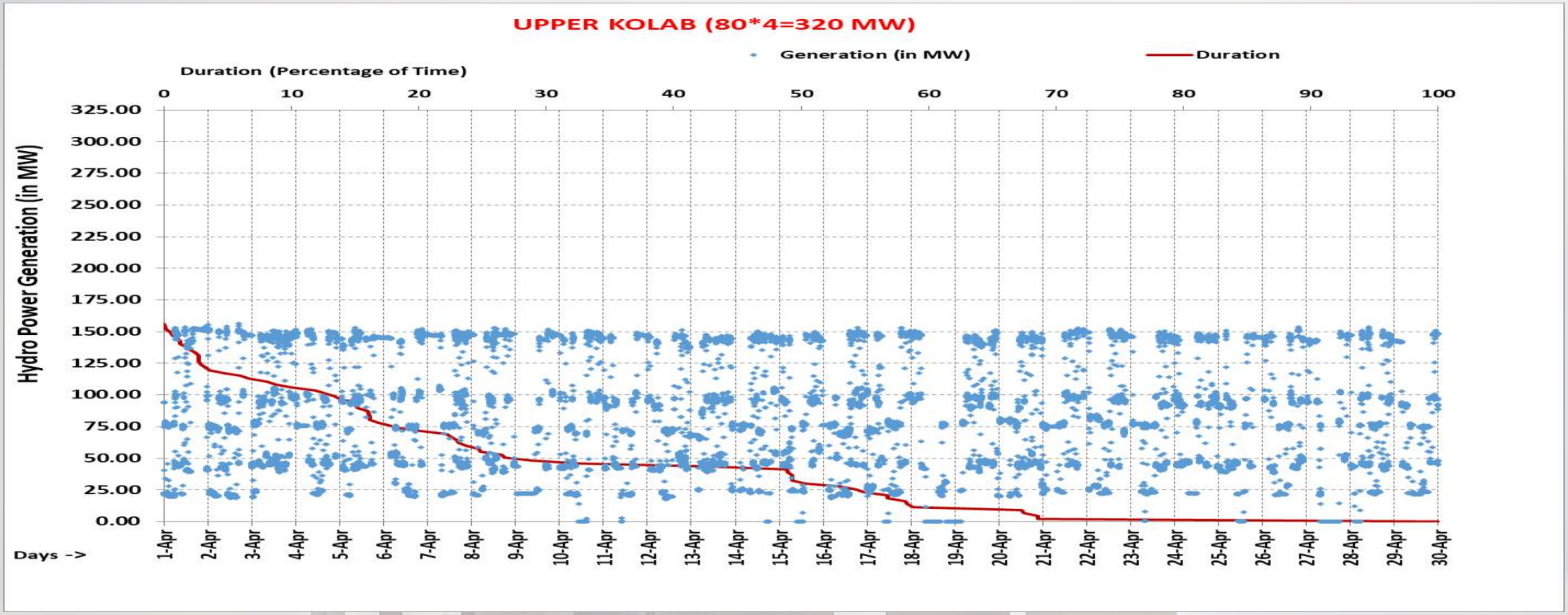
RENGALI(50*5=250 MW)
Generation (in MW)
Duration
Duration (Percentage of Time)
Hydro Power Generation (in MW)
Days ->

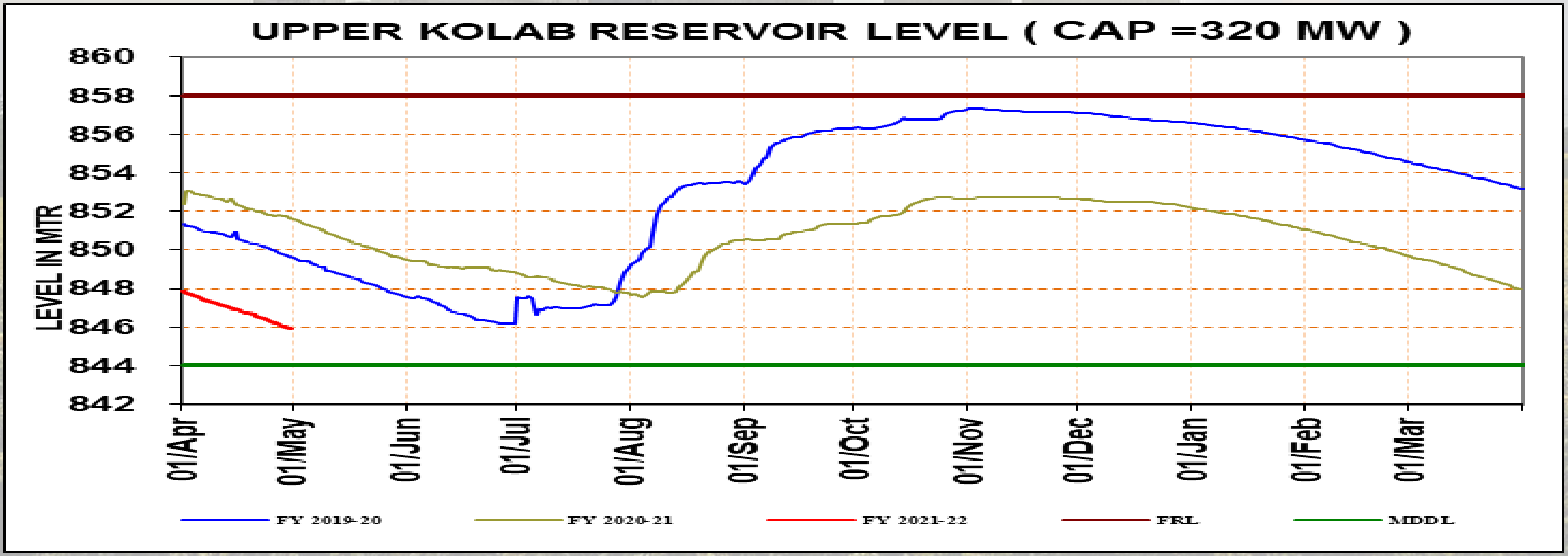


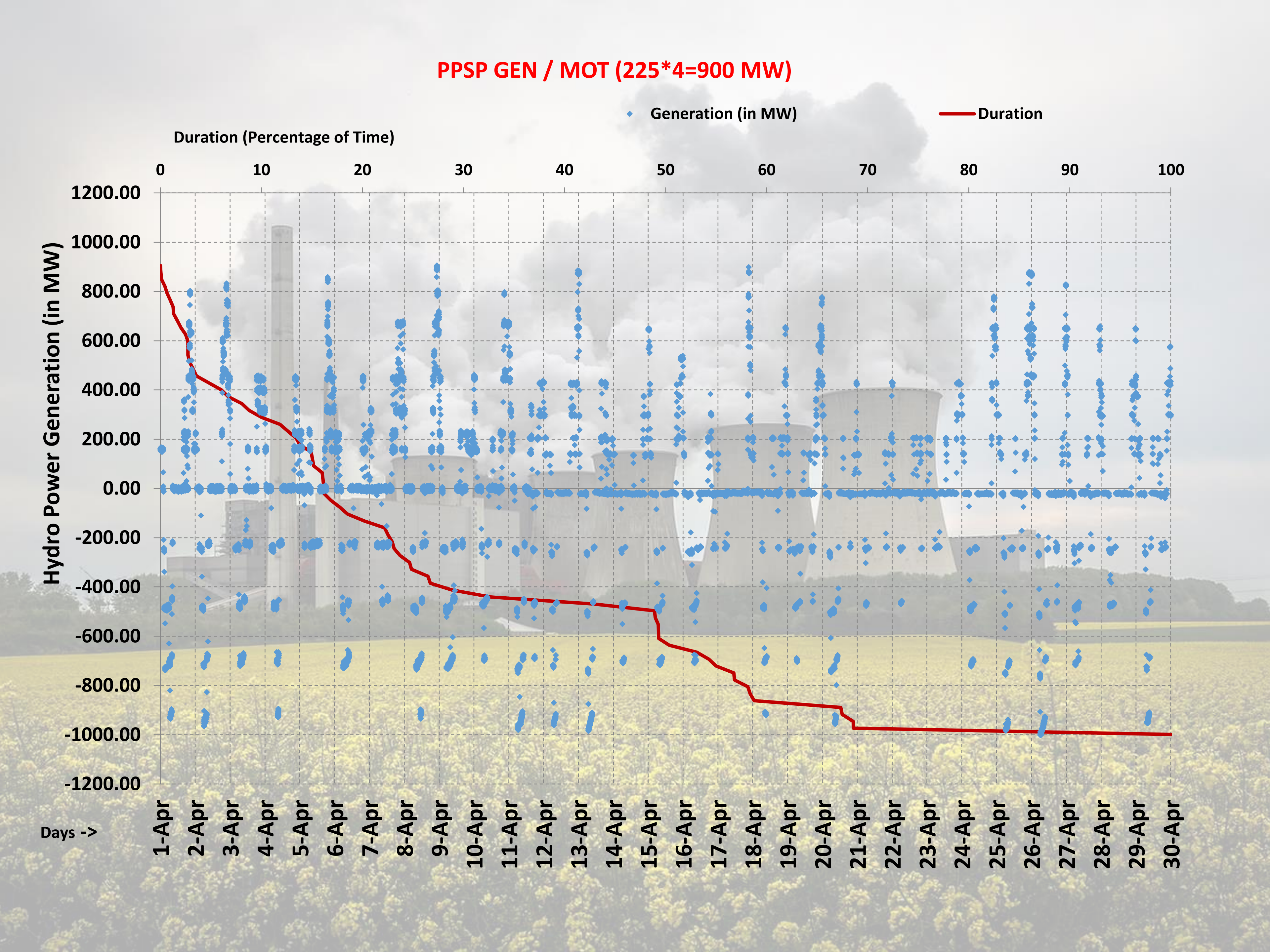
RENGALI RESERVOIR LEVEL (CAP= 250 MW)
LEVEL IN MTR
FY 2019-20
FY 2020-21
FY 2021-22
FRL
MDDL


INDRAVATI GEN (150*4=600 MW)
Generation (in MW)
Duration
Duration (Percentage of Time)
Hydro Power Generation (in MW)
Days ->


INDRAVATI RESERVOIR LEVEL (CAP = 600 MW)
LEVEL IN MTR
FY 2019-20
FY 2020-21
FY 2021-22
FRL
MDDL


UPPER KOLAB (80*4=320 MW)
Generation (in MW)
Duration
Duration (Percentage of Time)
0
10
20
30
40
50
60
70
80
90
100
325.00
300.00
275.00
250.00
225.00
200.00
175.00
150.00
125.00
100.00
75.00
50.00
25.00
0.00
Hydro Power Generation (in MW)
Days ->
1-Apr
2-Apr
3-Apr
4-Apr
5-Apr
6-Apr
7-Apr
8-Apr
9-Apr
10-Apr
11-Apr
12-Apr
13-Apr
14-Apr
15-Apr
16-Apr
17-Apr
18-Apr
19-Apr
20-Apr
21-Apr
22-Apr
23-Apr
24-Apr
25-Apr
26-Apr
27-Apr
28-Apr
29-Apr
30-Apr


UPPER KOLAB RESERVOIR LEVEL (CAP =320 MW)
860
858
856
854
852
850
848
846
844
842
LEVEL IN MTR
01/Apr
01/May
01/Jun
01/Jul
01/Aug
01/Sep
01/Oct
01/Nov
01/Dec
01/Jan
01/Feb
01/Mar
FY 2019-20
FY 2020-21
FY 2021-22
FRL
MDDL



PPSP GEN / MOT (225*4=900 MW)
Generation (in MW)
Duration
Duration (Percentage of Time)
0
10
20
30
40
50
60
70
80
90
100
Hydro Power Generation (in MW)
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
-200.00
-400.00
-600.00
-800.00
-1000.00
-1200.00
Days ->
1-Apr
2-Apr
3-Apr
4-Apr
5-Apr
6-Apr
7-Apr
8-Apr
9-Apr
10-Apr
11-Apr
12-Apr
13-Apr
14-Apr
15-Apr
16-Apr
17-Apr
18-Apr
19-Apr
20-Apr
21-Apr
22-Apr
23-Apr
24-Apr
25-Apr
26-Apr
27-Apr
28-Apr
29-Apr
30-Apr

THANKS

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड
(भारत सरकार का उद्यम)
POWER SYSTEM OPERATION CORPORATION LIMITED
(A Government of India Enterprise)
Eastern Regional Load Despatch Centre: 14, Golf Club Road, Tollygunge, Kolkata-700 033.
CIN: U40105DL2009GOI188682
फोन: 033- 24235755, 24174049 फैक्स : 033-24235809/5029 Website: www.erldc.org, Email ID- erldc@posoco.in

Date: 17-05-2021

Report on primary frequency response observed in the generating units of Eastern Region for April 2021 (April 2021 के लिए पूर्वी क्षेत्र के विधुत इकाइयों पर प्राथमिक आवृत्ति प्रतिक्रिया पर रिपोर्ट)

Frequency response characteristics (FRC) have been analyzed pan India for one event of sudden frequency change that occurred in the month of April 2021. The details of this event and the overall response of the Eastern region have been summarized in Table 1.

Table 1: Summary of the events and Frequency Response Characteristic (FRC) of the Eastern Region for the events

Event	Frequency Change	Power Number (ΔMW/Δf)	ER FRC
Event 1: On 08th April 2021 at 03:31:34 hrs, around 1045 MW generation loss occurred at Bhadla in NR.	**49.994Hz to 49.903 Hz.** Later stabilized at 49.95 Hz	**11484**	**14 %**

Summary of the analysis of these events are given below:

1. **In spite of repeated reminders, generation end data (generation output in MW and frequency/speed measured at generator end) and FRCs are yet to be received from few regional generating stations (ISGS and IPP) and SLDCs respectively**. List of such regional generating stations/SLDCs are shown below **(as per status on 16th May2021)**.
   a. NTPC Farakka
   b. NTPC Kahalgaon
   c. NTPC Talcher
   d. NTPC Barh
   e. NTPC Darlipalli
   f. BRBCL
   g. JITPL
   h. Bihar SLDC
   i. Jharkhand SLDC
   j. WB SLDC
2. Based on data received from regional generating stations & SLDCs and SCADA data archived at ERLDC, regional generating stations' and state control areas' performance have been analyzed and summarized in **table 2.**

3. Based on data received from state generating stations & SLDCs, the performance of state generating stations has been analyzed and summarized in **table 3.**

Table 2: performance of regional generating stations and state control areas for the events in April 2021*

Generating Station/ SLDC	Response observed
NTPC Farakka	**Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)**
NTPC Kahalgaon	**Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)**
NTPC Talcher	**Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)**
NTPC Barh	**Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)**
NTPC Darlipalli	**Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)**
BRBCL	**Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)**
NPGC Nabinagar	**Non-Satisfactory**
GMR	Unit 1 satisfactory; Unit 2 Non satisfactory
JITPL	**Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)**
MPL	**Non-Satisfactory;** Both the units were being run in VWO due to poor vaccum
Adhunik	**Non-Satisfactory**
Teesta V HEP	Unit not in service
Teesta III HEP	Unit not in service
Dikchu HEP	Unit not in service
Bihar SLDC	**Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)**
Jharkhand SLDC	**Satisfactory (As per FRC calculated based on ERLDC SCADA data)**
DVC SLDC	**Non-Satisfactory**
GRIDCO SLDC	**Non-Satisfactory**
WB SLDC	**Non-Satisfactory (As per FRC calculated based on ERLDC SCADA data)**

***Response of the generating stations are shown in Annexure 1**

Table 3: performance of state generating stations for the events in April 2021 (Based on data received from SLDC/generating stations) **

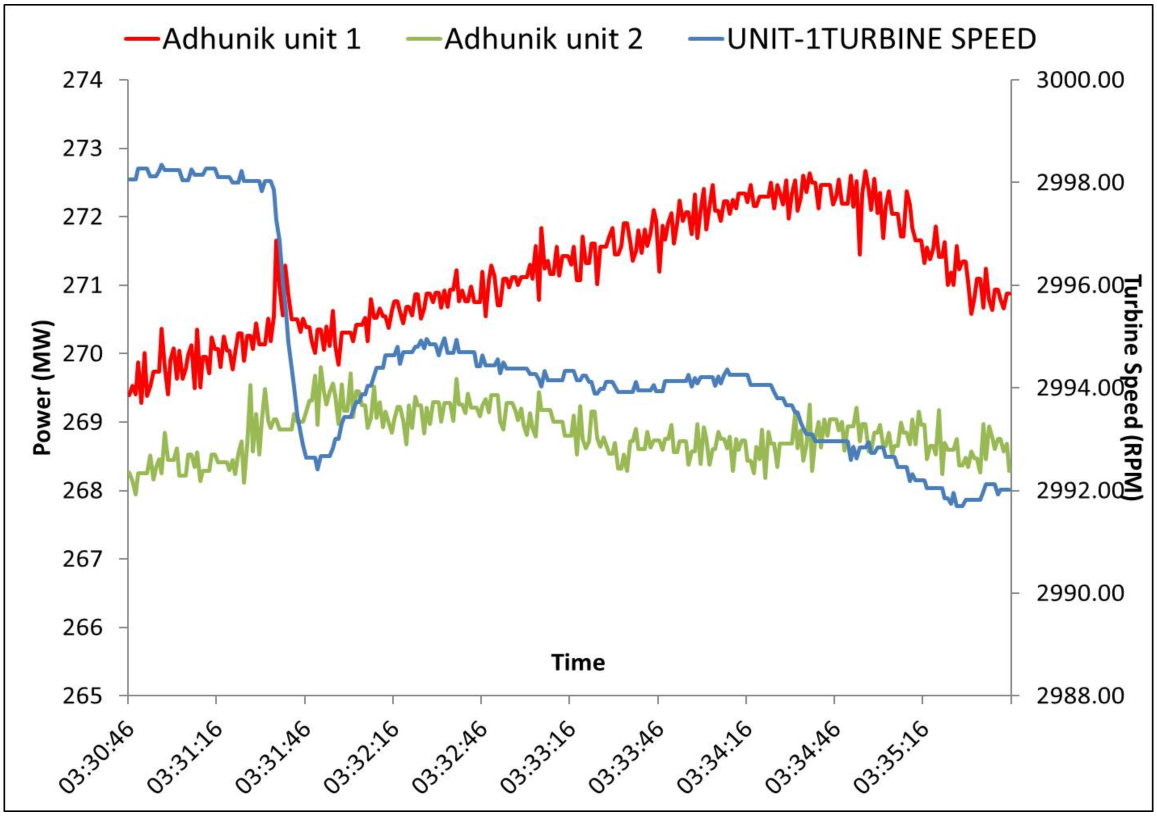
Generating Station	Response observed
HEL	**Satisfactory;**
BBGS	**Non-Satisfactory for unit 1 and 3**; Both units were being run at more than installed capacity. Satisfactory for unit 2.
GMR unit 3	Satisfactory
Koderma, RTPS, DSTPS	**Non-Satisfactory**

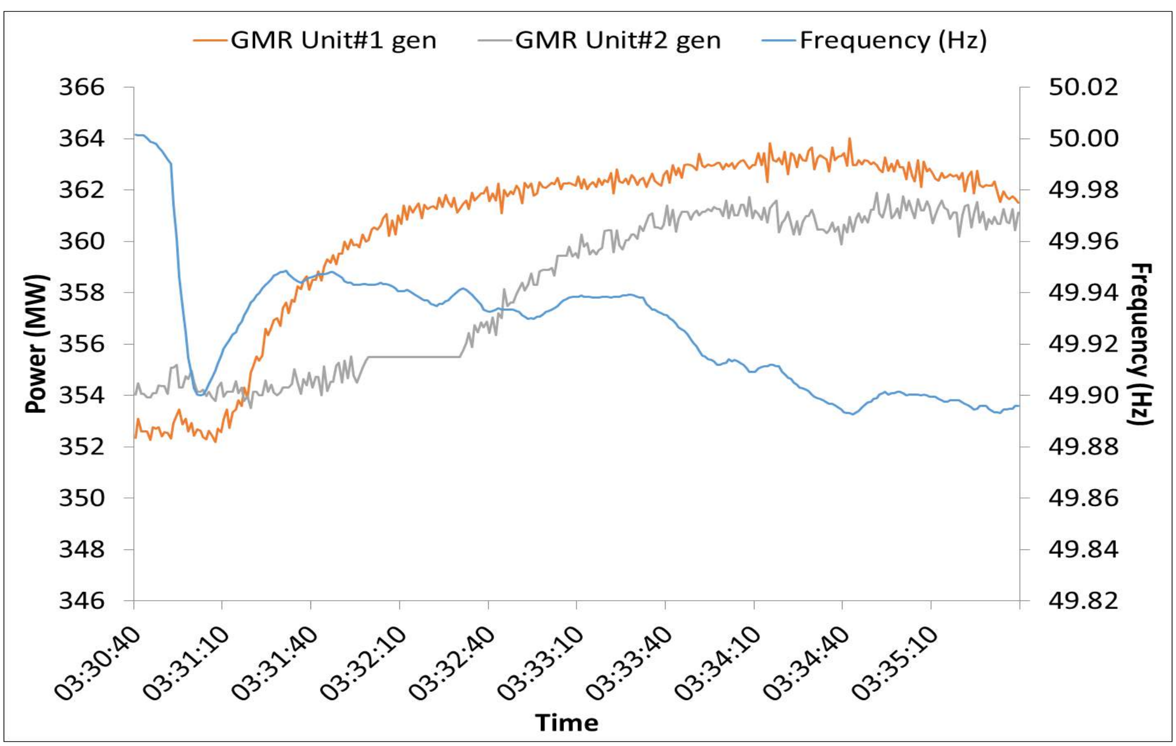
****Response of these generating stations are shown in Annexure 2**

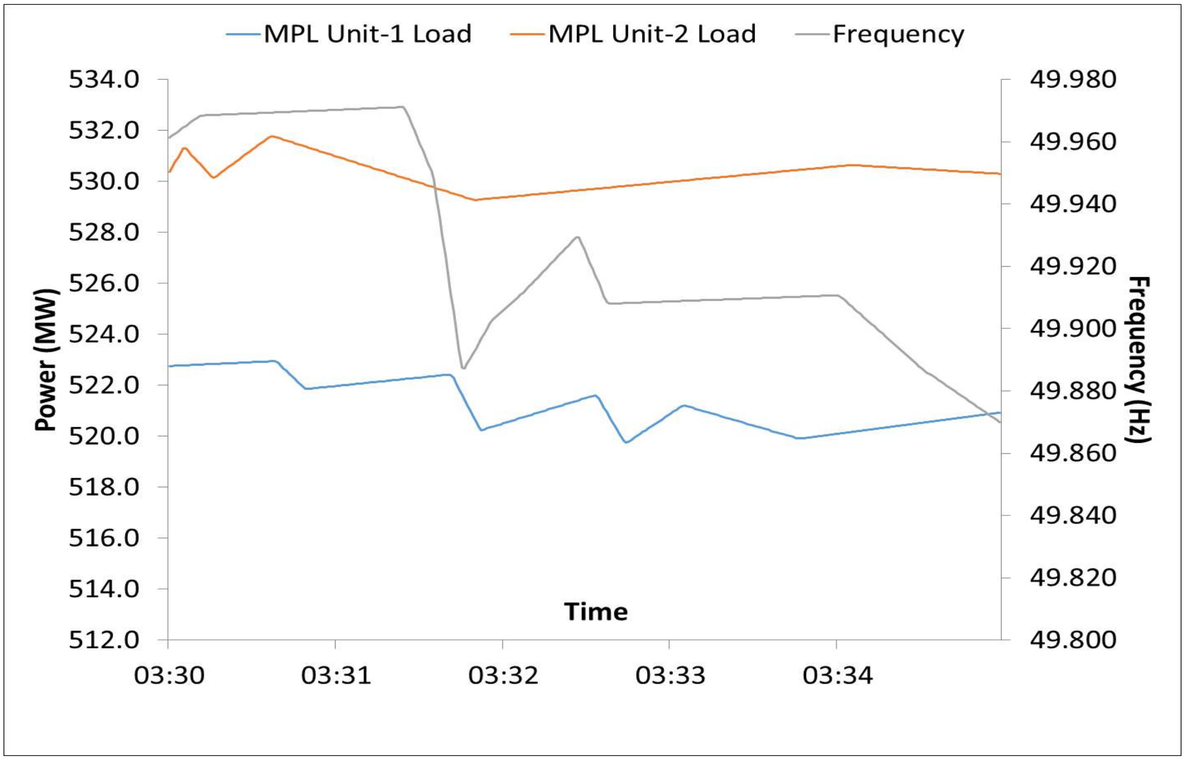
Remarks on the primary frequency response observed at generating stations (प्राथमिक आवृत्ति प्रतिक्रिया पर टिप्पणियां देखी गईं):

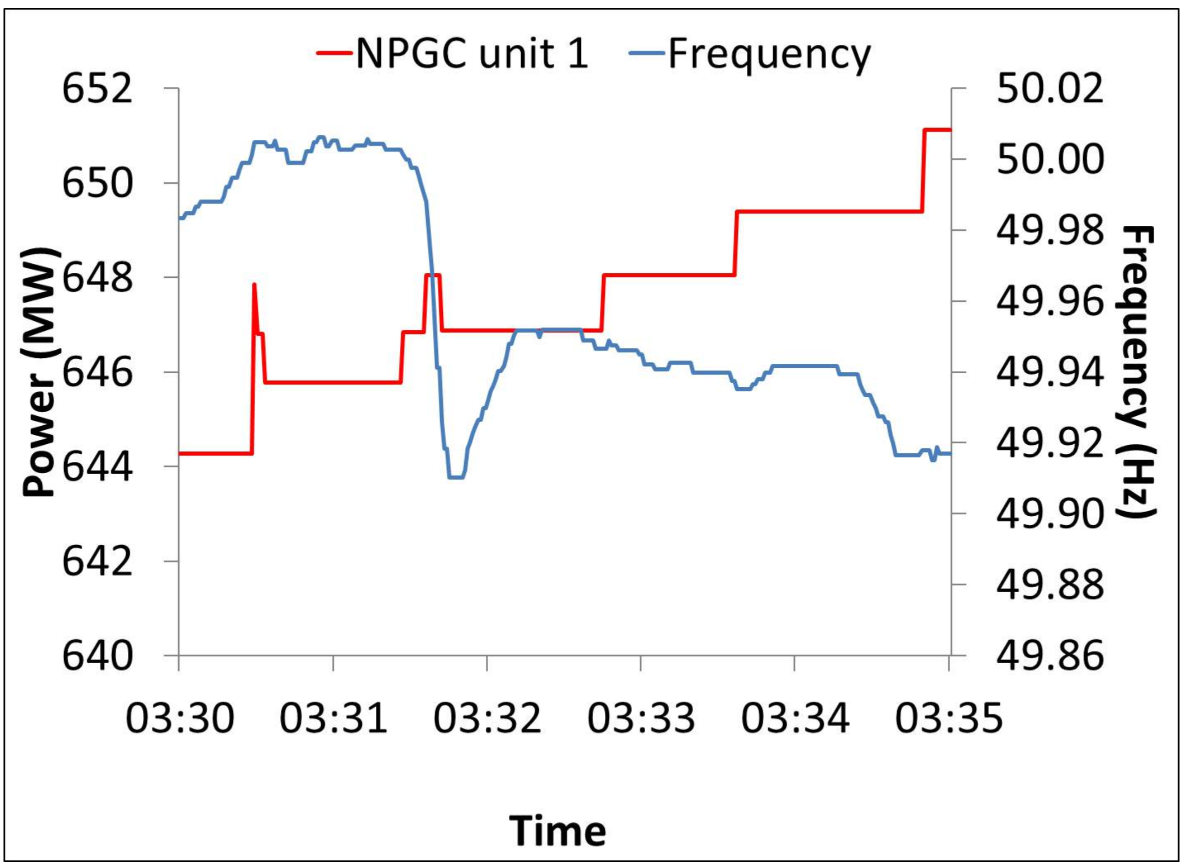
- **MPL**: Unit 2 was being run at Valve wide open (VWO) condition. So no response has been observed in case of unit 2. As per section 5.2 (h) of IEGC, generating units are not to be run in VWO condition. **In compliance of IEGC, it is advised to avoid running unit in VWO condition**.
- **HEL**: Response did not sustain for more than 90 seconds. Governor may be tuned for providing sustained response for at least 3-5 minutes.

Annexure 1: Variation of generation of regional generating units during frequency change (plotted based on data shared by generating station)

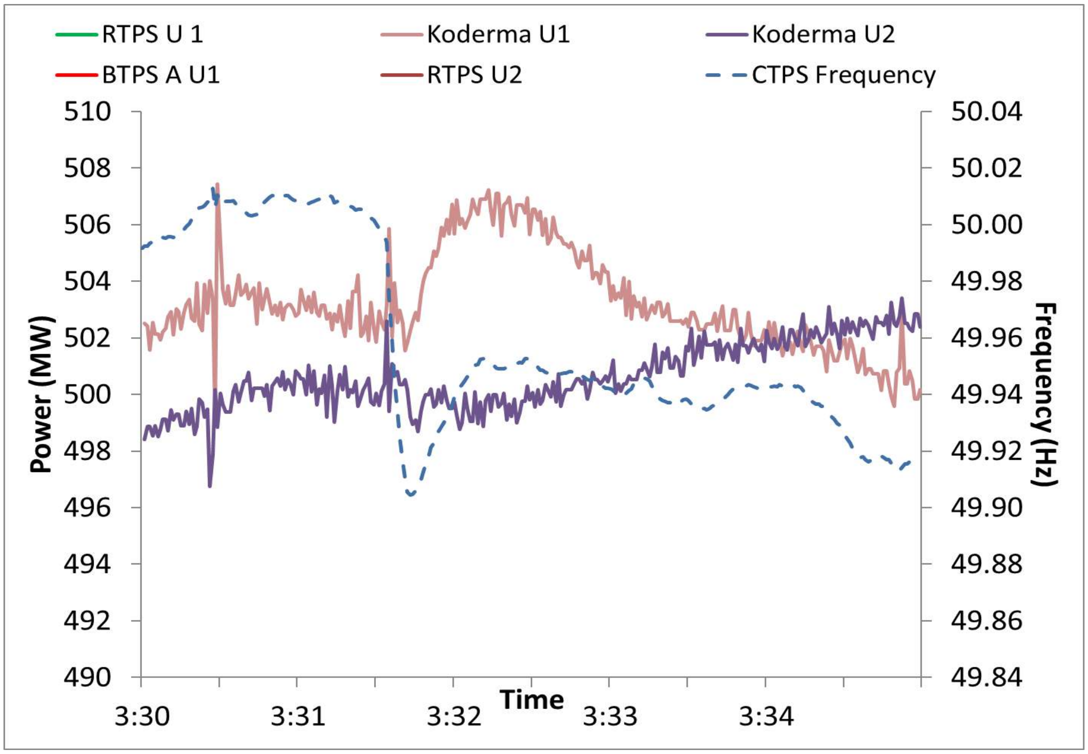


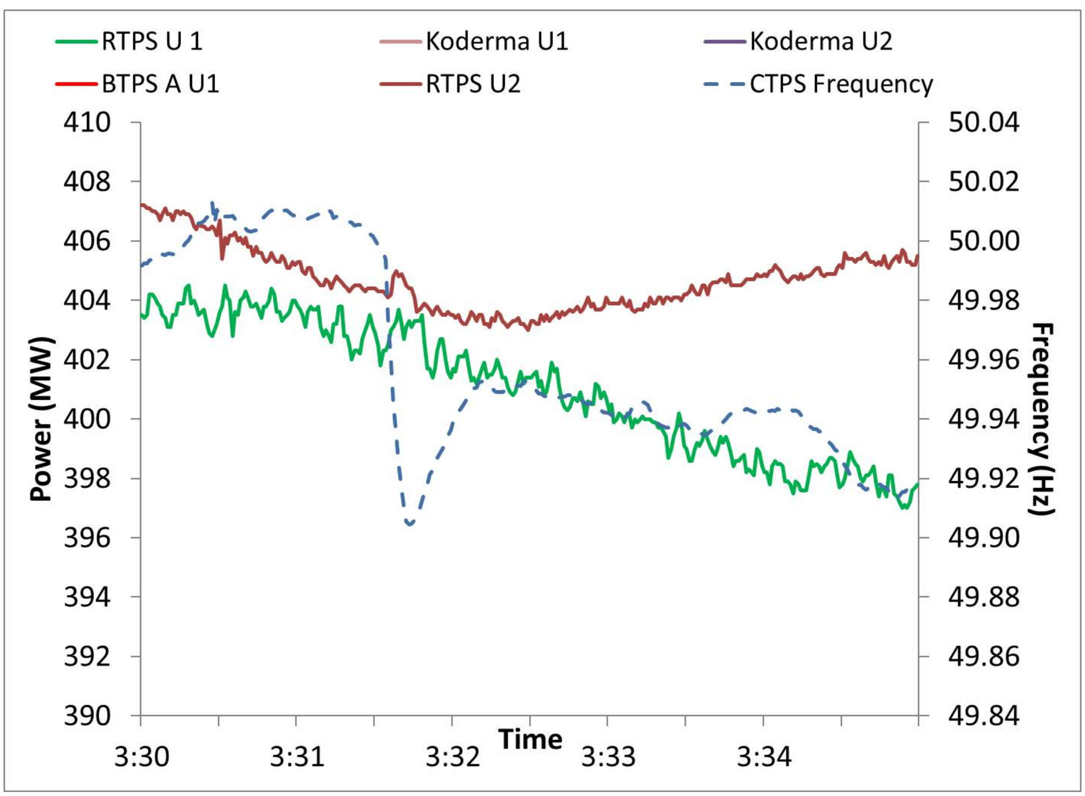


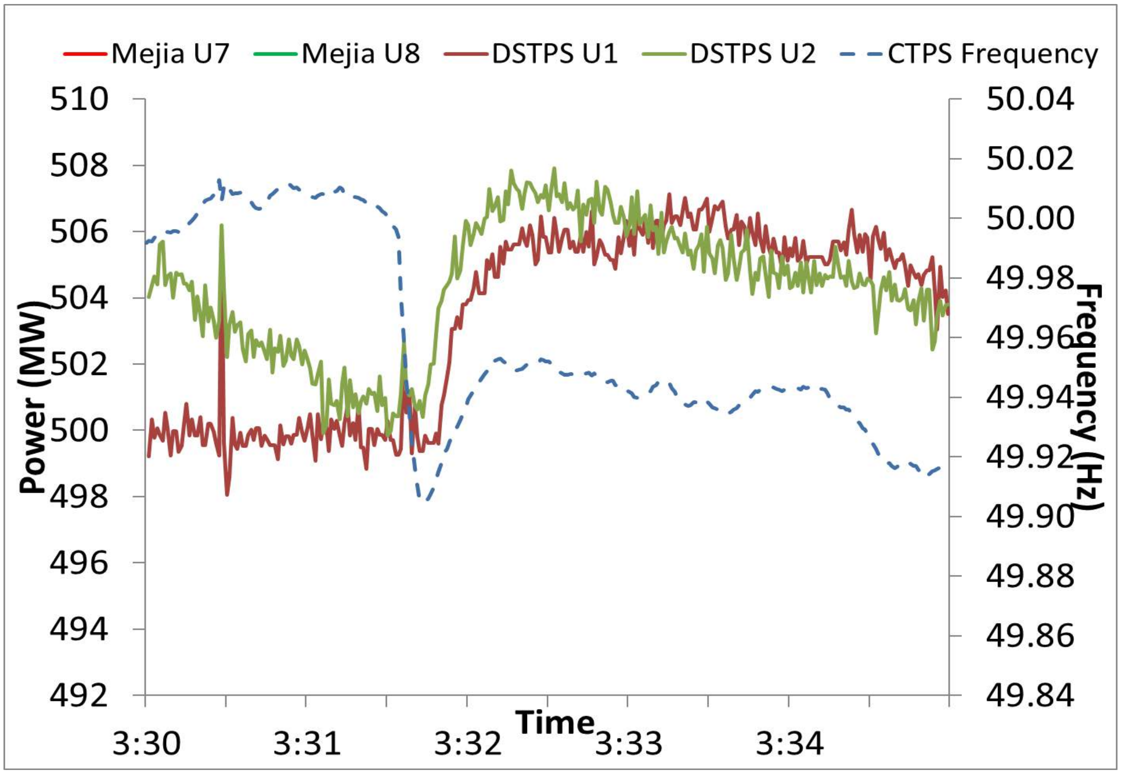

MPL Unit-1 Load
MPL Unit-2 Load
Frequency
534.0
532.0
530.0
528.0
526.0
524.0
522.0
520.0
518.0
516.0
514.0
512.0
Power (MW)
49.980
49.960
49.940
49.920
49.900
49.880
49.860
49.840
49.820
49.800
Frequency (Hz)
Time
03:30
03:31
03:32
03:33
03:34


NPGC unit 1
Frequency
652
650
648
646
644
642
640
Power (MW)
50.02
50.00
49.98
49.96
49.94
49.92
49.90
49.88
49.86
Frequency (Hz)
03:30
03:31
03:32
03:33
03:34
03:35
Time

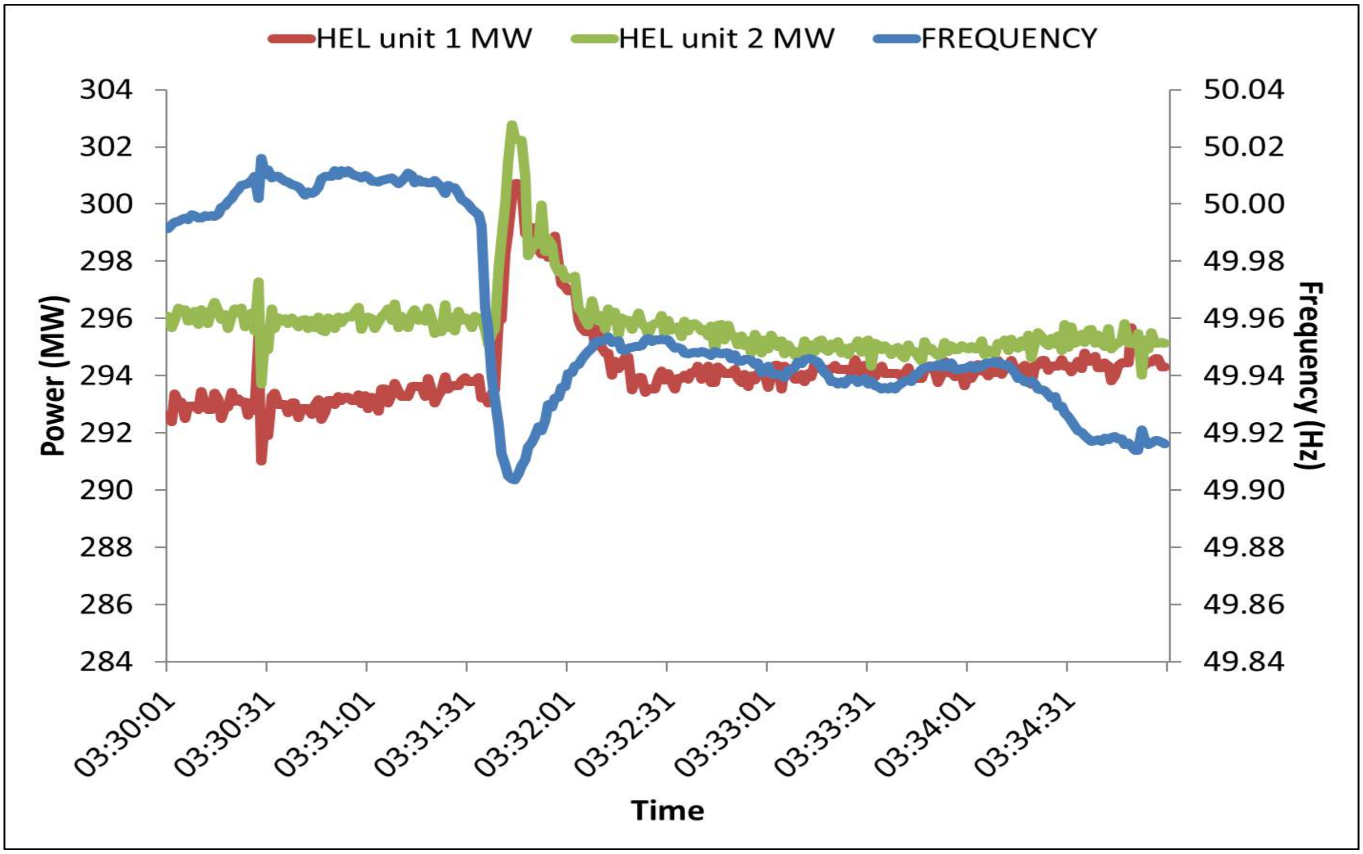
Annexure 2: Variation of generation of state generating stations during frequency change (plotted based on data shared by generating station)







8th April, 2021							
	Capacity	Gov	F_{avg}	P-ideal rise	P-actual rise	T	Remarks
Unit 1	250	FGMO	0.095	9.5	3	13	
Unit 2	250	FGMO	0.095	9.5	3	12	
Unit 3	250	RGMO	0.099	10	5	48	


HEL unit 1 MW
HEL unit 2 MW
FREQUENCY
Power (MW)
Frequency (Hz)
Time
304
302
300
298
296
294
292
290
288
286
284
50.04
50.02
50.00
49.98
49.96
49.94
49.92
49.90
49.88
49.86
49.84
03:30:01
03:30:31
03:31:01
03:31:31
03:32:01
03:32:31
03:33:01
03:33:31
03:34:01
03:34:31

Annexure 3: FRC shared by DVC SLDC

Frequency Response Characteristic Calculation in Eastern Region			
	On the event of generation loss at Tutikorin on 08th April 2021 at 03:31 Hrs		
S No	Pariculars	**Dimension**	**DVC Interchange**
1	Actual Net Interchange before the Event (03:31:30)	**MW**	-2312
2	Actual Net Interchange before the Event (03:33:50)	**MW**	-2370
3	Change in Net Interchange (2 - 1)	**MW**	-58.9
4	Generation Loss (+) / Load Throw off (-) during the Event	**MW**	0.0
5	Control Area Response (3 - 4)	**MW**	-58.9
6	Frequency before the Event	**HZ**	50.01
7	Frequency after the Event	**HZ**	49.94
8a	Change in Frequency (7 - 6)	**HZ**	-0.063
8	Effective change in Frequency considering RGMO *	**HZ**	-0.063
9	Frequency Response Characteristic (5 / 8)	**MW/HZ**	938
10	Net System Demand met before the Event	**MW**	3100
11	Internal Generation before the Event (10 - 1)	**MW**	5412
12	Ideal load response assuming 4% per Hz (0.04*Row 10)	**MW/Hz**	124.0
13	Ideal generator response assuming 5% droop……….40% per Hz (40% of Row 11)	**MW/Hz**	2164.6
14	Composite ideal response (12 + 13)	**MW/Hz**	2288.6
15	Percentage of ideal response {(9/14)x100}	**%**	41.0%

Annexure 4: FRC shared by GRIDCO SLDC

S No	Pariculars	Dimension	Balimela	Burla	Rengali	Indravati	Upper Kolab	IBTPS	GKEL #3	VAL IPP #2	IBTPS Stage 2	GRIDCO Interchange
	Frequency Response Characteristic Calculation in GRIDCO control area											
1	Actual Net Interchange before the Event (03:31:34)	MW	-272	0	0	-249	-21	-322	-330	-328	-357	-186
2	Actual Net Interchange after the Event (03:32:08)	MW	-274	0	0	-252	-21	-323	-334	-328	-356	-209
3	Change in Net Interchange (2 - 1)	MW	-1.3	0.0	0.0	-2.5	-0.1	-0.8	-3.4	0.0	0.7	-23.1
4	Generation Loss (+) / Load Throw off (-) during the Event	MW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Control Area Response (3 - 4)	MW	-1.3	0.0	0.0	-2.5	-0.1	-0.8	-3.4	0.0	0.7	-23.1
6	Frequency before the Event	HZ	49.99	49.99	49.99	49.99	49.99	49.99	49.99	49.99	49.99	49.99
7	Frequency after the Event	HZ	49.95	49.95	49.95	49.95	49.95	49.95	49.95	49.95	49.95	49.95
8a	Change in Frequency (7 - 6)	HZ	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.043
8	Effective change in Frequency considering RGMO *	HZ	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.043
9	Frequency Response Characteristic (5 / 8)	MW/HZ	31	0	0	59	3	19	79	0	-17	540
10	Net System Demand met before the Event	MW	0	0	0	0	0	0	0	0	0	4485
11	Internal Generation before the Event (10 - 1)	MW	272	0	0	249	21	322	330	328	357	4671
12	Ideal load response assuming 4% per Hz (0.04*Row 10)	MW/Hz	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	179.4
13	Ideal generator response assuming 5% droop..........40% per Hz (40% of Row 11)	MW/Hz	108.9	0.0	0.0	99.8	8.2	128.9	132.1	131.2	142.9	1868.4
14	Composite ideal response (12 + 13)	MW/Hz	108.9	0.0	0.0	99.8	8.2	128.9	132.1	131.2	142.9	2047.8
15	Percentage of ideal response {(9/14)x100}	%	28.6%	0.0%	0.0%	59.1%	31.4%	14.9%	59.5%	0.0%	-11.8%	26.4%

Annexure-C3

Date of PFR testing scheduled /completed for generating stations in ER

Sr. No	Station	Generating Unit	Test schedule	Remarks
1	TALCHER STAGE 2	3	Unit 3 - 5: 23-11-2020 to 28-11-2020	Testing for unit 6 yet to be conducted
2		4		
3		5		
4		6		
5	Farakka	2	01-02-2021 to 10-01-2021	Testing completed
6		3		
7		4		
8		5		
9		6		
10	Kahalgaon	1	23-02-2021 to 02-03-2021	Scheduled
11		5		
12		6		
13		7		
14	Barh	4	18-02-2021 to 21-02-2021	Scheduled
15		5		
16	Teesta V	1	07-01-2021 - 08-01-2021	Testing completed
17	Teesta III	1	30-01-2021 - 10-02-2021	Testing completed
18		2		
19		3		
20		4		
21		5		
22		6		
23	Dikchu	1	Unit#1: 6th & 7th April' 21 Unit#2: 8th & 9th April' 21	Scheduled
24		2		
25	MPL	1	11th – 20th March 2021	Scheduled
26		2		

Annexure-C5

Power Plant	Unit No	PSS tuned (Yes/No)	PSS in Service (Yes/No)	Last PSS Tuning Date	Whether Done in Last 3 Years	Whether Next to be planned	Planned Next PSS Tuning
West Bengal							
Kolaghat-WBPDCL	1	No	Yes	Long Back	No	Yes	Under retirement
Kolaghat-WBPDCL	2	No	Yes	Long Back	No	Yes	Under retirement
Kolaghat-WBPDCL	3	No	Yes	Long Back	No	Yes	When Unit will be on Bar
Sagardighi-WBPDCL	2	No	No	Long Back	No	Yes	When Unit will be on Bar
Bakreshwar-WBPDCL	2	Yes	Yes	2019	Yes	Yes	Retuning to be done as from plot response is not good
Bakreshwar-WBPDCL	3	Yes	Yes	2019	Yes	Yes	Retuning to be done as from plot response is not good
Bakreshwar-WBPDCL	4	Yes	Yes	2019	Yes	Yes	Retuning to be done as from plot response is not good
Bakreshwar-WBPDCL	5	Yes	Yes	2019	Yes	Yes	Retuning to be done as from plot response is not good
DPL	7	No	No	N.A	No	Yes	Planned in March 2021
DPL	8	No	Yes	No	No Detail	Yes	To be updated by WBPDCL/DPL
PPSP	1	No	Yes	2009	No	Yes	To be updated by WBSEDCL
PPSP	2	No	Yes	2009	No	Yes	To be updated by WBSEDCL
PPSP	3	No	Yes	2009	No	Yes	To be updated by WBSEDCL
PPSP	4	No	Yes	2009	No	Yes	To be updated by WBSEDCL
TLDP III	4 x 33			No Detail	No Detail	Yes	To be updated by WBSEDCL
TLDP IV	4 X 44			No Detail	No Detail	Yes	To be updated by WBSEDCL
CESC							
Budge Budge-CESC	1	Yes	Yes	2015	No	Yes	2021-22
Budge Budge-CESC	2	Yes	Yes	2015	No	Yes	2021-22
DVC							
Bokaro B 210 MW	3				No Detail	Yes	Unit Is out of Service
Mejia-DVC	4	Yes	Yes	2009	No	Yes	Jun-21
Raghunathpur-DVC	1	No	No		No Detail	Yes	Will be done after AOH
Raghunathpur-DVC	2	No	No		No Detail	Yes	Jun-21
Koderma-DVC	1	Yes	Yes	2013	No	Yes	Sep-21
Waria	4	Yes	Yes	2008	No	Yes	Unit Is out of Service
ISGS							
Kahalgaon NTPC	1	Yes	Yes	2017	Yes	Yes	Apr-21
Kahalgaon NTPC	2	Yes	Yes	2018	Yes	Yes	April 2021 (During AOH)
Kahalgaon NTPC	3	Yes	Yes	2016	Yes	Yes	Jul-21
Kahalgaon NTPC	4	Yes	Yes	2015	No	Yes	Mar-21
Kahalgaon NTPC	6	Yes	Yes	2009	No	Yes	Mar-21
Talcher Stage 2	3	Yes	Yes	2016	Yes	Yes	July 2021 (As per SRPC decision)

Talcher Stage 2	4	Yes	Yes	No Details	No Details	Yes	July 2021 (As per SRPC decision)
Talcher Stage 2	5	Yes	Yes	No Details	No Details	Yes	July 2021 (As per SRPC decision)
Talcher Stage 2	6	Yes	Yes	2016	Yes	Yes	July 2021 (As per SRPC decision)
Barh NTPC	4			2015		Yes	In Next AOH
Barh NTPC	5			During Unit commissioning		Yes	June 2021 (AOH)
Teesta V	1	Yes	Yes	2008	No	Yes	Jun-21
Teesta V	2	Yes	Yes	2008	No	Yes	Jun-21
Teesta V	3	Yes	Yes	2008	No	Yes	Jun-21
BRBCL	1	No	Yes	Vendor to Do	No	Yes	Jun-21
BRBCL	2	Yes	Yes	2019	Yes	Yes	Jun-21
BRBCL	3	No	Yes	Vendor to Do	No	Yes	Jun-21
KBUNL	1	Yes	Yes	2014	No	Yes	2021-22
KBUNL	2	Yes	Yes	2014	No	Yes	2021-22
KBUNL	3	Yes	Yes	Not Available	No	Yes	2021-22
KBUNL	4	Yes	Yes	Not Available	No	Yes	2021-22
Rangit	3 x 20			Not Available	No	Yes	To be updated by NHPC
IPP							
Jorethang	1	Yes	Yes	2015	No	Yes	Apr-21
Jorethang	2	Yes	Yes	2015	No	Yes	Apr-21
ADHUNIK	1	Yes	YES	2013	No	Yes	Mar-21
ADHUNIK	2	Yes	YES	2013	No	Yes	Mar-21
JITPL	1	Yes	Yes	2016	Yes	Yes	Jul-21
JITPL	2	Yes	Yes	2016	Yes	Yes	Jul-21
GMR	1	Yes	Yes	2013	No	Yes	May-21
GMR	2	Yes	Yes	2013	No	Yes	May-21
GMR	3	Yes	Yes	2013	No	Yes	May-21
Orissa							
IB TPS	1	Yes	Yes	2011	No	Yes	Mar'2021
IB TPS	2	Yes	Yes	2012	No	Yes	Mar'2021
Upper Indravati	1	Yes	No	2015	No	Yes	To be updated by OHPC
Upper Indravati	2	Yes	No	2015	No	Yes	To be updated by OHPC
Upper Indravati	3	Yes	No	2000	No	Yes	To be updated by OHPC
Upper Indravati	4	Yes	No	2001	No	Yes	To be updated by OHPC
Balimela	1 (60 MW)			No detail		Yes	To be updated by OHPC
Balimela	2 (60 MW)			No detail		Yes	To be updated by OHPC
Balimela	3 (60 MW)	No	No	Not tuned	No	Yes	To be updated by OHPC
Balimela	4 (60 MW)	No	No	Not tuned	No	Yes	To be updated by OHPC
Balimela	5 (60 MW)	No	No	Not tuned	No	Yes	To be updated by OHPC
Balimela	6 (60 MW)	No	No	Not tuned	No	Yes	To be updated by OHPC
Balimela	7 (75 MW)	No	No	Not tuned	No	Yes	To be updated by OHPC

Balimela	8 (75 MW)	No	No	Not tuned	No	Yes	To be updated by OHPC
Upper Kolab	1	Yes	Yes	2007	No	Yes	To be updated by OHPC
Upper Kolab	2	Yes	Yes	2007	No	Yes	To be updated by OHPC
Upper Kolab	3	Yes	Yes	2007	No	Yes	To be updated by OHPC
Upper Kolab	4	Yes	Yes	2007	No	Yes	To be updated by OHPC
Rengali	1	Yes	Yes	Not tuned	No	Yes	To be updated by OHPC
Rengali	2	Yes	Yes	Not tuned	No	Yes	To be updated by OHPC
Rengali	3	Yes	Yes	Not tuned	No	Yes	To be updated by OHPC
Rengali	4	Yes	Yes	Not tuned	No	Yes	To be updated by OHPC
Rengali	5	No	Yes	Not tuned	No	Yes	To be updated by OHPC
Sterlite	4 X 600			No detail		Yes	To be updated by SLDC Orissa
Jharkhand							
Tenughat	1	Yes	Yes	2017	Yes	Yes	No report has been submitted. So tuning to be planned
Tenughat	2	Yes	Yes	2017	Yes	Yes	No report has been submitted. So tuning to be planned
Subarnrekha	2 X 65					Yes	To be updated
Bihar							
BTPS	6 (110)					Yes	To be updated by BSPGCL
BTPS	7 (110)					Yes	To be updated by BSPGCL
BTPS	8					Yes	To be updated by BSPGCL
BTPS	9					Yes	To be updated by BSPGCL
Bhutan							
Tala	1	No	Yes			Yes	To be updated by BPC
Tala	2	No	Yes			Yes	To be updated by BPC
Tala	3	No	Yes			Yes	To be updated by BPC
Tala	4	No	Yes			Yes	To be updated by BPC
Tala	5	No	Yes			Yes	To be updated by BPC
Tala	6	No	Yes			Yes	To be updated by BPC
Chukha	1	No	Yes	2005	No	Yes	To be updated by BPC
Chukha	2	No	Yes	2005	No	Yes	To be updated by BPC
Chukha	3	No	Yes	2005	No	Yes	To be updated by BPC
Chukha	4	No	Yes	2005	No	Yes	To be updated by BPC
Mangdechu	1	No	Yes			Yes	To be updated by BPC
Mangdechu	2	No	Yes			Yes	To be updated by BPC
Mangdechu	3	No	Yes			Yes	To be updated by BPC
Mangdechu	4	No	Yes			Yes	To be updated by BPC

SL.NO	P A R T I C U L A R S	PEAK DEMAND IN MW	ENERGY IN MU
1	**BIHAR**		
i)	NET MAX DEMAND	5950	3710
ii)	NET POWER AVAILABILITY- Own	525	186
iii)	Central Sector+Bi-Lateral	5150	2952
iv)	SURPLUS(+)/DEFICIT(-)	-275	-391
2	**JHARKHAND**		
i)	NET MAXIMUM DEMAND	1580	878
ii)	NET POWER AVAILABILITY- Own Source	389	182
iii)	Central Sector+Bi-Lateral+IPP	1081	644
iv)	SURPLUS(+)/DEFICIT(-)	-110	-53
3	**DVC**		
i)	NET MAXIMUM DEMAND	3000	2010
ii)	NET POWER AVAILABILITY- Own Source	5600	2910
iii)	Central Sector+MPL	290	259
iv)	Bi- lateral export by DVC	2500	1626
v)	SURPLUS(+)/DEFICIT(-) AFTER EXPORT	390	-467
4	**ODISHA**		
i)	NET MAXIMUM DEMAND(OWN)	4500	2707
ii)	NET MAXIMUM DEMAND(In Case,600 MW CPP Drawal)	5100	2779
ii)	NET POWER AVAILABILITY- Own Source	3475	2115
iii)	Central Sector	1350	914
iv)	SURPLUS(+)/DEFICIT(-) (OWN)	325	322
v)	SURPLUS(+)/DEFICIT(-) (In Case, 600 MW CPP Drawal)	-275	250
5	**WEST BENGAL**		
5.1	**WBSEDCL**		
i)	NET MAXIMUM DEMAND	7300	4380
ii)	TOTAL WBSEDCL Requirement (incl.B'Desh+Sikkim)	7310	4471
iii)	NET POWER AVAILABILITY- Own Source (including DPL)	4907	2169
iv)	Central Sector+Bi-lateral+IPP&CPP+TLDP	2585	1471
v)	EXPORT (TO B'DESH & SIKKIM)	10	7
vi)	SURPLUS(+)/DEFICIT(-) AFTER EXPORT	182	-831
5.2	**IPCL**		
i)	IPCL DEMAND	130	84
ii)	IPCL IMPORT	130	84
iii)	SURPLUS(+)/DEFICIT(-)	0	0
5.3	**CESC**		
i)	NET MAXIMUM DEMAND	2320	1090
ii)	NET POWER AVAILABILITY- Own Source	820	531
iii)	FROM OTHER SOURCE (INCL. IPP/CPP-29-30 MU/M)	960	176
iv)	IMPORT FROM HEL	540	383
v)	TOTAL AVAILABILITY OF CESC	2320	1090
vi)	SURPLUS(+)/DEFICIT(-)	0	0
	WEST BENGAL (WBSEDCL+IPCL+CESC) (excluding DVC's supply to WBSEDCL's command area)		
i)	NET MAXIMUM DEMAND	9760	5554
ii)	NET POWER AVAILABILITY- Own Source	5727	2700
iii)	CS SHARE+BILATERAL+IPP/CPP+TLDP+HEL	4215	2030
iv)	SURPLUS(+)/DEFICIT(-) BEFORE WBSEDCL'S EXP.	182	-824
v)	SURPLUS(+)/DEFICIT(-) AFTER WBSEDCL'S EXP.	172	-831
6	**SIKKIM**		
i)	NET MAXIMUM DEMAND	102	47
ii)	NET POWER AVAILABILITY- Own Source	8	1
	- Central Sector	184	117
iii)	SURPLUS(+)/DEFICIT(-)	90	71
	EASTERN REGION		
i)	**NET MAXIMUM DEMAND**	**24404**	**14906**
ii)	**NET MAXIMUM DEMAND (In Case, 600 MW CPP Drawal of Odisha)**	**24992**	**14978**
iii)	**BILATERAL EXPORT BY DVC**	**2258**	**1626**
iv)	**EXPORT BY WBSEDCL TO SIKKIM**	**10**	**7**
v)	**EXPORT TO B'DESH & NEPAL OTHER THAN DVC**	**642**	**545**
vi)	**NET TOTAL POWER AVAILABILITY OF ER**	**27994**	**15010**
	(INCLUDING CS ALLOCATION +BILATERAL+IPP/CPP+HEL)		
vii)	**SURPLUS(+)/DEFICIT(-) OF ER**	**680**	**-2074**
viii)	**SURPLUS(+)/DEFICIT(-) (In Case, 600 MW CPP Drawal of Odisha)**	**92**	**-2146**

Report on Summer Preparedness of Major Constituents of Eastern Region

April, 2021

Eastern Regional Load Despatch Centre, Kolkata

Power System Operation Corporation Limited

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Report on Summer Preparedness of Major Constituents of ER

1.0. Summary

Easter region is uniquely placed in India's energy landscape in general and electricity sector in particular in many aspects. It's the only region that is electrically connected to all other regions like NR, WR, NER and SR. It's also connected transnationally to Bhutan, Nepal & Bangladesh. Traditionally a coal producing region east has been traditionally a power exporting region. However with sharp increase in loads be it domestic or industrial among the constituents or large scale renewable energy integration in adjoining regions the LGBR characteristic of eastern region has become dynamic as ever.

The onset of summer brings in eastern region a host of challenges as well as opportunities. Being a predominant agricultural zone in India, a substantial kharif load creeps in as summer spans out. Further domestic and industrial cooling loads also reach their peak in summer. The aggregated demand both in terms of energy consumption and also peak load reaches its apogee during this time. As demand steps in generators are required to be running in their full load at best of their conditions. Any inadvertent outage of generators or transmission evacuation may severely impact power adequacy and dispatch. Further large part of eastern region stretching from Odisha to WB connected to coast of Bay of Bengal. This area remains prone to frequent, moderate to neither high impact cyclonic turbulence, norwester and associated inclement weather conditions. Partial or full lockdown implemented in various eastern states to fight corona has made the gamut of load following more challenging.

To overcome such host of challenges and to remain ahead of the curve preparedness remains sine-qua-non.

ERLDC has collected detail with all constituents on following points and sensitized the need for summer preparedness in 177th OCC held on 17-03-21.

1. Anticipated Power Supply Position and Resource adequacy
2. Actual availability of effective conventional Generating Capacity
3. Generation Outage Plans and maintenance schedule
4. Generation shortage due to coal or Water shortage
5. Hydro Reservoir details and generation
6. Revival of Units under RSD
7. Action Plans
8. Transmission Constraint
9. Any other issues

Each state shared their input via mail and based on the input a summer preparedness report is prepared. Also based the LGB received from the states a detailed load flow study is conducted for identifying the low voltage area, angular spread etc.

Further based on the identified low voltage area PV analysis was carried out for South Bengal area. Results of the study included in the report.

1. Summer preparedness -2021 of West Bengal

1.1. Forecasted LGB and resource adequacy details:

Anticipated power supply position for the month of APRIL-2021, MAY -2021, and JUNE-2021 (All figures are in MW) :-

Description	APRIL -2021	MAY -2021	JUNE -2021
WBPDCL Generation	3793	3452	3511
WBSEDCL Own Maximum Demand	7000	7200	7250
CESC Maximum Demand	2100	2290	2320
CESC Own gen. + HEL	830+540	830+540	830+540
DPL Generation Availability	450	450	450
Hiranmayee Energy Limited Generation Availability	264	264	264
IPCL demand connected to J.K.Nagar system	110	110	110

1.2.Planned Generation outage details:

As per information received from West Bengal SLDC there would be no [planned unit outage during the April-June-21 for ensuring the Resource adequacy and meeting the peak demand.

Also No unit is under RSD.

1.3.Anticipated Coal or water shortage:

No Coal shortage or water shortage is anticipated which can affect the generation during the summer.

1.4.Hydro Reservoir details and generation:

Not applicable

1.5.Constraint:

a. Low voltage in major part of south Bengal
b. N-1 violation of 220 kV Jeerat-Barasat
c. N-1 violation of 220 kV Rajarhat-New Town

1.6.Assessment of TTC/ATC:

West Bengal has submitted the ATC/TTC for the Month of April and May 2021.

Month	TTC/ATC	Anticipated TTC Violation
April-21	5283/4883	NIL
May-21	5523/5123	NIL
June-21	5325/4925	NIL

1.7.Action plans:

a. MVAR control measures:

1. In 62nd SLCF meeting SLDC, West Bengal has already handed over the format to deliver report for MW vs MVAR during peak hours for close monitoring of the MVAR generation level, so that it should be to the tune of limits of capability curve of respective units. However, after reviewing these reports for 15 days, SLDC will decide whether there is need to change GT tap and/or to review P-Q limiter setting etc. The format circulated is prepared by SLDC and is attached a draft format in excel sheet herewith.

2. All possible combination of circuits is explored to see the load sharing and advantage, disadvantages to find out with proper risk assessment, so that over loading followed by high MVAR absorption can be avoided.

3. WBSETCL already has installed additional Cap banks of around 190 MVAR in last one year out of targeted 630 MVAR (PSDF funded) + 40 MVAR (own funded). From SLCF forum it is requested to WBSETCL to give a list of cap banks which are not in service out of total recorded cap banks. Also, it is requested to WBSETCL to inform the tentative time by which the planned cap banks of south 24 pgs and North 24 pgs can be expected to come in service.

b. High loading and (n-1) non-compliance measures:

1. Other than midterm plans of circuit strengthening works, in short term certain SPS
2. SPS has been introduced and/or going to be introduced to save transmission elements from peak summer load like:
   - To avoid cascade tripping in respect of 220 kV Jeerat-Barasat ckt 1, 2 the sps already introduced is, "if 600 Amp flows in any one circuit of 220 kV Jeerat-Barasat circuit, then 2 numbers of 160 MVA transformers at 220 kV Barasat GIS will be switched off automatically, thereby Barasat will be on 132 kV source from Jeerat.

This condition will happen only in case of tripping of any one ckt of 220 kV Jeerat-Barasat. In such condition the remaining circuit will carry part load of Kasba 220 kV sub-station only, thus saving it from tripping / breakdown.

•SPS is going to be introduced for 220 kV lines between Rajarhat (PG)-New Town AA3 ckts. If 580 Amp crossed in any of these circuits, then the 220 kV bus coupler at New Town AA3 will be off, thus limiting the flow of power from New Town AA3 to Subhasgram (PG) sub-station via direct ckt and through KLC. So the loading of 220 kV Rajarhat (PG)-New Town AA3 ckts will be within safe limit of (n-1) compliance.

c. WBSEDCL has projected a demand of 7100 MW (for WBSEDCL+ erstwhile DPL) for the month of April. No planned outage of state generating unit will be allowed during the month of April or

d. May, 2021.

e. No planned shutdown is now been allowed from SLDC, West Bengal during April for assembly election. However, for emergency route clearance work or for emergency repair/ maintenance work very few shutdowns are allowed with exceptional merits. From May onwards after completion of election, shutdowns will be allowed following prevailing norms.

2. **Summer preparedness -2021 of Odisha**

2.1. Forecasted LGB and resource adequacy details:

Anticipated power supply position for the month of APRIL-2021, MAY -2021, and JUNE-2021 (All figures are in MW): -

Forecasted Demand & Availability in April 2021			Forecasted Demand & Availability in May 2021			Forecasted Demand & Availability in June 2021		
Source	Peak (MW)	Average(MW)	Source	Peak (MW)	Average(MW)	Source	Peak (MW	Average(MW)
Burla	110	35	Burla	110	20	Burla	80	15
Chiplima	20	25	Chiplima	40	15	Chiplima	22	12
Balimela	280	180	Balimela	280	180	Balimela	280	180
Rengali	180	50	Rengali	185	60	Rengali	180	70
U Kolab	220	80	U Kolab	220	60	U Kolab	220	60
U Indravati	580	250	U Indravati	450	100	U Indravat	300	100
Machhkund	30	25	Machhkund	30	25	Machhkun	30	25
Total Hydro	**1420**	**645**	**Total Hydro**	**1315**	**460**	**Total Hydr**	**1112**	**462**
TTPS	0	0	TTPS	0	0	TTPS	0	0
OPGC -I	340	340	OPGC -I	340	340	OPGC -I	340	340
OPGC-II	800	800	OPGC-II	800	800	OPGC-II	800	800
Total Thermal	**1140**	**1140**	**Total Thermal**	**1140**	**1140**	**Total Thermal**	**1140**	**1140**
VAL #2	440	440	VAL #2	440	440	VAL #2	440	440
GKEL #3	240	240	GKEL #3	240	240	GKEL #3	240	240
Total IPP	**680**	**680**	**Total IPP**	**680**	**680**	**Total IPP**	**680**	**680**
Solar	0	53	Solar	0	55	Solar	0	53
Meen.	10	8	Meen.	10	8	Meen.	10	8
OPCL	8	7	OPCL	7	7	OPCL	7	7
BTPL	2	2	BTPL	2	2	BTPL	2	2
Total RE	**20**	**70**	**RE**	**19**	**72**	**RE**	**19**	**70**
CGP	**300**	**300**	**CGP**	**300**	**300**	**CGP**	**300**	**300**
ISGS	1535	1535	**ISGS**	1563	1563	**ISGS**	**1350**	**1350**
Total Availability	**5095**	**4370**	**Total Availability**	**5017**	**4215**	**Total Availability**	**4601**	**4002**
Demand	**4500**	**3860**	**Demand**	**4550**	**3925**	**Demand**	**4500**	**3850**
Surplus(+)/Deficit(-)	**595**	**510**	**Surplus(+)/Deficit(-)**	**467**	**290**	**Surplus(+)/Deficit(-)**	**101**	**152**
N.B:- 1. ISGS Availability is based on the approved LGBR.			**N.B:-** 1. ISGS Availability is based on the approved LGBR.					
2. If IBTPS #1 avails S/D as per the maintenance schedule, then there is sufficient surplus in hand			2. If IBTPS #1 avails S/D as per the maintenance schedule, then there is sufficient surplus in hand					

2.2. Planned Generation outage details:

As per information received from Odisha SLDC following are the annual maintenance plan:

System	Station	Unit	Capacity (MW)	Period		No. of Days	Reason
				From	To		
ODISHA	IB TPS	1	210	02.05.2021	25.05.2021	24	AOH
	UIHEP	2	150	26.04.2021	25.05.2021	30	Ann. Maint.

** TTPS 460 MW power plant is decommissioned. No unit on RSD

2.3.Anticipated Coal or water shortage:

No Coal shortage or water shortage is anticipated which can affect the generation during the summer.

2.4.Hydro Reservoir details and generation:

13-May-21			RESERVOIR LEVEL		
NAME OF P.H	FRL	MDDL	Previous day	Today	This day of Previous year
BHEP,BALIMELA	1516 Ft	1440 Ft	1464	1464.1	1474.2
HHEP,BURLA	630 Ft	590 Ft	604.87	604.81	614.97
CHEP,CHIPILMA	*********	*********	*********	*********	*********
RHEP,RENGALI	123.5 M	109.72 M	113.49	113.45	115.1
UIHEP,MUKHIGUDA	642 M	625 M	631.1	631.06	632.99
UKHEP,BARINIPUT	858 M	844 M	845.86	845.87	850.72
MHEP,MACHKUND	2750 Ft	2685 Ft	2722.4	2722.1	2724.1

2.5.Constraint:

Nodes where Low voltage may occur during the summer 2021 in Odisha		
Sl. No.	**Sub-Stations**	**Discom**
1	Bhubaneswar	TPCODL
2	Puri	
3	Cuttack	
4	Paradeep	
5	Bolangir	TPWODL
6	Kesinga	
7	Khariar	
8	Balasore	NESCO
9	Bhadrak	
10	Berhampur	TPSODL
11	Chatrapur	

Probable N/W congestion nodes in Odisha		
Sl No.	**Substation**	**Feeder**
1	Bolangir	Bolangir-Thusra-Saintala-Khariar
2	Theruvali	Theruvali-Muniguda-VAL-Kesinga

2.6.Assessment of TTC/ATC:

Odisha has submitted the ATC/TTC for the Month of April 2021.

Month	Export TTC/ATC	Import TTC/ATC	Anticipated TTC Violation
April-21	1340/(1279+700 (counter flow))	2167/2079	NIL
May-21	Yet to be submitted	Yet to be submitted	N.A
June-21	Yet to be submitted	Yet to be submitted	N.A

2.7.Action plans:

1. All the State Hydro and Thermal generating stations have been advised to complete their annual maintenance programme prior to the summer so that the unit outage can be minimized.
2. All the State generators are being advised to use the VAR injection capability to the optimum as per their capability curve to minimize the low voltage issue in and around the area.
3. LGBR has been prepared to ascertain any deficit in order to take necessary steps in advance.
4. Plan is being prepared to utilize the VAR injection capability of the Solar inverters during night time where low voltage issues are generally observed
5. All the scheduled maintenance works in the EHT S/S and Lines have been completed prior to the ensuing summer in order to minimize any breakdowns.

3. **Summer preparedness -2021 of Bihar**

3.1. Forecasted LGB and resource adequacy details:

Anticipated power supply position for the month of APRIL-2021, MAY -2021, and JUNE-2021 (All figures are in MW): -

		Apr-21	May-21	Jun-21
(A)	Peak Demand Projection (MW)	5803	6183	6318
(B)	Availability from Central Sector+Bilateral (MW)	4281	4958	5254
(C)	Intrastate Generation (MW)	519	842	842
A-(B+C)	**Deficit(+)/Surplus(-)**	**1003**	**383**	**222**

3.2.Planned Generation outage details:

As per information received from Bihar SLDC there would be no planned unit outage during the April-June-21 for ensuring the Resource adequacy and meeting the peak demand.

No unit on RSD.

3.3.Anticipated Coal or water shortage:

No Coal shortage or water shortage is anticipated which can affect the generation during the summer.

3.4.Hydro Reservoir details and generation:

Not Applicable

3.5.Constraint:

Low voltage nodes of BSPTCL		
Sr No	GSS	Low voltage observed in last Summer
1	Buxar	115
2	Raghunathpur	117
3	Ekma	119
4	Ramnagar	114
5	Siwan	119
6	Gopalganj	116
7	Masrakh	118
8	Maharajganj	114
9	Forbesganj	118

Details of overloaded 132 KV transmission line						
Sr No	Name of transmission line	Conductor type	80 percent of permissible maximum loading (ambient temp-40 deg)	Peak load Achieved (MW)	Line loading in percentage	SLDC Obersvation
1	132 KV D/C Samastipur New - Samastipur	Zebra	392	170	43.37	Line is Under utilized due to panther conductor in some part of 132 KV Main Bus at Samastipur.
2	132 KV D/C DMTCL(M)-Bettia	Panther	151	160	105.96	(a)Synchronization of 132 KV D/C DMTCL(M)-Bettiah and 132 KV D/C Gopalganj-Bettiah at Bettiah GSS. (b)Reconductoring with Zebra/HTLS may be proposed.
3	132 KV D/C Kishanganj New - Kishanganj Old	Panther	151	154	101.99	
4	132 KV D/C Madhepura - Supaul	Panther	151	154	101.99	(a)After commissioning of 200 MVA transformer at Darbhanga load of Bennipatti or Jainagar may be shifted on Darbhanga which will create margin on mentioned transmission line at sr no 4 ,5,6,7 and 8.
5	132 KV S/C Laukahi-Supaul	Panther	75.5	70	92.72	
6	132 KV S/C Laukahi-Raghopur	Panther	75.5	70	92.72	
7	132 KV S/C Supaul-Phulparas	Panther	75.5	65	86.09	
8	132 KV S/C Supaul-Nirmali	Panther	75.5	65	86.09	
9	132 KV D/C DMTCL(M)-Raxaul	Panther	151	140	92.72	(a)Reconductoring with Zebra/HTLS may be proposed.
10	132 KV D/C Hajipur New - Hajipur old	Panther	151	150	99.34	(a)Reconductoring with Zebra/HTLS may be proposed.
11	132 KV D/C Mushahri - Sitamadhi	Panther	151	150	99.34	(a) Dhaka may be shifted on Motihari.
12	132 KV Dehri-Bikramganj S/C	Panther	75.5	70	92.72	(a).Synchronisation of 132 KV Dehri-Bikaramganj and 132 Dumraon-Bikramganj. (b) Part loading of Bikramganj on Dumraon and Dehri.
13	132 KV Pusauli-Kudra TSS	Panther	75.5	70	92.72	(a) Synchronization of 132 KV Pusauli-Kudra TSS - Karamnasha-Mohania-Ramgarh-Pusauli. (b) Commissioning of Karamnasa(New) by the end of May 2021.
14	132 KV Biharsarif-Ekangarsarai S/C	Panther	75.5	64	84.77	(a)132 KV BSF-Hulasganj S/C T/L may be utilized to feed power to Ekangarsarai via T/B of Hulasganj. (b)2nd ckt stringing or reconductoring may be considered.
15	132 KV Ramgarh-Pusauli	Panther	75.5	60	79.47	(a) Synchronization of 132 KV Pusauli-Kudra TSS - Karamnasha-Mohania-Ramgarh-Pusauli. (b) Commissioning of Karamnasa(New) by the end of May 2021.
16	132 KV Baripahari-Harnaut	Panther	75.5	60	79.47	(a)Synchronisation of 132 KV Fathua-Ultratech-Harnaut nd 132 KV Harnaut-Baripahari transmission line at Harnaut GSS. (b) load of 33 KV Bakhtiyarpur (15 MW)may be shifted on Barh permanentaly

Details of overloaded 220 KV transmission line						
Sr No	Name of transmission line	Conductor type	80 percent of permissible maximum loading (ambient temp-40 deg)	Peak load Achieved (MW)	Line loading in percentage	Remarks
1	220 KV D/C DMTCL(D)-Darbhanga	Zebra	392	420	107.14	Load sharing of Mushari from Darbhanga and Motipur is highly uneven(75% from Darbhanga and 25 % from Mushahri). Hence to prevent overloading, Mushahri may be fed radially from Motipur .
2	220 KV D/C Muzaffarpur(PG)-Hajipur New	Zebra	392	340	86.73	Restoration of 220 KV BTPS-Hazipur ckt 1 should be expedited.
3	220 KV D/C Pusauli(PG)-Pusauli	Zebra	392	400	102.04	Load shifting of Mohania and Karamnasha on to be commissioned Karamnasa(New)
4	220 KV D/C Biharsarif-Khizarsarai	Zebra	392	340	86.73	Commissioning of 220 KV Gaya(PG)-Sonenagar LILO at Chandauti(New) and Bodhgaya.

3.6.Assessment of TTC/ATC:

Bihar has submitted the ATC/TTC for the Month of April and May 2021.

Month	Import TTC/ATC	Anticipated TTC Violation
April-21	5690/5578	NIL
May-21	6075/5953	NIL
June-21	Yet to be submitted	N.A

3.7.Action plans:

Action plan to relief the constraint is mentioned in the constraint section.

4. Summer preparedness -2021 of DVC

4.1. Forecasted LGB and resource adequacy details:

Anticipated power supply position for the month of APRIL-2021, MAY -2021, and JUNE-2021 (All figures are in MW): -

	Month wise Demand Forecast & Availability (MW)					
	Apr-21		May-21		Jun-21	
	Pk	Off-Pk	Pk	Off-Pk	Pk	Off-Pk
Demand Forecast (MW)	**3120**	**2470**	**3160**	**2500**	**3220**	**2550**
Avg. Generation Availability (MW)	**5430**		**5600**		**5600**	

4.2.Planned Generation outage details:

As per information received from DVC SLDC there would be no planned unit outage during the April-June-21 for ensuring the Resource adequacy and meeting the peak demand.

No unit on RSD.

4.3.Anticipated Coal or water shortage:

No Coal shortage or water shortage is anticipated which can affect the generation during the summer.

4.4.Hydro Reservoir details and generation:

Not applicable

4.5.Constraint:

Areas likely to experience low voltage in each state:

With CTPS U#8 being out of bar, low voltage was noticed in the following S/Ss of DVC:

(a) CTPS-220kV.
(b) BTPS-220kV/132kV.
(c) Jamshedpur-220kV/132kV.

Anticipated network congestion in STU systems:

(a) 220kV Dhanbad-Maithon PG Ckts if one of the CTPS units is out of bar.
(b) BTPS-A ICTs(each of 315MVA Rating) –with single running unit at CTPS-B.
(c) 315MVA DSTPS ICT#2 – Overloading of lone ICT.

4.6.Assessment of TTC/ATC:

DVC has submitted the ATC/TTC for the Month of April, May and June-2021.

Month	Export TTC/ATC	Import TTC/ATC	Anticipated TTC Violation
April-21	2650/2598	1801/1735	NIL
May-21	2925/2872	1663/1596	NIL
June-21	3350/3296	1718/1650	NIL

4.7.Action plans:

1. To avoid O/L of 220kV Dhanbad-Maithon PG D/C---220kV Dhanbad-Giridih D/C kept open.(i.e. Giridih load is shifted on Koderma only).

2. To avoid O/L of BTPS-A ICTs --- 220kV BTPS-CTPS-B D/C are kept open & power assistance is availed from 132kV Patratu- PTPS(JUSNL) Tie under radial mode to feed 132kV North Karanpura and Patratu load.

3. To avoid O/L of DSTPS ICT#2 – 220kV DSTPS-Waria D/C are kept Open.

4. The Low voltage problem in CTPS & Jamshedpur is expected to be overcome after synchronization of CTPS U#8(under S/D for COH purpose). Also, provision exists for raising of Taps of BTPS-A ICTs, if sustained low voltage is noticed.

5. Summer preparedness -2021 of Jharkhand

5.1. Forecasted LGB and resource adequacy details:

Anticipated power supply position for the month of APRIL-2021, MAY -2021, and JUNE-2021 (All figures are in MW): -

Availability of power in the month of April'21 to June'21 of Jharkhand State (JUSNL System only)					
S.N.	**Name of Generating Stations**		**Allocation (MW)**	**Availability(MW)**	**Remarks**
1	NTPC	Farrakka	139.06	116	
		Farrakka III	84.74	77	
		Khalagaon I	27.66	17	
		Talcher	89.38	75	
		Khalagaon II	45.72	21	
		Barh	87.63	85	
		Korba	50	45	
		Kanti Power	12	12	
		NPGC	40	38	
		Darliparli	73.79	67	
		Total	**649.98**	553	
2	NHPC	Rangit	8	5	
		Teesta	62.83	60	
		Total	**70.83**	65	
3	PTC	Chukha	38.66	30	
		Tala	116.9	110	
		Total	**155.56**	140	
4	**Total Central Sector**		**876.37**	758	
5	TVNL		**420**	280	
6	APNRL	Unit I			
		Unit II			
		APNRL (Add.)			
		ERLDC APNRL			
		Adjustment			
		Total	**189**	183	
7	SOLAR	SECI	**10**	10	
		State	**16**	16	
		Total	**26**	26	
8	Wind	PTC	**200**	100	
		SECI	**50.40**	20	
		Total	**250.40**	120	
9	INLAND		**63**	54	
10	ABCIL		**11**		
11	Rungta Mines		**4**		
12	PTC-IEX/PXIL (Purchase)		-		
13	PTC-IEX/PXIL (Sale)		-		
14	**Total Purchase**		**1839.77**	1421	
15	SRHPS (Generation)		130	0	
16	**Grand Total**		**1969.77**	1421	

5.2.Planned Generation outage details:

As per information received from Jharkhand SLDC there would be no planned unit outage during the April-June-21 for ensuring the Resource adequacy and meeting the peak demand.

No unit on RSD.

5.3.Anticipated Coal or water shortage:

No Coal shortage or water shortage is anticipated which can affect the generation during the summer.

5.4.Hydro Reservoir details and generation:

5.5.Constraint:

No major constraint is anticipated to meet the summer load.

5.6.Assessment of TTC/ATC:

Jharkhand has submitted the ATC/TTC for the Month of April and May 2021.

Month	Import TTC/ATC	Anticipated TTC Violation
April-21	1570/1517	NIL
May-21	1544/1488	NIL
June-21	1668/1616	NIL

5.7.Action plans:

1. 1.It has been scheduled to declare COD of NPGC unit-2 in the month of April'21, so additional 20 MW power availability from NPGC has been considered .
2. SRHP Unit-2 (capacity-65 MW) is available for generation. As per the requirement of power and also, availability of water from Getelsud Dam, schedule is being given to SRHP for generation of power.
3. In case of shortage/surplus of power and to maintain DSM, power is being purchased/sold from IEX/PXIL.

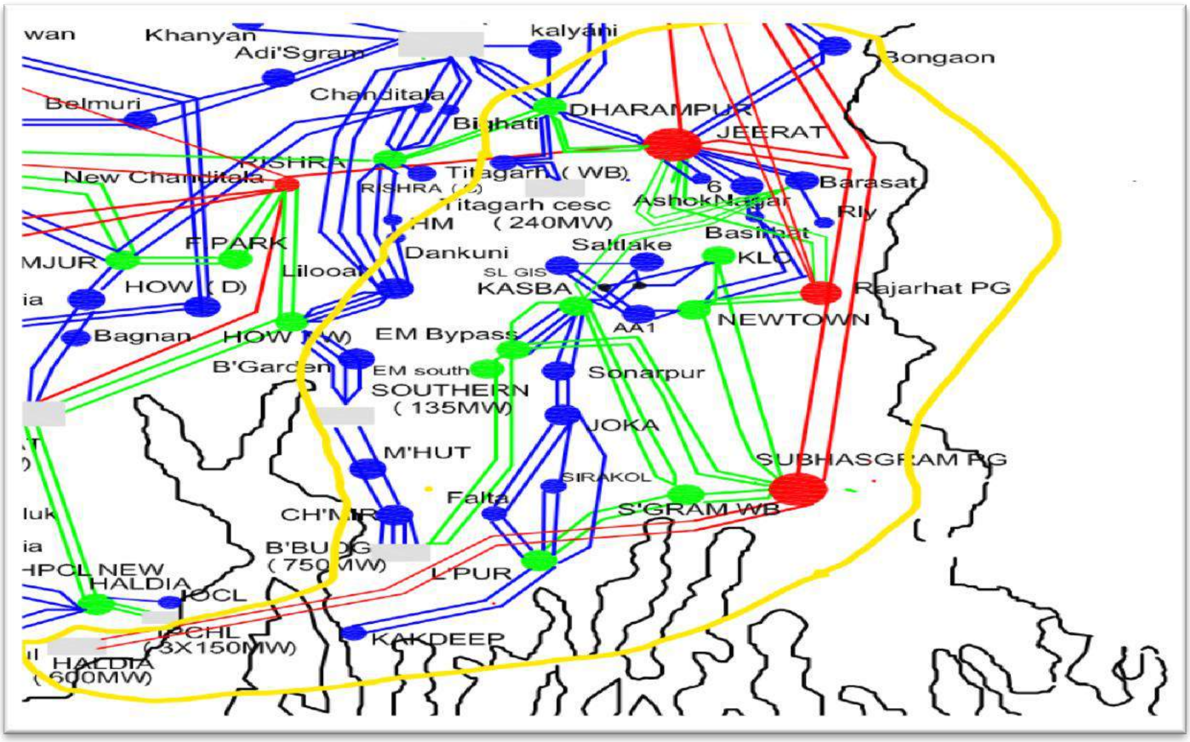
6. **Summer preparedness Study by ERLDC:**

   A. Load flow analysis:

1. Base case is prepared using the TTC cases received from states and LGBR as submitted by them for peak hours only.
2. Two base cases are prepared: Case 1: considering 100 % reactive power capability of all Generators and case 2: considering 60% reactive power capability.
3. Based on case 2 low voltage areas are identified and 400 kV Nodes where voltage is outside IEGC band are identified.
4. PV analysis is performed for south Bengal area as four number of 400 kV nodes in this area is lying outside IEGC band.

   B. PV analysis:

1. Area as shown below is selected as Sink system and rest of the eastern regional grid is selected as source system.



2. Total load on Jeerat,Rajarhat and Subhasgram ICT is around 2675 MW
3. Following contingency cases are considered
   a. All 400 KV Tie and inter line of the Sink system
   b. Largest 400/220 kV ICT at all the 400 kV substation inside the system
   c. 500 MW unit at Sagardighi
   d. One unit of HEL
4. Monitored system parameters are as follows:
   a. Voltage of all 220 and 400 kV nodes inside the sink system.
   b. 400 kV line flows of internal and Tie line of the sink system.

C. Plots and Results:

1. Load contour:

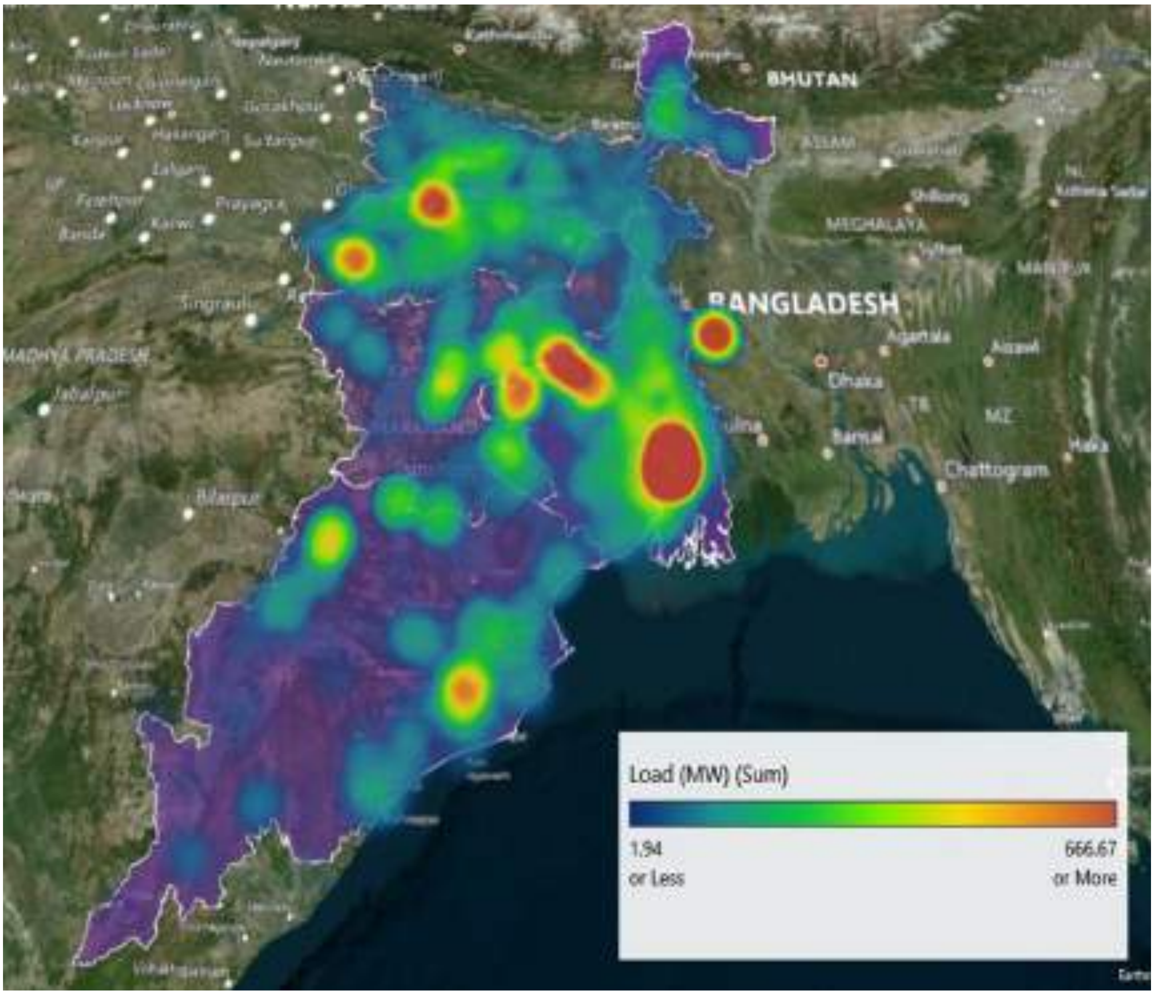


Figure 1: Load contour plot of eastern region

From the above plot it can be seen that major load concentration is round the capital cities of the states. Other than that Durgapur, Asansol area in west Bengal and Sasaram area in Bihar is having relatively high concentration of load.

Also drawl of Bangladesh is modelled as load at Bheramera which is prominent in the plot due to single point representation.

2. **Plot of concentration of Number of node where voltage is below the lower band of IEGC:**

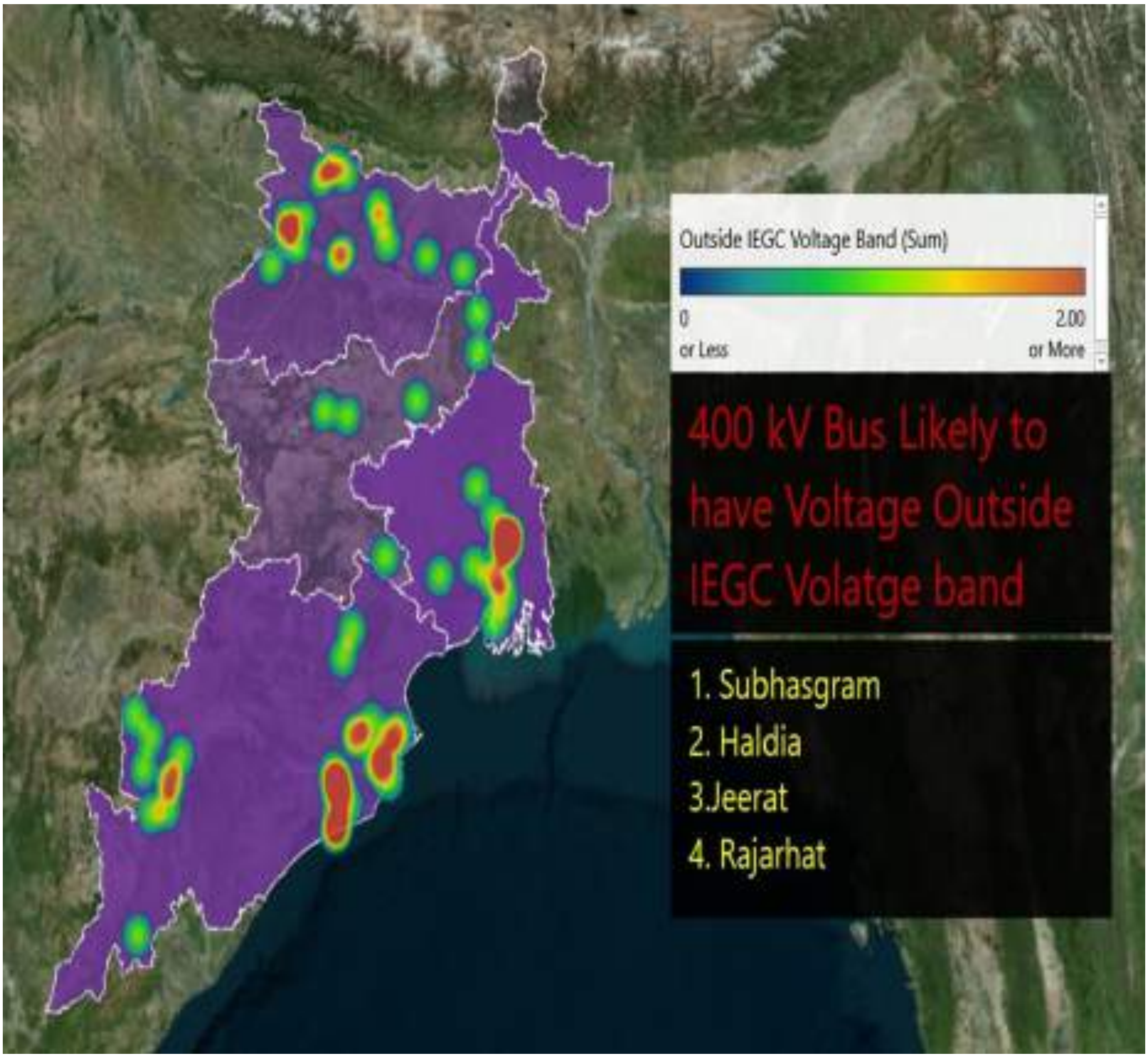


Figure 2: Geographical plot of Concentration of Low Voltage nodes

From the above plot is seen that South Bengal area around Kolkata and greater Kolkata are most likely to experience low voltage below the lower limit of IEGC.

Also few pockets of North Bihar and Bhubaneswar, Odisha are also likely to experience very severe low voltage.

3. **Angular spread:**

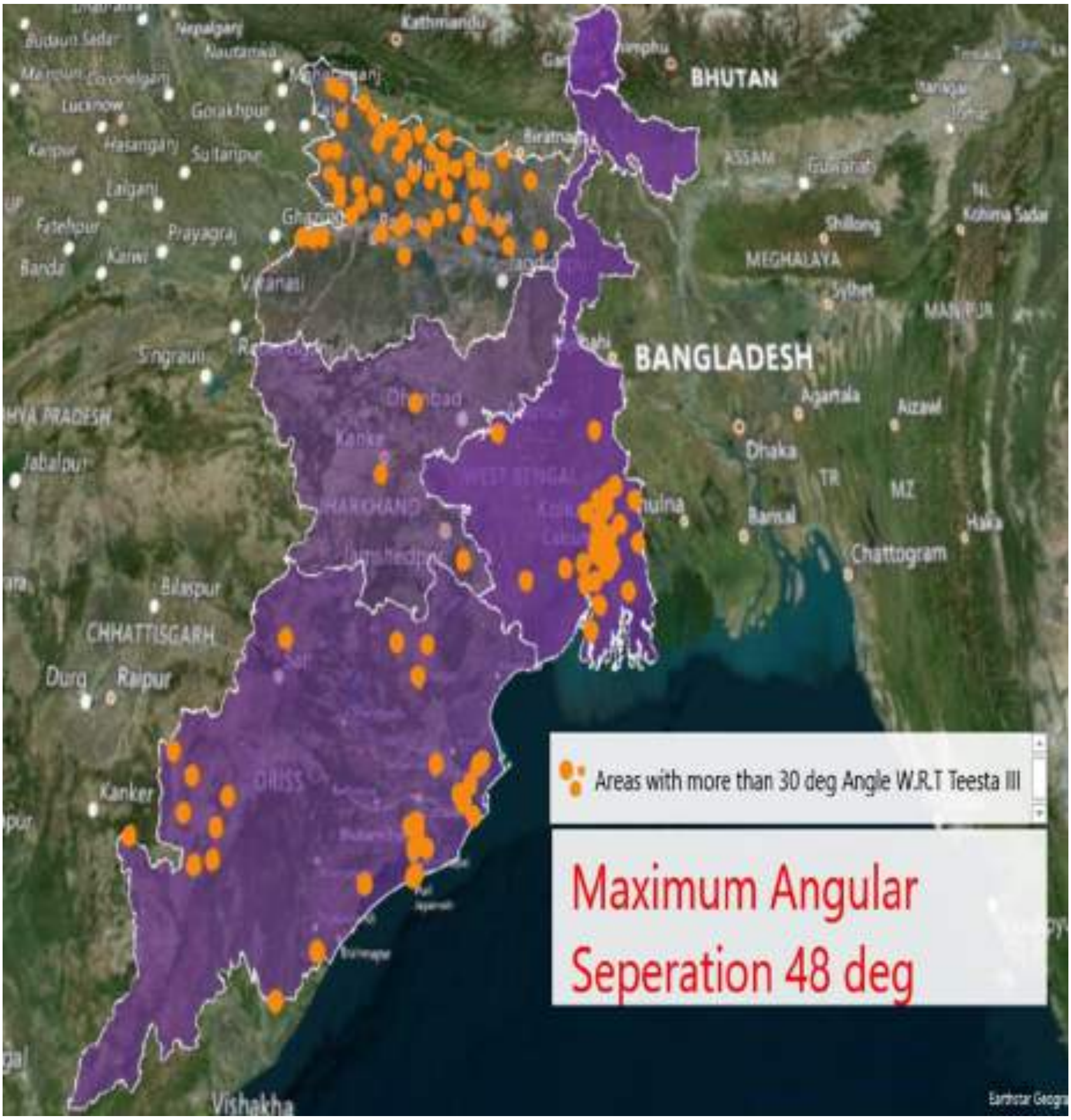


Figure 3:Substation which are having more than 30 deg Angular separation with respect to Teesta III

From the plot it is clear that remote load centers are having more than 30 deg angular separation with respect to Teesta III.

Balmikinanagar is having the maximum angular separation of 48 deg with respect to Teesta III. Balmikinanagar is located at the North-west Bihar Boundary.

Load center around Durgapur, Asansol is having relatively lower angular separation with Teesta III as there are lot of local Generators are located in that area.

4. PV Results:

a. Maximum incremental transfer during different contingency:

PV Contingencies			
CON#	LABEL	Max MW Increment	DESCRIPTION
	BASE CASE	225	BASE CASE
1	SUBHASGRAM_500_ICT_TRIP	150	TRIP BRANCH FROM BUS 264013 [SUBHASGRAM4 400.00] TO BUS 262034 [SUBHASPG 220.00] CIRCUIT 5
2	RAJARHAT_500_ICT_TRIP	225	TRIP BRANCH FROM BUS 264028 [RAJARHAT 400.00] TO BUS 262099 [RAJARHAT2 220.00] CIRCUIT 3
3	SUBHASGRAM_315_ICT_TRIP	175	TRIP BRANCH FROM BUS 264013 [SUBHASGRAM4 400.00] TO BUS 262034 [SUBHASPG 220.00] CIRCUIT 1
4	JEERAT_315_ICT_TRIP	200	TRIP BRANCH FROM BUS 264002 [JEERAT 4 400.00] TO BUS 262004 [JEERAT2 220.00] CIRCUIT 1
5	**SUBHASGRAM_SAGARDIGHI_LINE_TRIP**	**0**	**TRIP LINE FROM BUS 264013 [SUBHASGRAM4 400.00] TO BUS 264003 [SAGAR4 400.00] CKT T1**
6	**SUBHASGRAM_RAJARHAT_LINE_TRIP**	**0**	**TRIP LINE FROM BUS 264013 [SUBHASGRAM4 400.00] TO BUS 264028 [RAJARHAT 400.00] CKT T1**
7	JEERAT_RAJARHAT_LINE_TRIP	200	TRIP LINE FROM BUS 264002 [JEERAT 4 400.00] TO BUS 264028 [RAJARHAT 400.00] CKT T1
8	JEERAT_SAGARDIGHI_LINE_TRIP	150	TRIP LINE FROM BUS 264002 [JEERAT 4 400.00] TO BUS 264003 [SAGAR4 400.00] CKT T1
9	JEERAT_CHANDITALA_TRIP	150	TRIP LINE FROM BUS 264002 [JEERAT 4 400.00] TO BUS 264018 [NEW CHANDI4 400.00] CKT T1
10	GOKARNA_RAJARHAT_LINE_TRIP	100	TRIP LINE FROM BUS 264017 [GOKARNA 400.00] TO BUS 264028 [RAJARHAT 400.00] CKT S1
11	FARAKKA_RAJARHAT_LINE_TRIP	125	TRIP LINE FROM BUS 264008 [FARAKKA 400.00] TO BUS 264028 [RAJARHAT 400.00] CKT S1
12	HEL_UNIT_TRIPPING	100	REMOVE MACHINE T2 FROM BUS 264012 [HEL 400.00]
13	SAGARDIGHI_500UNIT_TRIPPING	225	REMOVE MACHINE T4 FROM BUS 264003 [SAGAR4 400.00]

- From the above table it can be seen that in during base scenario another 225 MW increment is possible
- Top Three Worst contingencies are:
    1. 400 kV Subhasgram-Sagardighi
    2. 400 kV Subhasgram-Rajarhat
    3. Tripping of Unit of HEL
- During the top two contingency no further increment is possible
- During contingency of HEL one unit another 100 MW power can be imported by the Sink area.
- Tripping of 400 kV Subhasgram-Sagardighi & Subhasgram-Rajarhat may led to cascading voltage collapse in South Bengal area hence healthiness and proper maintenance of the above two lines must be ensured.
- The above PV results obtained using 60% reactive power dispatch from all generators. However, if 100% dispatch of reactive power according to capability of generator will increase the transfer limit.
- MVAR dispatch from HEL, Sagardighi, BBGS and Kolaghat may be maintained as high as possible as per capability cure and the same needs to be monitored by SLDC very closely.

b. Plots of Voltage with incremental Power transfer:

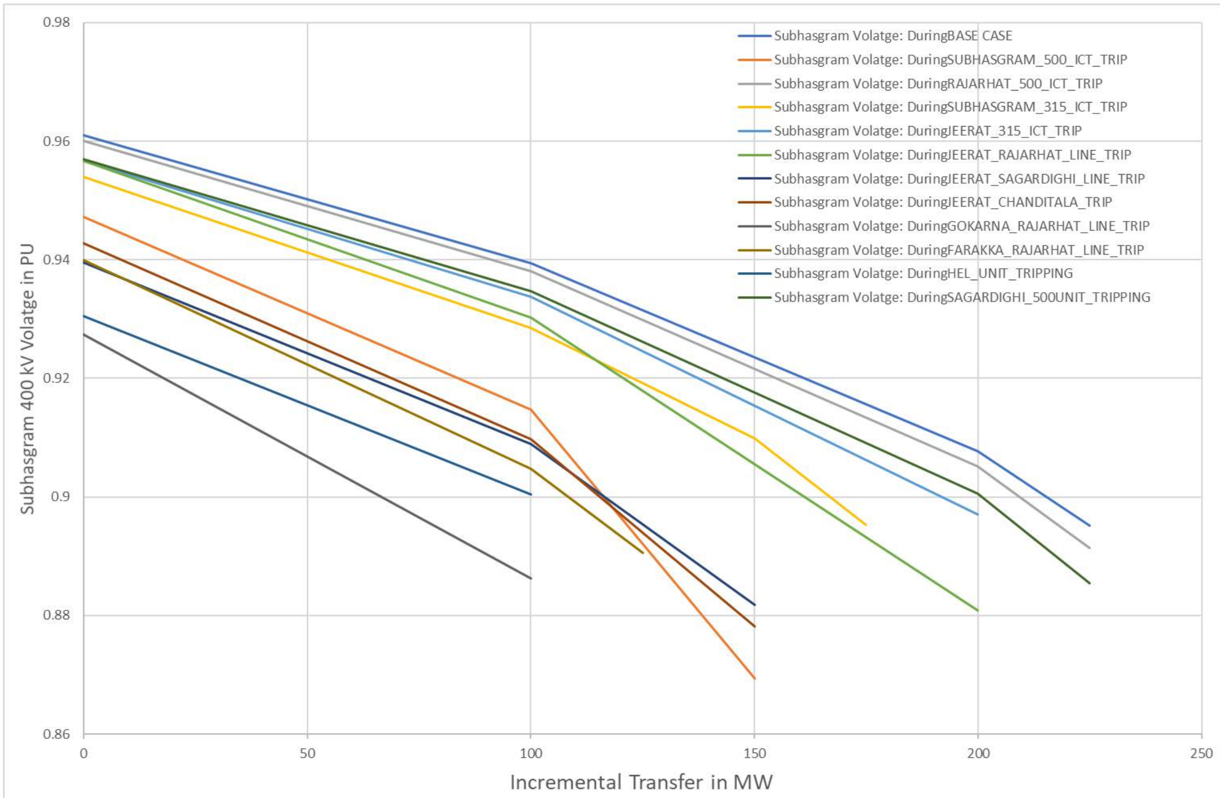


Figure 4: 400 kV Subhasgram PU voltage plot against incremental power transfer during different contingency

5. Action plan based on the system study:

Based on the study following action plans are suggested:

a. MVAR generation by all generators as per capability.
b. Maintaining healthiness of all generating units near load center is extremely important.
c. Ensuring healthiness of lines as well as protection system of those lines, which are mentioned in the constraint list and top contingency list should be the top priority of the utilities.
d. Monitoring of the Voltage of the critical nodes should be done vigorously.
e. GT as well as ICT tap optimization study needs to be done periodically for exploring possibility of voltage profile improvement at various nodes.