Eastern Regional Power Committee, Kolkata

Minutes of Special Meeting on Operationalization of 400 kV Durgapur Bus Splitting Scheme held at ERPC, Kolkata on 26th December 2018 at 11:00hrs

List of participants is enclosed at **Annexure-A.**

In line with discussion of 151st OCC meeting, a special meeting on Operationalization of 400 kV Durgapur Bus Splitting was held on 26th December 2018 at ERPC. At the start of the meeting, ERLDC explained that during the high hydro season the fault level of 400 kV Durgapur Bus crosses 40-43 kA while in Lean hydro season it is between 35-40 kA. PGCIL ERTS 2 explained that the bus split arrangement at 400 kV Durgapur is ready for operationalization for reduction in fault level as per the decision taken in 18th SCM meeting of the Eastern Region. Powergrid ERTS 2 further explained that during one of the faults, the fault current has exceeded 35 kA. Powergrid ERTS 2 also presented the bus split arrangement at 400 kV Durgapur through SLD, which is attached as **Annexure-1**. Powergrid ERTS 2 added that that 3rd ICT of 315 MVA at Durgapur will be commissioned by the end of Feb 2019.

ERLDC explained the Bus split study report of the CTU shared during the 18th SCM of Eastern Region (attached at **Annexure-2) and the key findings, which can be summarized as follows:**

1. 2 X 315 MVA 400/220 kV Durgapur ICTs loading considered in CTU scenario is 15 MW Each. The Loading on these ICTs becomes 194/-49 MW after bus split.
2. No Constraint in 220 kV network of DVC has been highlighted in the study after bus split operation at Durgapur.
3. Impact of future 3rd 315 MVA ICT at Durgapur on DVC Network after bus split has not been explained in the study.
4. Study on the Pump Mode operation of PPSP and its impact on the Network after the bus split operation has not been included in the study results.

ERLDC presented the existing operational scenarios, which are as following:

1. Loading of 2 X 315 MVA Durgapur ICTs are around 130 MW each without bus splitting at Durgapur.
2. 220 kV Durgapur(PG)-Parulia (DVC) D/C loading is around 130 MW/ckt and has a sensitivity of 96 % on the other in case of one ckt tripping (**Existing constraint**).
3. 220 kV Maithon-Kalyaneshwari D/C are a constraint in DVC system as its loading varies between 70-170 MW per circuit (**Existing constraint**).

ERLDC presented the impact of Durgapur Bus Split operationalization on the existing network, which are as follows:

1. The Third ICT at Durgapur will result in further increase in the loading of 220 kV Durgapur(PG)-Parulia (DVC) D/C making it more insecure for real-time operation.
2. After the Bus split operation of 400 kV Durgapur, the Loading on 220 kV Durgapur-Parulia (DVC) D/C will further increase and may go above 200 MW per circuit making it N-1 non-compliant.
3. In addition, with Bus split at Durgapur and Pump Mode operation at PPSP, the loading of 220 kV Maithon-Kalyneshwari D/C may go above 200 MW /ckt making it N-1 non-compliant.

Presentation from ERLDC is attached as **Annexure-3**.

DVC SLDC confirmed and explained that the above loading patterns are going to continue and loadings are further going to increase in case of outage of any Generating unit of DVC.

Members observed that due to these challenges, operationalization of 400 kV Bus Split at Durgapur is difficult without having any remedial action plan to ensure system reliability in DVC network. Members were also of the view that the N-1 reliability issues of 220 kV Durgapur-Parulia (DVC) D/C and 220 kV Maithon-Kalyaneshwari D/C need an immediate short-term action plan in the form of load trimming scheme or SPS. However, along with short-term remedial action plan, a long-term plan is also envisaged in order to ensure DVC network reliability and security before as well as after 400 kV Bus Split operationalization at Durgapur.

Based on these, it was decided that there is a need of detailed discussion with the CTU, System Planning DVC, System Planning WBSETCL, and SLDC (DVC, West Bengal) on the operationalization of 400 kV Bus Split at Durgapur with existing operational scenario which has changed significantly from the revised study submitted to Standing Committee on ER Transmission Planning in 2016. Thus, it was decided that a separate meeting would be convened at ERPC, Kolkata for deliberating the issues in detail with all the involved utilities.

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Annexure-A

Participants in Special Meeting on "Bus Splitting Arrangement at 400kV Durgapur S/s"

Venue: ERPC Conference Hall, Kolkata Time: 11:00 hrs Date: 26.12.2018 (Wednesday)

Sl No	Name	Designation/ Organization	Contact Number	Email	Signature
1	**J. Bandyopadhyay**	**Member Secretary ERPC**	**9432326351**	**mserpc-power@gov.in**	
2	**D. K. Jain**	**Executive Director, ERLDC**	**9910344127**	**dk.jain@posoco.in**	
3	J. G. Rao	EE, ERPC	9547891353	erpcprotection@gmail.com	
4	P. GHOSH	ER-II	9434748263	parthasarathi.ghosh@powergridindia.in	
5	G. Mitra	ERLDC	9831297394		
6	S. K. Panda.	EE, SLDC	9438692977	Santosh.Panda@dvc.gov.in	
7	A. Mitra	S. E. (E), SLDC	9832177078	arnab.mitra@dvc.gov.in	
8	Surajit Banerjee	ERLDC	9433041823	surajit.banerjee@posoco.in	
9	Chandan Mallick	ERLDC	9007059660	chandan.mallick@posoco.in	
10	CHANDAN KUMAR	Dy. Manager/ ERLDC/Posoco	9869251460	Chandan@posoco.in	
11					
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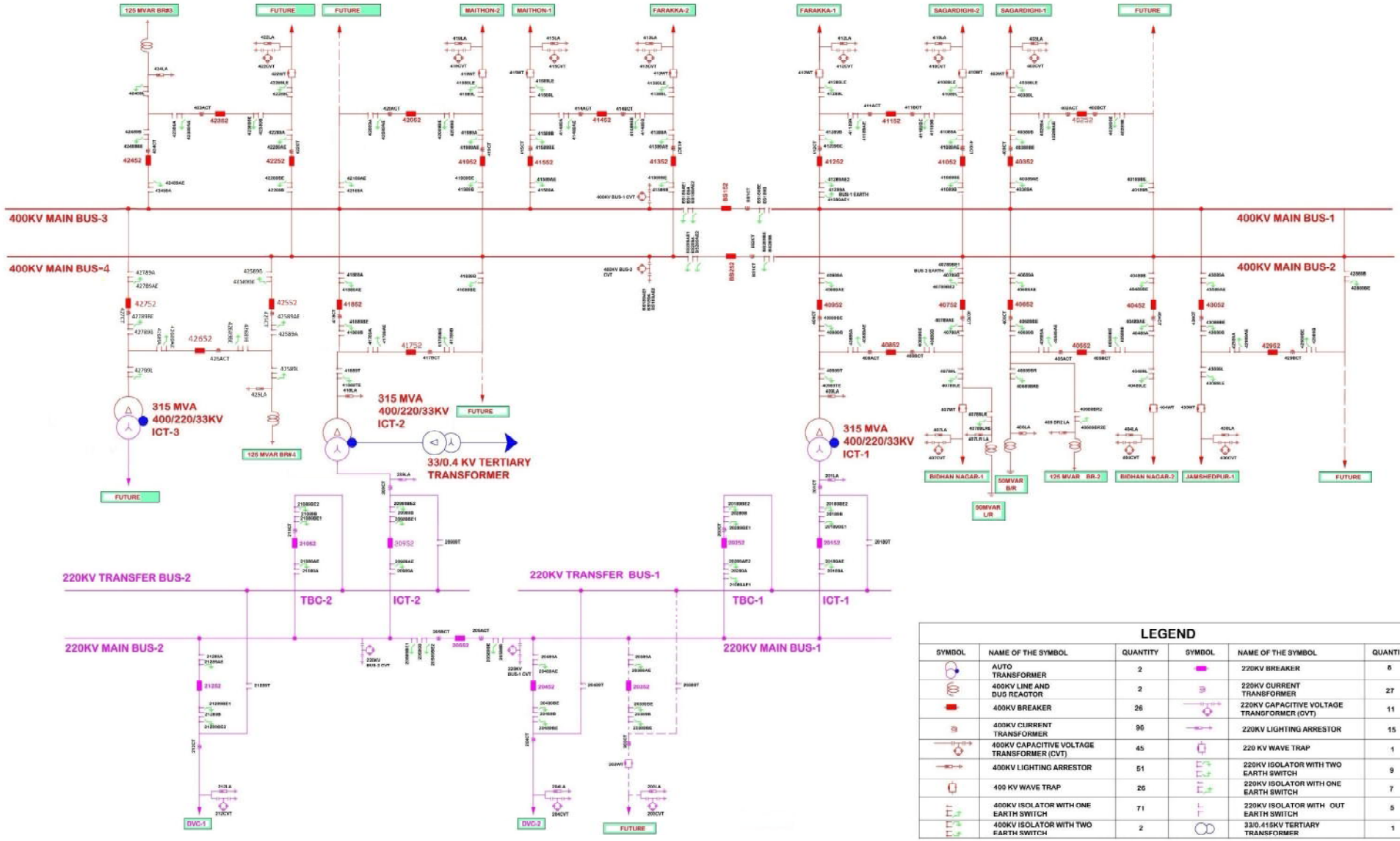
"Coming together is a beginning, staying together is progress, and working together is success." –Henry Ford

POWER GRID CORPORATION OF INDIA LIMITED

SINGLE LINE DIAGRAM OF 400/220/33KV DURGAPUR SUBSTATION



LEGEND

SYMBOL	NAME OF THE SYMBOL	QUANTITY	SYMBOL	NAME OF THE SYMBOL	QUANTITY
	AUTO TRANSFORMER	2		220KV BREAKER	8
	400KV LINE AND BUS REACTOR	2		220KV CURRENT TRANSFORMER	27
	400KV BREAKER	26		220KV CAPACITIVE VOLTAGE TRANSFORMER (CVT)	11
	400KV CURRENT TRANSFORMER	90		220KV LIGHTING ARRESTOR	15
	400KV CAPACITIVE VOLTAGE TRANSFORMER (CVT)	45		220 KV WAVE TRAP	1
	400KV LIGHTING ARRESTOR	51		220KV ISOLATOR WITH TWO EARTH SWITCH	9
	400 KV WAVE TRAP	26		220KV ISOLATOR WITH ONE EARTH SWITCH	7
	400KV ISOLATOR WITH ONE EARTH SWITCH	71		220KV ISOLATOR WITH OUT EARTH SWITCH	5
	400KV ISOLATOR WITH TWO EARTH SWITCH	2		33/0.415KV TERTIARY TRANSFORMER	1

Study report on implementation of bus splitting at 400kV bus at Maithon, Durgapur and Biharsharif substations of POWERGRID in Eastern Region

1.0 Introduction

In view of increasing fault level at 400kV level at various substations in ER, it was decided to implement split bus arrangement at 400kV level at Maithon, Durgapur and Biharsharif substations of POWERGRID and at Kahalgaon generation switchyard of NTPC by respective owners. The updated schematic diagram showing before and after split conditions at 400kV bus at Maithon, Durgapur and Biharsharif substations is attached at **Annexure-1**.

In the 33rd TCC/ERPC meetings held at Patna on 24th/25th June 2016, it was informed that bus splitting arrangement at Biharsharif, Maithon and Durgapur substations is in advance stage of completion and split bus arrangement at Kahalgaon generation switchyard is also under implementation. Further, in view of the fact that splitting arrangement was planned in 2010 and power scenario today may be different, it was decided that detailed studies need to be carried out considering present connectivity to verify operational constraints due to split bus operation at these substations of POWERGRID.

Studies have been carried out in Present Scenario i.e. 2016-17 time-frame for following three cases:

(a) Without Bus Splitting at any substation (bus sectionalizer in closed condition)

(b) With Bus Splitting at Maithon, Durgapur and Biharsharif.

(c) With Bus Splitting at Maithon and Biharsharif only #

 # Since Jamshedpur – Durgapur 400kV D/c line was terminated at DTPS due to RoW problems, the fault level at Durgapur bus (considering Maithon and Biharsharif substations in split condition) is slightly below 40kA.

2.0 Observations from Studies

2.1 Power Flow Results

Power Flow results for the above mentioned cases are enclosed as mentioned below:

Sl. No.	Cases	Exhibit No.
1	Without Bus Splitting at any substation	1
2	With Bus Splitting at Maithon, Durgapur and Biharsharif S/s	2
3	With Bus Splitting at Maithon and Biharsharif S/s	3

From the results of power flow, it is observed that none of the transmission links are critically loaded in any of the three cases.

2.2 Short Circuit Studies

Results of the Short Circuit Studies for the above mentioned cases are given below:

Substation-section	kV Level	Fault Level (in kA)			
		Without Split	With Split at POWERGRID S/s	With Durgapur Split Closed	Design Capacity
BIHARSHARF-A	400	40.17	26.25	26.25	40
BIHARSHARF-B	400	40.17	22.35	22.35	40
DURGAPUR-A	400	40.60	25.65	38.61	40
DURGAPUR-B	400	40.60	18.76	38.61	40
KAHALGAON-A	400	43.35	43.30	43.31	40
KAHALGAON-B	400	43.35	43.30	43.31	40
MAITHON-A	400	51.86	30.55	36.16	40
MAITHON-B	400	51.86	20.99	20.99	40

3.0 Conclusion

From the results it can be observed that without implementing split bus arrangement at Biharsharif, Maithon, Durgapur, and Kahalgaon substations, the fault level crosses the design limit of 40kA. Further, by implementation of split bus at Biharsharif, Maithon and Durgapur, the fault level is controlled to design limit for these substations. NTPC needs to complete splitting of Kahalgaon 400kV bus expeditiously so as to control the fault level at Kahalgaon generation switchyard.

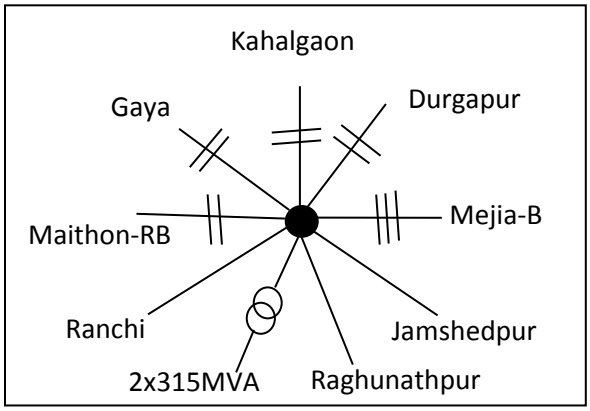
Since Jamshedpur – Durgapur 400kV D/c line was terminated at DTPS due to RoW problems near Durgapur area, the fault level at Durgapur bus (considering Maithon and Biharsharif substations in split condition) is slightly below 40kA. Therefore, at present the splitting arrangement at Durgapur can be operated in closed condition and this splitting arrangement at Durgapur shall be utilized at a later date.

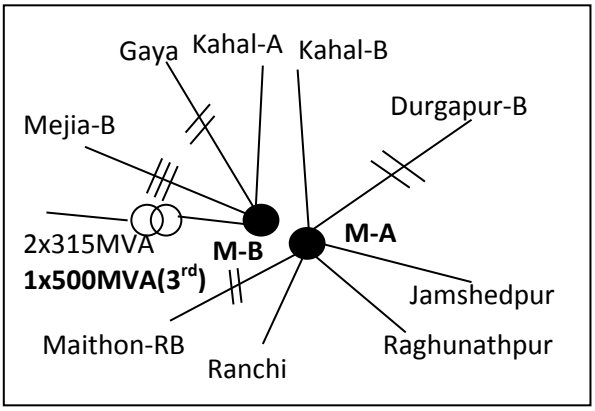
Annexure-1

Split bus arrangement at 400kV level in ER

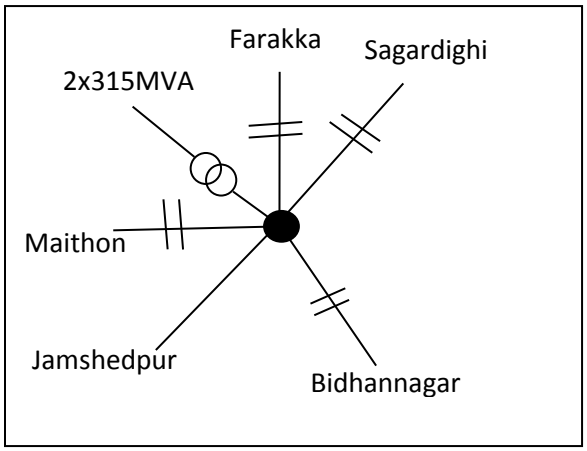
Before Splitting **After Splitting**

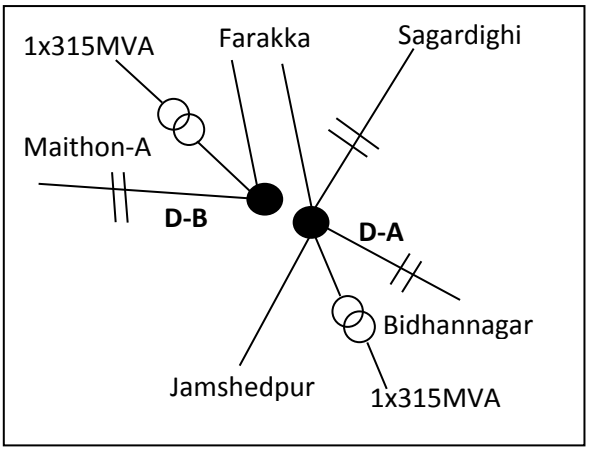
Maithon S/s



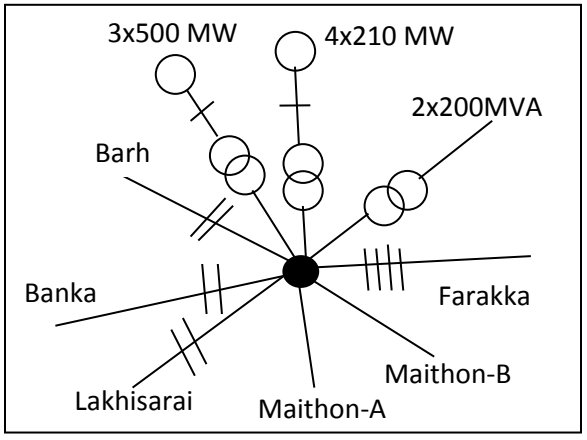


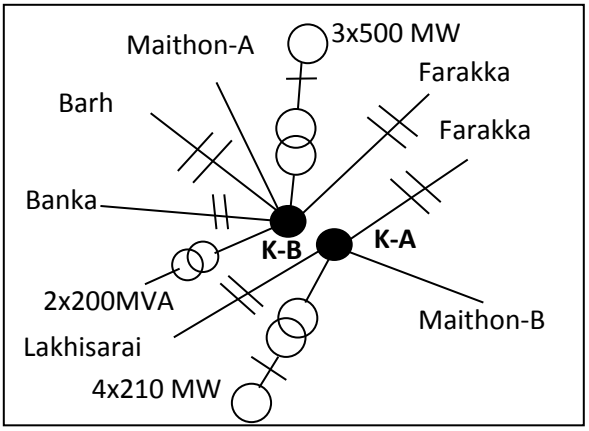
Durgapur S/s



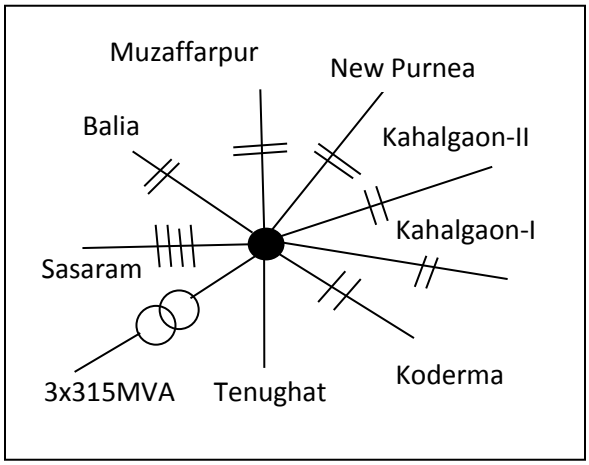


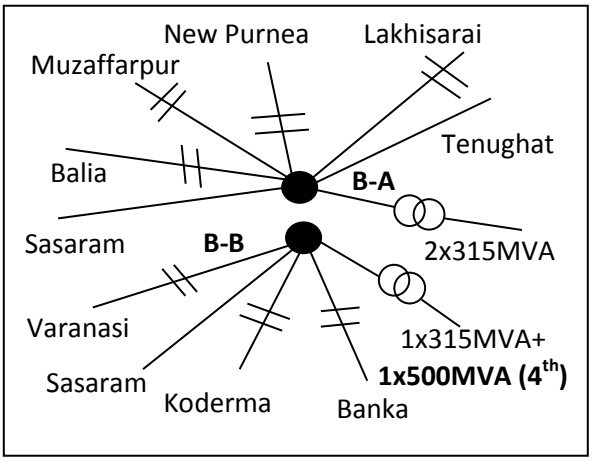
Kahalgaon Switchyard





Biharsharif S/s



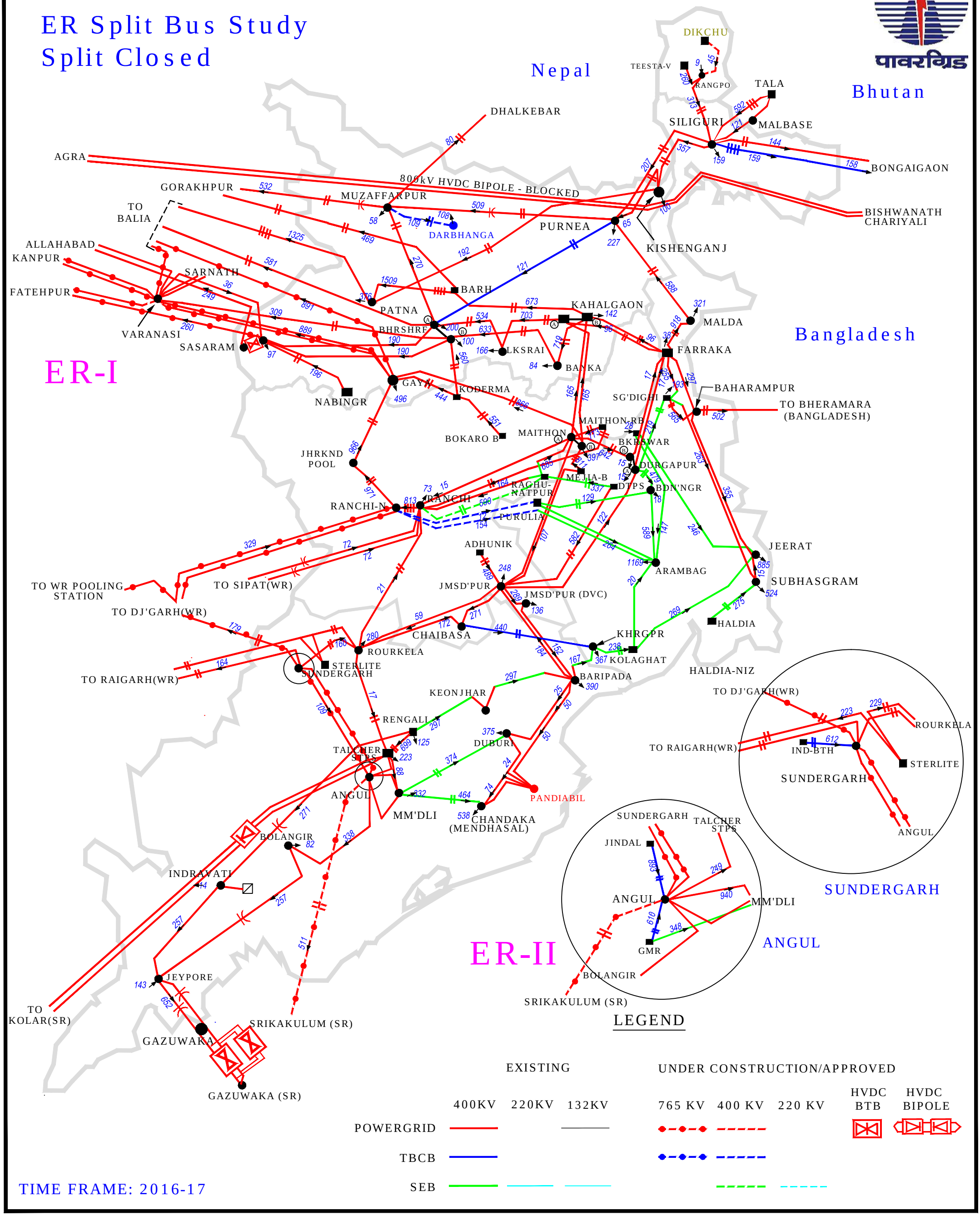


Note: *3rd 400/220kV, 500MVA ICT at Maithon and 4th 400/220kV, 500MVA ICT at Biharsharif is to be implemented under ERSS-XX in future.*

Exhibit-1

POWER MAP OF EASTERN REGION

ER Split Bus Study
Split Closed



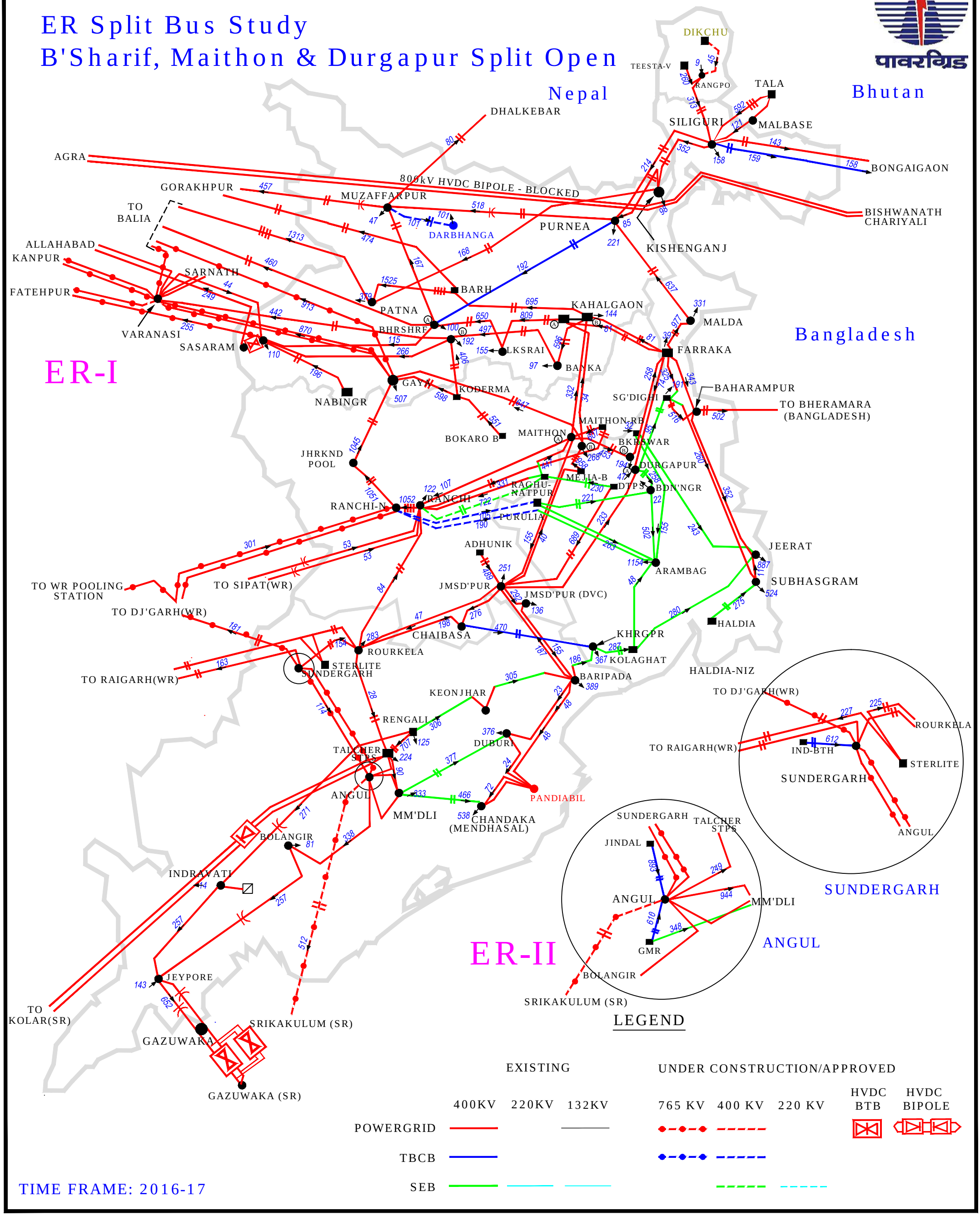
LEGEND

	EXISTING			UNDER CONSTRUCTION/APPROVED				
	400KV	220KV	132KV	765 KV	400 KV	220 KV	HVDC BTB	HVDC BIPOLE
POWERGRID								
TBCB								
SEB								

TIME FRAME: 2016-17

POWER MAP OF EASTERN REGION

ER Split Bus Study
B'Sharif, Maithon & Durgapur Split Open



LEGEND

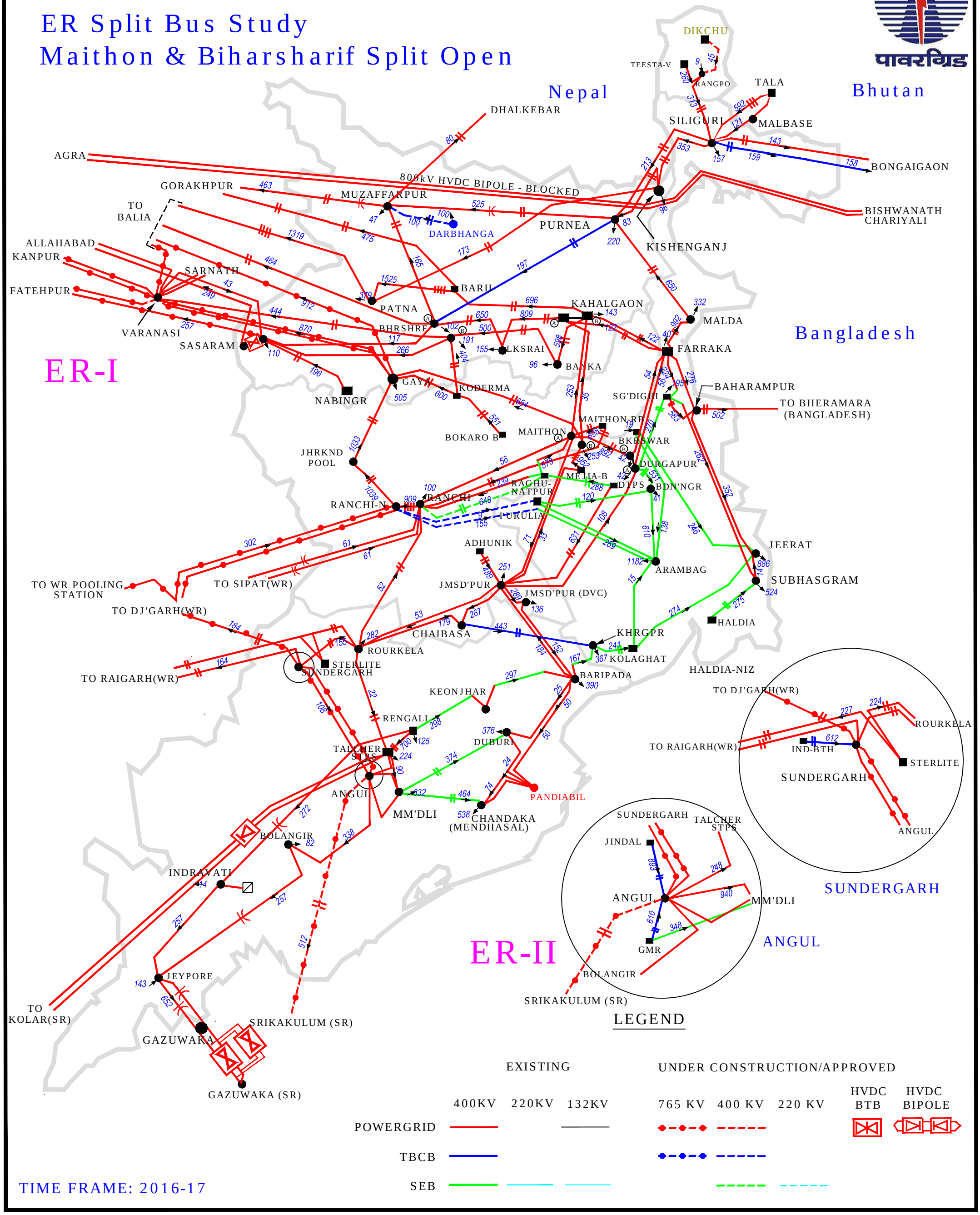
	EXISTING			UNDER CONSTRUCTION/APPROVED				
	400KV	220KV	132KV	765 KV	400 KV	220 KV	HVDC BTB	HVDC BIPOLE
POWERGRID								
TBCB								
SEB								

TIME FRAME: 2016-17

Exhibit-3

POWER MAP OF EASTERN REGION

ER Split Bus Study
Maithon & Biharsharif Split Open



TIME FRAME: 2016-17

Annexure-3

Bus Split Arrangement

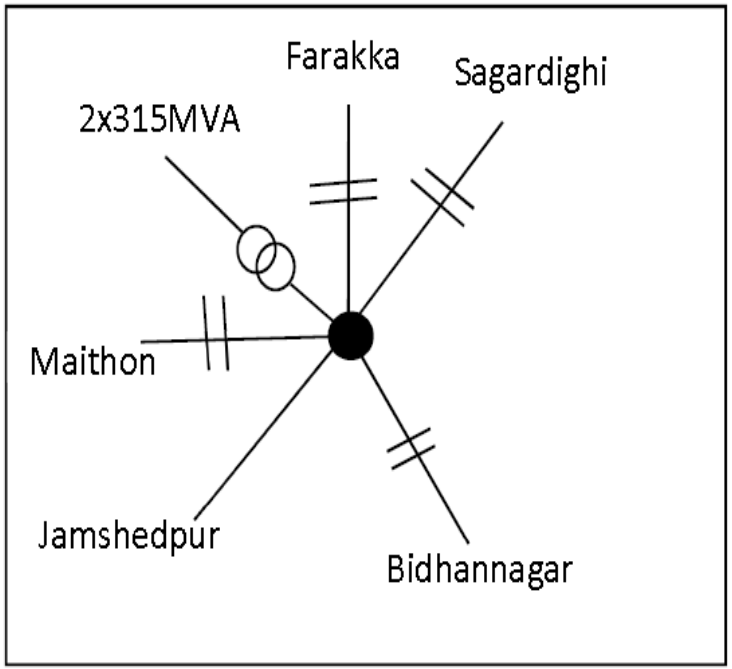
DURGAPUR

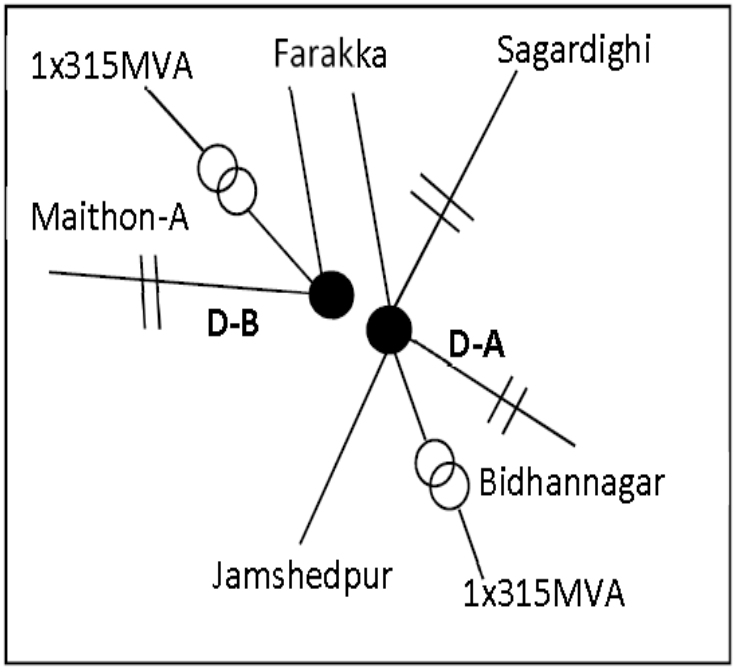
Background

- The Bus splitting of 400/220 kV Biharsharif (PG), 400/220 kV Maithon (PG), 400/132 kV Kahalgaon (NTPC) and 400 /220 kV Durgapur(PG) were discussed and agreed in principle in the 11th Standing Committee meeting of Eastern region held on 20th Sept 2010.
- In the 18th SCM of Eastern region, the bus splitting study with an updated network of the eastern region have reviewed these substations.
- The Bus splitting at Maithon, Durgapur and Bihar Sharif have been completed and Split arrangement at Kahalgaon NTPC is expected to complete by end of 2018

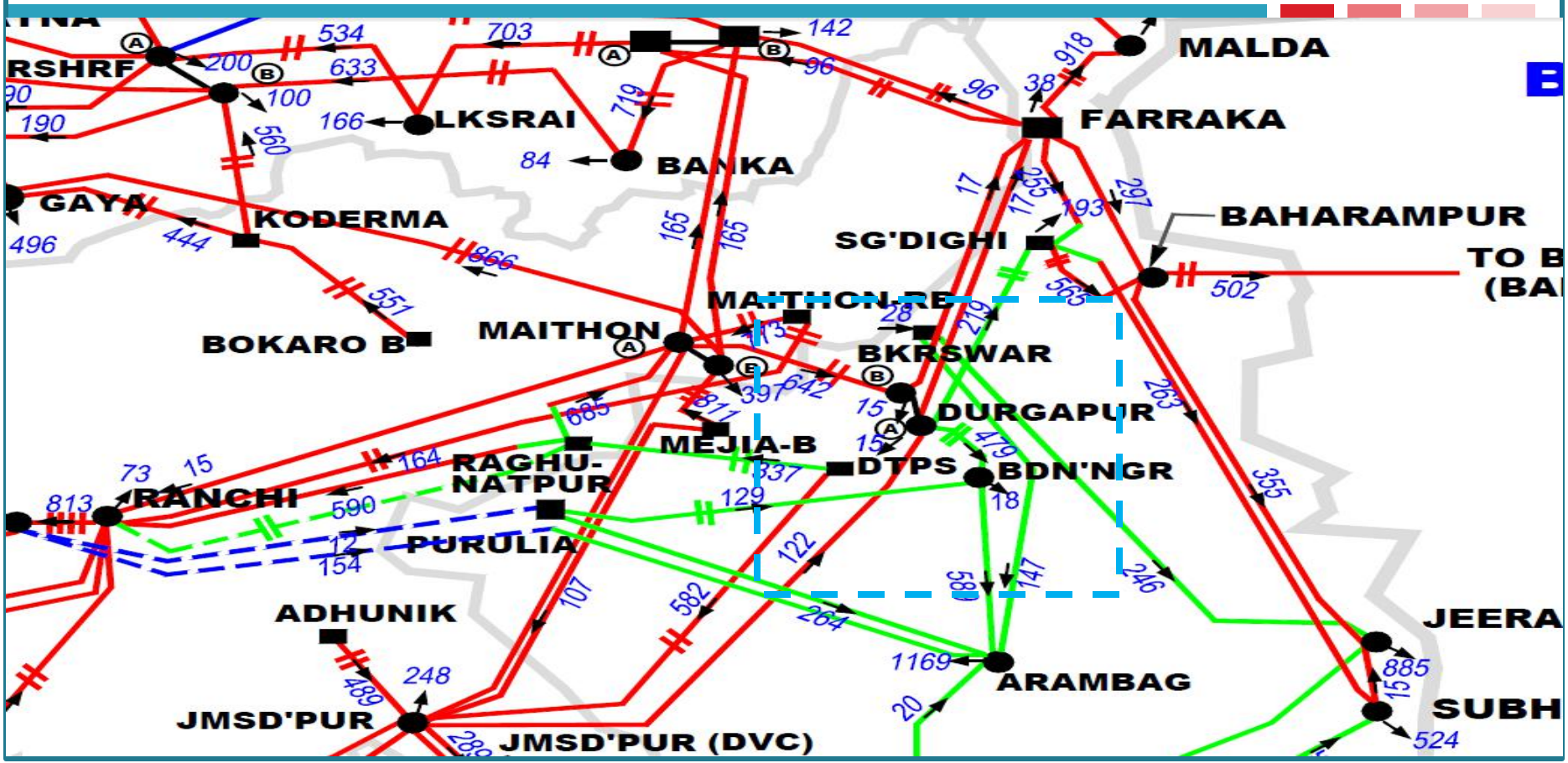
Bus Split at Durgapur

Durgapur S/s

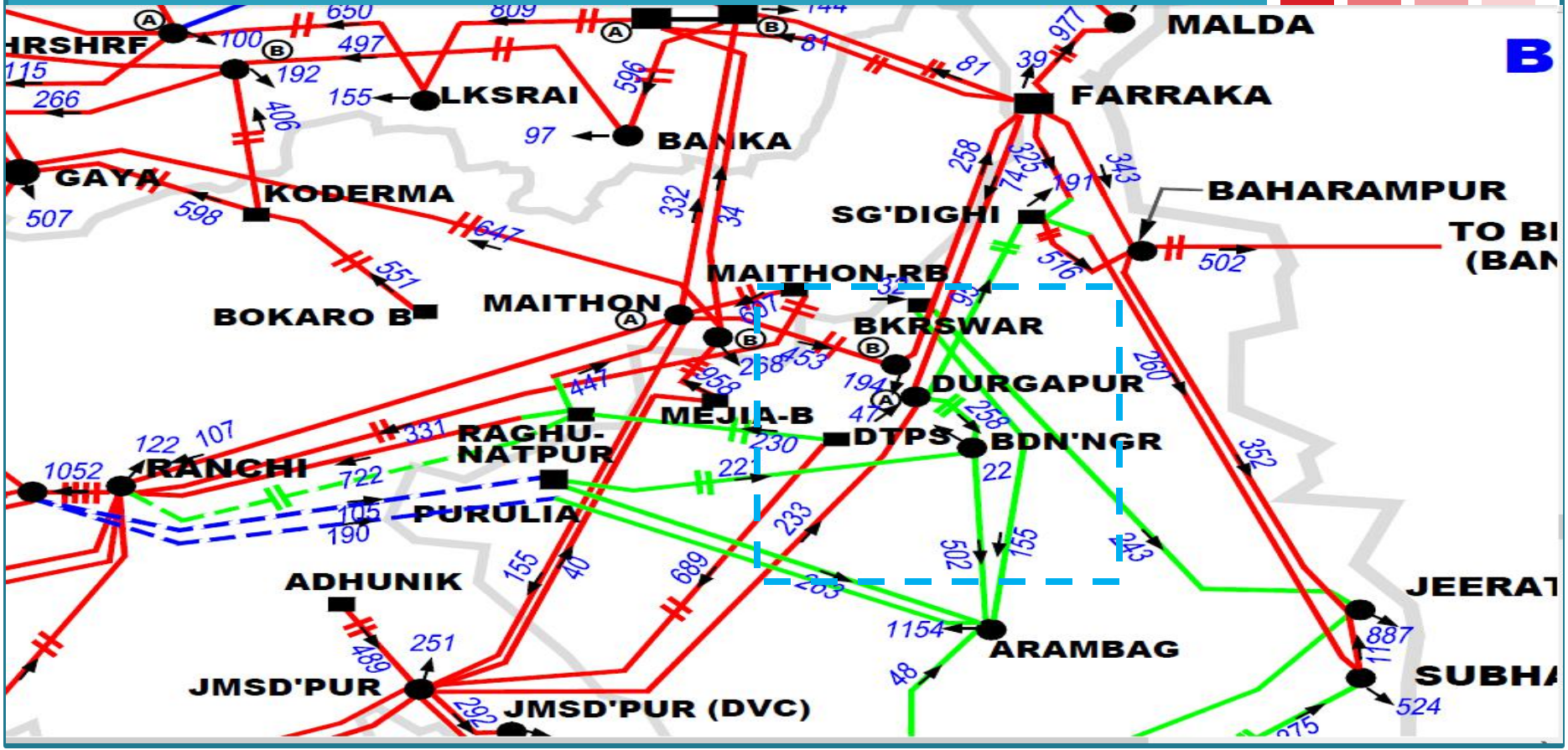




ER Split Bus Study
Split Closed



ER Split Bus Study
B'Sharif, Maithon & Durgapur Split Open



Durgapur Bus Split Study Observations

- The Fault level of 400 kV Durgapur Bus is **higher during high hydro season and crossing 40-43 kA** while it is in the range of 40-35 kA during low hydro season.
- The Fault level of 400 kV Durgapur will significantly reduce from after the Bus Split Operation (37.6 kA to 26.9 kA and 18.6 kA). However it has no appreciable change in fault level of Farakka and Kahalgaon.
- Further, the 400 kV Bus Splitting at Kahalgaon NTPC and Bypass Arrangement at Farakka has no significant contribution in reducing the fault level of Durgapur.

Durgapur Bus Split Study Observations…

- The 400 kV Durgapur Bus Split arrangement results in uneven loading on the 315 MVA 400/220 kV ICT 1 and 2. One ICT is loaded more than two times the other ICT. However, in the West Bengal and DVC 220 kV network has no significant impact Except.
  - 220 kV Parulia- Parulia (DVC) D/C loading is not n-1 compliant during peak case (Each Circuit Loading changes from 142 MW to 168 MW, 18 % sensitivity).
  - The sensitivity of one circuit outage of 220 kV Durgapur (PG) - Durgapur DVC is higher on the other circuit (Around 96 %).
  - **This may need a review from DVC and SPS may be required to ensure timely action to reduce equipment damage.**

Durgapur Bus Split Study Observations…

- For 400 kV Durgapur Bus Split, it was observed that during any outage/prolonged tripping of 400 kV Durgapur-Maithon one circuit or 400/220 kV Durgapur ICT or 400 kV Farakka-Durgapur B ckt, the bus split should be closed to ensure reliability.

During PPSP in Pump Storage:

- In this case, Under N-1 contingency of highly loaded 400/220 kV ICT at Durgapur, 220 kV Kalyaneshwari –Maithon D/C gets loaded to 200 MW from 164 MW per ckt (Sensitivity of around 12 % on each circuit) making it insecure for next contingency and vulnerable for DVC system. **Therefore, this also may need a review from the DVC point of view.**
- N-2 Contingency of 400 kV Durgapur A –Bidhanagar D/C will lead to a Serious threat to 315 MVA ICT at Durgapur and 220 kV Durgapur-Durgapur D/C so under such condition also **the split bus operation to be avoided**.

Protection Coordination Requirement

- Protection Coordination and readiness with two-group setting have to be there at all remote end substation from Durgapur for Common Bus mode and Bus Split,

Summary of Change in Fault level after Durgapur and Kahalgaon Bus Splitting

Substation and Voltage level	3 Phase Fault current (kA) : Base Case	3 Phase Fault Current (kA) after Bus Split at Durgapur	3phase fault current (kA) after Bus Split at Durgapur and Kahalgaon
Bihar Sharif	42.0	42.7	42.0
Kahalgaon A	50.9	51.3	25.2
Kahalgaon B	50.9	51.3	35.3
Maithon A	26.1	26.6	25.9
Jamshedpur	32.3	32.9	32.1
Maithon B	37.4	33.4	32.5
Sagardighi	33.9	34.0	32.8
Bakreshwar	10.4	11.0	10.3
Bidhan Nagar	33.2	25.9	24.9
Farakka	50.3	51.3	49.7
Durgapur A	37.6	26.9	25.8
Durgapur B	37.6	18.7	18.2