

Bihar: Transmission System Study for 13th Plan

1. Introduction

Presently, the unrestricted demand of the state of Bihar is of the order of 4500MW and demand met is about 3500MW. The state has been experiencing high power demand growth in recent times. Further, large scale system strengthening works are being carried out at sub-transmission and distribution level which will further enhance the power demand. Additionally, numbers of central sector generation project are under construction in ER from which Bihar has substantial amount of share:

Sl. No.	Project	Unit Size	Installed Capacity (in MW)	Bihar Share (ex-bus in MW)	Commissioning Schedule
1	Barh-I & II	3x660 2x660	1320+ 1980	1883	Uncertain Commissioned
2	Nabinagar-I	4x250	1000	100	2016-17
3	Nabinagar-II	3x660	1980	1295 (+169)	2017-18
4	North Karanpura	3x660	1980	645	2018-19
5	Darlipalli	2x800	1600	154	2018-19
6	Talcher-III	2x660	1320	140	2019-20
		Total	11180	3741 (ex-bus)	

Under the Govt. of India initiative of 24x7 power to all by 2018-19, power demand of Bihar is expected to increase to 8774 MW (50% agriculture load). This demand is expected to rise further on account of 100% segregation of the agriculture feeder and by 2021-22 (13th Plan end) demand of the state is expected to be about 11,000MW.

Accordingly, system studies have been carried out for 2021-22 time-frame for Bihar grid to identify the system strengthening requirements.

New state sector generation projects expected by 2021-22 are:

Generation Complex	Existing	Addition	Schedule	Total
Muzaffarpur/Kanti (MTPS)	2x110MW	2x195MW	Oct'16/Dec'16	610MW
Barauni (BTPS)	2x110MW	2x250MW	Dec'16	720MW

Further, three numbers of generation projects (Case-II bidding) at Buxar, Lakhisarai and Pirpaintieach of1320MW (2x660MW) capacity are also under consideration in Bihar and are expected by end of 2022.

2. Load Flow Study and Study Results

Following three no. of case studies have been performed:

- (a) Base Case (2021-22) [without any additional strengthening]
- (b) With new required system strengthening
- (c) With new required system strengthening + Generation Linked scheme for three Case-II IPPs

All approved and under construction transmission system in Bihar by state and ISTS were considered in base case and the study results are at **Exhibit-1 (a) & (b)**.

High load growth is expected in the following areas as per data from BSPTCL and from base case study results it has been observed that numbers of transmission lines and ICTs are overloaded in these areas:

- (i) West Champaran, East Champaran and Sitamarhi dist. – Motihari & Sitamarhi areas
- (ii) Gaya, Aurangabad, Rohtas and Kaimur (Bhabua) districts – Gaya & Sasaram areas
- (iii) Saharsa, Khagaria and Begusarai districts
- (iv) Patna district

In view of the above, new 400kV substations have been proposed at Sitamarhi, Chandauti and Saharsa and new 220kV substations have been proposed at Karmnasa, Motihari and Korha (near Katihar). For Patna area three new 400kV substations were already evolved along with 12th system. Space availability in and around state capital was reviewed and a modified scheme has been worked out.

Load flow study results with proposed new transmission system and system strengthening required in Bihar Grid to meet the 13th Plan end load of about 11,000MW is at **Exhibit-2 (a) & (b)**.

Following new transmission system and system strengthening is required in Bihar Grid for 13th Plan:

A. New Substations

1. Sitamarhi(New) S/s: 400/220/132kV, 2x500MVA + 2x200MVA

- (a) Darbhanga – Sitamarhi(New) 400kV D/c (Triple Snowbird)
- (b) Sitamarhi (New) – Motihari 400kV D/c (Triple Snowbird)
- (c) Sitamarhi (New) – Motipur 220kV D/c
- (d) Sitamarhi (New) – Sitamarhi 132kV D/c (Single Moose)
- (e) Sitamarhi (New) – Pupri 132kV D/c

2. Motihari (New) S/s: 220/132kV, 2x200MVA

- (a) Sitamarhi (New) – Motihari (New) 220kV D/c (Twin Moose)
- (b) Motihari (New) – Gopalganj 220kV D/c (Twin Moose)

- (c) Motihari (New) – Raxaul 132kV D/c
- (d) Motihari (New) – Betiah 132kV D/c (Single Moose)

3. Chandauti (New) S/s: 400/220/132kV, 3x500MVA + 3x200MVA

- (a) LILO of Nabinagar-II – Gaya 400kV D/c (Quad) at Chandauti (New)
- (b) LILO of Gaya (POWERGRID) – Sonenagar 220kV D/c at both Bodhgaya (BSPTCL) and Chandauti (New) substations, so as to form Gaya (POWERGRID) – Bodhgaya (BSPTCL) – Chandauti (New) – Sonenagar 220kV D/c line
- (c) Reconductoring of Chandauti – Rafiganj – Sonenagar 132kV S/c line with HTLS conductor of 240MVA (ampacity - 1050A)
- (d) LILO of Chandauti – Rafiganj 132kV S/c line at Chandauti (New)
- (e) Reconductoring of Chandauti – Sonenagar 132kV S/c line with HTLS conductor of 240MVA (ampacity - 1050A)
- (f) LILO of Chandauti – Sonenagar 132kV S/c line at Chandauti (New)

4. Karmanasa (New) 220/132kV S/s: 2x200MVA

- (a) LILO of Sasaram – Sahupuri 220kV S/c at Karmanasa (New)
- (b) Karmanasa (New) – Pusauli (BSPTCL) 220kV D/c line (Twin Moose)
- (c) Karmanasa (New) – Mohania 132kV D/c (Single Moose)
- (d) Karmanasa (New) – Karmanasa 132kV D/c (Single Moose)

5. Saharsa (New) 400/220/132kV S/s: 2x500MVA + 2x200MVA

- (a) LILO of Kishanganj – Patna 400kV D/c (Quad) at Saharsa (New)
- (b) Saharsa (New) – Begusarai 220kV D/c
- (c) Saharsa (New) – Khagaria (New) 220kV D/c
- (d) Saharsa (New) – Saharsa 132kV D/c (Single Moose)

6. Upgradation of Korha (New) 132/33kV to 220/132kV S/s with 2x100MVA* ICT

- (a) LILO of Purnea (POWERGRID) – Khagaria (New) 220kV D/c at Korha (New)

* To be utilised from ICTs available after replacement in other substations

B. ICT Augmentation

(a) POWERGRID / ISTS ICT Augmentations

Substation	kV-1	kV-2	Rating	Loading	N-1 Loading	Addition
Banka-PG	132	400	2x200	2x169	238	3 rd 315 ICT
Biharsharif- B	220	400	315	2x155	-	2 nd 500 ICT

Substation	kV-1	kV-2	Rating	Loading	N-1 Loading	Addition
Lakhisarai-PG	132	400	2x200	2x188	213	3 rd 315 ICT
Motihari-New	132	400	2x200	2x81	265	3 rd 315 ICT

(b) BSPTCL ICT Augmentations

Substation	kV - 1	kV - 2	Rating	Loading	N-1 Loading	Addition	Replace-ment
Bihta New	132	220	2x160	2x180	257	3 rd 200 ICT	
Chapra New	132	220	2x160	2x116	175	3 rd 160 ICT	
Gopalganj	132	220	2x160	2x159	232	3 rd 160 ICT	
Darbhanga	132	220	3x100	3x93	119		3x100 by 3x200
Hazipur	132	220	3x100	3x88	108		3x100 by 3x200
Khagaul	132	220	4x100	4x126	150		4x100 by 4x200
Kishanganj New	132	220	2x160	2x162	238	3 rd 160 ICT	
Sipara	132	220	2x150+ 1x160	2x142 +151	170		2x150+160 by 3x200
Sonenagar	132	220	2x160	2x147	205	3 rd 160 ICT	

After proposed ICT augmentations transformation capacity at various levels shall be as below (details at **Appendix-1**):

Transformation Level	Capacity (in MVA)
765/400kV	7500
400/220kV	15390
400/132kV	2745
220/132kV	17050
220/33kV	200

Further, if required, BSPTCL may plan for additional transformation capacity augmentation/replacement or creation on new substations at lower voltage levels (220/132kV) to meet the projected demand.

C. Re-conductoring of lines with HTLS**(a) 220kV lines**

1. Purnea – Purnea (New) 220kV D/c (line of POWERGRID)

(b) 132kV lines with HTLS of 240MVA (1050A ampacity) – BSTPCL lines

1. Kanti – SKMCH 132kV D/c
2. Dehri – Banjari 132kV S/c

3. Barauni – Begusarai 132kV D/c
4. Mithapur – Karbhigaiya 132kV S/c
5. Arrah (POWERGRID) – Arrah 132kV S/c
6. Lakhisarai (POWERGRID) – Lakhisarai 132kV D/c
7. Chhapra (New) – Chhapra 132kV D/c
8. Kishanganj (Old) – Kishanganj (New) 132kV D/c
9. Chandauti – Tekari 132kV D/c
10. Kahalgaon – Sabour 132kV S/c
11. Kahalgaon – Kahalgaon (BSPTCL) 132kV S/c
12. Dehri – Sonenagar 132kV D/c
13. Biharsharif – Baripahari 132kV D/c

D. Stringing of 2nd Circuit

1. Stringing of 2nd circuit of Saharsa – Sonebarsa 132kV S/c on D/c
2. Stringing of 2nd circuit of Muzaffarpur – SKMCH 132kV S/c on D/c

E. Scheme modification

Sl. No.	Old Scheme	New Scheme
1	Banka – Banka (New) 132kV D/c	Banka (POWERGRID) – Banka (New) 132kV D/c with HTLS
2	Bihta – Bihta (New) 132kV D/c with Panther	Bihta – Bihta (New) 132kV D/c with HTLS of 240MVA
3	Motihari (ISTS) – Motihari 132kV D/c (Panther)	Motihari (ISTS) – Motihari 132kV D/c with HTLS of 240MVA

F. New lines

1. Muzaffarpur – Chhapra 220kV D/c
2. Laukhi – Phulparas 132kV D/c (HTLS)
3. Vaishali – Hazipur 132kV D/c

G. Issues

- (a) It is proposed to re-conductor Khagaul – Digha and Bihta – Digha 132kV S/c lines to feed about 250MW load of Digha. However, the same is not feasible as informed by BSPTCL. Needs to be resolved.

H. Generation Linked Scheme

Transmission system for three new Case-II IPPs at Buxar, Lakhisarai and Pirpainti was evolved along with identification of transmission system requirement for meeting 12th Plan end load demand. The same evacuation system has been considered along with above proposed 13th Plan system and the study results are at **Exhibit-3 (a) & (b)**.

Appendix-1

Substation	Voltage Level		Id	Rating
GAYA-PG	765	400	1	1500
GAYA-PG	765	400	2	1500
GAYA-PG	765	400	3	1500
GAYA-PG	765	400	4	1500
SASARAM-ER	765	400	1	1500
Total				7500
PATNA	400	220	1	500
PATNA	400	220	2	500
BIHARSHARIF-A	400	220	1	315
BIHARSHARIF-A	400	220	2	315
BIHARSHARIF-B	400	220	1	315
BIHARSHARIF-B	400	220	2	500
GAYA-PG	400	220	1	315
GAYA-PG	400	220	2	500
GAYA-PG	400	220	3	500
MUZAFARPR-PG	400	220	1	315
MUZAFARPR-PG	400	220	2	315
MUZAFARPR-PG	400	220	3	500
SASARAM-PG	400	220	1	500
SASARAM-PG	400	220	2	500
SAHARSA NEW	400	220	1	500
SAHARSA NEW	400	220	2	500
PURNEA-NW-PG	400	220	1	500
PURNEA-NW-PG	400	220	2	500
BAKHTIYR-NEW	400	220	1	500
BAKHTIYR-NEW	400	220	2	500
SITAMARHI NW	400	220	1	500
SITAMARHI NW	400	220	2	500
DARBHANG-NEW	400	220	1	500
DARBHANG-NEW	400	220	2	500
KISHENGAN-PG	400	220	1	500
KISHENGAN-PG	400	220	2	500
NAUBATPUR	400	220	1	500
NAUBATPUR	400	220	2	500
JAKKANPUR-NW	400	220	1	500
JAKKANPUR-NW	400	220	2	500
CHANDAUTI NW	400	220	1	500
CHANDAUTI NW	400	220	2	500
CHANDAUTI NW	400	220	3	500
Total				15390
BANKA-PG	400	132	1	200
BANKA-PG	400	132	2	200
BANKA-PG	400	132	3	315
LAKHISRA-PG	400	132	1	315

Substation	Voltage Level		Id	Rating
LAKHISRA-PG	400	132	2	200
LAKHISRA-PG	400	132	3	200
MOTIHARI-NEW	400	132	1	200
MOTIHARI-NEW	400	132	2	200
MOTIHARI-NEW	400	132	3	315
# KAHALGAON-B	400	132	1	200
# KAHALGAON-B	400	132	2	200
# BARH	400	132	1	200
Total				2745
# KANTI	220	132	1	100
# KANTI	220	132	2	100
# KANTI	220	132	3	100
SAMASTPR NEW	220	132	1	160
SAMASTPR NEW	220	132	2	160
HAZIPUR	220	132	1	200
HAZIPUR	220	132	2	200
HAZIPUR	220	132	3	200
FATUHA	220	132	1	100
FATUHA	220	132	2	100
FATUHA	220	132	3	100
FATUHA	220	132	4	100
FATUHA	220	132	5	100
BIHARSARIF	220	132	1	150
BIHARSARIF	220	132	2	150
BIHARSARIF	220	132	3	150
KHAGAUL	220	132	1	200
KHAGAUL	220	132	2	200
KHAGAUL	220	132	3	200
KHAGAUL	220	132	4	200
BODHGAYA	220	132	1	150
BODHGAYA	220	132	2	150
BODHGAYA	220	132	3	150
BODHGAYA	220	132	4	150
BODHGAYA	220	132	5	160
DEHRI	220	132	1	100
DEHRI	220	132	2	100
DEHRI	220	132	3	100
DEHRI	220	132	4	100
BEGUSRAI	220	132	1	100
BEGUSRAI	220	132	2	100
BEGUSRAI	220	132	3	100
BEGUSRAI	220	132	4	100
KARAMNASA	220	132	1	200
KARAMNASA	220	132	2	200
PURNEA-PG	220	132	1	160

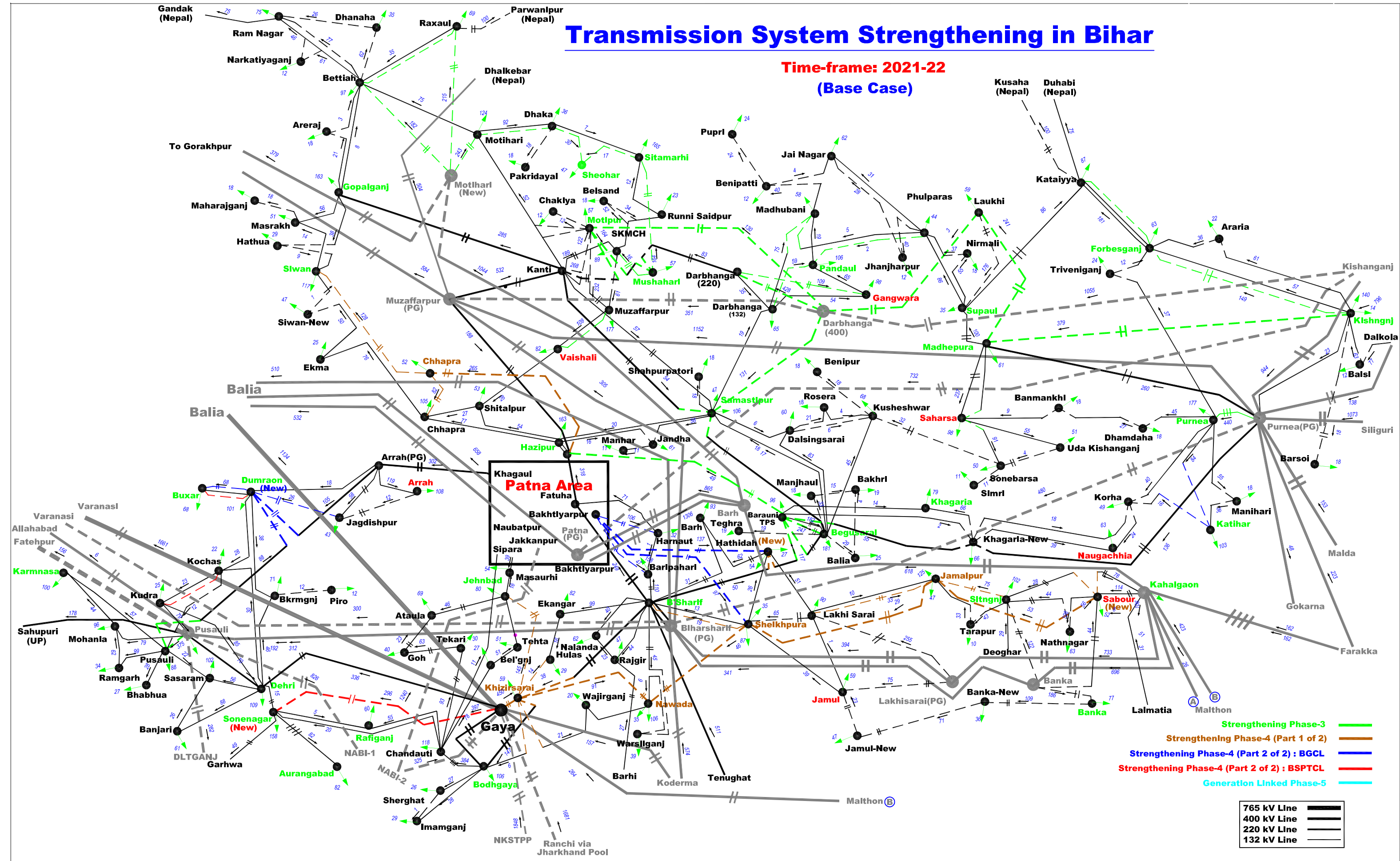
Substation	Voltage Level		Id	Rating
PURNEA-PG	220	132	2	160
PURNEA-PG	220	132	3	160
KHIZIRSARAI	220	132	1	160
KHIZIRSARAI	220	132	2	160
BIHTA NEW	220	132	1	200
BIHTA NEW	220	132	2	160
BIHTA NEW	220	132	3	160
# BARAUNI	220	132	1	150
# BARAUNI	220	132	2	150
SONENAGAR	220	132	1	160
SONENAGAR	220	132	2	160
SONENAGAR	220	132	3	160
PUSAULI BSPT	220	132	1	150
PUSAULI BSPT	220	132	2	150
SIPARA	220	132	1	200
SIPARA	220	132	2	200
SIPARA	220	132	3	200
MADHEPURA	220	132	1	100
MADHEPURA	220	132	2	100
MADHEPURA	220	132	3	100
MADHEPURA	220	132	4	100
DUMRAON NW	220	132	1	160
DUMRAON NW	220	132	2	160
ARRAH-PG	220	132	1	100
ARRAH-PG	220	132	2	100
ARRAH-PG	220	132	3	160
DARBHANGA	220	132	1	160
DARBHANGA	220	132	2	160
DARBHANGA	220	132	3	160
CHAPRA NEW	220	132	1	160
CHAPRA NEW	220	132	2	160
CHAPRA NEW	220	132	3	160
GOPALGANJ	220	132	1	200
GOPALGANJ	220	132	2	200
GOPALGANJ	220	132	3	200
LAUKHI	220	132	1	160
LAUKHI	220	132	2	160
SABOUR-NEW	220	132	1	160
SABOUR-NEW	220	132	2	160
JAMALPUR NEW	220	132	1	160
JAMALPUR NEW	220	132	2	160
KISH-NW-BSEB	220	132	1	160
KISH-NW-BSEB	220	132	2	160
KISH-NW-BSEB	220	132	3	160
SITAMARHI NW	220	132	1	200

Substation	Voltage Level		Id	Rating
SITAMARHI NW	220	132	2	200
MOTIHAR1 NW	220	132	1	200
MOTIHAR1 NW	220	132	2	200
BAKHTIYR-NEW	220	132	1	160
BAKHTIYR-NEW	220	132	2	160
KHARWA-NWADA	220	132	1	320
MOTIPUR	220	132	1	160
MOTIPUR	220	132	2	160
SHEKHPURA NW	220	132	1	160
SHEKHPURA NW	220	132	2	160
MUSHAR-SKMNW	220	132	1	160
MUSHAR-SKMNW	220	132	2	160
HATIDAH-NEW	220	132	1	160
HATIDAH-NEW	220	132	2	160
JAKKANPUR-NW	220	132	1	160
JAKKANPUR-NW	220	132	2	160
JAKKANPUR-NW	220	132	3	160
KORHA	220	132	1	100
KORHA	220	132	2	100
KHAGARIA NEW	220	132	1	160
KHAGARIA NEW	220	132	2	160
CHANDAUTI NW	220	132	1	200
CHANDAUTI NW	220	132	2	200
CHANDAUTI NW	220	132	3	200
SAHARSA NEW	220	132	1	200
SAHARSA NEW	220	132	2	200
NAUBATPUR	220	132	1	160
NAUBATPUR	220	132	2	160
Total				17050
BHUSAULA	220	33	1	100
BHUSAULA	220	33	2	100
Total				200

: Generation Switchyard

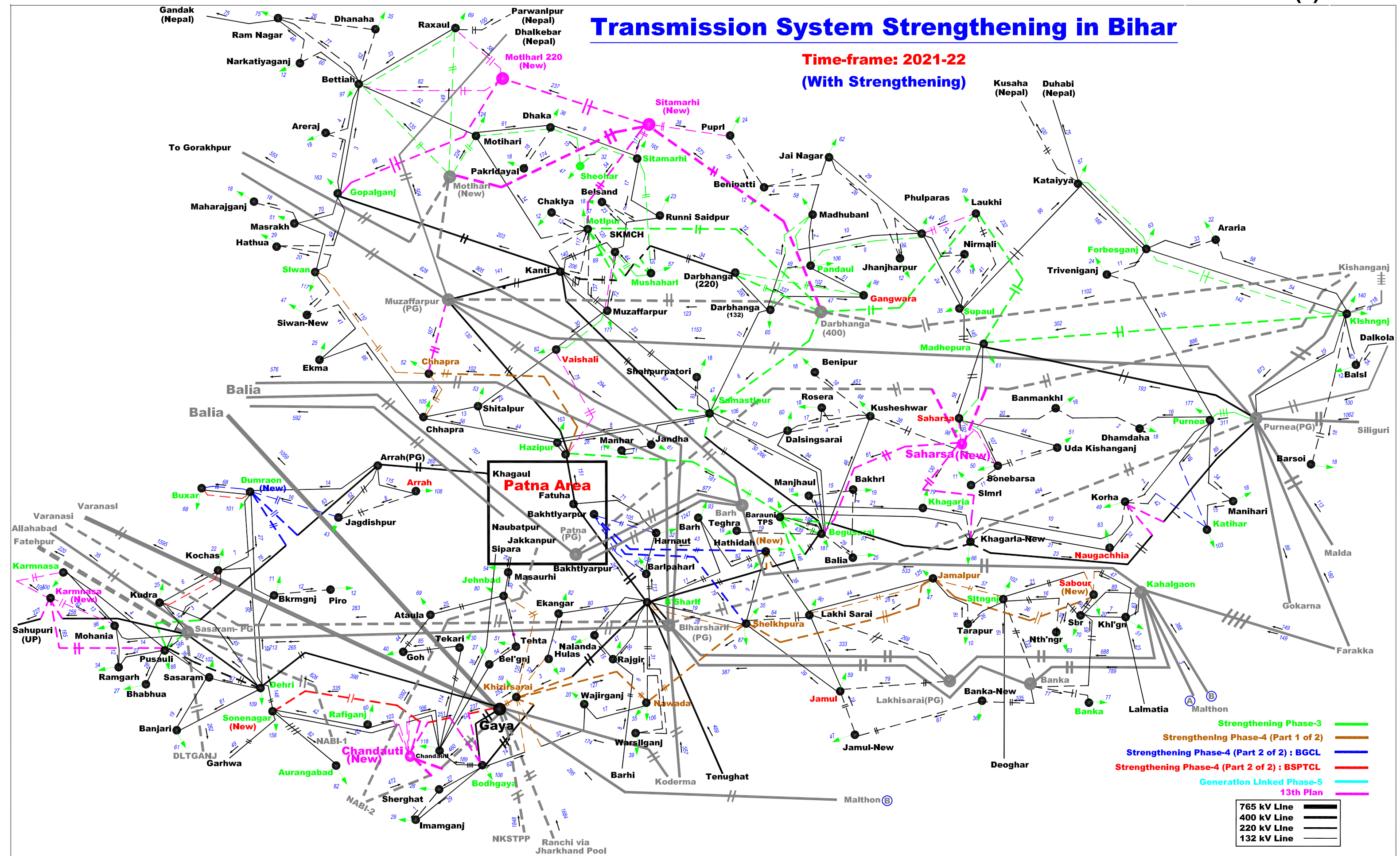
Transmission System Strengthening in Bihar

Time-frame: 2021-22
(Base Case)



Transmission System Strengthening in Bihar

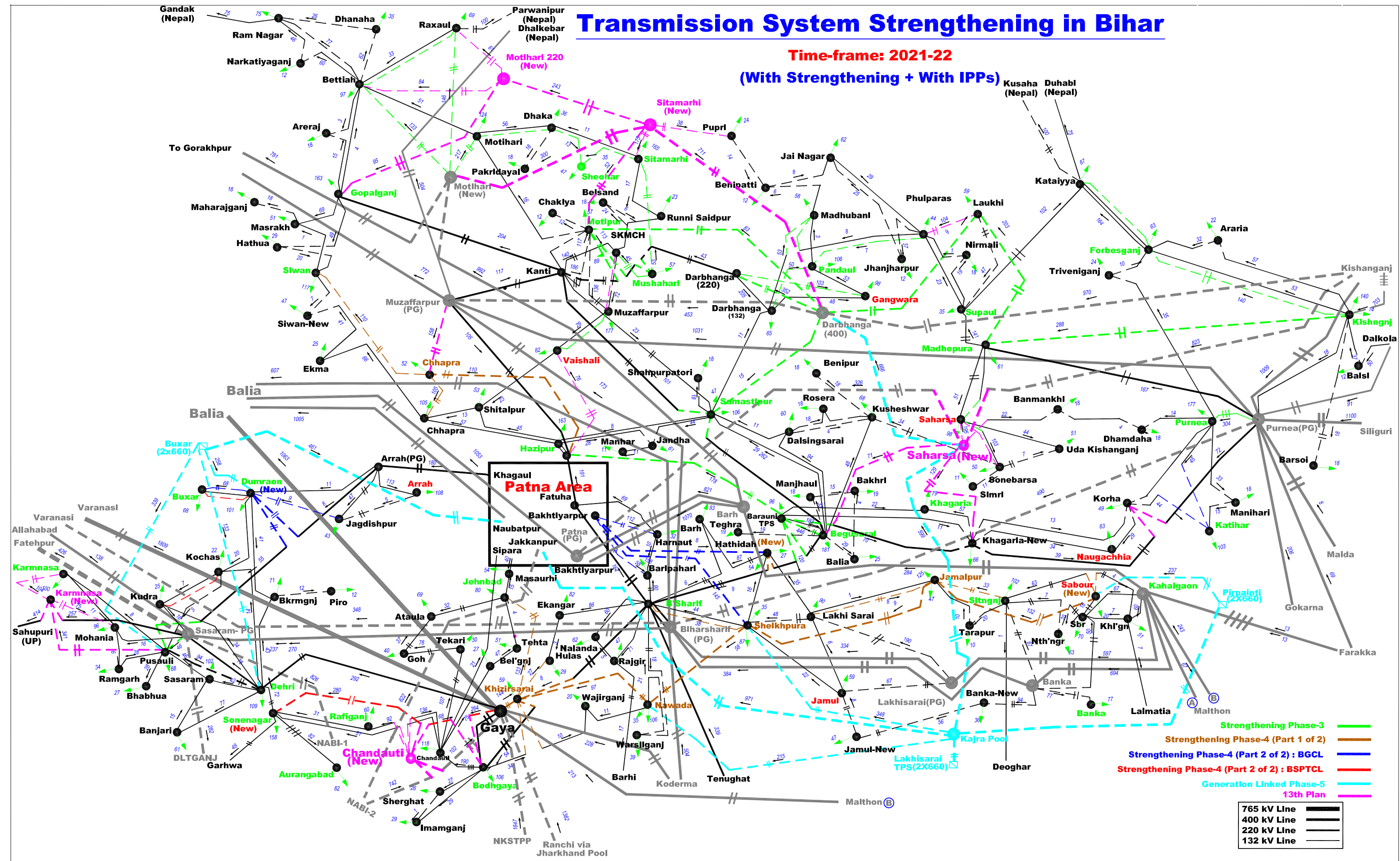
Time-frame: 2021-22
(With Strengthening)



- Strengthening Phase-3 —
 - Strengthening Phase-4 (Part 1 of 2) —
 - Strengthening Phase-4 (Part 2 of 2) : BGCL —
 - Strengthening Phase-4 (Part 2 of 2) : BSPTCL —
 - Generation Linked Phase-5 —
 - 13th Plan —
- | | |
|-------------|---|
| 765 kV Line | |
| 400 kV Line | |
| 220 kV Line | |
| 132 kV Line | |

Transmission System Strengthening in Bihar

Time-frame: 2021-22
(With Strengthening + With IPPs)

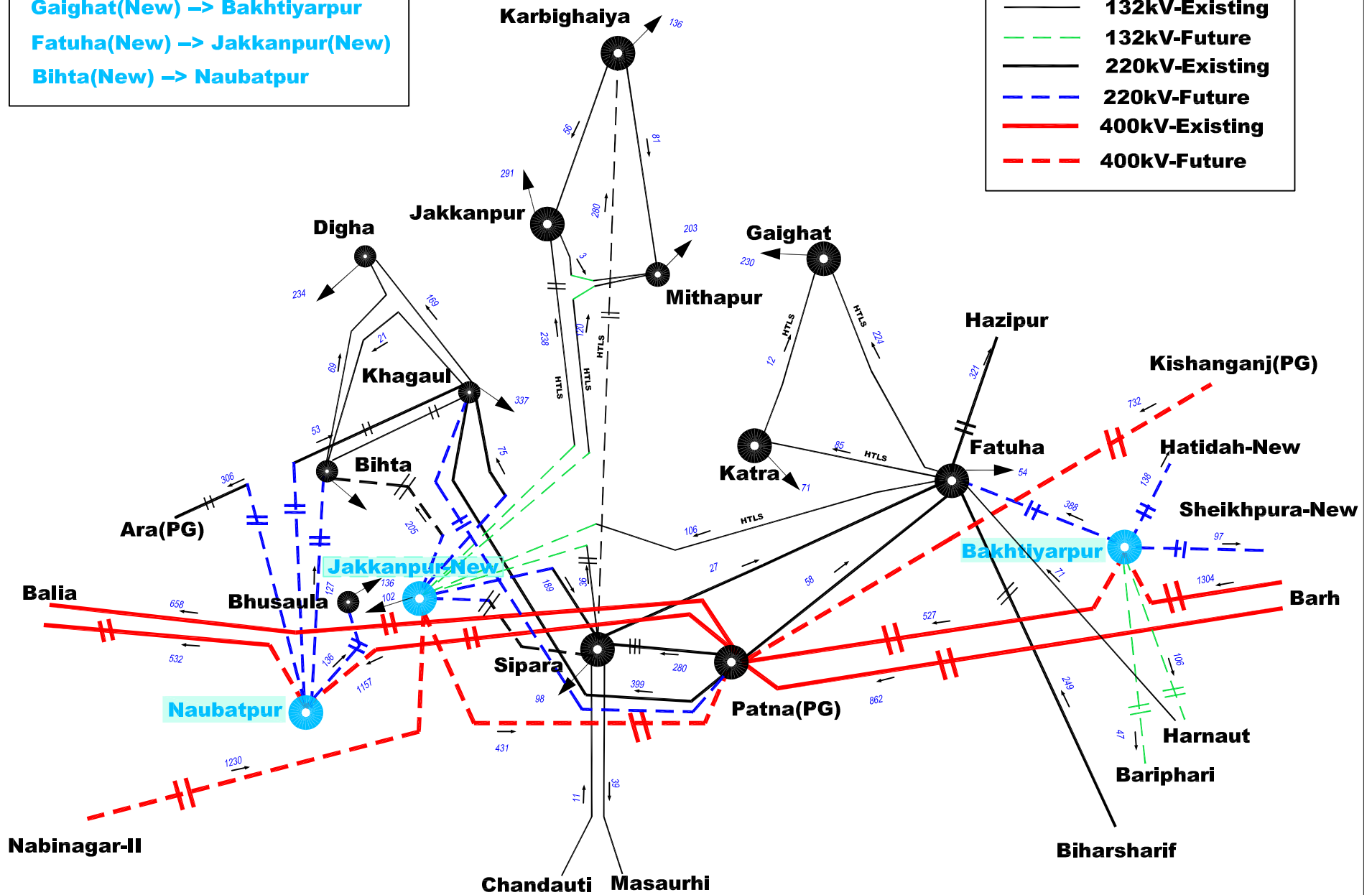


Transmission System Strengthening in Bihar System Exhibit - 1 (b)

(Patna area: 2021-22)
(Base Case)

New 400kV S/s
 Gaighat(New) → Bakhtiyarpur
 Fatuha(New) → Jakkampur(New)
 Bihta(New) → Naubatpur

LEGEND	
	132kV-Existing
	132kV-Future
	220kV-Existing
	220kV-Future
	400kV-Existing
	400kV-Future

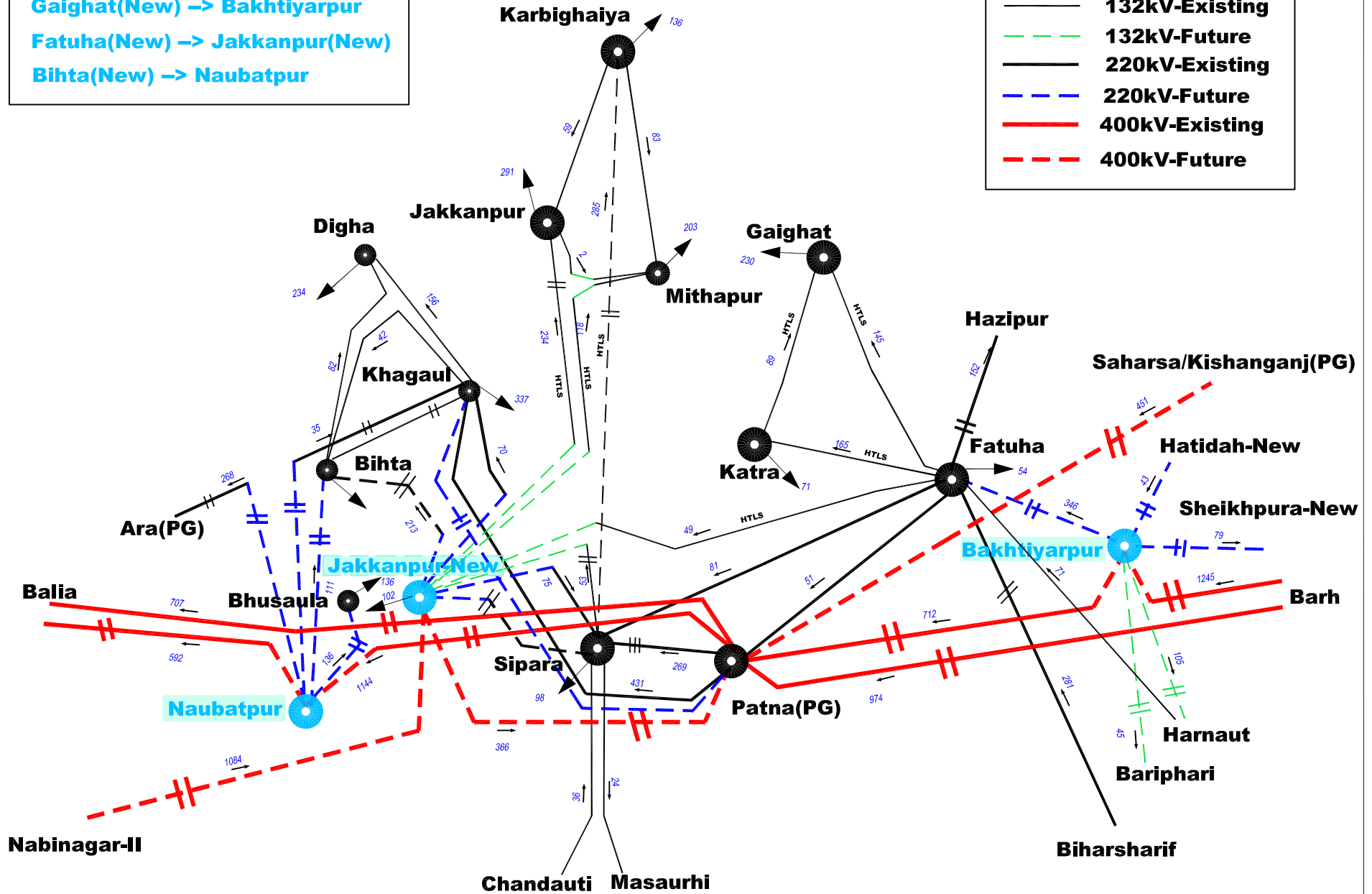


Transmission System Strengthening in Bihar System Exhibit - 2 (b)

(Patna area: 2021-22)
(With Strengthening)

New 400kV S/s
 Gaighat(New) → Bakhtiyarpur
 Fatuha(New) → Jakkampur(New)
 Bihta(New) → Naubatpur

LEGEND	
	132kV-Existing
	132kV-Future
	220kV-Existing
	220kV-Future
	400kV-Existing
	400kV-Future



Transmission System Strengthening in Bihar System Exhibit - 3 (b)

(Patna area: 2021-22)
(With Strengthening + With IPPs)

New 400kV S/s
 Gaighat(New) → Bakhtiyarpur
 Fatuha(New) → Jakkampur(New)
 Bihta(New) → Naubatpur

LEGEND	
	132kV-Existing
	132kV-Future
	220kV-Existing
	220kV-Future
	400kV-Existing
	400kV-Future

