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**Bhutan Power Corporation Limited**  
(An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company)  
Registered Office, Thimphu  
Bhutan Power System Operator  
Thimphu: Bhutan



02/BPC/BPSO/PSOD/Vol-I/20/06

January 23, 2020

Chief Executive Officer,  
Bhutan Electricity Authority,  
Thimphu: Bhutan.

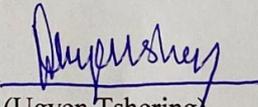
**Sub: Submission of Transmission System Performance Annual Report for the year, 2019.**

Sir,

Kindly find enclosed with the transmission system performance Annual Report as per the Grid Code Regulation, 2008 Clause No: 6.14.1, for the year 2019. Soft copy of the report is available in the BPSO website: <http://bpso.bpc.bt>.

Thanking you,

Yours faithfully,

  
(Ugyen Tshering)  
Senior Manager

Copy to:

1. Director, Operation & Maintenance Department, Druk Green Power Corporation, Thimphu
2. Director, Transmission Services, BPC for kind information
3. Director, Distribution Services, BPC for kind information.

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**BHUTAN POWER CORPORATION LIMITED**

**BHUTAN POWER SYSTEM OPERATOR**

**THIMPHU: BHUTAN**



**ANNUAL TRANSMISSION SYSTEM PERFORMANCE REPORT FOR THE YEAR 2019**

**JANUARY-2020**

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## 1.0 INTRODUCTION

In compliance to Grid Code Regulation 2008, Clause No. 6.14.2.1, this office prepared an annual report covering the performance of the Transmission System and details as required by the Ministry and the Authority annually for development of power system master plan and formulation of other policy decisions, thus this report contains the performance of Transmission System for the year 2019.

All the index and other calculations in this report have been executed based on the data received from substations and generating plants.

## 2.0 PERFORMANCE OF GENERATING STATIONS

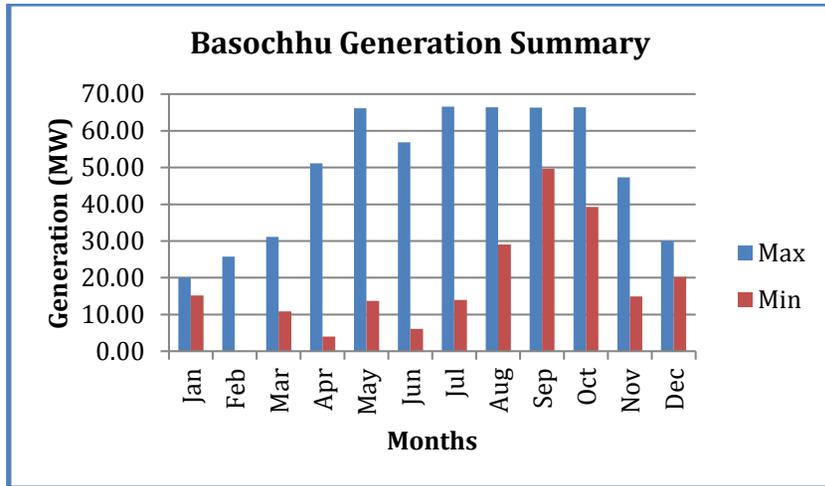
### 2.1 POWER GENERATION

The maximum individual plant generation was recorded as 1122.00 MW by the Tala Hydropower Plant, followed by 369.15 MW by Chhukha Hydropower Plant.

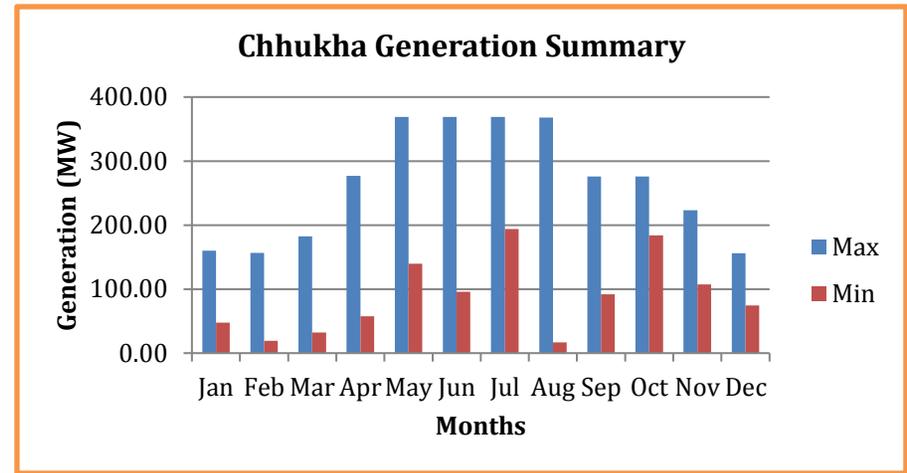
Table: 2.1.1 Monthly maximum and minimum generation summary

Sl. No	Hydropower Plant		Monthly Maximum and Minimum Generation (MW)												Max/Min of year (MW)	
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1	BHP	Max	20.01	25.74	31.12	51.13	66.12	56.91	66.60	66.40	66.30	66.40	47.30	30.00	66.60	
		Min	15.18	0.05	10.80	4.03	13.67	6.10	13.96	29.00	49.70	39.30	14.90	20.20		0.05
2	CHP	Max	159.87	156.79	182.24	276.68	369.15	369.04	368.78	368.00	276.00	276.00	223.28	156.11	369.15	
		Min	47.50	19.10	31.99	57.62	139.74	96.00	193.70	17.00	92.00	184.00	107.21	74.47		17.00
3	THP	Max	240.00	290.00	480.00	680.00	1,122.00	1,122.00	1,122.00	1,122.00	1,122.00	1,122.00	460.00	320.00	1,122.00	
		Min	120.00	120.00	120.00	120.00	185.00	140.00	400.00	794.00	767.00	360.00	200.00	160.00		120.00
4	KHP	Max	32.42	49.01	48.77	66.00	66.00	66.00	66.00	66.00	66.00	66.00	43.00	33.22	66.00	
		Min	16.00	15.00	10.27	22.26	33.00	33.00	32.70	33.00	14.10	16.50	17.30	10.08		10.08
5	DHP	Max	23.50	30.27	55.24	63.46	122.36	126.37	95.10	100.70	100.79	100.70	52.27	40.03	126.37	
		Min	13.16	12.27	13.20	14.27	15.25	14.63	5.50	1.13	40.30	48.74	31.31	23.06		1.13

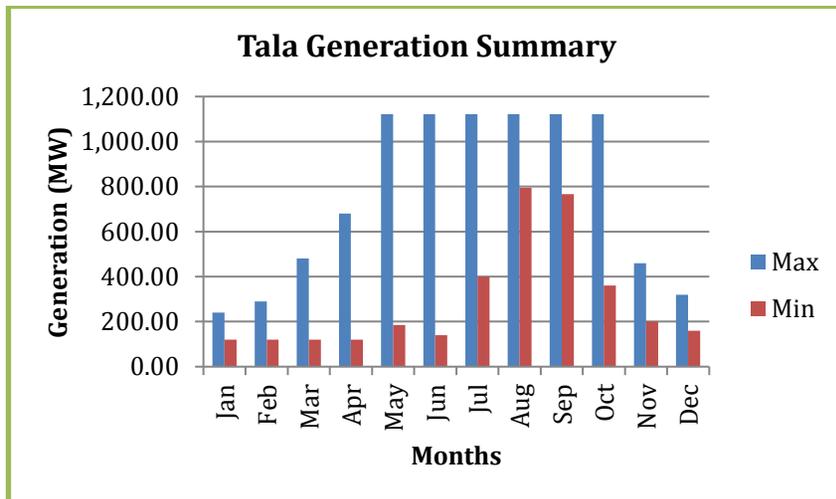
Graph: 2.1.1 Basochhu generation summary



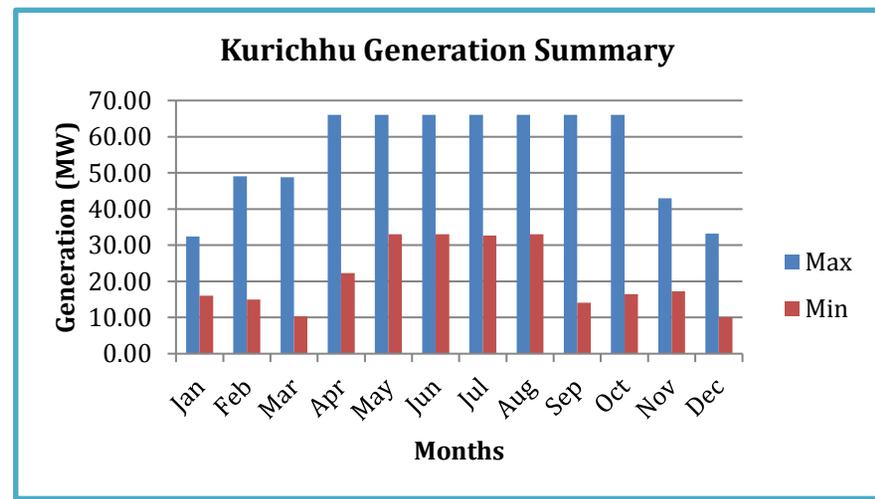
Graph: 2.1 Chhukha generation summary



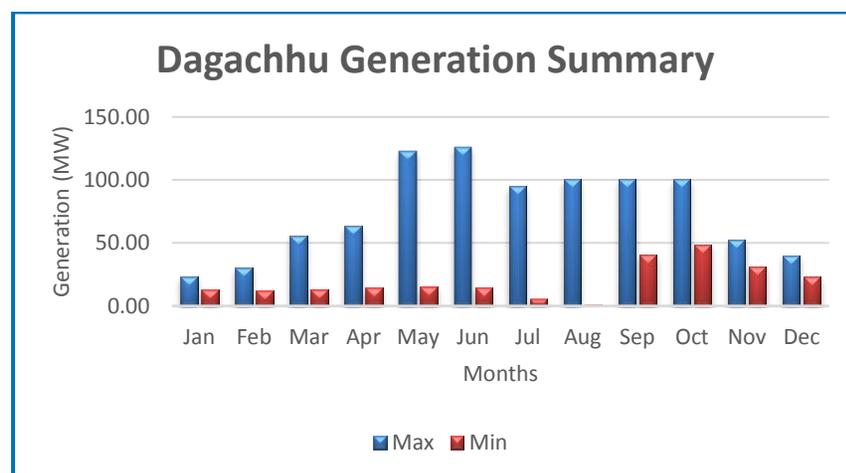
Graph: 2.1.3 Tala generation summary



Graph: 2.1.4 Kurichhu generation summary



Graph: 2.1.5 Dagachhu generation summary



## 2.2 PLANT FACTOR

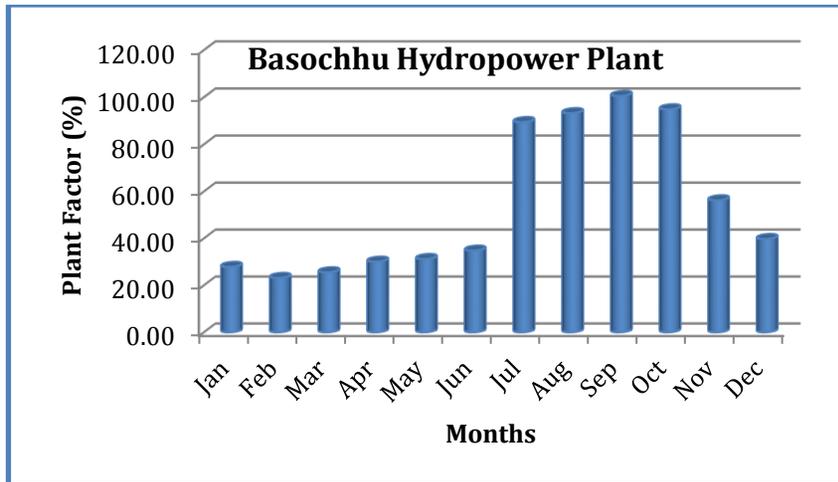
The plant factor of each generating plant was calculated as below:

$$\begin{aligned} \text{Plant factor} &= (\text{Actual output of a plant over a period of time}) / (\text{Output when operated at name plate rated capacity for entire time}) \\ &= (\text{Total energy plant has produced over a period}) / (\text{Total energy plant would produce when operated at full rated capacity}) \end{aligned}$$

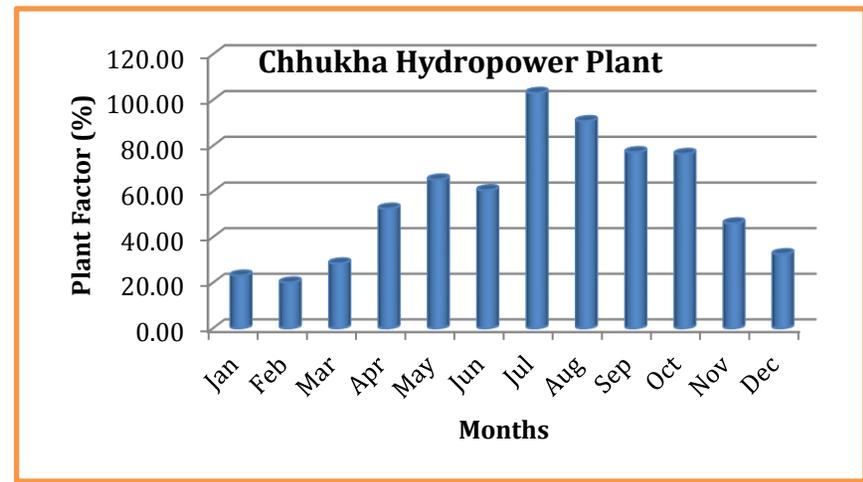
Table: 2.2.1 Monthly plant factor of the hydropower plants

Sl. No	Hydropower Plant	Monthly Plant Factor (%)												Max/Min of year (%)	
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min
1	BHP	27.85	23.17	25.56	30.08	31.22	34.80	89.46	93.23	100.53	94.86	56.25	39.73	100.53	23.17
2	CHP	23.11	20.06	28.42	52.46	65.22	60.54	103.08	90.74	77.17	76.39	46.01	32.50	103.08	20.06
3	THP	15.21	13.87	18.91	35.12	44.65	42.06	97.20	106.15	96.48	68.16	30.88	21.49	106.15	13.87
4	KHP	30.85	26.65	37.30	66.63	102.12	100.31	104.59	109.16	104.57	101.12	52.29	41.19	109.16	26.65
5	DHP	13.73	11.74	13.60	16.36	17.65	21.55	71.86	75.89	78.69	14.03	6.93	4.88	78.69	4.88

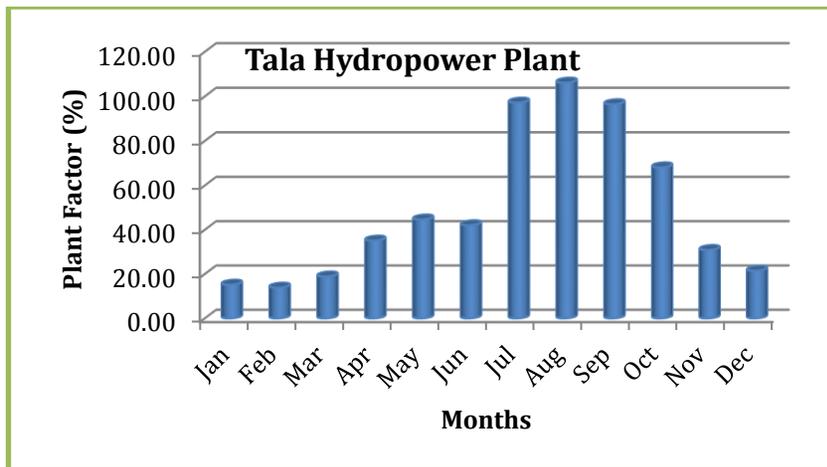
Graph: 2.2.1 Plant factor of Basochhu Hydropower Plant



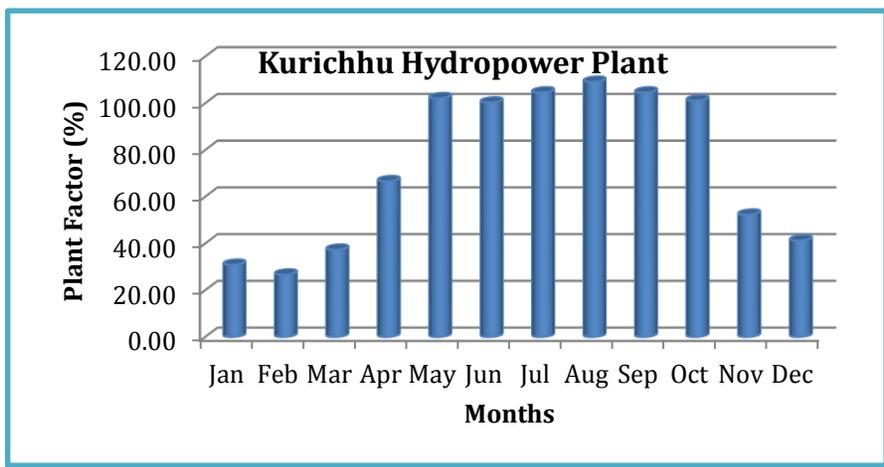
Graph: 2.2.2 Plant factor of Chhukha Hydropower Plant



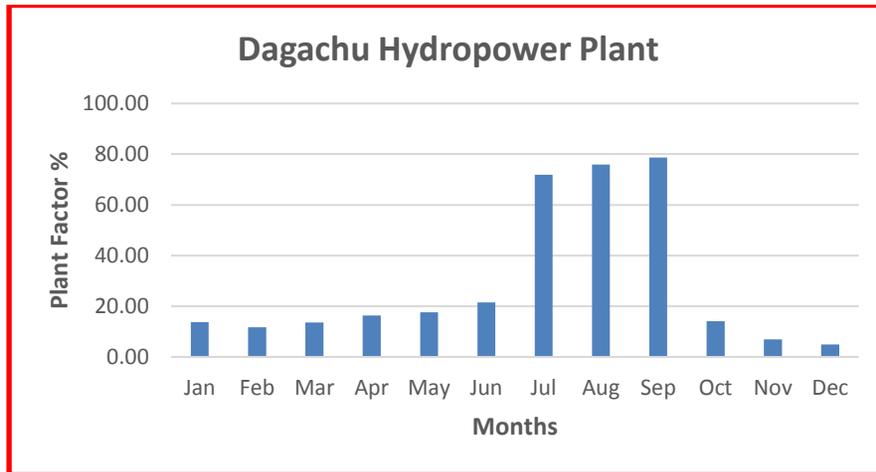
Graph: 2.2.3 Plant factor of Tala Hydropower Plant



Graph: 2.2.4 Plant factor of Kurichhu Hydropower Plant



Graph: 2.2.4 Plant factor of Dagachhu Hydropower Plant



### 3.0 PEAK DEMAND, ENERGY AVAILABILITY AND REQUIREMENT FOR THE COUNTRY

Calculation of coincidental peak load for the eastern grid, western grid and national load, we use the following methods:

1. *National Demand = (Sum of all total generation of each plant) – (Sum of all Export/Import)*
2. *National Demand = (Sum of all feeders loading at hydropower plant) – (Sum of all Export/Import)*
3. *National Demand = (Sum of all substation loading)*

The national load calculated using method-3 is considered in the report.

### 3.1 NATIONAL LOAD

The national coincidental peak load for the year was recorded 387.66 MW (almost reduced by 3% compare to 2018 (399.35 MW)) on January 1, 2019 at 19:02:13 Hrs. using method-2 (sum of all feeder loading at hydropower plant minus sum of export/import). The peak load persisted for 6 second as per the record in the Scada system. The main factor contributing towards the fall in Bhutan peak load from 2018 could be because of less production by the industries in 2019. It had been also observed that the total sale of

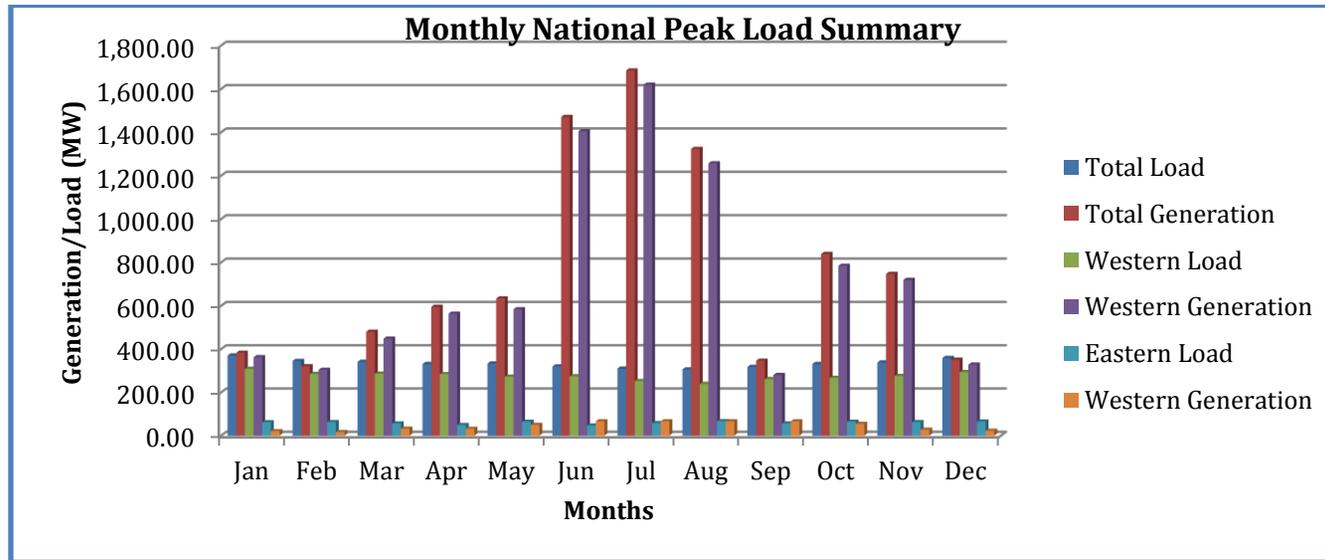
energy to BPC is less by about 50 MU this year compare to 2018. The table below shows the coincidental peak load summary from 2007:

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Peak Load (MW)</b>	157.36	187.05	237.17	256.95	276.24	282.44	313.94	333.41	336.52	335.87	362.09	399.35	387.66
<b>% Growth over previous Year</b>	-	18.87	26.79	8.34	7.51	2.24	11.15	6.20	0.93	-0.19	7.81	10.29	-2.93

Table: 3.1.2 Monthly national peak load and corresponding generation using method- 3

Sl. No	Months	Date	Time	Total Grid (MW)		Western Grid (MW)		Eastern Grid (MW)	
				Load	Generation	Load	Generation	Load	Generation
1	Jan	1-Jan-19	19:00	370.21	382.92	308.60	362.38	61.61	20.54
2	Feb	27-Feb-19	19:00	347.64	320.57	285.13	304.33	62.50	16.24
3	Mar	5-Mar-19	19:00	342.38	480.20	286.38	448.05	56.00	32.15
4	Apr	6-Apr-19	19:00	330.99	595.30	284.30	563.72	48.85	31.58
5	May	23-May-19	19:00	333.54	633.74	272.50	584.24	63.68	49.50
6	Jun	17-Jun-19	19:00	319.74	1,470.94	274.23	1,404.94	46.68	66.00
7	Jul	19-Jul-19	20:00	309.72	1,685.26	251.99	1,619.29	57.73	65.97
8	Aug	28-Aug-19	19:00	305.90	1,323.30	239.02	1,257.30	66.88	66.00
9	Sep	20-Sep-19	19:00	317.42	346.29	261.47	280.29	55.95	66.00
10	Oct	25-Oct-19	18:00	331.07	839.22	267.06	784.72	64.00	54.50
11	Nov	7-Nov-19	18:00	338.06	747.01	276.02	719.60	62.04	27.41
12	Dec	26-Dec-19	18:00	358.73	350.92	293.58	328.20	65.15	22.72
<b>National Peak Load of the year (MW)</b>				<b>370.21</b>					

Graph: 3.1.2 Monthly national peak load and corresponding generation using method- 3



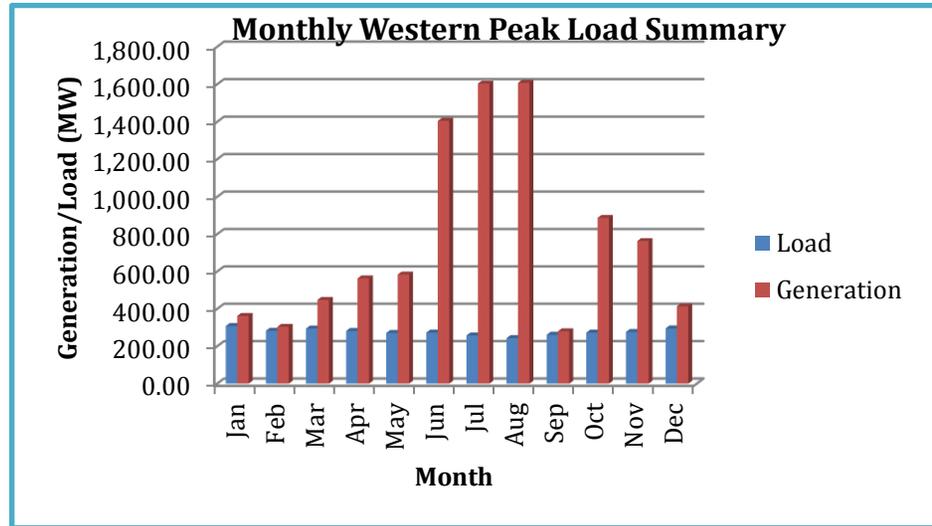
### 3.2 WESTERN GRID PEAK LOAD

Using method-3, the peak load for the western grid was 308.60 MW which occurred on January 1, 2019.

Table: 3.2.1 Monthly western peak load and corresponding generation

Sl. No	Months	Date	Time	Western Grid (MW)	
				Load	Generation
1	Jan	1-Jan-19	19:00	308.60	362.38
2	Feb	27-Feb-19	19:00	285.13	304.33
3	Mar	5-Mar-19	19:00	286.38	448.05
4	Apr	6-Apr-19	19:00	282.13	563.72
5	May	3-May-19	19:00	271.22	584.24
6	Jun	17-Jun-19	19:00	273.06	1,404.94
7	Jul	20-Jul-19	20:00	258.01	1,603.31
8	Aug	3-Aug-19	20:00	243.70	1,607.64
9	Sep	20-Sep-19	19:00	261.47	280.29
10	Oct	23-Oct-19	19:00	273.03	887.30
11	Nov	7-Nov-19	19:00	276.61	763.09
12	Dec	26-Dec-19	19:00	295.71	413.52
Western Peak Load of the year (MW)				<b>308.60</b>	

Graph: 3.2.1 Monthly western peak load and corresponding generation



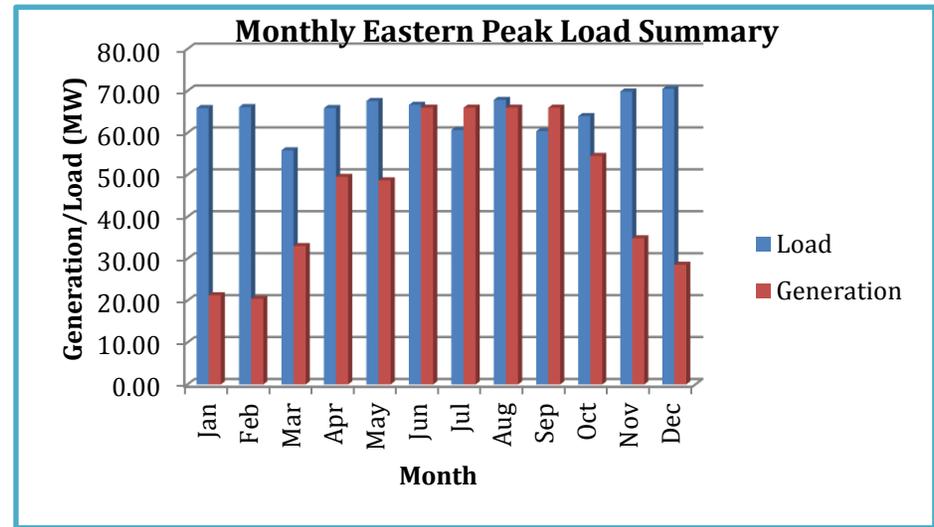
### 3.3 EASTERN GRID PEAK LOAD

Using method-2, the peak load for the eastern grid was 70.48 which occurred on December 6, 2019.

Table: 3.3.1 Monthly eastern peak load and corresponding generation

Sl. No	Months	Date	Time	Eastern Grid (MW)	
				Load	Generati on
1	Jan	2-Jan-19	18:00	65.91	21.26
2	Feb	11-Feb-19	19:00	66.55	20.44
3	Mar	16-Mar-19	19:00	62.64	33.00
4	Apr	17-Apr-19	19:00	65.91	49.50
5	May	14-May-19	19:00	67.61	48.68
6	Jun	20-Jun-19	20:00	66.68	66.00
7	Jul	3-Jul-19	20:00	60.68	66.00
8	Aug	21-Aug-19	19:00	67.87	66.00
9	Sep	3-Sep-19	19:00	60.42	66.00
10	Oct	25-Oct-19	18:00	64.00	54.50
11	Nov	11-Nov-19	18:00	69.87	34.85
12	Dec	6-Dec-19	19:00	70.48	28.53
<b>Eastern Peak Load of the year (MW)</b>				<b>70.48</b>	

Graph: 3.3.1 Monthly eastern peak load and corresponding generation



#### 4.0 EXPORT AND IMPORT OF ELECTRICITY TO/FROM NEIGHBORING COUNTRIES

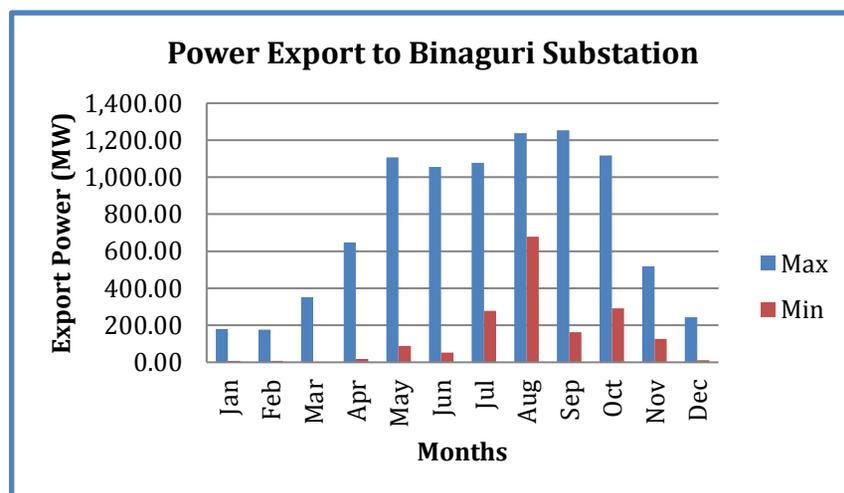
#### 4.1 EXPORT OF ELECTRICITY TO NEIGHBORING COUNTRY

Maximum export of electricity for the year was 1,254.00MW to Binaguri substation in September, 2019, followed by 452.00MW to Birpara substation. The minimum export was 0.03 MW to Salakoti & Rangia substation.

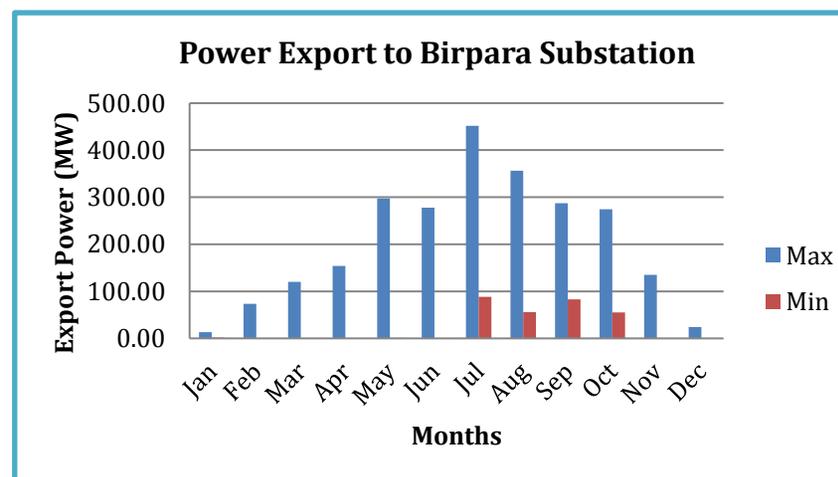
Table: 4.1.1 Monthly power export summary

Sl. No	Substation in India		Monthly Maximum and Minimum Export (MW)												Max/Min of year (MW)	
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1	Binaguri	Max	179.00	176.00	351.00	648.00	1,107.00	1,056.00	1,078.00	1,237.00	1,254.00	1,117.00	519.00	244.00	1,254.00	1.00
		Min	8.00	7.00	1.00	18.00	89.00	52.00	277.00	679.00	163.00	291.00	127.00	11.00		
2	Birpara	Max	13.00	73.50	120.20	154.10	297.50	277.80	452.00	356.00	287.00	274.60	135.10	24.00	452.00	0.10
		Min	1.70	0.60	0.20	0.10	0.89	0.40	88.50	56.00	83.00	55.00	0.10	0.30		
3	Salakoti & Rangia	Max	0.60	7.60	27.80	37.90	86.30	99.03	133.33	148.21	117.11	105.20	47.11	15.62	148.21	0.03
		Min	0.30	1.20	0.10	0.10	2.30	0.30	23.10	24.90	16.92	18.44	0.03	0.03		

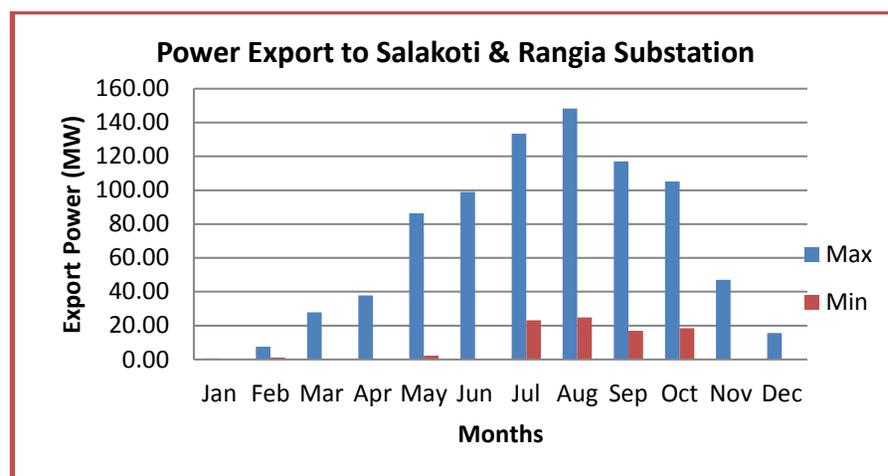
Graph: 4.1.1 Monthly power export to Binaguri substation



Graph: 4.1.2 Monthly power export to Birpara substation



Graph: 4.1.3 Monthly net power export to Salakoti and Rangia substation



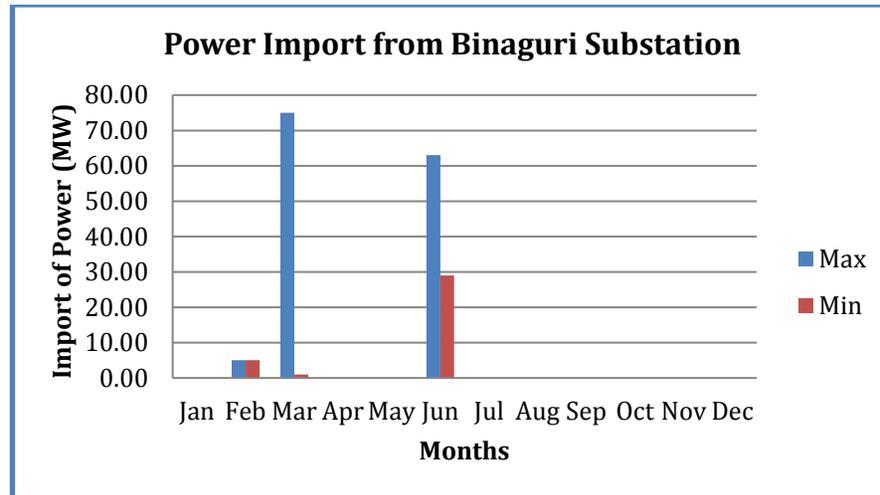
#### 4.2 IMPORT OF ELECTRICITY FROM NEIGHBORING COUNTRY

Maximum import of power was 116.20 MW from Birpara substation which occurred in February, 2019 followed by 89.50 MW and 75 MW from Salakoti and Rangia and Binaguri respectively.

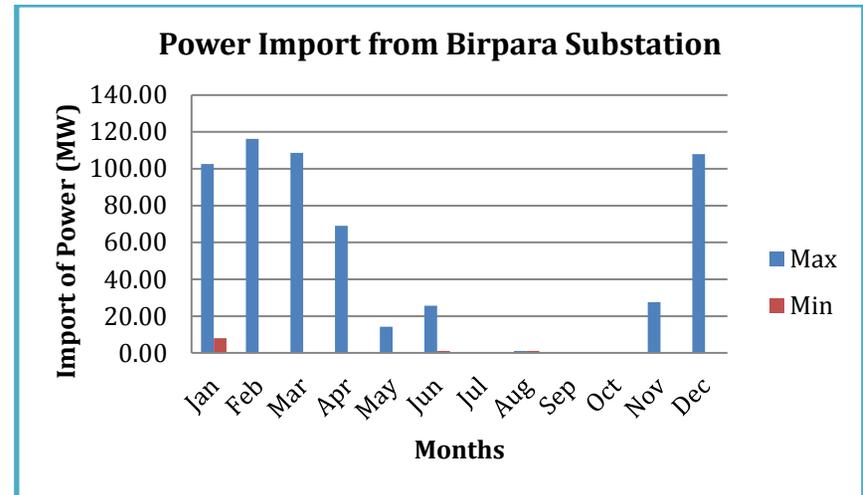
Table: 4.2.1 Monthly power import summary

Sl. No	Substation in India	Monthly Maximum and Minimum Import (MW)												Max/Min of year (MW)			
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
1	Binaguri	Max	0.00	5.00	75.00	0.00	0.00	63.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.00	
		Min	0.00	5.00	1.00	0.00	0.00	29.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00
2	Birpara	Max	102.50	116.20	108.60	69.10	14.20	25.70	0.00	1.00	0.00	0.00	27.50	108.00	116.20		
		Min	8.00	0.38	0.30	0.01	0.40	1.10	0.00	1.00	0.00	0.00	0.20	0.20		0.00	
3	Salakoti & Rangia	Max	51.30	45.80	89.50	32.80	2.20	30.53	0.00	0.00	0.00	0.00	13.62	22.73	89.50		
		Min	0.30	0.40	0.20	0.20	2.20	0.40	0.00	0.00	0.00	0.00	0.03	0.01		0.00	

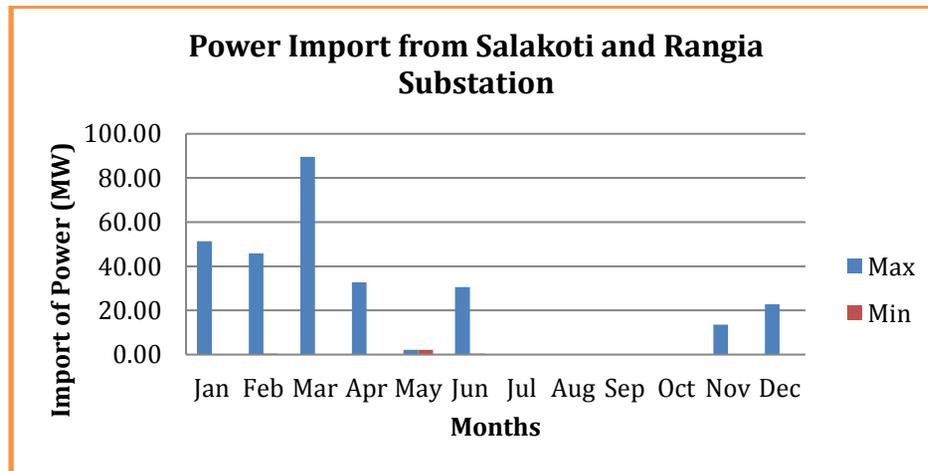
Graph: 4.2.1 Power import from Binaguri substation summary



Graph: 4.2.2 Power import from Birpara substation summary



Graph: 4.2.3 Power import from Salakoti and Rangia substation summary



**5.0 FREQUENCY PROFILE: MAXIMUM AND MINIMUM FREQUENCY RECORDED AND THE FREQUENCY DURATION IN DIFFERENT FREQUENCY BANDS**

As per the Grid Code Regulation 2008, Clause 6.4.1 the transmission system frequency was classified into three different bands as follows:

1. *Normal state*  
The transmission system frequency is within the limit of 49.5Hz to 50.5Hz
2. *Alert state*  
The transmission system frequency is beyond the normal operating limit but within 49.0Hz to 51.0Hz
3. *Emergency state*  
There is generation deficiency and frequency is below 49.0Hz.

We base our frequency at 220kV Bus frequency at 220/66/11kV Semtokha substation in the western grid and 132kV Bus frequency at 60MW Kurichhu Hydropower Plant in the eastern grid.

Table: 5.0.1 Frequency profile at Semtokha substation

Sl. No	Months	220kV Bus Frequency Operation State (%)			
		Normal	Alert	Emergency	Blackout/Other
1	Jan	99.33	0.00	0.00	0.67
2	Feb	99.33	0.00	0.00	0.67
3	Mar	99.33	0.00	0.00	0.67
4	Apr	96.51	0.13	0.00	3.36
5	May	100.00	0.00	0.00	0.00
6	Jun	99.33	0.00	0.00	0.67
7	Jul	99.33	0.00	0.00	0.67
8	Aug	99.23	0.00	0.00	0.40
9	Sep	96.77	0.00	0.00	3.23
10	Oct	100.00	0.00	0.00	0.00
11	Nov	96.64	0.00	0.00	3.36
12	Dec	0.00	0.00	0.00	3.36
<b>Operation State for the year</b>		<b>90.48%</b>	<b>0.01%</b>	<b>0.00%</b>	<b>1.42%</b>

Graph: 5.0.1 Frequency profile at Semtokha substation

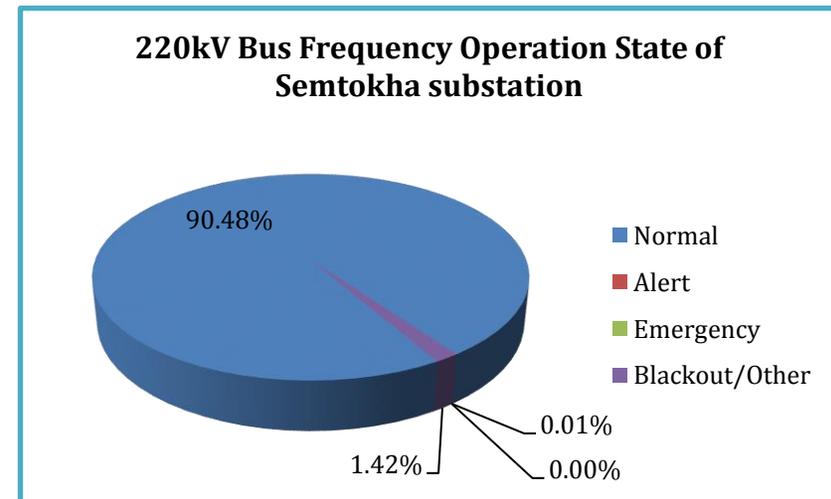
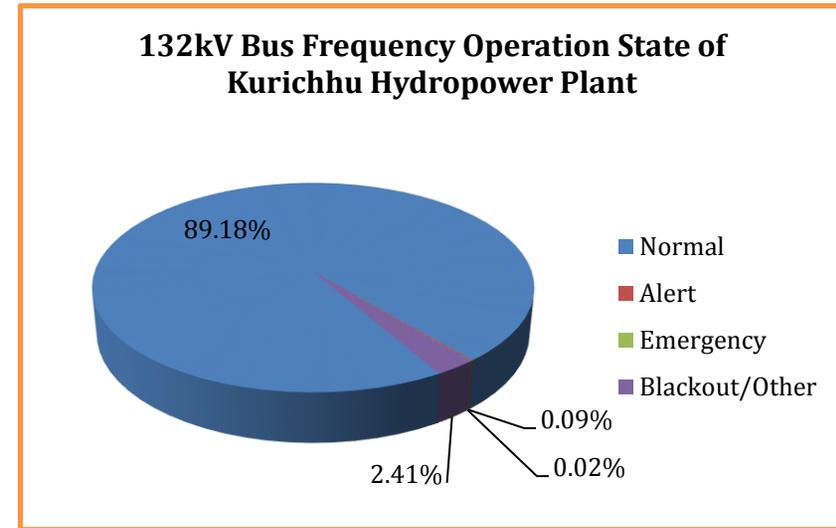


Table: 5.0.2 Frequency profile at Kurichhu Hydropower plant

Sl. No	Months	132kV Bus Frequency Operation State (%)			
		Normal	Alert	Emergency	Blackout/Other
1	Jan	99.87	0.00	0.00	0.13
2	Feb	87.77	0.13	0.00	12.10
3	Mar	99.33	0.27	0.13	0.27
4	Apr	96.37	0.00	0.00	3.63
5	May	100.00	0.00	0.00	0.00
6	Jun	96.37	0.00	0.00	3.63
7	Jul	97.31	0.13	0.00	2.55
8	Aug	100.00	0.27	0.00	0.13
9	Sep	96.64	0.13	0.00	3.23
10	Oct	99.73	0.13	0.13	0.00
11	Nov	96.77	0.00	0.00	3.23
12	Dec	0.00	0.00	0.00	0.00
Operation State for the year		89.18%	0.09%	0.02%	2.41%

Graph: 5.0.2 Frequency profile at Kurichhu Hydropower Plant



## 6.0 VOLTAGE PROFILE OF SELECTED SUBSTATIONS

As the Grid Code Regulation 2008, Clause 6.4.1, the voltage at all connection points was classified into three different bands as follows:

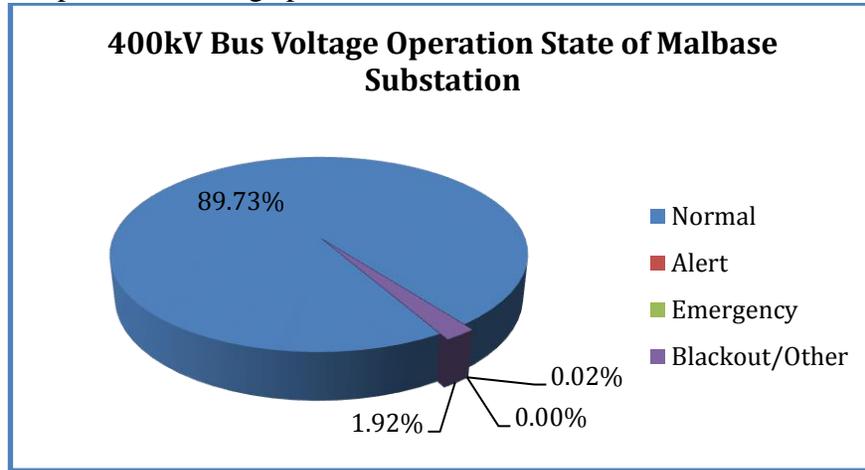
1. *Normal state*  
The voltages at all connection point are within the limits of 0.95 times and 1.05 times of the normal values
2. *Alert state*  
The voltage at all connection points are outside the normal limit but within the limits of 0.9 times and 1.1 times of the normal values
3. *Emergency state*  
Transmission system voltages are outside the limits of 0.9 times and 1.1 times of nominal values.

The voltage profile of 400/220/66/11kV Malbase substation in western grid and 132/33/11kV Nangkhor substation in the eastern grid are considered in the report.

Table: 6.0.1 Voltage profile at Malbase substation

Sl. No	Months	400kV Bus Voltage Operation State (%)				220kV Bus Voltage Operation State (%)			
		Normal	Alert	Emergency	Blackout/Other	Normal	Alert	Emergency	Blackout/Other
1	Jan	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00
2	Feb	90.32	0.00	0.00	9.68	90.32	0.00	0.00	9.68
3	Mar	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00
4	Apr	96.10	0.27	0.00	3.63	92.07	4.44	0.00	3.49
5	May	100.00	0.00	0.00	0.00	99.87	0.13	0.00	0.00
6	Jun	96.77	0.00	0.00	3.23	96.77	0.00	0.00	3.23
7	Jul	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00
8	Aug	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00
9	Sep	96.77	0.00	0.00	3.23	96.77	0.00	0.00	3.23
10	Oct	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00
11	Nov	96.77	0.00	0.00	3.23	96.77	0.00	0.00	3.23
12	Dec	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Operation State for year		<b>89.73%</b>	<b>0.02%</b>	<b>0.00%</b>	<b>1.92%</b>	<b>97.72%</b>	<b>0.38%</b>	<b>0.00%</b>	<b>1.90%</b>

Graph: 6.0.1 Voltage profile at Malbase substation at 400kV bus



Graph: 6.0.2 Voltage profile at Malbase substation at 220kV bus

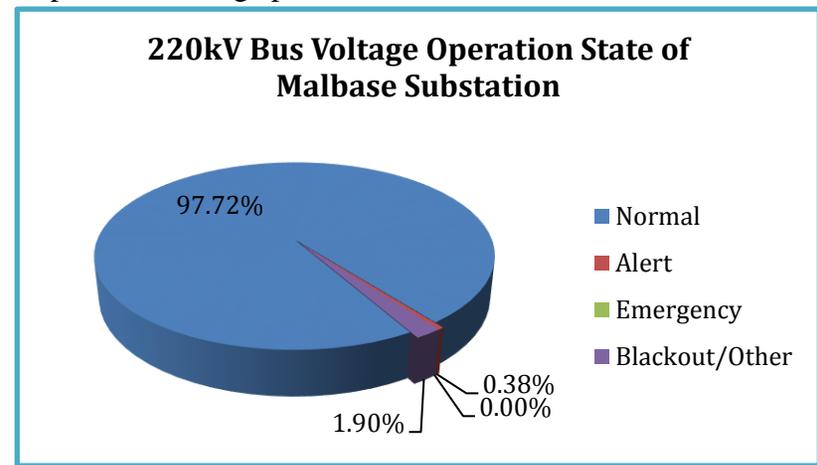
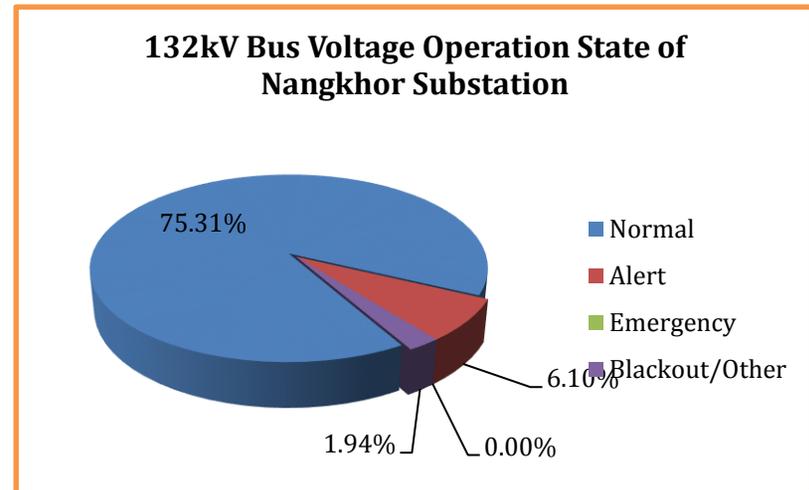


Table: 6.0.2 Voltage profile at Nangkhor substation

Sl. No	Months	132kV Bus Voltage Operation State (%)			
		Normal	Alert	Emergency	Blackout/Other
1	Jan	72.72	27.15	0.00	0.13
2	Feb	64.11	24.06	0.00	11.83
3	Mar	88.31	11.56	0.00	0.13
4	Apr	94.89	4.97	0.00	0.13
5	May	97.18	2.82	0.00	0.00
6	Jun	95.97	0.67	0.00	3.36
7	Jul	98.25	1.48	0.00	0.27
8	Aug	0.00	0.13	0.00	0.13
9	Sep	95.56	0.40	0.00	4.03
10	Oct	100.00	0.00	0.00	0.00
11	Nov	96.77	0.00	0.00	3.23
12	Dec	0.00	0.00	0.00	0.00
<b>Operation State for year</b>		<b>75.31%</b>	<b>6.10%</b>	<b>0.00%</b>	<b>1.94%</b>

Graph: 6.0.3 Voltage profile at Nangkhor substation



**7.0 MAJOR GENERATING AND TRANSMISSION OUTAGE**

The summary of the major transmission outages for the eastern grid and western grid are attached as Annexure- I and Annexure- II respectively.

The outages of transmission line or transformer or any power system equipment below 66kV, tripping/outage of less than 30minutes and planned shutdown which do not cause supply interruption to the customers are not reflected.

**8.0 TRANSMISSION CONSTRAINTS**

There are no instant of transmission constraints during normal condition in Bhutan Power System.

**9.0 INSTANCES OF PERSISTENT OR SIGNIFICANT NON-COMPLIANCE WITHIN THE GRID CODE REGULATION**

The instance of non-compliance with the Grid Code Regulation 2008 for the year 2019 was not recorded.

## Eastern Grid Outages

132/33/11kV, Nganglam substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (HH:MM)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	16.03.2019	12:32	16.03.2019	14:43	11	20.7	132kV Tingtibi-Nganglam feeder	Tingtibi-Nganglam feeder	Earth Fault: 132kV Main Bus Y-Phase Insulator got punctured	E/F & 86opted	Tingtibi SS	Fault Value:- IA-68.76A IB-711.2A IC-34.72 Distance:-72.99km Zone 2. Charged after replacing the insulator.
132/33/11kV, Tingtibi substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (HH:MM)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	3/16/2019	12:37 Hrs	3/16/2019	16:45 Hrs	8	26.960	132kV Tingtibi-Jigmeling Fdr.	132kV Tingtibi-Jigmeling Feeder	Y phase insulator punctured for 132kV main Bus.	Distance realy and Over current realy	132kV Tingtibi - Jigmeling Feeder	
2	3/16/2019	12:37 Hrs	3/16/2019	16:45 Hrs	8	21.760	132kV Tingtibi-Nanglam Fdr.	132kV Tingtibi-Nanglam Feeder	Y phase insulator punctured for 132kV main Bus.	Distance realy and Over current realy	132kV Tingtibi - Nanglam Feeder	
132/33kV, Yurmoo substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (HH:MM)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	16.03.2019	12:55hrs	16.03.2019	17:40hrs	45.00	4.70	132kV Tingtibi I/C	132/33kV Yurmoo Ss	Main bus of Y-Phase insulator was punctured	Nil	Tingtibi Ss	
132/33/11kV, Deothang substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
3	17-Apr	3:18	17-Apr	4:46	28	30.02	132kV Motonga fdr	Deothang to Motonga Line	Tripped on fault	Nil	Nganglam ss	
220/132/33kV, Jigmeling substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	14-Apr	7:04	14-Apr	7:28	24	1.16	220 kV Dagachu Line	220 kV Dagachu line	Earth Fault at B-phase	Main 1. R,Y,B phase tripped, Main 2. B- phase tripped.	main 1. 12 km main 2. 11.06km	
2	14-Apr	7:04	14-Apr	7:40	36	11.94	220 kV Tsirang Line	220 KV Tsirang Line	Earth Fault at B-phase	main 1. B-phase tripped at zone 1.	9.1 km	

132/66/33/11kV, Gelephu substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	6-Apr	03.20hrs	6-Apr	03.55hrs	35	-5.4	132kV Gel-Sal fdr	Non	Line fault	General Trip, B Phase trip, Zone 1 & Dist; 34.16km towards Salakati end.	Unknown	bad weather
132/33/11kV, Tingtibi substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	19-Apr	20:26 Hrs	19-Apr	20:32 Hrs	6	20.700	132kV Tingtibi-Nanglam Fdr.	132kV Tingtibi-Nanglam Feeder	Transient Fault	Relay Operation (Distance protection relay) :Fault Location=115.4 KM, Fault zone-3, Fault resistance=2.581 ohms IA=752A,IB=196.6A,IC=842.5A, VAN=49.90kV,VBN=73.98kV, VCN=42.37kV,	132kV Tingtibi - Nanglam Feeder	
2	22-Apr	04:22 Hrs	22-Apr	04:36 Hrs	14	21.760	132kV Tingtibi-Jigmeling Fdr.	132kV Tingtibi-Jigmeling Feeder	Over current	Relay operation (Over current relay P14D):IA=248.2A,IB=675.2A,IC=2444.6A, VAB=109.7kV,VBC=107.1kV,VCA=104.4kV,IN measured:192.A,IN derived:191.8A,VAN=76.26kV, VBN=50.46kV,VCN=78.22kV.	132kV Tingtibi - Jigmeling Feeder	
3	22-Apr	04:22 Hrs	22-Apr	04:38Hrs	16	21.760	132kV Tingtibi-Nanglam Fdr.	132kV Tingtibi-Nanglam Feeder	Transient Fault	Relay Operation (Distance protection relay) : Fault Location=102.3 KM, Fault zone-3, Fault resistance=8.719 ohms IA=668.8A,IB=81.93A,IC=161.5A, VAN=48.8kV VBN=80.26kV	132kV Tingtibi - Nanglam Feeder	

132/33/11kV, Deothang substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	12.05.2019	21:22	12.05.2019	21:26	0:04	45.83	132kV Motonga fdr	Deothang to Motonga Line	Due to bad weather condition	Distance relay	Deothang-Motonga line	Feeder tripped with the operation of distance relay with a fault distance of 95.419km fault Loop: L1-L2.
2	15.05.2019	7:47	15.05.2019	8:00	0:13	-32.11	132kV Nangkor incomer	Nangkor to Deothang line	Tripped on fault	Nil	Tingibi substation	Supply fail from Tingibi substation. At that time both the end breaker are in normal condition.
3	15.05.2019	7:47	15.05.2019	8:00	0:13	29.12	132kV Motonga fdr	Motonga fdr	Overcurrent on Y Phase and Earthfault	Z2 & Z3 operated,R,Y,B trip, Fault dist.=1km, Fault loop= L2-L3	Motonga end	
132/66/33/11kV, Gelephu substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	16.05.2019	19.15hrs	16.05.2019	20.25hrs	1:10	-5.2	132kV Gel-Sal fdr	Gelephu substation	Bad weather	General Trip, B Phase trip, Zone 1 & Dist; 17.12km towards Salakati end.	Salakati line	Heavy Rain, thunder & lightning (Supply was back feeded from Jigmeling )
2	20.05.2019	21.50hrs	20.05.2019	22.12hrs	1:22	-9.4	132kV Gel-Sal fdr	Gelephu substation	Bad weather	General Trip, R & B Phases trip, Zone 1 & Dist; 6.2km towards Salakati end.	Salakati line	Heavy Rain, thunder & lightning (Supply was back feeded from Jigmeling )
220/132/33kV, Jigmeling substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	30.06.2019	10:26	30.06.2019	11.41	15	177.400	400kV Alipurduar Ckt.2	line segment	Direct trip (DT) received from Alipurduar	main 1, R,Y ,B phase tripped	line segment.	
2	30.06.2019	10:26	30.06.2019				400kV Mangdichu Line 1	Line segment	Direct trip (DT) received from Alipurduar	main 1 R&Y phase tripped	Line segment	
3	30.06.2019	10:26	30.06.2019	12:23	57	178.160	400kV Mangdichu line 2	line segment	Direct trip (DT) received from Alipurduar	main1 R&Y phase pick up	Line segment	

220/66/33kV, Dhajay substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	14.06.2019	13:30hrs	14.06.2019	14:25hrs	55		Grid fail, Non of the 220kV Breaker opened at Tsirang end. As per the information collected from NLDC the cause of grid failure is due to the Machine /Unit tripped					
2	25.06.2019	03:14hrs	25.06.2019	03:20hrs	6	28.7	220kV Tsirang-Jigmeling	Dhajay Substation	OC at R and Bphase	Distance relay main-I operated (Z1/Z1B) 29.2km	Line segment	
3	25.06.2019	03:22hrs	25.06.2019	05:12hrs	50	27.2	220kV Tsirang-Jigmeling	Dhajay Substation	OC at R and Bphase	Distance relay Main - Ioperated (Z1/Z1B) 23.8km	Line segment	
4	25.06.2019	05:20hrs	25.06.2019	07:15hrs	55	0.12	220kV Tsirang-Jigmeling	Dhajay Substation	OC at Bphase	Distance relay Main-I operated (Z1/Z1B) 10.9km	Line segment	
132/66/33/11kV, Gelephu substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	11.06.2019	02.32hrs	11.06.2019	10.25hrs	57	8.2	132kV Gel-Sal fdr	Gelephu substation	Bad weather condition	General Trip, Y and B Phase trip, Zone 1 & Dist; 37.96km towards Salakati end.	Salakati feeder	
2	24.06.2019	06.50hrs	24.06.2019	07.32hrs	42	3.6	132kV Gel-Sal fdr	Gelephu substation	Bad weather condition	B Phase trip, Zone 1, REL 670, differential protection relay.	Salakati feeder	Supply extended from jigmeling.
3	25.06.2019	03.18hrs	25.06.2019	04.12hrs	54	24.8	132kV Gel-Sal fdr	Gelephu substation	Bad weather condition	General Trip, R and Y Phase trip, Zone 4.	Salakati feeder	Supply extended from jigmeling.
132/33/11kV, Tingtibi substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
8	6/25/2019	02:05 Hrs	6/25/2019	05:33Hrs	28	29.000	132kV Tingtibi-Jigmeling Fdr.	132kV Ting-Jigmeling Feeder	Bad weather	Trip Phasr-ABC ,Zone-1, Fault Location:16.20 KM.& (Micom P14D) Dirctional OC/EF: start phase ABN ,Start IN1>1.E/F statrt IN1>12.	132kV Tingtibi - Jigmeling Feeder	
132/33/11kV, Deothang substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
8	07.08.2019	22:56	08.08.2019	003	7	77.22	132kV Deothang-Silcon factory/Rangia	Deothang	Overcurrent on all phase	Distance protn rely, Z1,Z2,Z3 & CRS operated at Deothang end with a distance of 8.8079km, Fault loop: L1-L2	Tingtibi and Rangia (Same time)	

132/33/11kV, Kanglung substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
4	12.07.2019	0:09	12.07.2019	2:10	0:01	1.14	132kV Incomer	All O/G fdr.	due to bad weather condition	E/F - 51N	Kanglung ss	Supply tripped on E/F due to bad weather condition after that could not charge the incomer breaker, supply feed via transfer bus
5	12.07.2019	3:30	12.07.2019	8:23	0:53	1.45	132kV Incomer	All O/G fdr.	NA	Nil	Kurichu end	Due to R phase conductor got burned at Kurichu and shutdown taken for maintenance.
6	14.07.2019	12:42	14.07.2019	12:47	0:05	2.15	132kV Incomer	All O/G fdr.	Tripped on fault	Nil	Kurichu end	Supply failed from Kurichu.
220/132/33kV, Jigmeling substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	17.07.2019	10:37hrs	17.07.2019	22:30	11:53	-173.070	400kV Jigmeling-MHPA LINE 1(B417)	400kV Jigmeling- MHPA line	Earth fault	R,Y and b phase pickup , DTT trip	line Segment	
2	18.07.2019	11.26hrs	18.07.2019	18.55hrs	7:29	-178.160	400kV Jigmeling-MHPA LINE 1	400kV Jigmeling- MHPA line	RY&B phase picked up	Received DTT trip.	line Segment	
3	18.07.2019	11.26hrs	18.07.2019	12.23hrs	0:57	-178.160	MHPA LINE 2	400kV Jigmeling- MHPA line	RY&B phase picked up	Received DTT trip.	line Segment	
4	19.07.2019	9.21hrs	20.07.2019	15:23hrs	30:02	365.050	400kV Interim Alipurdaur ckt.1	400kV Jigmeling- Allipurduar line	phase to earth fault	phase to earth fault	line Segment	
5	21.07.2019	20:39hrs	24.07.2019	10:16hrs	62:37	-184.710	400kV Jigmeling-MHPA line 2	400kV Jigmeling- MHPA line	phase to ground fault	main1 and main 2 optd. Y-phase tripped	main 1=13.7 km main 2=13.9km	mhpa line 1 charged at 21:39 (22.07.19), power evacuated from the line 1.
6	28.07.2019	4:09hrs	28.07.2019	12:57hrs	8:48	370.870	400kV Jigmeling-MHPA line 1	Mangdichu power plant	Line fault at 400kv Jigmeling Alipurduar line	Main1 R&B phase picked up. Main2 R,Y &B phase Picked up. Received DTT.	line Segment	
132/66/33/11kV, Gelephu substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	04.07.2019	20.28	04.07.2019	21.35	1:07	6.6	Gelephu-Salakati	Non	Heavy lightning & Rainfall	General Trip,R Y B phase.Zone 1,dist .81km,REL 670 & master relay operated.	Salakati line	
2	04.07.2019	21.52	04.07.2019	8.22	10:30	6.6	Gelephu-Salakati	Non	contineous spark on B-phase CB clamp	Hand trip	Gelephu Substation	

220/132/33kV, Jigmeling substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
3	8.10.2019	1:49	8.10.2019	19:33	45	133.800	400kV MHEP Line 2	400kV MHEP Line 2	Earth Fault on R&Y phase	Distance relay main 1 and main 2 optd. DT trip	Line segment	
4	8.10.2019	1:49	8.10.2019	19:33	45	266.880	400kV Alipurduar CKT.1	400kV Alipurduar Ckt.1	Earth Fault on R&Y phase	Distance relay main 1 and main 2 optd. DT trip	Line segment	
5	31.10.2019	15:45	31.10.2019	16:20	35	120.710	400kV MHEP Line 2	400kV MHEP Line 2	Over current	Distance relay main 1 and main 2.	Main1=59.1km main2= 58.2km	
220/132/33kV, Jigmeling substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	28.11.2019	10:22hrs	28.11.2019	10:35hrs	13	-79.260	Jigmeling-MHPA Line-1	Line segment		Main1: R,Y &Bph Trip Main-2: R,Y &Bph Trip		
2	28.11.2019	10:22hrs	28.11.2019	11:51hrs	29	-79.450	Jigmeling-MHPA Line-2	Line segment		Main1: R,Y &Bph Trip Main-2: R,Y &Bph Trip		
3	28.11.2019	10:22hrs	28.11.2019	12:25hrs	3	78.540	Jigmeling-Alipur Line 1	Line segment	Over Voltage	Main1: Yph Overtage		
4	13.11.2019	14:34hrs	13.11.2019	15:12hrs	38	-17.47	Jigmeling-Tsirang	Jigmeling-Tsirang Line	3Phase Fault	Main1: R,Y &Bph Trip Main-2: Relay General trip		
5	13.11.2019	14:34 hrs	13.11.2019	14:53hrs	19	-8.280	Jigmeling-Tingtibi	Tingtibi Substation	3Phase Fault	Main1: R,Y &Bph Trip Main-2: Relay General trip		
132/33/11kV, Kilikhar substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	17.12.2019	7:01	17.12.2019	7:26	25	7.92	132kV kurichu incomer	All O/G feeder	Tripped on fault	86 relay operated	Kurichu	Tripped on fault
2	30.12.2019	21:41	30.12.2019	22:15	34	4.39	132kV Corlung fdr	Corlung & kanglung s/s	Tripped on fault	86 relay operated	corlung	Tripped on fault
3	30.12.2019	22:25	31.12.2019	9:22	7	4.39	132kV Corlung fdr	Corlung & kanglung s/s	Tripped on fault	86 relay operated	corlung	Tripped on fault

## Western Grid Outages

220/66/11kV Singhigaon substation													
7	31.03.2019	7:44	31.03.2019	9:06	22	4	220kV Singhigaon - Samtse Feeder.	220kV Singhigaon - Samtse Feeder.	Tripped			Stormy weather at the time of event. The restoration of power took time since the relay needs to be reset manually from Singhigaon substation.	
66/33/11kV Phuentsholing substation													
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (HH:MM)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation		Exact location of fault (Line segment/substation)	Remarks
4	18.03.2019	21:11	18.03.2019	23:12	1	-3.460	66kV Pling-Gomtu	66kV Pling-Gomtu	Tripped	1. Dist prot	2.186	3.86	Weather condition was heavy rainfall with lightning.
7	28.03.2019	4:34	28.03.2019	5:37	3	6.540	66kV Pling-Malbase	66kV Pling-Malbase	Tripped	51N ,86			At 05:37hrs normalised after getting charging code 1240 from BPSO.
66/33/11kV Gomtu substation													
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation		Exact location of fault (Line segment/substation)	Remarks
1	9-Apr	4:06	9-Apr	4:23	17	-7.084	66kV Dhamdhum feeder	Gomtu substation	Fault on R & B phase	General trip. Zone 4 Trip. R PH fault & B PH fault		NA	Charged the feeder after receiving charging code 1275 from BPSO and charge withstand.
2	17-Apr	0:43	17-Apr	5:40	57	0.16	66kV Pling feeder	Nil	Over current	O/C relay 51AX 51BX 51CX		NA	Charged the feeder after receiving charging code 1294 from BPSO. The line was charged after subsiding the thunder, lightning and rainfall.
3	21-Apr	05:30	21-Apr	05:35	5	1.27	66kV Pling feeder	Nil	Over current	O/C relay 51AX 51BX & 51CX		NA	Test charged the feeder after receiving the charging Code No. 1313 from BPSO and charge withstand.
4	30-Apr	16:39	30-Apr	16:50	11	-10.99	66kV Dhamdhum feeder	Nil	Fault on R phase & Y phase	Distance prot relay opd, General trip, Zone I trip, R phase fault & Y phase fault		NA	Test charged after receiving charging code 1333 from BPSO and charge withstand.
66/33/11kV Gomtu substation													
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages (HH:MM)	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation		Exact location of fault (Line segment/substation)	Remarks
3	18.03.2019	21:11	18.03.2019	23:15	4	3.46	66kV Gomtu-P/Ling	Nil	Over Current	IDMTL O/C 51 BX 51 CX		P/Ling Sub Station	

66/33/11kV Gomtu substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	9-Apr	4:06	9-Apr	4:23	17	-7.084	66kV Dhamdhum feeder	Gomtu substation	Fault on R & B phase	General trip.Zone 4 Trip.R PH fault & B PH fault	NA	Charged the feeder after receiving charging code 1275 from BPSO and charge withstand.
2	17-Apr	0:43	17-Apr	5:40	57	0.16	66kV Pling feeder	Nil	Over current	O/C relay 51AX 51BX 51CX	NA	Charged the feeder after receiving charging code 1294 from BPSO. The line was charged after subsiding the thunder, lightning and rainfall.
3	21-Apr	05:30	21-Apr	05:35	5	1.27	66kV Pling feeder	Nil	Over current	O/C relay 51AX 51BX & 51CX	NA	Test charged the feeder after receiving the charging Code No. 1313 from BPSO and charge withstand.
4	30-Apr	16:39	30-Apr	16:50	11	-10.99	66kV Dhamdhum feeder	Nil	Fault on R phase & Y phase	Distance prot relay opd, General trip, Zone I trip, R phase fault & Y phase fault	NA	Test charged after receiving charging code 1333 from BPSO and charge withstand.
400/220/66/11kV Malbase substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	11.05.2019	10:38	11.05.2019	10:54	0:16	154	400kV Siliguri Feeder	400kV Siliguri Feeder	O/C on R phase to Neutral.	Main 1 & 2 trip, Zml trip,Fuse fail, M1-CAR-SEND Trip Values: IL1=5377A<284.1deg, IL2=815.3A<274.6deg.	L1 - N, Dist =8.1km	Heavy Rainfall with lightning, thundering & Windy.
2	11.05.2019	10:50	11.05.2019	11:10	20	20	66kV Feeder, Pasakha IV	66kV Feeder, Pasakha IV	Overcurrent on R-phase ,Y-phase to Neutral.	IEF -50N trip,General Trip,& 86 OPTD,51 Start, IOC 50 trip, 51N Trip,51N Start L1-L2-L3. Trip Values: IL1=807.99A<69.02deg.		Stormy weather at the time of tripping.
3	11.05.2019	10:52	11.05.2019	11:10	18	19	66kV Feeder, Pasakha I	66kV Feeder, Pasakha I	Overcurrent on B- phase to Neutral	IEF -50N trip,General Trip,& 86 OPTD. Trip Values: IL1=428.93A<69.65deg, IL2=224.23A<-173.3deg.		
4	11.05.2019	10:51	11.05.2019	11:10	19	19	66kV Feeder, Pasakha II	66kV Feeder, Pasakha II	Overcurrent on B- phase.	IEF -50N trip,General Trip,& 86 OPTD,51 Start, IOC 50 trip, 51N Trip,51N Start L3. Trip Values: IL1=320.97A<46.84deg.		
5	11.05.2019	16:02	11.05.2019	16:05	3	109	200MVA ICT	200MVA ICT	Bad Weather	RET 521 operated, Main CB trip,Tie CB trip,86 optd. Trip Values: IL1= 241.8A.		Stormy weather at the time of tripping.
6	11.05.2019	16:02	11.05.2019	16:18	16	94	220kV Chhukha Feeder.	220kV Chhukha Feeder.	Bad Weather	General trip, Zone-1 trip,86 optd. Trip Values: IL1= 164.6A/162.3deg. IL2=360.6A/49.51deg.	Fault Loop=L3 - N Dist.=8.9 km	

220/66/11kV Singhigaon substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	01.05.2019	14:17	01.05.2019	19:17	0	42.7	66kV Bhutan Concast Feeder.	66kV Bhutan Concast Feeder.	Tripped			No tripping data available due to communication fault.
2	02.05.2019	19:45	02.05.2019	20:02	17	2.1	220kV Singhigaon - Samtse Feeder.	220kV Singhigaon - Samtse Feeder.	Tripped	General trip,R,Y,B phase trip,Zone-I trip.	Fault loop: L1-N, Distance = 34.6KM.	Light rainfall with thunder and lightning at the time of event.
3	02.05.2019	22:57	02.05.2019	23:28	31	33	66kV BFAL Feeder	66kV BFAL Feeder	Tripped			No tripping data available due to communication fault.
4	11.05.2019	10:52	11.05.2019	11:14	22	15	66kV Bhutan Concast Feeder.	66kV Bhutan Concast Feeder.	Tripped			No tripping data available due to communication fault.
5	11.05.2019	17:21	11.05.2019	18:52	31	1.2	220kV Singhigaon - Samtse Feeder.	220kV Singhigaon - Samtse Feeder.	Tripped	General trip, 86 optd.		Stormy weather at the time of event
66/33/11kV Gomtu substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	01.05.2019	10:15	01.05.2019	16:13	58	2.65	66/11kV 10MVA Transformer	11kV Lhaki and Samtse feeder	Seepage of water in Transformer OSR chamber	Relay: 30D OLTC Buch Trip & 86. Indication: Transformer trouble trip & Breaker Auto trip	Gomtu substation	Charge the Transformer after removing the stagnant water from OSR chamber and charge withstand.
66/33/11kV Phuentsholing substation												
Sl. No	Date of Tripping	Time of Outage (Hrs)	Date of Normalization	Time of Fault cleared (Hrs)	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
8	22.06.2019	9:56	22.06.2019	12:46	2	idle charge	66kV Pling- Malbase	66kV Pling- Malbase		Null	Null	
9	24.06.2019	22:56	24.06.2019	23:02		-5.16	66kV Chukha-Pling	66kV Chukha-Pling	Tripped	Dist prot, 86 & 186	Line	

400/220/66/11kV Malbase substation												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	14.06.2019	13:32	14.06.2019	13:37	0	85	200MVA ICT	200MVA ICT	Tripped	400kV side B/U O/C E/F protection trip		Heavy Rainfall with thunder and lightning at the time of event. Due to continuous tripping of many feeders at a time, were not able to download the fault data.
12	25.06.2019	4:20	25.06.2019	5:09	0	16	66kV Pasakha Feeder I	66kV Pasakha Feeder I	Tripped			
13	25.06.2019	4:20	25.06.2019	5:09	0	16	66kV Pasakha Feeder II	66kV Pasakha Feeder II	Tripped			
14	25.06.2019	4:20	25.06.2019	5:09	0	18	66kV Pasakha Feeder IV	66kV Pasakha Feeder IV	Tripped			
15	25.06.2019	4:20	25.06.2019	5:09	0	-	66kV Bus Coupler	66kV Bus Coupler	Tripped			
16	25.06.2019	4:49	25.06.2019	5:20	0	9	220kV Malbase - Birpara	220kV Malbase - Birpara	Tripped	General trip, Trip - R Phase.	Fault loop LI -N, Distance 18.3 KM.	
17	25.06.2019	6:25	25.06.2019	6:35	0	-190	400kV Tala Feeder	400kV Tala Feeder	Tripped	Zone 1 trip,	Distance 13.7 KM	
66kV Chumdo switching station												
Sl. No	Date of Tripping	Time of Outage	Date of Normalization	Time of Fault cleared	Duration of Outages (hh:mm)	Load before Outage (MW)	Name of Feeders/Equipment Tripped	Name of Substations/Line affected by fault	Reason of Fault	Relay indication and operation	Exact location of fault (Line segment/substation)	Remarks
1	04.12.2019	1325hrs	04.12.2019	1337hrs	12min	2.82MW	66KV O/G Pangbasa Feeder	Pangbasa Substation	Transient Fault	C.B open, Main II optd, O/C	Chumdo substation	
2		1437hrs		1447hrs	10min	0.66MW						
3	10.12.2019	1517hrs	10.12.2019	1524hrs	7min	2.6MW	66KV O/G Pangbasa Feeder	Pangbasa Substation	Transient Fault	O/C on B phase	Chumdo substation	
4	22.12.2019	1350hrs	22.12.2019	1400hrs	10min	2.36MW						
5		1437hrs		1450hrs	13min	2.22MW						
6		1539hrs		1550hrs	11min	2.29MW						