**Bhutan Power Corporation Limited**

**Bhutan Power System Operator**

**Thimphu: Bhutan**

# Transmission System Performance Report

## Fourth Quarterly Report – October to December, 2019

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## 1. Introduction

The electricity transmission network in Bhutan is solely owned by Bhutan Power Corporation limited (BPC) and electricity generation is solely owned by Druk Green Power Corporation Limited (DGPC). Bhutan Power System Operator (BPSO) under BPC is responsible for safe, secure and efficient operation of Bhutan transmission network and generation.

This quarterly report is prepared in compliance to the Grid Code Regulation (GCR) 2008, clause 6.14.1, "System Operator has to submit a quarterly report covering the performance of the Transmission System to all Licensees, Authority and Ministry". This transmission performance report contains summary of growth of peak demand, performance of generating stations (power and energy generation), energy availability and requirement for the country, export and import of electricity to/ from India, frequency profile of selected substation and voltage profile of few important substations.

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

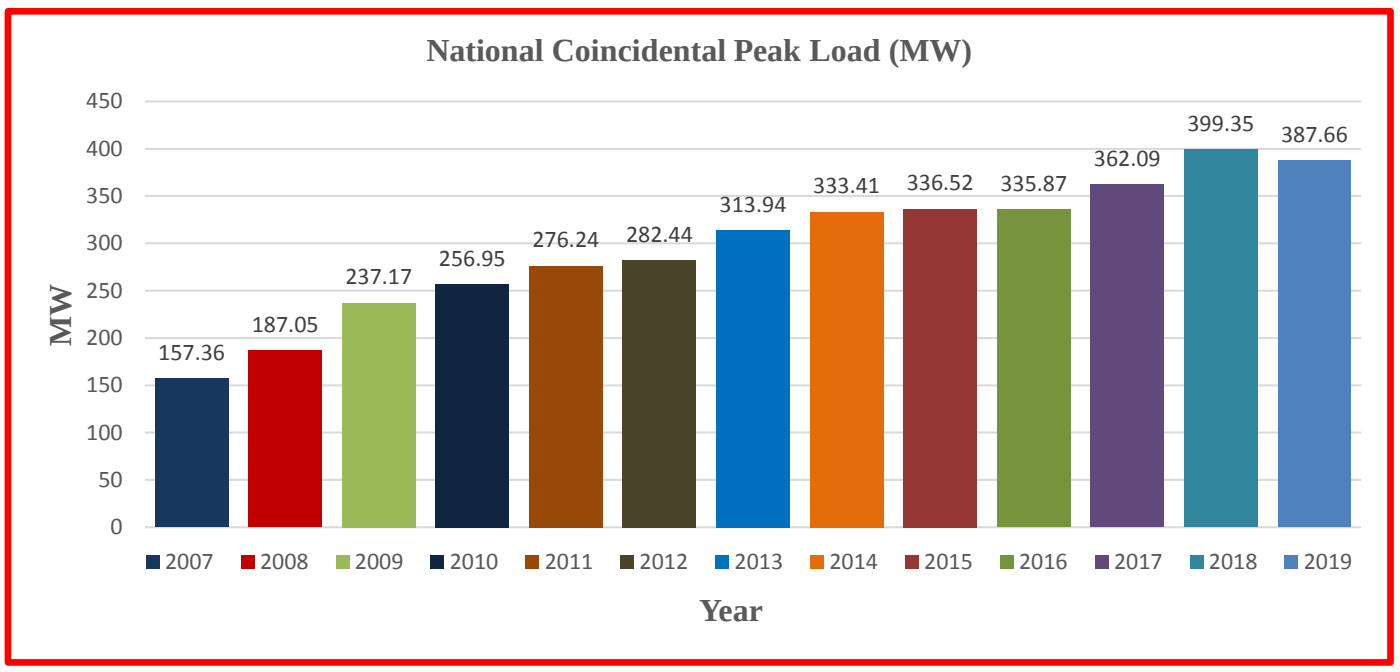
## 2. National Peak Demand

The national peak demand till now is recorded at **399.35MW** which was occurred on 27th December, 2018 at 18:18 hours. This is calculated by summation of Feeder Loading at Plants minus Export.

Table 2.1. The National Peak Demand since 2007

| Year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Peak Load (MW)** | 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 |
| **% Growth over previous Year** | - | 18.87 | 26.79 | 8.34 | 7.51 | 2.24 | 11.15 | 6.20 | 0.93 | -0.19 | 7.81 | 10.29 | -2.93 |

Graph 2.1. The growth in National Peak Demand since 2007




### 2.1. Power (MW) consumed by country

Following methods are used to calculate peak demand for the Eastern Grid, Western Grid and National demand.

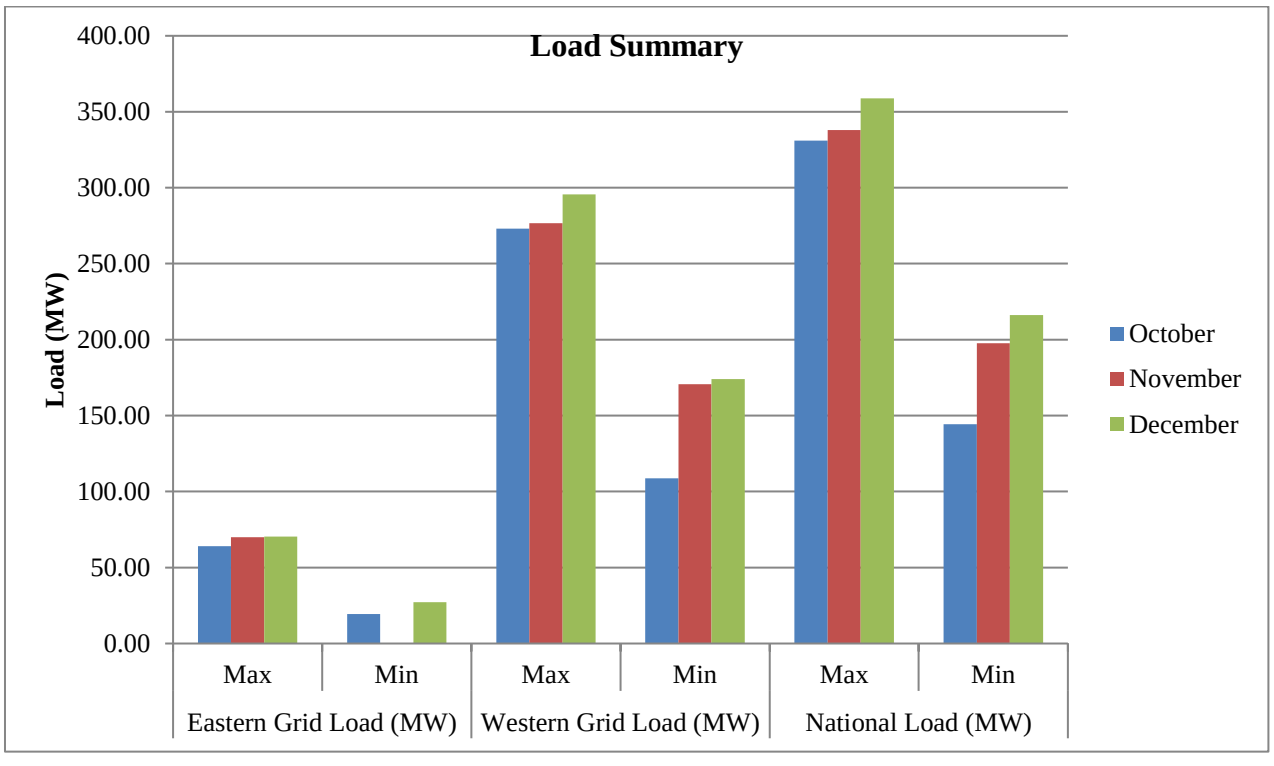
1. **National Demand** = (Sum of all total generation)-(Sum of all Export of Import)
2. **National Demand** = (Sum of all feeders loading at hydropower station) – (Sum of all Export/Import)
3. **National Demand** = (Sum of all substation loading)

For this report, the National Demand was calculated using method-3.

Table 2.1.2. Domestic demand for Eastern Grid, Western Grid and National using method- 3

| Grid | Eastern Grid Load (MW) | | Western Grid Load (MW) | | National Load (MW) | |
|---|---|---|---|---|---|---|
| Month | Max | Min | Max | Min | Max | Min |
| October | 64.00 | 19.47 | 273.03 | 108.71 | 331.07 | 144.28 |
| November | 69.87 | 0.09 | 276.61 | 170.69 | 338.06 | 197.63 |
| December | 70.48 | 27.21 | 295.71 | 173.97 | 358.73 | 216.22 |

Graph 2.1.2. Domestic demand for Eastern Grid, Western Grid and National using method- 3




The national load pattern for the month of October to December, 2019 calculated using method-3 is attached as **Annexure-II**

## 3. Energy Availability and Requirement for the country

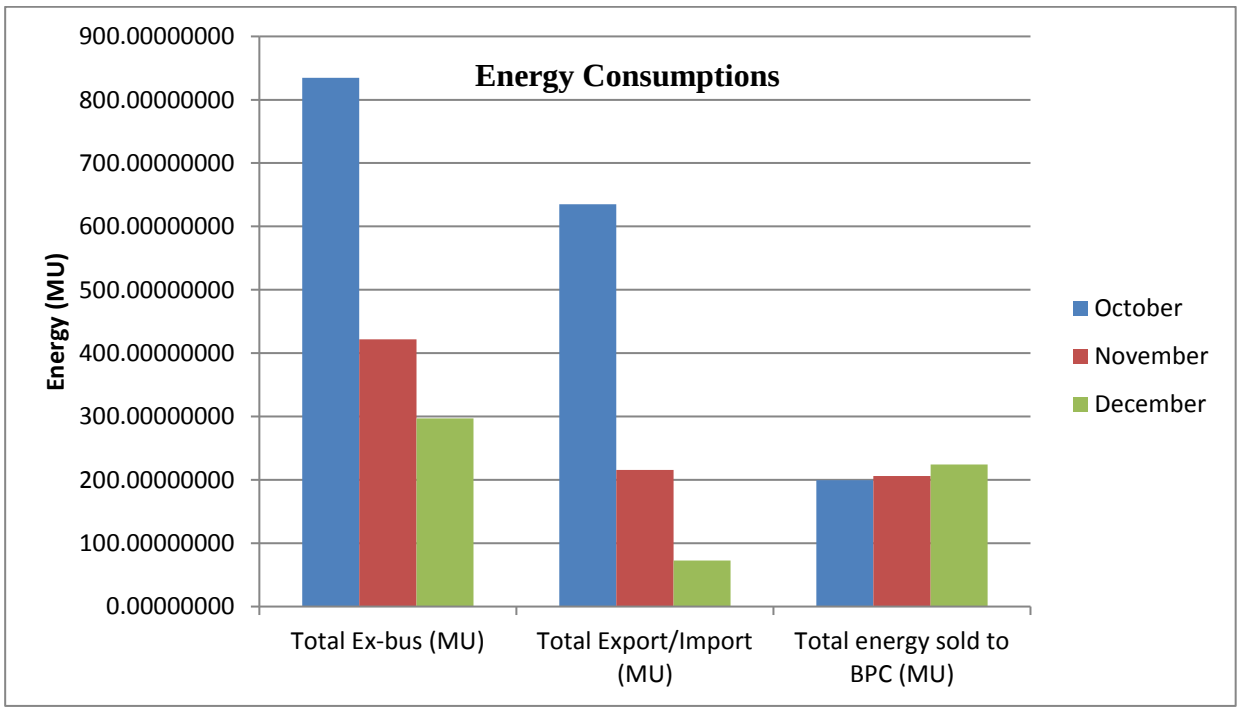
### 3.1. Energy (MU) consumed by Country

The total energy consumed within Bhutan is computed from the total energy DGPC had sold to BPC including the royalty energy.

Table 3.1.1. Energy (MU) consumed

| Month | Total Ex-bus (MU) | Total Export/Import (MU) | Total energy sold to BPC (MU) |
|---|---|---|---|
| October | 834.50933745 | 634.89526800 | 199.61406945 |
| November | 421.98731384 | 215.89184100 | 206.09547284 |
| December | 297.25389469 | 72.80358500 | 224.45030969 |

Graph 3.1.1. Energy (MU) consumed



## 4. Performance of generating plants

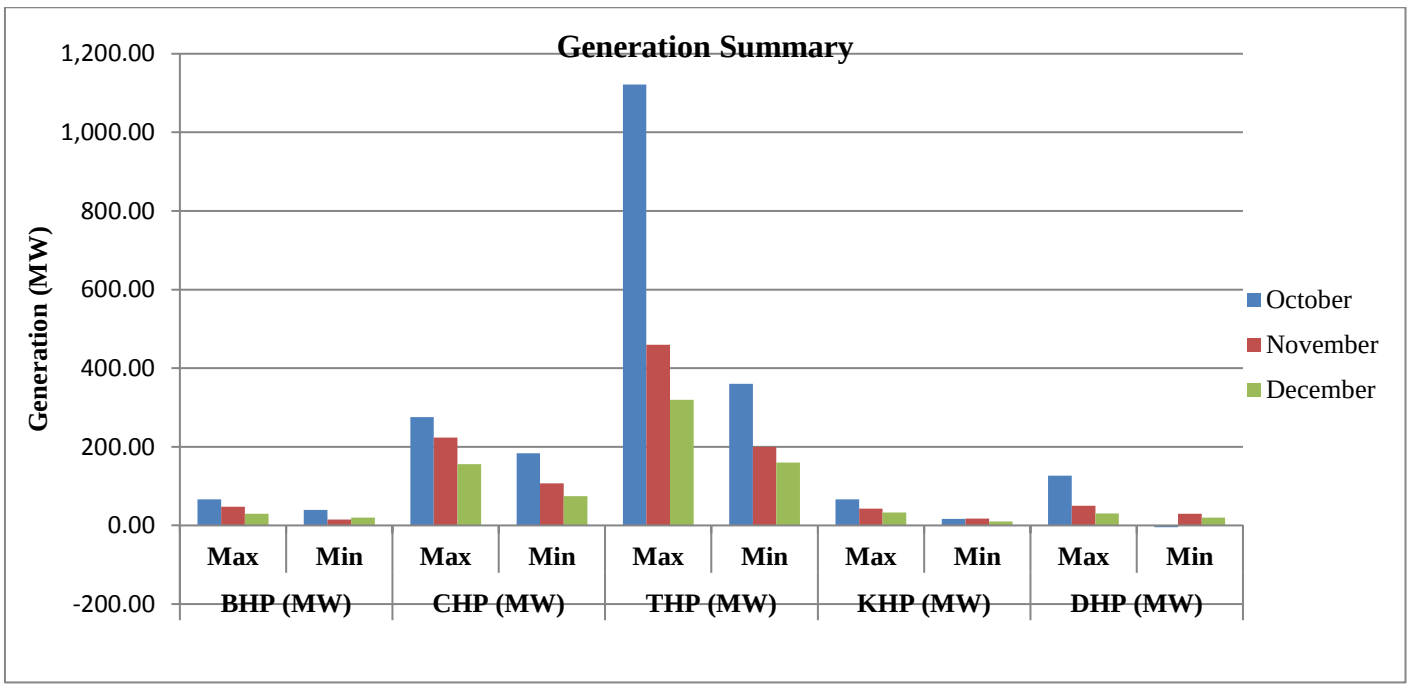
### 4.1. Power and Energy Generation

The maximum total generation for the Fourth quarter of year 2019 was 1657.31 MW in month of October and minimum generation was 569.60 MW in the December month.

Table: 4.1.1 Summary of maximum and minimum generation by various hydropower plant

| Generation By | BHP (MW) | | CHP (MW) | | THP (MW) | | KHP (MW) | | DHP (MW) | | TOTAL (MW) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| October | 66.40 | 39.30 | 276.00 | 184.00 | 1,122.00 | 360.00 | 66.00 | 16.50 | 126.91 | -4.90 | 1,657.31 | 594.90 |
| November | 47.30 | 14.90 | 223.28 | 107.21 | 460.00 | 200.00 | 43.00 | 17.30 | 50.44 | 29.74 | 824.02 | 369.15 |
| December | 30.00 | 20.20 | 156.11 | 74.47 | 320.00 | 160.00 | 33.22 | 10.08 | 30.27 | 20.15 | 569.60 | 284.90 |

Graph: 4.1.1 Summary of maximum and minimum generation by various hydropower plant




Daily maximum, minimum and average generation by each generating plant for the month of October to December, 2019 is attached as **Annexure-I.**

### 4.2.Plant Capacity Factor

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

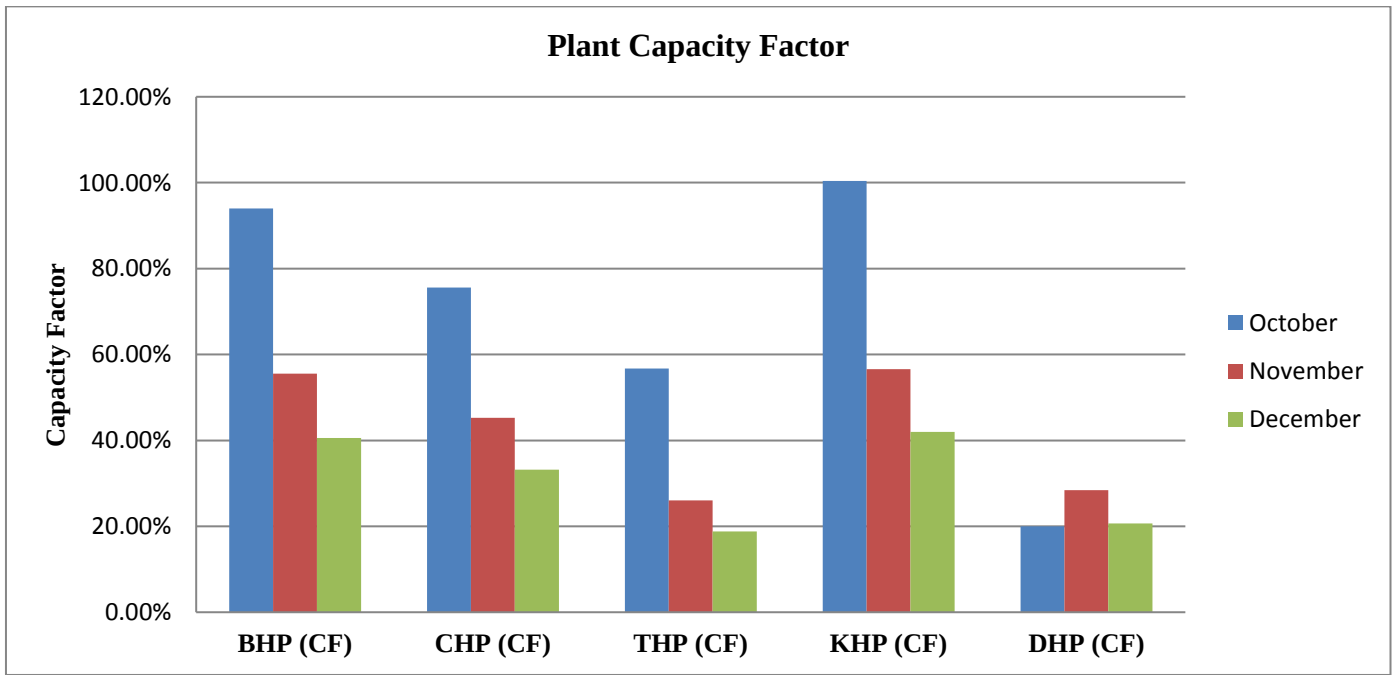
$$Capacity\ factor = \frac{Total\ energy\ plant\ has\ produce\ over\ a\ period}{Total\ energy\ plant\ would\ produce\ when\ operated\ at\ full\ capacity}$$

Table 4.2.1: Total generation and capacity factor of various hydropower plants

| Month | BHP (MU) | BHP (CF) | CHP (MU) | CHP (CF) | THP (MU) | THP (CF) | KHP (MU) | KHP (CF) | DHP (MU) | DHP (CF) |
|---|---|---|---|---|---|---|---|---|---|---|
| October | 44.76583 | 94.01% | 189.01638 | 75.61% | 502.222545 | 56.73% | 44.830742 | 100.43% | 18.7572 | 20.01% |
| November | 26.45050 | 55.55% | 113.22199 | 45.29% | 230.38036 | 26.02% | 25.265047 | 56.60% | 26.669412 | 28.45% |
| December | 18.68769 | 40.55% | 80.34148 | 33.21% | 161.322909 | 18.83% | 18.144623 | 42.00% | 18.7572 | 20.68% |

**Source: TD, BPC**

Graph 4.2.1: Capacity factor of various hydropower plants



## 5. Export and Import of Electricity

Maximum export for the Fourth quarter of year 2019 was 1117.00 MW in the month of October to Binaguri substation in India. The minimum export recorded was 15.62 MW to Salakoti and Rangia substation in India during the month of December.

Table 5.1. Export of electricity to India

| Export To | Binaguri (MW) | | Birpara (MW) | | Salakoti and Rangia (MW) | |
|---|---|---|---|---|---|---|
| Month | Max | Min | Max | Min | Max | Min |
| October | 1,117.00 | 291.00 | 274.60 | 55.00 | 105.20 | 18.44 |
| November | 519.00 | 127.00 | 135.10 | 0.10 | 47.11 | 0.03 |
| December | 244.00 | 11.00 | 24.00 | 0.30 | 15.62 | 0.03 |

Graph 5.1. Export of electricity to India

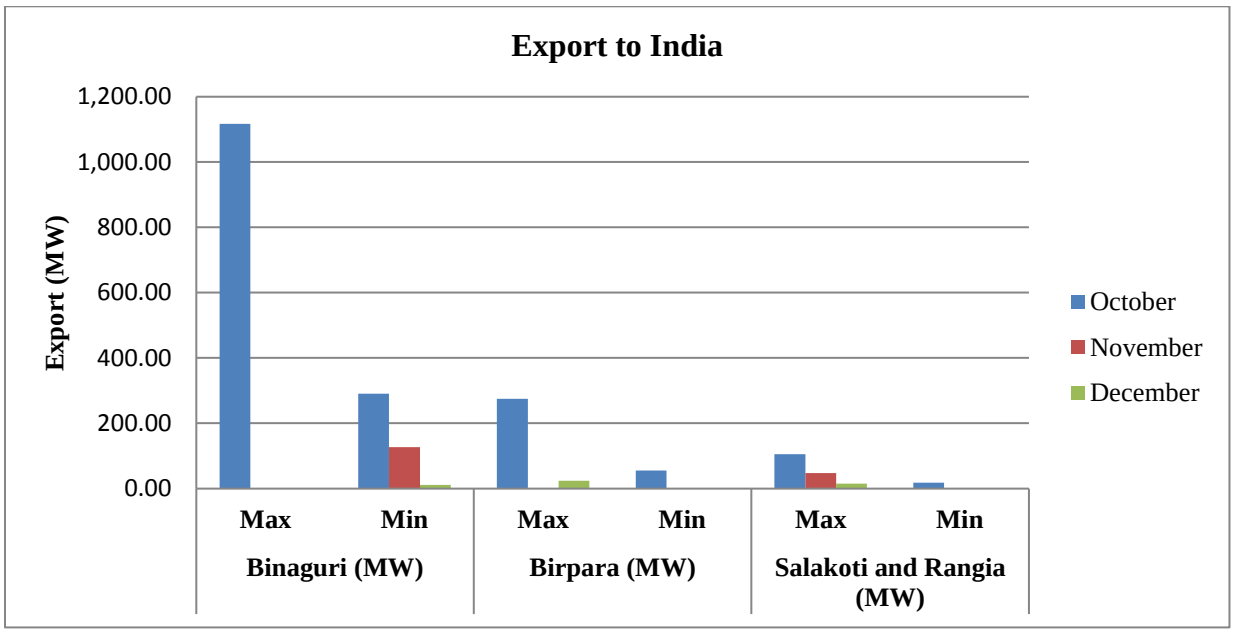



Table 5.2. Import of electricity from India.

| Import From | Binaguri (MW) | | Birpara (MW) | | Salakoti and Rangia (MW) | |
|---|---|---|---|---|---|---|
| Month | Max | Min | Max | Min | Max | Min |
| October | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| November | 0.00 | 0.00 | 27.50 | 0.20 | 13.62 | 0.03 |
| December | 0.00 | 0.00 | 108.00 | 0.20 | 22.73 | 0.01 |

## 6. Frequency profile

The nominal allowed frequency range shall be 50Hz ± 1% in Bhutan. The system is normally managed such that frequency is maintained within operational limit of 49.5 Hz to 50.5 Hz. However, frequency may move outside these limit under faulty condition.

As per the Grid Code 2008, clause 6.4.1 the frequency is classified into three different bands as follows:

a. Normal state
   The transmission System frequency is within the limit of 49.5Hz to 50.5Hz.
b. Alert state
   The Transmission System frequency is beyond the normal operating limit but within 49.0Hz to 50.0Hz.
c. Emergency state
   There is generation deficiency and frequency is below 49.0Hz.

The frequency at 220kV Bus at 220/66/11kV Semtokha substation in the western grid and 132kV Bus at 60MW Kurichhu Hydropower Plant in the eastern grid is considered.

### 6.1.Frequency for the month of October, 2019

Table 6.1.1. Bus Frequency profile of Semtokha Substation

| Sl. No. | Operating State | 220kV Bus Voltage |
|---|---|---|
| 1 | Normal State | 100.00% |
| 2 | Alert State | 0.00% |
| 3 | Emergency State | 0.00% |
| 4 | Blackout/Other | 0.00% |

Graph 6.1.1. Bus Frequency of Semtokha Substation

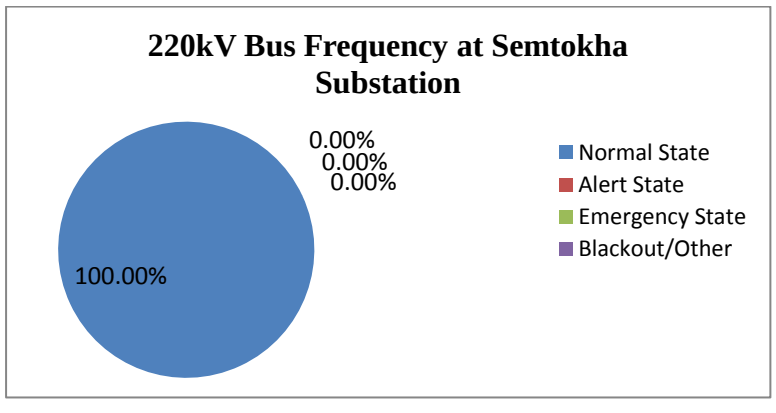
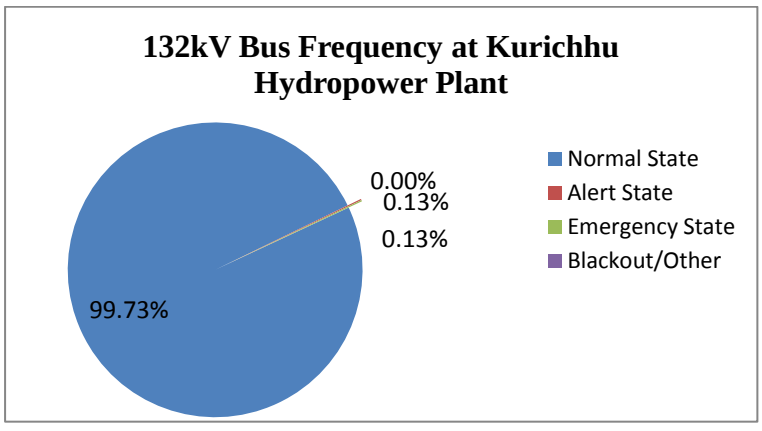



Table 6.1.2. Bus frequency of Kurichhu Hydro Power Plant

| Sl. No. | Operating State | 132kV Bus Voltage |
|---|---|---|
| 1 | Normal State | 99.73% |
| 2 | Alert State | 0.13% |
| 3 | Emergency State | 0.13% |
| 4 | Blackout/Other | 0.00% |

Graph 6.1.2. Bus frequency of Kurichhu Hydro Power Plant




In the month of October, 2019, the Western grid was maintained within the normal operating limit of 100% whereas Eastern grid have operated 97.73% in operating limit and deviated 0.13% and 0.13% to alert state and blackout/others respectively.

### 6.2.Frequency for the month of November, 2019

Table 6.2.1. Bus frequency of Semtokha Substation

| Sl. No. | Operating State | 220kV Bus Voltage |
|---|---|---|
| 1 | Normal State | 96.64% |
| 2 | Alert State | 0.00% |
| 3 | Emergency State | 0.00% |
| 4 | Blackout/Other | 3.36% |

Graph 6.2.1. Bus frequency of Semtokha Substation

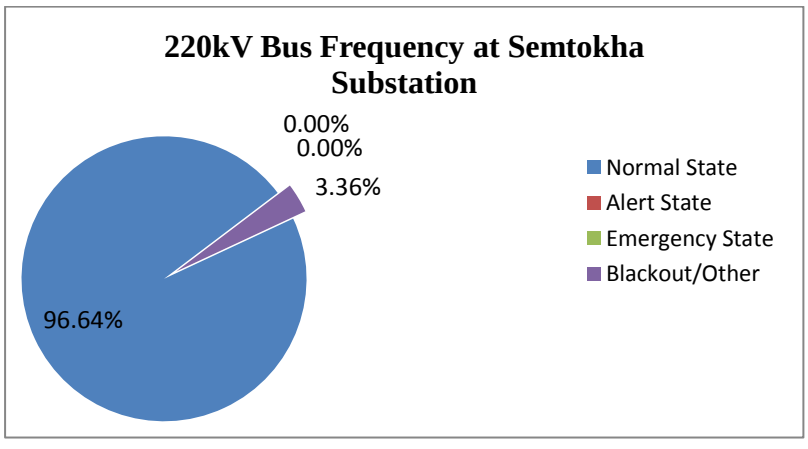
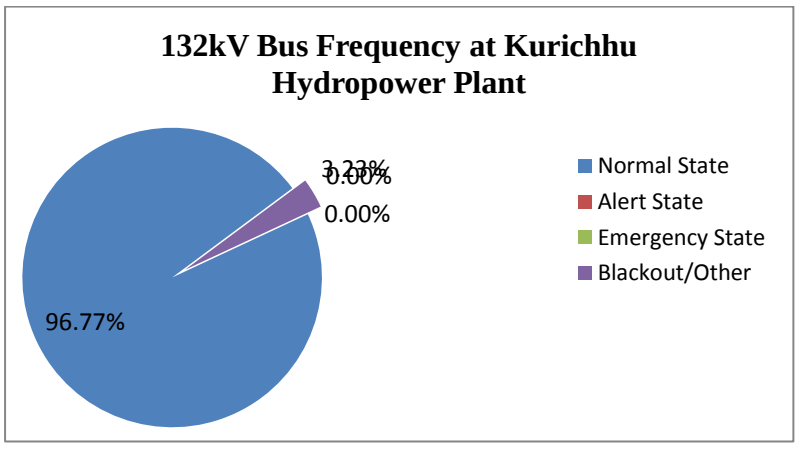



Table 6.2.2. Bus frequency of Kurichhu Hydro Power Plant

| Sl. No. | Operating State | 132kV Bus Voltage |
|---|---|---|
| 1 | Normal State | 96.77% |
| 2 | Alert State | 0.00% |
| 3 | Emergency State | 0.00% |
| 4 | Blackout/Other | 3.23% |

Graph 6.2.2. Bus frequency of Kurichhu Hydro Power Plant




In the month of November, 2019, the western grid frequency was maintained at normal operating range of 96.64% and 3.36% deviated within blackout and others.

### 6.3.Frequency for the month of December, 2019

Table 6.3.1. Bus frequency of Semtokha Substation

| Sl. No. | Operating State | 220kV Bus Voltage |
|---|---|---|
| 1 | Normal State | 96.64% |
| 2 | Alert State | 0.00% |
| 3 | Emergency State | 0.00% |
| 4 | Blackout/Other | 3.36% |

Graph 6.3.1. Bus frequency of Semtokha Substation

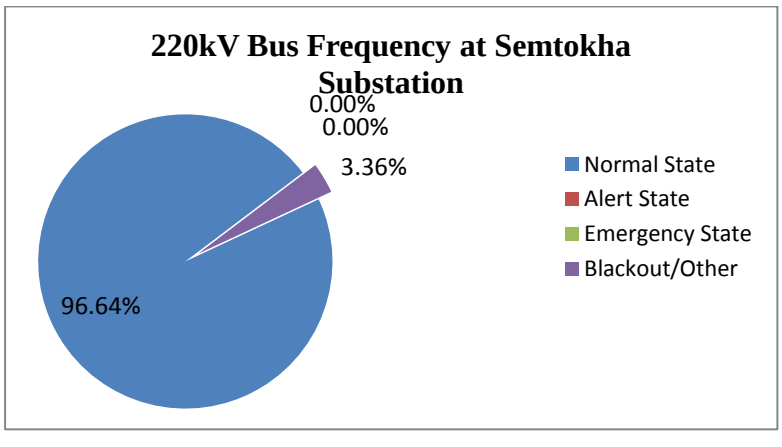
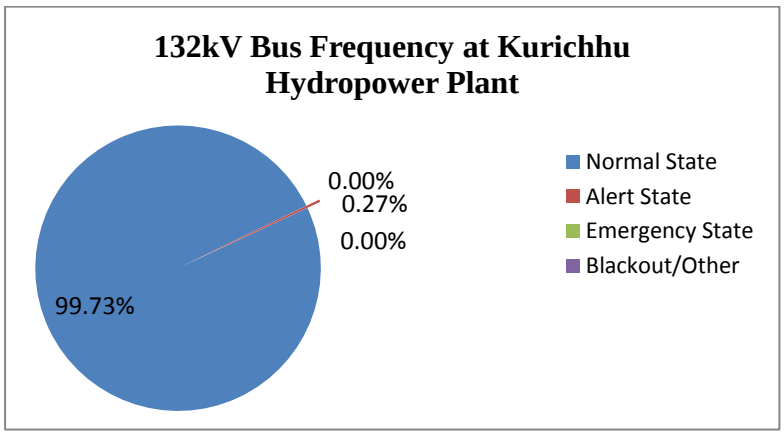



Table 6.3.2. Bus frequency of Kurichhu Hydro Power Plant

| Sl. No. | Operating State | 132kV Bus Voltage |
|---|---|---|
| 1 | Normal State | 99.73% |
| 2 | Alert State | 0.27% |
| 3 | Emergency State | 0.00% |
| 4 | Blackout/Other | 0.00% |

Graph 6.3.2. Bus frequency of Kurichhu Hydro Power Plant



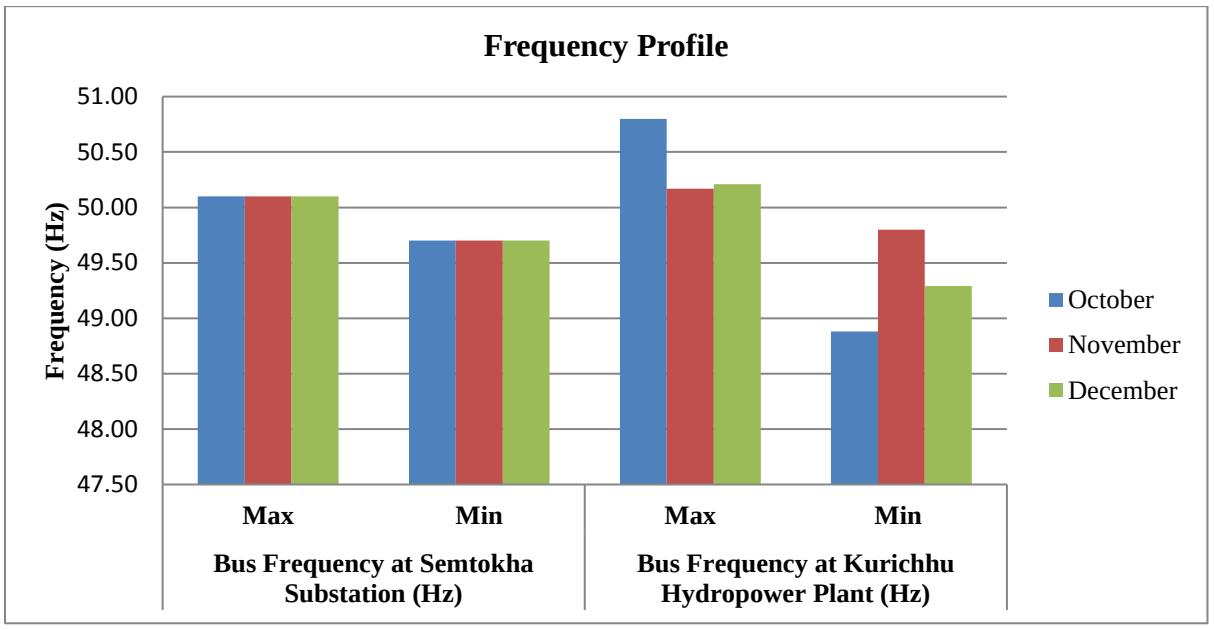

In the month of December, 2019, the Western gird frequency was maintained 96.64% within the normal operating range and deviated 3.36% was blackout/others. Eastern grid frequency was maintained within normal operating range of 99.73 % and system frequency was deviated 0.27 % to alert.

### 6.4.Frequency Summary for the month of October to December, 2019

Table 6.4.1. Frequency summary for the month of October to December, 2019

| Substation/Plant | Bus Frequency at Semtokha Substation (Hz) | | Bus Frequency at Kurichhu Hydropower Plant (Hz) | |
|---|---|---|---|---|
| **Month** | **Max** | **Min** | **Max** | **Min** |
| **October** | 50.10 | 49.70 | 50.80 | 48.88 |
| **November** | 50.10 | 49.70 | 50.17 | 49.80 |
| **December** | 50.10 | 49.70 | 50.21 | 49.29 |

Graph 6.4.1. Frequency summary for the month of October to December, 2019




Daily maximum, minimum and average Frequency of Semtokha substation in western grid and Kurichhu Hydro Power Plant in eastern grid for the month of October to December, 2019 is attached as **Annexure-III**

## 7. Voltage Profile of selected substation

As per the Grid Code 2008, clause 6.4.1 the voltage at all connection point is classified into three different bands as follows:

1. *Normal State*
   *The voltage at all connection points 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 nominal values.*

3. *Emergency State*
   *Transmission system voltages are outside the limit of 0.9 times and 1.1 times of nominal values.*

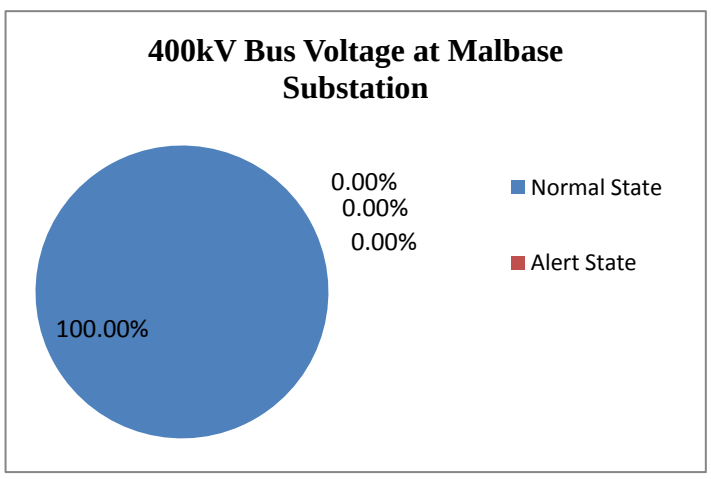
Due to the location of 400/22/66/11kV Malbase substation in western grid and 132/33/11kV Nangkhor substation in the eastern grid, the voltage profile of these substations are considered.

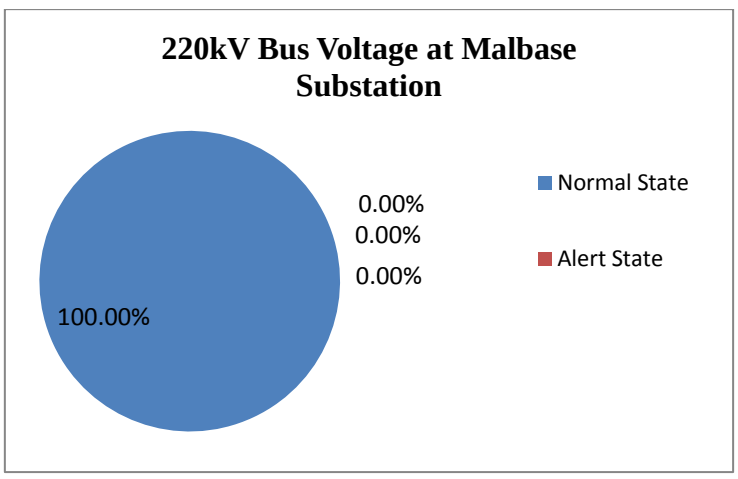
### 7.1. Voltage profile for the month of October, 2019

Table 7.1.1. Voltage Profile for 400/220/66kV Malbase Substation

| Sl. No. | Operating State | 400kV Bus Voltage | 220kV Bus Voltage | 66kV Bus Voltage |
|---|---|---|---|---|
| **1** | Normal State | 100.00% | 100.00% | 100.00% |
| **2** | Alert State | 0.00% | 0.00% | 0.00% |
| **3** | Emergency State | 0.00% | 0.00% | 0.00% |
| **4** | Blackout/Other | 0.00% | 0.00% | 0.00% |

Graph 7.1.1. Voltage Profile for 400/220/66kV Malbase Substation



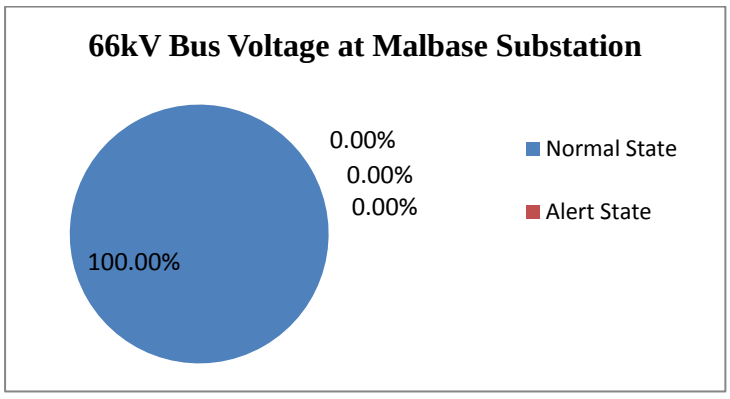
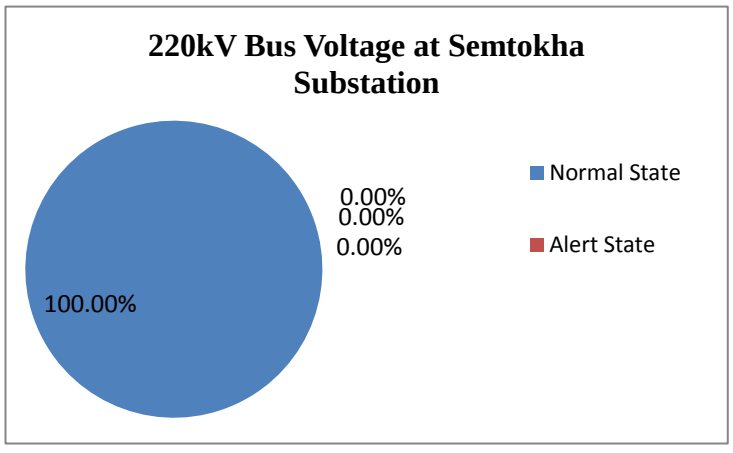



Table 7.1.2. Voltage Profile of 220/66/11kV Semtokha Substation

| Sl. No. | Operating State | 220kV Bus Voltage | 66kV Bus Voltage |
|---|---|---|---|
| 1 | Normal State | 100.00% | 100.00% |
| 2 | Alert State | 0.00% | 0.00% |
| 3 | Emergency State | 0.00% | 0.00% |
| 4 | Blackout/Other | 0.00% | 0.00% |

Graph 7.1.2. Voltage Profile of 220/66/11kV Semtokha Substation



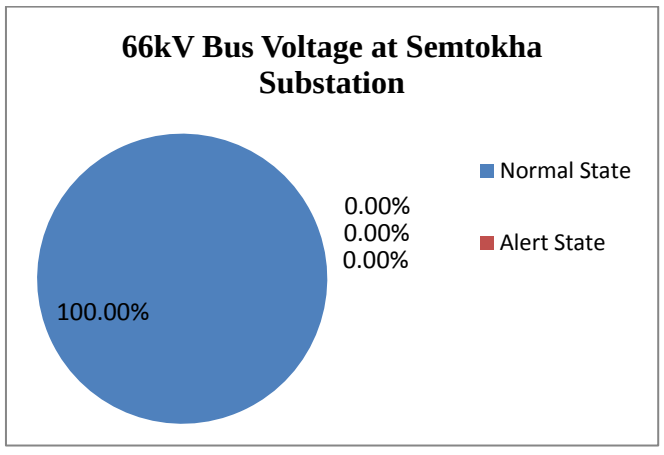
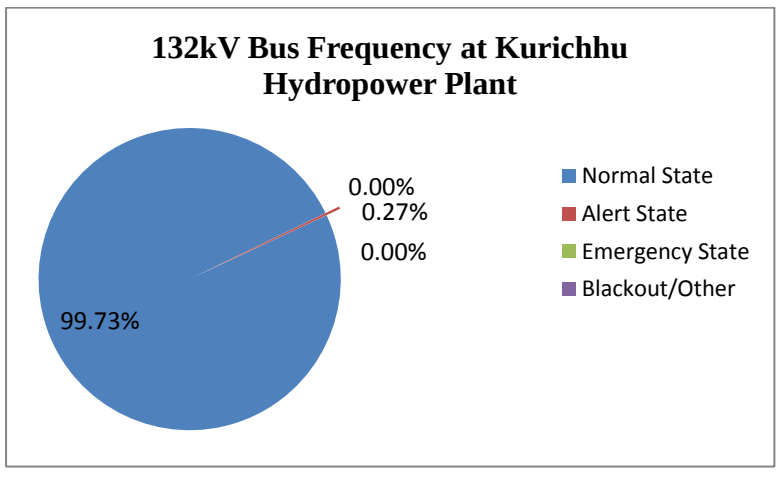




Table 7.1.3. Voltage Profile of 132/33/11kV Nangkhor Substation

| Sl. No. | Operating State | 132kV Bus Voltage |
|---|---|---|
| 1 | Normal State | 100.00% |
| 2 | Alert State | 0.00% |
| 3 | Emergency State | 0.00% |
| 4 | Blackout/Other | 0.00% |

Graph 7.1.3. Voltage Profile of 132/33/11kV Nangkhor Substation

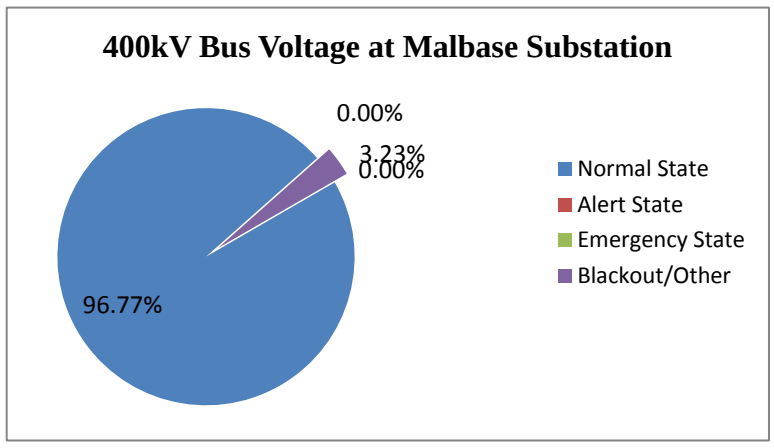


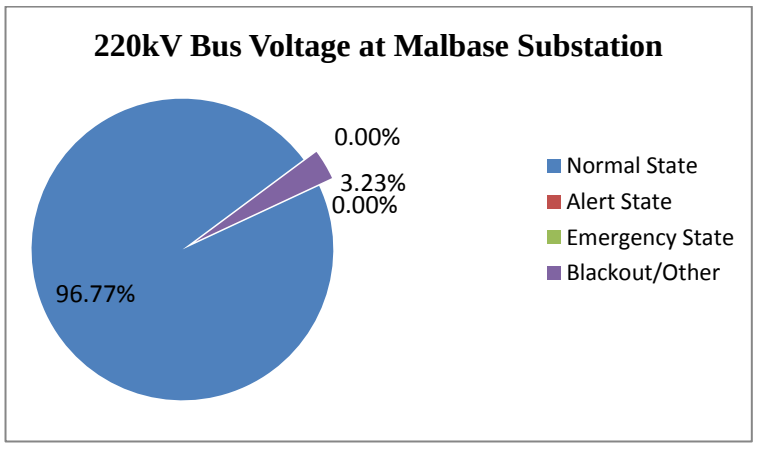

**7.2.Voltage Profile for month of November, 2019**

Table 7.2.1. Voltage Profile for 400/220/66kV Malbase Substation

| Sl. No. | Operating State | 400kV Bus Voltage | 220kV Bus Voltage | 66kV Bus Voltage |
|---|---|---|---|---|
| 1 | Normal State | 96.77% | 96.77% | 96.77% |
| 2 | Alert State | 0.00% | 0.00% | 0.00% |
| 3 | Emergency State | 0.00% | 0.00% | 0.00% |
| 4 | Blackout/Other | 3.23% | 3.23% | 3.23% |

Graph 7.2.1. Voltage Profile for 400/220/66kV Malbase Substation



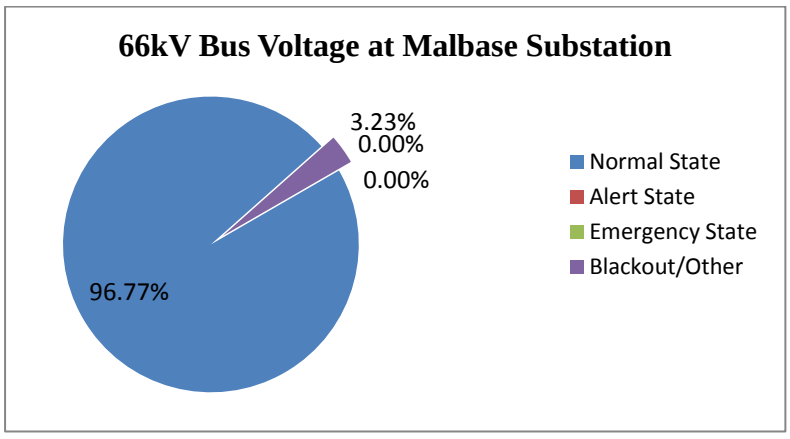
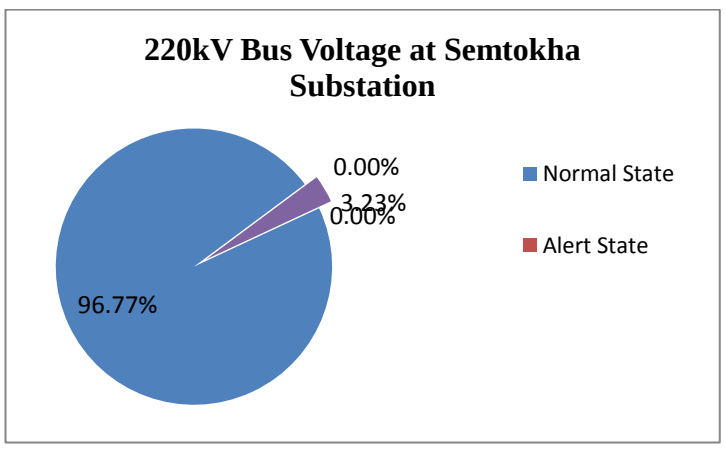




Table 7.2.2. Voltage Profile of 220/66/11kV Semtokha Substation

| Sl. No. | Operating State | 220kV Bus Voltage | 66kV Bus Voltage |
|---|---|---|---|
| 1 | Normal State | 96.77% | 96.64% |
| 2 | Alert State | 0.00% | 0.00% |
| 3 | Emergency State | 0.00% | 0.13% |
| 4 | Blackout/Other | 3.23% | 3.23% |

Graph 7.2.2. Voltage Profile of 220/66/11kV Semtokha Substation



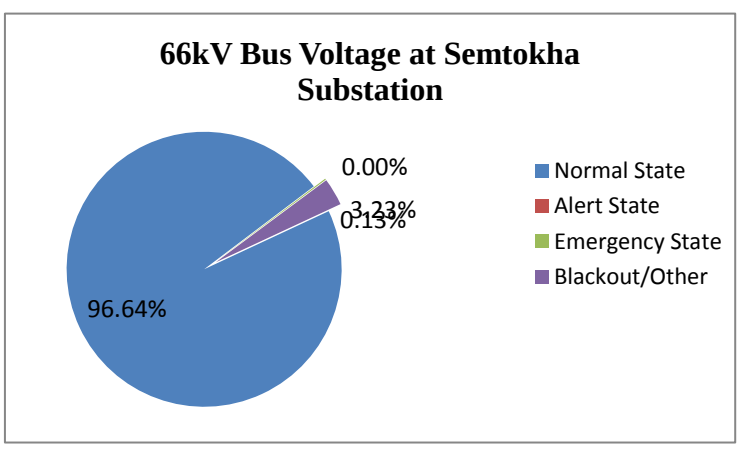
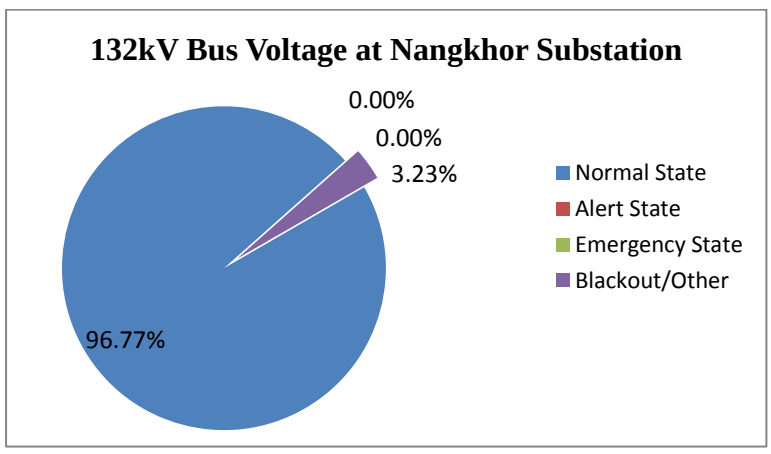




Table 7.2.3. Voltage Profile of 132/33/11kV Nangkhor Substation

| Sl. No. | Operating State | 132kV Bus Voltage |
|---|---|---|
| 1 | Normal State | 96.77% |
| 2 | Alert State | 0.00% |
| 3 | Emergency State | 0.00% |
| 4 | Blackout/Other | 3.23% |

Graph 7.2.3. Voltage Profile of 132/33/11kV Nangkhor Substation



### 7.3.Voltage Profile for the month of December, 2019

Table 7.3.1. Voltage Profile for 400/220/66kV Malbase Substation

| Sl. No. | Operating State | 400kV Bus Voltage | 220kV Bus Voltage | 66kV Bus Voltage |
|---|---|---|---|---|
| 1 | Normal State | 100.00% | 100.00% | 100.00% |
| 2 | Alert State | 0.00% | 0.00% | 0.00% |
| 3 | Emergency State | 0.00% | 0.00% | 0.00% |
| 4 | Blackout/Other | 0.00% | 0.00% | 0.00% |

Graph 7.3.1. Voltage Profile for 400/220/66kV Malbase Substation

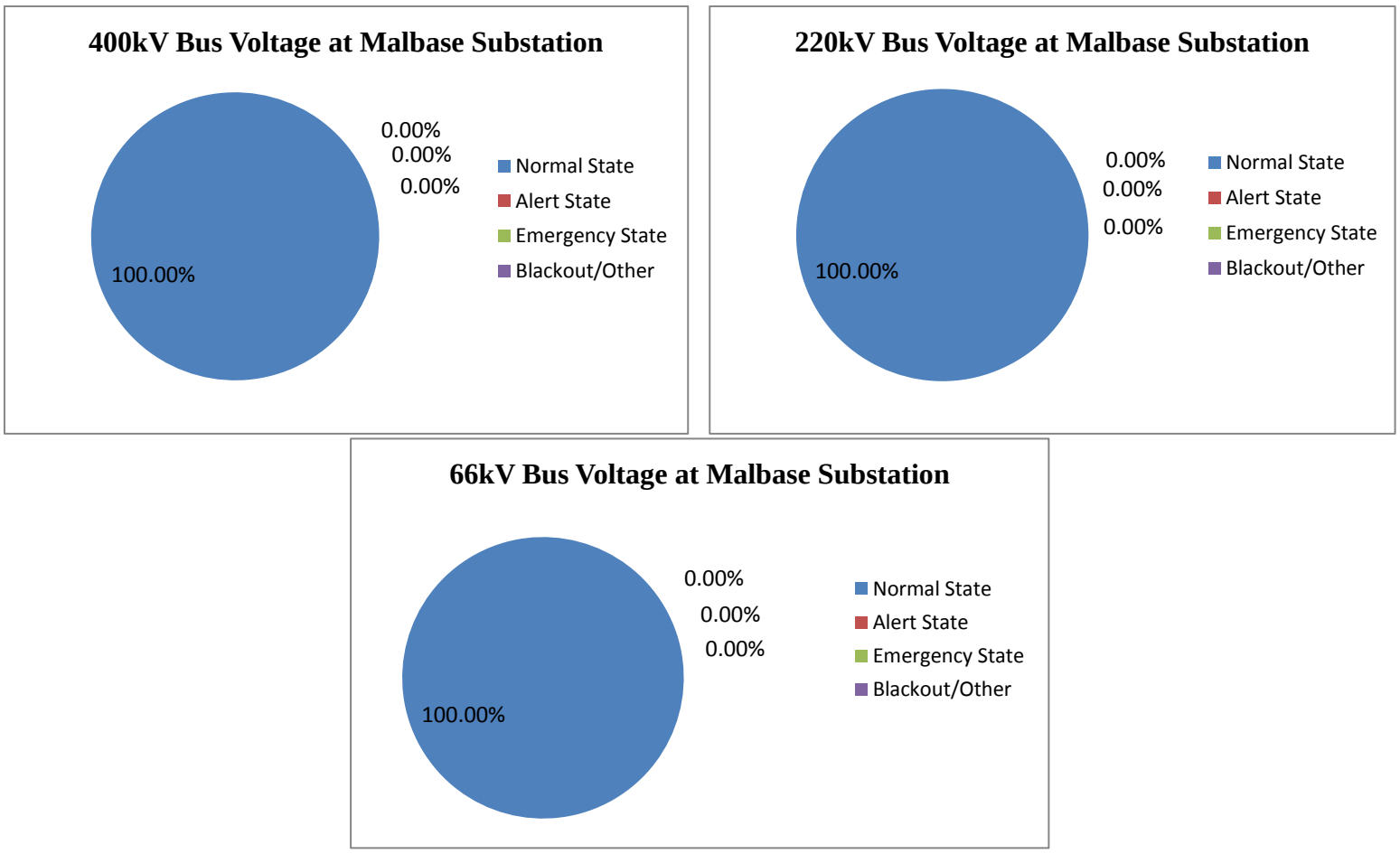



Table 7.3.2. Voltage Profile of 220/66/11kV Semtokha Substation

| Sl. No. | Operating State | 220kV Bus Voltage | 66kV Bus Voltage |
|---|---|---|---|
| 1 | Normal State | 100.00% | 99.73% |
| 2 | Alert State | 0.00% | 0.00% |
| 3 | Emergency State | 0.00% | 0.13% |
| 4 | Blackout/Other | 0.00% | 0.13% |

Graph 7.3.2. Voltage Profile of 220/66/11kV Semtokha Substation

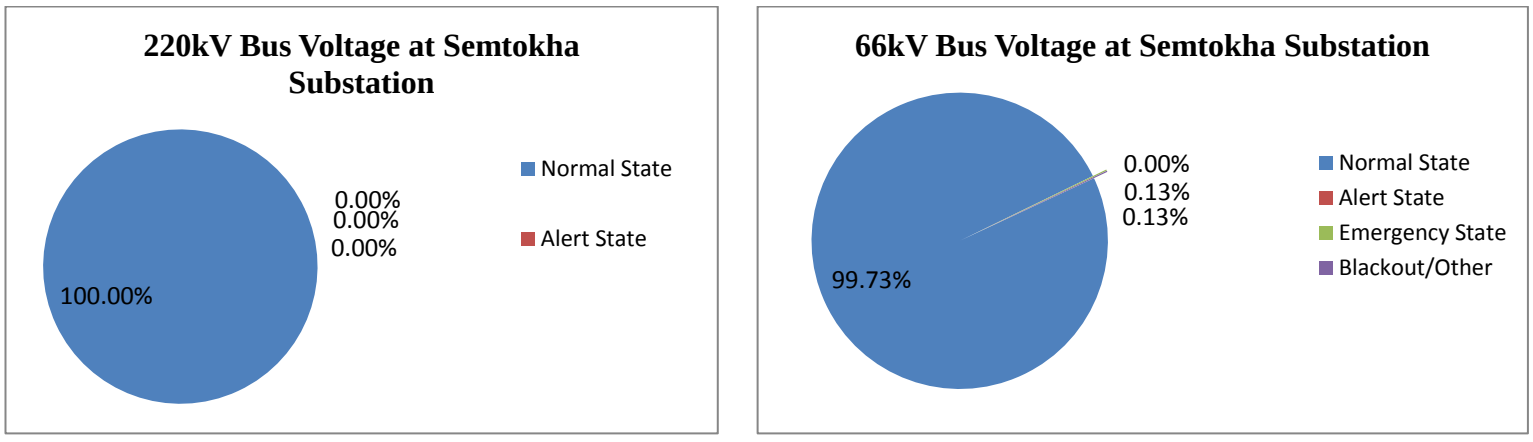
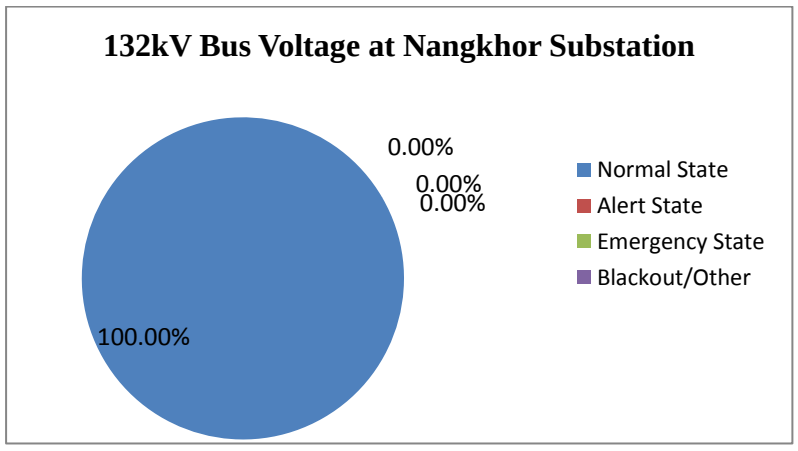



Table 7.3.3. Voltage Profile of 132/33/11kV Nangkhor Substation

| Sl. No. | Operating State | 132kV Bus Voltage |
|---|---|---|
| 1 | Normal State | 100.00% |
| 2 | Alert State | 0.00% |
| 3 | Emergency State | 0.00% |
| 4 | Blackout/Other | 0.00% |

Graph 7.3.3. Voltage Profile of 132/33/11kV Nangkhor Substation

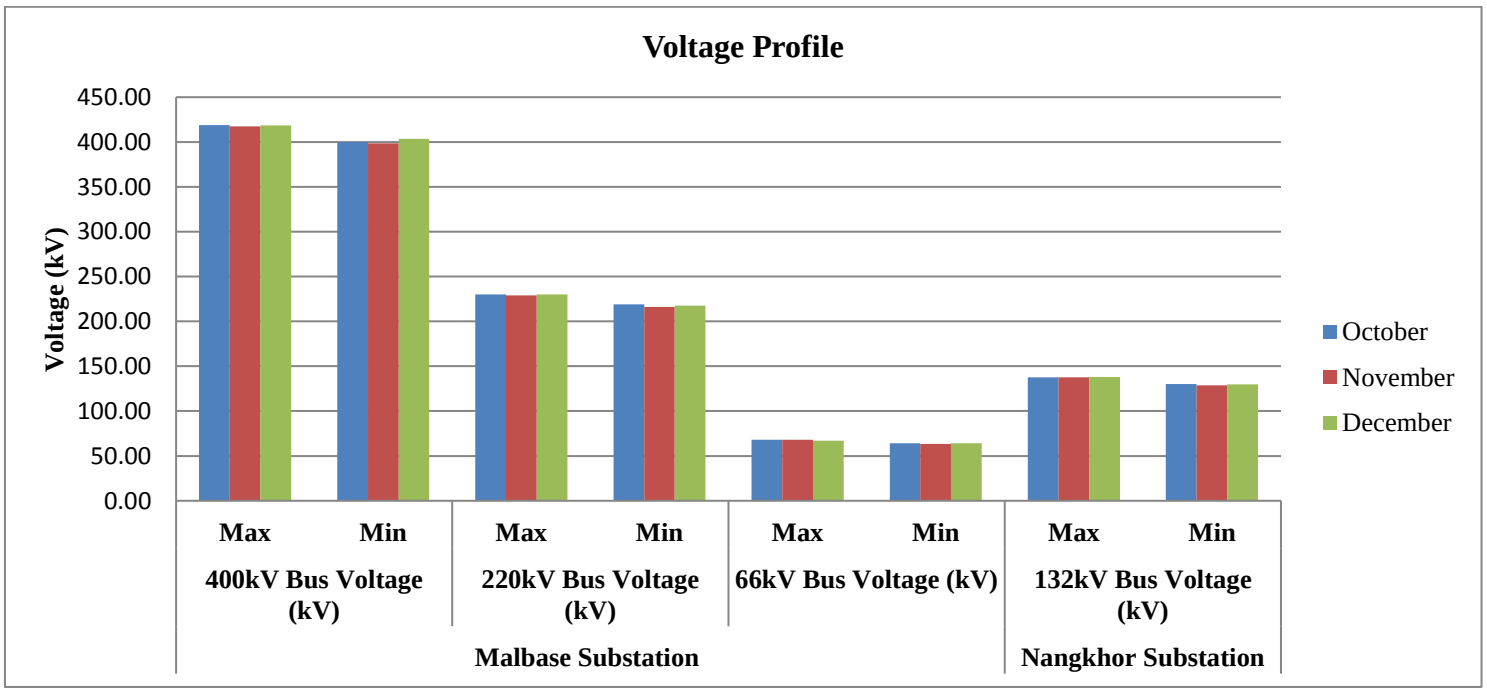



### 7.4.Voltage Summary for the Month of October to December, 2019

Table 7.4.1. Voltage Summary for the month of October to December, 2019

| Substation | Malbase Substation | | | | | | Nangkhor Substation | |
|---|---|---|---|---|---|---|---|---|
| Voltage Level | 400kV Bus Voltage (kV) | | 220kV Bus Voltage (kV) | | 66kV Bus Voltage (kV) | | 132kV Bus Voltage (kV) | |
| Month | Max | Min | Max | Min | Max | Min | Max | Min |
| October | 419.00 | 400.00 | 230.00 | 219.00 | 68.00 | 64.00 | 137.70 | 130.00 |
| November | 417.50 | 398.50 | 229.00 | 216.00 | 68.00 | 63.50 | 137.50 | 128.80 |
| December | 418.50 | 403.50 | 230.00 | 217.50 | 67.00 | 64.00 | 137.90 | 129.88 |

Graph 7.4.1. Voltage Summary for the month of October to December, 2019




Daily maximum, minimum and average bus voltage of Malbase substation in western grid and Nangkhor substation in eastern grid for the month of October to December, 2019 is attached as **Annexure-IV**

## 8. Major Outages of Feeders and Equipment

The transmission lines and equipment which were shut down for annual maintenance are not considered in the report.

### 8.1.Major Outages in Eastern Grid

It had been observed that the number of tripping in eastern grid has been reduced during the fourth quarter of the year compare to other quarter of the year. There was no prolong outage for feeders in eastern grid except 400 kV MHEP Line-2 which was out of service for almost one day during the month of October.

The feeders and equipment outages for the Eastern grid is attached as **Annexure-V**.

### 8.2.Major Outages in Western Grid

During the fourth quarter of the year, there was no major outage occurred in western grid.

The feeders and equipment outages for the Western grid is attached as **Annexure-VI.**

## 9. Annexures

**Annexure-I**

Table: Generation of October, 2019

| Oct-19 | BHP (MW) | | | CHP (MW) | | | THP (MW) | | | KHP (MW) | | | DHP (MW) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava |
| 1 | 66.10 | 65.80 | 66.06 | 276.00 | 276.00 | 276.00 | 1,122.00 | 1,122.00 | 1,122.00 | 66.00 | 66.00 | 66.00 | 126.81 | 108.02 | 118.10 |
| 2 | 66.20 | 65.70 | 66.08 | 276.00 | 276.00 | 276.00 | 1,122.00 | 1,122.00 | 1,122.00 | 66.00 | 66.00 | 66.00 | 126.69 | 101.44 | 109.97 |
| 3 | 66.10 | 65.70 | 66.04 | 276.00 | 276.00 | 276.00 | 1,122.00 | 1,122.00 | 1,122.00 | 66.00 | 66.00 | 66.00 | 116.43 | 96.46 | 103.83 |
| 4 | 66.40 | 66.10 | 66.11 | 276.00 | 276.00 | 276.00 | 1,122.00 | 994.00 | 1,073.17 | 66.00 | 66.00 | 66.00 | 125.33 | 88.61 | 105.73 |
| 5 | 66.10 | 65.90 | 66.05 | 276.00 | 276.00 | 276.00 | 994.00 | 790.00 | 962.58 | 66.00 | 66.00 | 66.00 | 98.69 | 63.38 | 91.66 |
| 6 | 66.10 | 65.90 | 66.08 | 276.00 | 276.00 | 276.00 | 920.00 | 850.00 | 880.42 | 66.00 | 66.00 | 66.00 | 93.65 | 80.61 | 87.80 |
| 7 | 66.10 | 65.80 | 66.01 | 276.00 | 218.00 | 271.08 | 850.00 | 850.00 | 850.00 | 66.00 | 66.00 | 66.00 | 106.39 | 86.11 | 93.72 |
| 8 | 66.20 | 65.90 | 66.08 | 276.00 | 184.00 | 271.25 | 1,065.00 | 850.00 | 923.75 | 66.00 | 66.00 | 66.00 | 126.91 | 90.18 | 111.76 |
| 9 | 66.14 | 56.10 | 65.66 | 276.00 | 184.00 | 256.50 | 1,028.00 | 900.00 | 979.50 | 66.00 | 66.00 | 66.00 | 110.50 | 89.54 | 96.15 |
| 10 | 66.40 | 66.00 | 66.16 | 276.00 | 276.00 | 276.00 | 900.00 | 800.00 | 839.17 | 66.00 | 66.00 | 66.00 | 90.55 | 82.42 | 86.77 |
| 11 | 66.10 | 66.00 | 66.10 | 276.00 | 276.00 | 276.00 | 800.00 | 750.00 | 781.67 | 66.00 | 66.00 | 66.00 | 83.98 | 78.47 | 81.52 |
| 12 | 66.10 | 65.80 | 66.03 | 276.00 | 276.00 | 276.00 | 780.00 | 720.00 | 751.25 | 66.00 | 16.50 | 62.56 | 83.43 | 76.44 | 79.30 |
| 13 | 66.10 | 66.00 | 66.08 | 276.00 | 276.00 | 276.00 | 720.00 | 700.00 | 709.17 | 66.00 | 66.00 | 66.00 | 77.46 | 70.53 | 75.06 |
| 14 | 66.10 | 65.50 | 65.94 | 276.00 | 184.00 | 257.46 | 780.00 | 560.00 | 640.83 | 66.00 | 49.50 | 65.31 | 74.38 | 70.44 | 72.47 |
| 15 | 65.60 | 64.70 | 65.11 | 276.00 | 276.00 | 276.00 | 690.00 | 650.00 | 653.33 | 66.00 | 66.00 | 66.00 | 70.50 | 67.30 | 69.30 |
| 16 | 64.70 | 63.60 | 64.34 | 276.00 | 276.00 | 276.00 | 770.00 | 610.00 | 632.50 | 66.00 | 61.56 | 64.52 | 68.41 | 65.32 | 67.06 |
| 17 | 66.10 | 62.10 | 63.40 | 276.00 | 276.00 | 276.00 | 740.00 | 570.00 | 597.50 | 61.57 | 59.52 | 60.76 | 67.52 | -4.90 | 62.34 |
| 18 | 66.10 | 61.80 | 63.45 | 276.00 | 276.00 | 276.00 | 683.00 | 547.00 | 581.96 | 63.62 | 55.74 | 60.22 | 76.69 | 63.19 | 66.58 |
| 19 | 61.90 | 60.20 | 61.08 | 276.00 | 276.00 | 276.00 | 590.00 | 570.00 | 577.50 | 58.02 | 57.04 | 57.79 | 63.57 | 60.43 | 62.43 |
| 20 | 60.10 | 58.80 | 59.44 | 276.00 | 256.00 | 265.08 | 590.00 | 560.00 | 563.38 | 57.52 | 52.62 | 55.26 | 61.49 | 60.44 | 60.92 |
| 21 | 59.50 | 58.10 | 58.80 | 276.00 | 254.97 | 264.22 | 561.00 | 561.00 | 561.00 | 66.00 | 56.16 | 61.72 | 60.49 | 22.55 | 58.19 |
| 22 | 57.80 | 56.20 | 56.99 | 262.00 | 184.00 | 225.33 | 561.00 | 380.00 | 465.67 | 66.00 | 66.00 | 66.00 | 58.50 | 57.41 | 57.97 |
| 23 | 56.50 | 55.20 | 55.78 | 275.00 | 200.00 | 249.36 | 600.00 | 380.00 | 520.92 | 66.00 | 54.72 | 58.28 | 58.26 | 54.14 | 56.98 |
| 24 | 55.30 | 54.30 | 54.77 | 267.00 | 230.00 | 241.89 | 600.00 | 480.00 | 511.67 | 66.00 | 52.97 | 57.16 | 58.12 | 54.13 | 56.27 |
| 25 | 54.90 | 53.30 | 54.09 | 254.77 | 219.00 | 231.98 | 520.00 | 360.00 | 487.08 | 55.04 | 52.78 | 54.23 | 65.51 | 2.20 | 55.02 |
| 26 | 59.80 | 39.30 | 53.07 | 249.00 | 222.00 | 230.13 | 510.00 | 480.00 | 483.75 | 58.56 | 52.94 | 55.78 | 56.24 | 52.96 | 54.44 |
| 27 | 52.50 | 50.70 | 51.58 | 244.00 | 213.00 | 221.38 | 480.00 | 440.00 | 450.00 | 57.60 | 50.86 | 54.84 | 53.23 | 52.01 | 52.75 |
| 28 | 51.10 | 49.70 | 50.57 | 247.00 | 203.00 | 213.55 | 480.00 | 440.00 | 441.67 | 51.19 | 39.93 | 50.00 | 52.20 | 50.20 | 51.47 |
| 29 | 50.20 | 48.40 | 49.33 | 241.00 | 204.91 | 211.33 | 440.00 | 420.00 | 425.00 | 64.10 | 45.54 | 48.21 | 51.20 | 49.14 | 50.28 |
| 30 | 49.00 | 47.70 | 48.29 | 243.60 | 197.00 | 204.89 | 460.00 | 420.00 | 428.33 | 48.72 | 41.70 | 45.65 | 49.69 | 48.00 | 49.16 |
| 31 | 48.30 | 46.60 | 47.45 | 219.21 | 197.00 | 201.22 | 460.00 | 410.00 | 412.08 | 45.86 | 42.02 | 44.48 | 49.16 | 47.03 | 47.90 |
| **Max** | **66.40** | | | **276.00** | | | **1,122.00** | | | **66.00** | | | **126.91** | | |
| **Min** | | **39.30** | | | **184.00** | | | **360.00** | | | **16.50** | | | **-4.90** | |
| Source: THP, CHP, BHP, KHP (DGPC) | | | | | | | | | | | | | | | |

Graph: Generation for the month of October, 2019

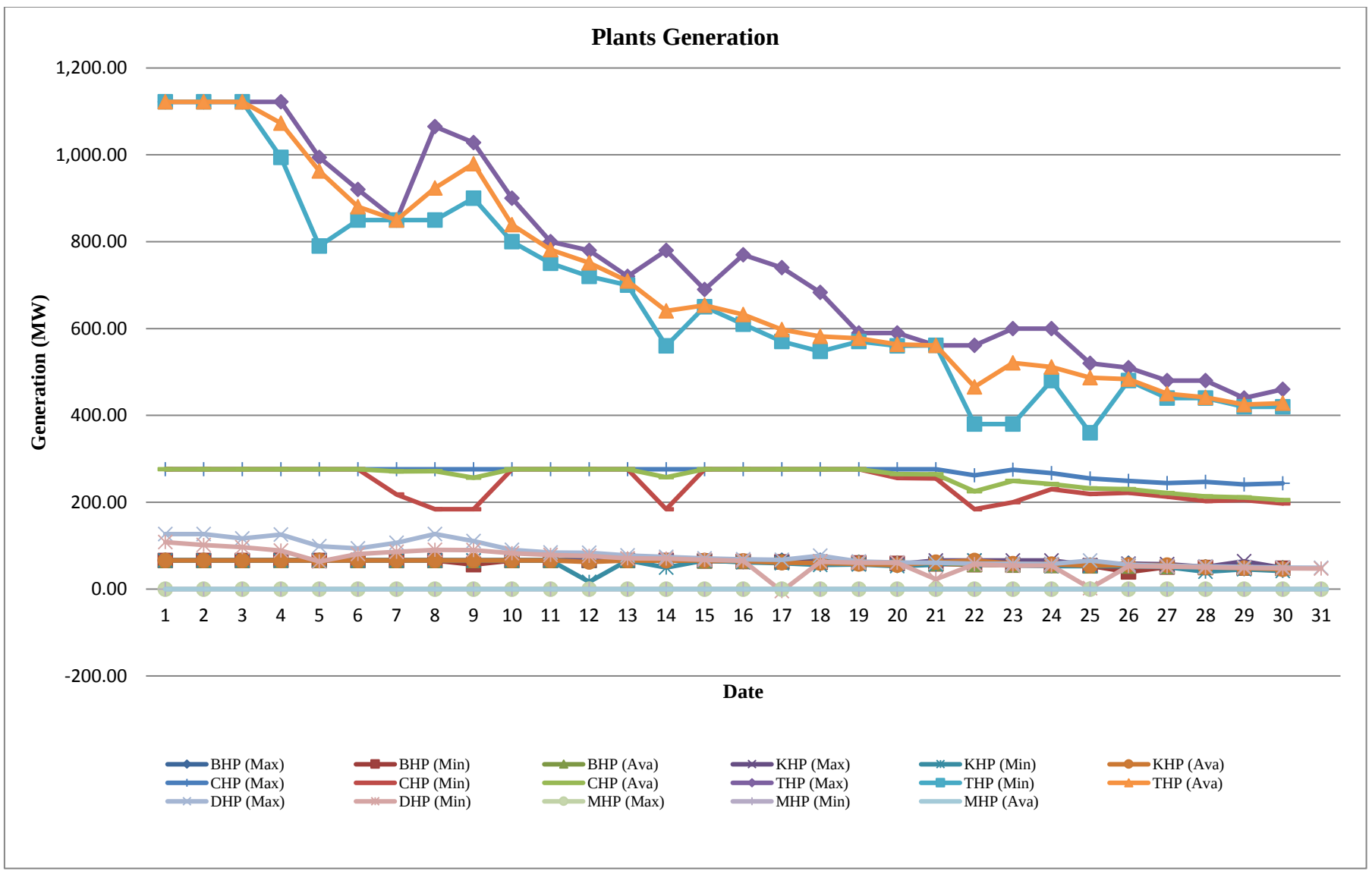


Table: Generation for the month of November, 2019

| Nov-19 | BHP (MW) | | | CHP (MW) | | | THP (MW) | | | KHP (MW) | | | DHP (MW) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava |
| 1 | 47.30 | 46.00 | 46.62 | 216.86 | 183.61 | 194.47 | 460.00 | 390.00 | 405.42 | 32.16 | 27.53 | 29.41 | 47.42 | 46.20 | 46.98 |
| 2 | 46.20 | 44.90 | 45.58 | 221.36 | 174.02 | 194.71 | 460.00 | 360.00 | 395.00 | 29.64 | 27.72 | 29.27 | 46.51 | 45.02 | 45.93 |
| 3 | 45.70 | 43.80 | 44.77 | 223.00 | 171.33 | 192.14 | 450.00 | 360.00 | 382.50 | 29.55 | 28.16 | 28.72 | 45.86 | 43.39 | 45.12 |
| 4 | 45.40 | 43.50 | 44.18 | 220.48 | 180.99 | 188.26 | 450.00 | 360.00 | 381.25 | 28.93 | 28.46 | 28.75 | 47.40 | 42.96 | 44.27 |
| 5 | 46.60 | 42.60 | 44.25 | 215.52 | 181.00 | 190.35 | 430.00 | 370.00 | 387.50 | 30.45 | 27.20 | 28.78 | 47.38 | 43.37 | 45.00 |
| 6 | 45.00 | 14.90 | 41.59 | 223.28 | 175.67 | 187.55 | 460.00 | 360.00 | 389.58 | 28.19 | 17.30 | 26.82 | 47.38 | 42.38 | 44.44 |
| 7 | 43.70 | 38.90 | 41.87 | 218.94 | 173.05 | 180.48 | 460.00 | 360.00 | 380.83 | 27.92 | 26.32 | 26.88 | 43.89 | 41.94 | 42.80 |
| 8 | 42.30 | 36.60 | 41.05 | 214.29 | 152.96 | 175.73 | 440.00 | 320.00 | 359.17 | 39.05 | 26.27 | 32.70 | 42.40 | 40.98 | 41.70 |
| 9 | 41.20 | 40.10 | 40.56 | 203.68 | 164.97 | 174.08 | 420.00 | 320.00 | 337.92 | 38.97 | 37.07 | 38.30 | 41.37 | 40.31 | 40.79 |
| 10 | 40.60 | 39.50 | 39.91 | 195.67 | 162.70 | 168.50 | 400.00 | 320.00 | 349.58 | 38.77 | 36.87 | 37.38 | 40.95 | 39.27 | 40.16 |
| 11 | 39.90 | 38.70 | 39.33 | 192.00 | 157.87 | 165.65 | 410.00 | 320.00 | 338.75 | 37.18 | 34.85 | 36.25 | 40.38 | 38.98 | 39.77 |
| 12 | 39.20 | 37.20 | 38.55 | 194.36 | 155.73 | 163.09 | 420.00 | 320.00 | 336.67 | 37.56 | 36.46 | 36.65 | 40.34 | 38.04 | 39.14 |
| 13 | 39.90 | 37.20 | 38.58 | 191.93 | 147.82 | 166.46 | 390.00 | 310.00 | 336.25 | 38.94 | 35.13 | 35.92 | 50.44 | 38.13 | 39.88 |
| 14 | 38.00 | 37.00 | 37.44 | 210.19 | 147.28 | 164.15 | 400.00 | 310.00 | 330.83 | 37.09 | 34.96 | 35.38 | 40.13 | 37.12 | 38.03 |
| 15 | 37.30 | 36.40 | 36.85 | 194.17 | 144.50 | 157.82 | 390.00 | 290.00 | 319.17 | 35.32 | 35.02 | 35.14 | 38.54 | 37.12 | 37.61 |
| 16 | 36.90 | 35.90 | 36.23 | 183.79 | 144.44 | 153.54 | 380.00 | 290.00 | 315.83 | 35.52 | 22.91 | 34.69 | 37.54 | 36.12 | 36.90 |
| 17 | 36.40 | 35.70 | 35.86 | 180.46 | 140.70 | 150.26 | 380.00 | 290.00 | 308.75 | 34.64 | 33.51 | 34.00 | 40.14 | 35.12 | 36.79 |
| 18 | 37.30 | 29.40 | 34.84 | 174.36 | 140.88 | 148.96 | 360.00 | 280.00 | 294.17 | 34.95 | 33.71 | 34.09 | 37.15 | 35.13 | 36.06 |
| 19 | 35.40 | 34.50 | 34.94 | 173.05 | 107.21 | 147.33 | 360.00 | 280.00 | 307.08 | 37.00 | 34.59 | 35.33 | 50.21 | 33.93 | 35.98 |
| 20 | 36.50 | 29.30 | 34.00 | 176.71 | 139.48 | 148.11 | 390.00 | 280.00 | 300.83 | 43.00 | 33.70 | 35.84 | 35.93 | 33.96 | 34.94 |
| 21 | 34.50 | 33.50 | 33.95 | 173.37 | 137.66 | 147.34 | 440.00 | 240.00 | 321.67 | 36.36 | 32.72 | 34.34 | 35.88 | 32.36 | 34.55 |
| 22 | 33.70 | 32.90 | 33.35 | 169.86 | 134.00 | 144.80 | 440.00 | 200.00 | 303.33 | 35.05 | 31.48 | 33.34 | 34.43 | 32.41 | 33.98 |
| 23 | 33.30 | 32.70 | 33.03 | 171.66 | 135.12 | 144.61 | 360.00 | 260.00 | 281.25 | 32.82 | 30.18 | 31.77 | 33.91 | 33.39 | 33.62 |
| 24 | 33.30 | 32.70 | 33.03 | 172.90 | 132.97 | 143.99 | 360.00 | 250.00 | 284.17 | 32.75 | 28.42 | 31.63 | 33.70 | 32.89 | 33.19 |
| 25 | 33.10 | 30.80 | 32.18 | 169.02 | 132.35 | 141.45 | 310.00 | 200.00 | 282.50 | 32.60 | 29.10 | 31.28 | 33.40 | 31.30 | 32.74 |
| 26 | 32.10 | 31.30 | 31.65 | 169.26 | 129.85 | 137.52 | 340.00 | 200.00 | 272.08 | 32.47 | 29.90 | 31.23 | 33.33 | 30.26 | 32.31 |
| 27 | 31.90 | 30.60 | 31.10 | 161.93 | 126.61 | 133.67 | 330.00 | 250.00 | 283.75 | 31.45 | 28.53 | 30.80 | 32.28 | 30.80 | 31.55 |
| 28 | 40.10 | 25.20 | 30.67 | 160.47 | 117.33 | 131.99 | 330.00 | 250.00 | 263.33 | 29.87 | 29.49 | 29.69 | 32.27 | 30.26 | 31.13 |
| 29 | 36.20 | 27.40 | 30.07 | 160.55 | 117.46 | 129.62 | 320.00 | 240.00 | 262.50 | 29.79 | 26.95 | 29.16 | 31.30 | 30.26 | 30.65 |
| 30 | 30.80 | 29.40 | 29.92 | 152.92 | 116.03 | 126.26 | 310.00 | 240.00 | 253.33 | 32.82 | 27.07 | 29.05 | 30.41 | 29.74 | 30.15 |
| 31 | 0.00 | No Generati | Error | 0.00 | No Generati | Error | 0.00 | No Generati | Error | 0.00 | No Generati | Error | 0.00 | No Generati | Error |
| **Max** | **47.30** | | | **223.28** | | | **460.00** | | | **43.00** | | | **50.44** | | |
| **Min** | | **14.90** | | | **107.21** | | | **200.00** | | | **17.30** | | | **29.74** | |
| Source: THP, CHP, BHP, KHP (DGPC) | | | | | | | | | | | | | | | |

Graph: Generation for the month of November, 2019

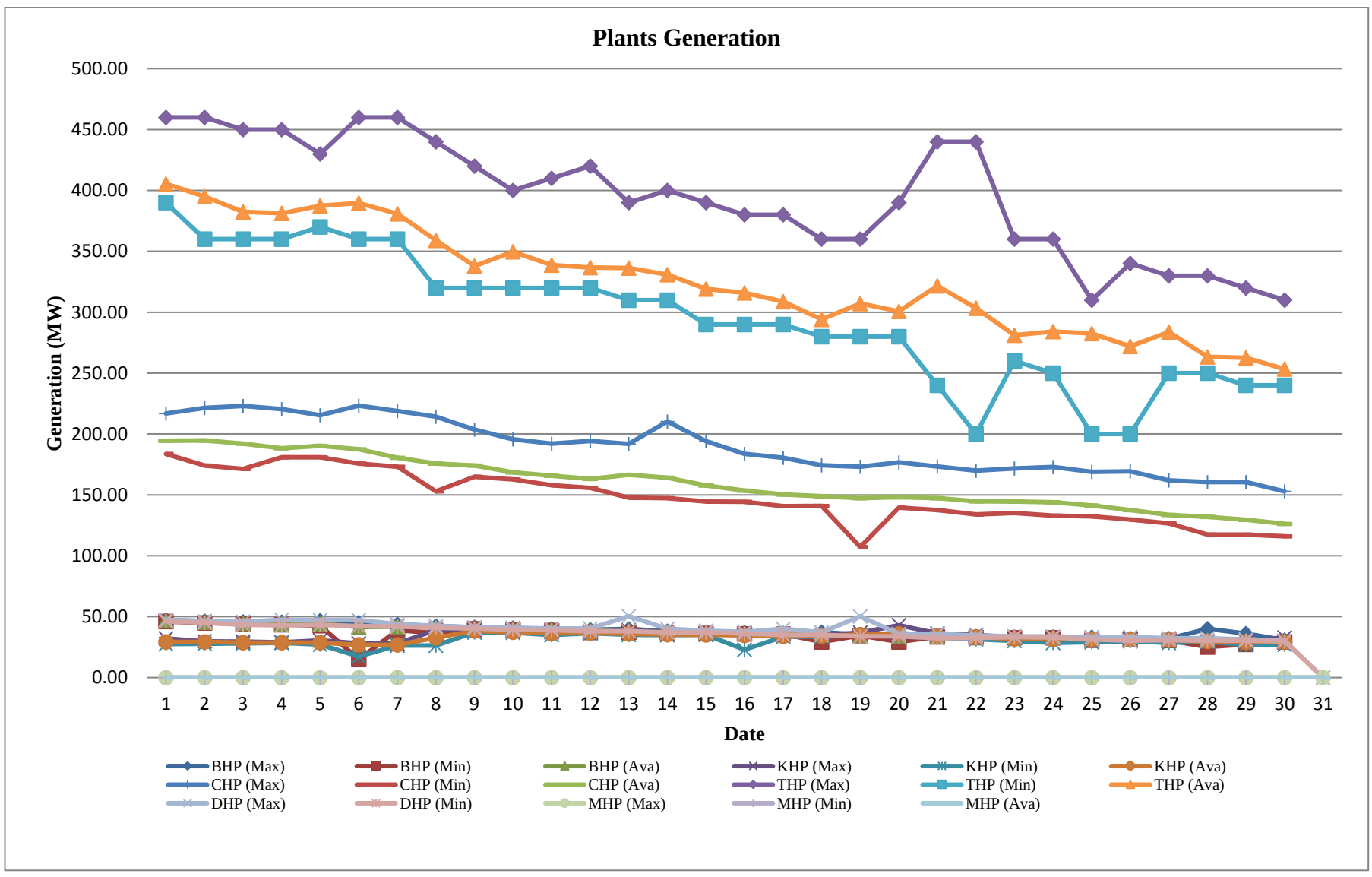


Table: Generation for the month of December, 2019

| Dec-19 | BHP (MW) | | | CHP (MW) | | | THP (MW) | | | KHP (MW) | | | DHP (MW) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava |
| 1 | 30.00 | 29.20 | 29.59 | 154.36 | 115.70 | 126.92 | 320.00 | 240.00 | 256.67 | 29.49 | 27.04 | 28.64 | 30.25 | 29.24 | 29.99 |
| 2 | 29.70 | 29.10 | 29.33 | 151.33 | 118.25 | 125.30 | 320.00 | 230.00 | 248.75 | 30.02 | 25.56 | 28.39 | 30.27 | 28.30 | 29.67 |
| 3 | 29.40 | 28.20 | 28.92 | 147.36 | 117.96 | 124.54 | 320.00 | 230.00 | 245.00 | 30.26 | 28.30 | 29.12 | 29.80 | 28.95 | 29.48 |
| 4 | 29.10 | 27.50 | 28.49 | 141.81 | 111.40 | 121.97 | 310.00 | 230.00 | 250.00 | 28.92 | 26.60 | 28.04 | 29.94 | 28.25 | 29.04 |
| 5 | 28.30 | 26.90 | 27.90 | 147.00 | 107.71 | 118.67 | 310.00 | 230.00 | 245.42 | 29.30 | 16.50 | 27.15 | 28.78 | 27.24 | 28.37 |
| 6 | 28.20 | 26.80 | 27.60 | 156.11 | 101.23 | 119.32 | 310.00 | 210.00 | 230.83 | 29.60 | 25.30 | 26.85 | 28.28 | 27.24 | 28.04 |
| 7 | 27.80 | 26.40 | 27.27 | 136.04 | 92.15 | 117.95 | 320.00 | 210.00 | 240.00 | 33.22 | 25.87 | 30.13 | 29.27 | 26.23 | 27.52 |
| 8 | 27.60 | 26.40 | 27.01 | 135.39 | 104.64 | 111.56 | 300.00 | 210.00 | 231.25 | 33.00 | 10.08 | 21.51 | 27.24 | 26.81 | 27.12 |
| 9 | 27.40 | 26.00 | 26.78 | 130.71 | 103.94 | 111.24 | 300.00 | 200.00 | 230.83 | 30.25 | 25.29 | 25.96 | 27.65 | 26.25 | 27.06 |
| 10 | 27.00 | 26.20 | 26.62 | 140.84 | 105.15 | 116.73 | 270.00 | 210.00 | 223.75 | 28.55 | 24.23 | 25.80 | 27.26 | 26.26 | 26.78 |
| 11 | 27.40 | 26.60 | 26.88 | 139.47 | 108.84 | 114.73 | 290.00 | 210.00 | 250.42 | 25.66 | 24.76 | 25.06 | 27.26 | 26.24 | 26.77 |
| 12 | 27.10 | 26.50 | 26.70 | 138.25 | 103.85 | 114.57 | 210.00 | 210.00 | 210.00 | 26.74 | 25.57 | 26.14 | 27.25 | 26.22 | 26.79 |
| 13 | 26.50 | 26.00 | 26.25 | 137.12 | 101.57 | 113.28 | 270.00 | 210.00 | 226.25 | 26.68 | 24.64 | 25.74 | 26.85 | 26.21 | 26.39 |
| 14 | 27.00 | 26.00 | 26.45 | 140.20 | 103.67 | 115.37 | 290.00 | 210.00 | 226.67 | 25.00 | 24.68 | 24.85 | 27.35 | 26.23 | 26.71 |
| 15 | 26.60 | 24.90 | 25.80 | 143.53 | 103.36 | 116.76 | 270.00 | 210.00 | 230.00 | 26.15 | 24.85 | 25.30 | 26.75 | 24.78 | 25.84 |
| 16 | 26.20 | 24.30 | 25.43 | 141.63 | 102.25 | 110.81 | 320.00 | 210.00 | 228.33 | 26.07 | 24.38 | 25.02 | 27.26 | 24.24 | 25.65 |
| 17 | 25.60 | 24.70 | 25.11 | 142.86 | 95.05 | 107.88 | 280.00 | 190.00 | 212.08 | 26.40 | 22.50 | 23.96 | 26.29 | 24.24 | 25.44 |
| 18 | 25.60 | 24.70 | 25.11 | 141.79 | 98.08 | 106.60 | 290.00 | 190.00 | 225.83 | 26.38 | 23.71 | 24.73 | 25.70 | 24.73 | 25.26 |
| 19 | 25.00 | 24.70 | 24.87 | 133.20 | 97.27 | 106.73 | 280.00 | 190.00 | 204.58 | 25.01 | 22.81 | 23.89 | 25.30 | 24.72 | 24.86 |
| 20 | 24.90 | 24.40 | 24.65 | 130.84 | 98.31 | 107.16 | 270.00 | 190.00 | 210.00 | 24.61 | 22.47 | 23.73 | 24.94 | 23.25 | 24.66 |
| 21 | 24.70 | 24.20 | 24.44 | 132.26 | 92.89 | 105.09 | 270.00 | 190.00 | 213.33 | 25.17 | 23.24 | 24.09 | 24.74 | 24.24 | 24.35 |
| 22 | 25.30 | 23.70 | 24.18 | 130.98 | 92.83 | 106.24 | 300.00 | 190.00 | 217.92 | 25.20 | 23.51 | 24.70 | 24.26 | 23.25 | 24.18 |
| 23 | 24.10 | 23.50 | 23.86 | 133.43 | 94.39 | 104.34 | 260.00 | 190.00 | 209.58 | 24.00 | 15.60 | 22.57 | 24.57 | 23.24 | 24.03 |
| 24 | 23.80 | 23.00 | 23.50 | 136.52 | 92.27 | 100.68 | 280.00 | 170.00 | 202.92 | 23.80 | 16.09 | 23.39 | 24.26 | 23.25 | 23.54 |
| 25 | 23.50 | 23.10 | 23.30 | 141.73 | 89.78 | 100.27 | 270.00 | 180.00 | 201.25 | 23.70 | 22.61 | 23.54 | 24.19 | 23.16 | 23.68 |
| 26 | 23.20 | 22.30 | 22.89 | 130.78 | 86.82 | 98.43 | 260.00 | 180.00 | 197.08 | 23.87 | 16.27 | 20.89 | 23.87 | 20.15 | 23.45 |
| 27 | 23.30 | 21.50 | 22.38 | 130.70 | 85.18 | 97.57 | 260.00 | 180.00 | 193.33 | 29.22 | 16.09 | 22.72 | 23.37 | 22.14 | 22.76 |
| 28 | 23.00 | 21.20 | 22.05 | 128.54 | 75.21 | 88.80 | 260.00 | 170.00 | 192.08 | 24.96 | 15.30 | 20.14 | 23.19 | 22.14 | 23.00 |
| 29 | 22.70 | 20.60 | 21.81 | 124.20 | 75.11 | 90.01 | 240.00 | 160.00 | 177.92 | 28.30 | 16.13 | 22.94 | 23.19 | 21.16 | 22.55 |
| 30 | 22.70 | 20.70 | 21.80 | 127.62 | 75.09 | 93.49 | 240.00 | 160.00 | 177.08 | 30.00 | 12.63 | 20.46 | 23.16 | 21.16 | 22.40 |
| 31 | 22.10 | 20.20 | 21.35 | 125.11 | 74.47 | 92.50 | 240.00 | 170.00 | 187.50 | 24.49 | 12.50 | 20.66 | 22.88 | 21.11 | 21.95 |
| Max | 30.00 | | | 156.11 | | | 320.00 | | | 33.22 | | | 30.27 | | |
| Min | | 20.20 | | | 74.47 | | | 160.00 | | | 10.08 | | | 20.15 | |
| Source: THP, CHP, BHP, KHP (DGPC) | | | | | | | | | | | | | | | |

Graph: Generation for the month of December, 2019

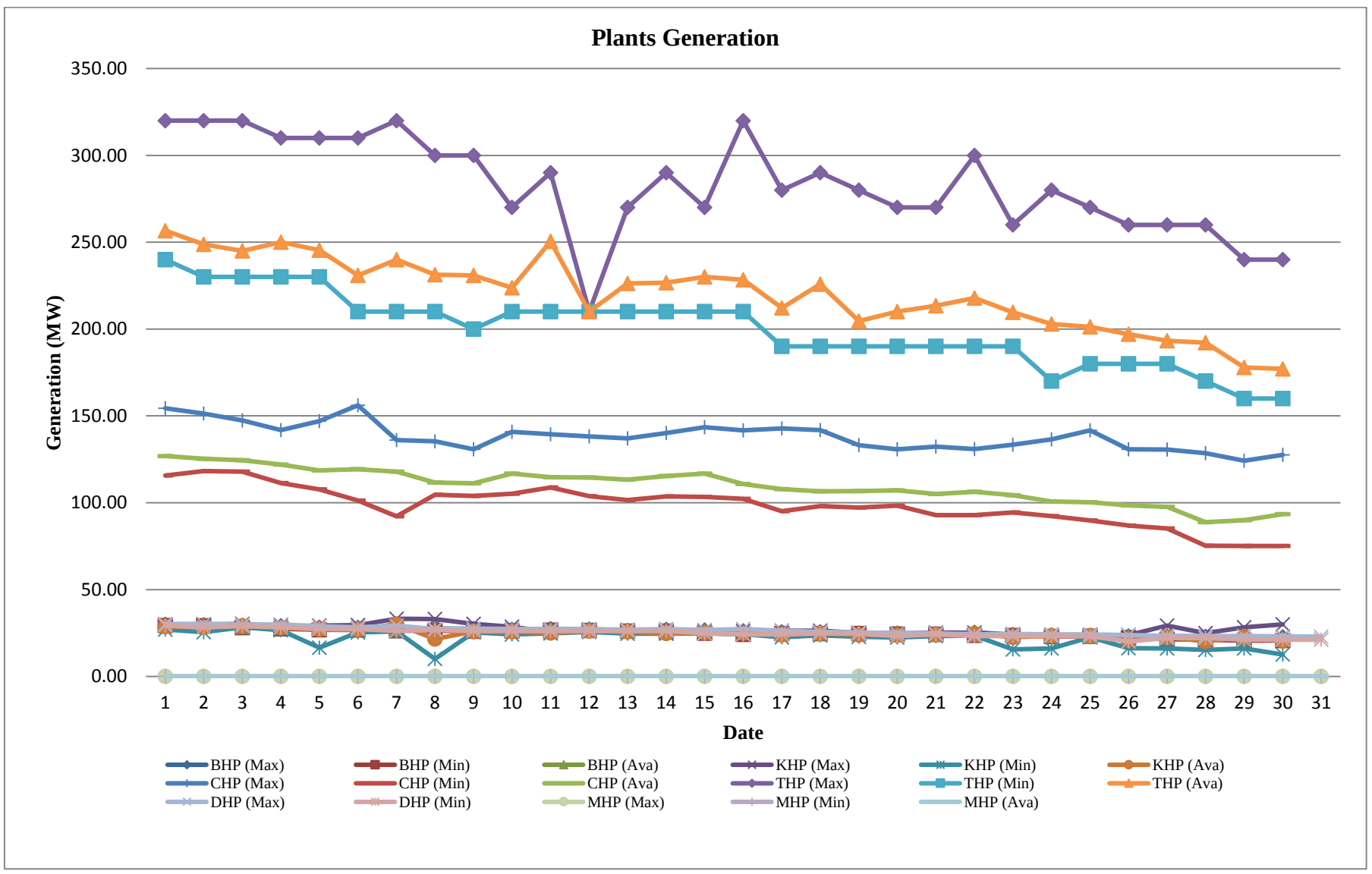
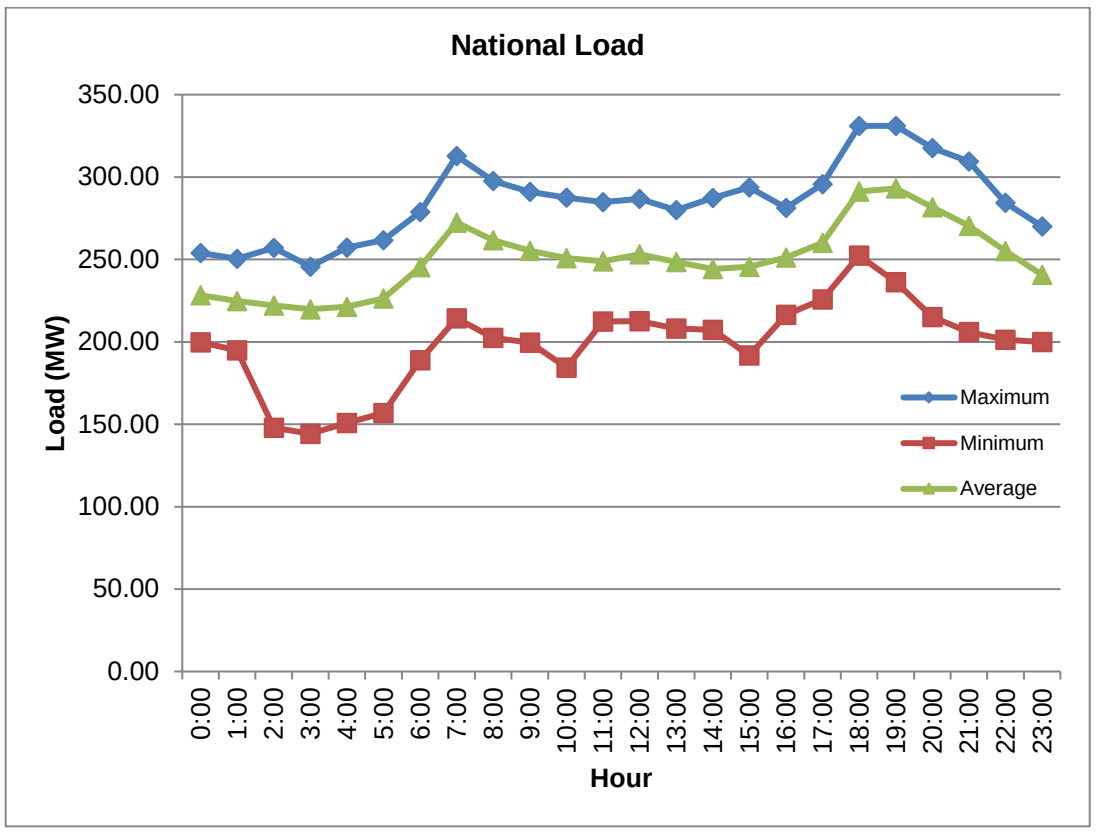


Table: National demand for October, 2019

| Oct-19 | Max | Min | Ava |
|---|---|---|---|
| 0:00 | 253.90 | 199.68 | 228.21 |
| 1:00 | 250.52 | 194.96 | 224.75 |
| 2:00 | 257.04 | 147.88 | 222.08 |
| 3:00 | 245.65 | 144.28 | 219.84 |
| 4:00 | 257.24 | 150.81 | 221.29 |
| 5:00 | 261.69 | 156.80 | 226.38 |
| 6:00 | 278.72 | 188.80 | 245.45 |
| 7:00 | 312.74 | 214.39 | 272.43 |
| 8:00 | 297.60 | 202.39 | 261.76 |
| 9:00 | 291.10 | 199.53 | 255.35 |
| 10:00 | 287.50 | 184.33 | 250.80 |
| 11:00 | 284.82 | 212.44 | 248.92 |
| 12:00 | 286.72 | 212.51 | 253.17 |
| 13:00 | 279.86 | 208.14 | 248.50 |
| 14:00 | 287.30 | 207.26 | 244.23 |
| 15:00 | 293.79 | 191.80 | 245.53 |
| 16:00 | 281.27 | 216.38 | 251.30 |
| 17:00 | 295.67 | 225.85 | 260.05 |
| 18:00 | 331.07 | 252.38 | 291.18 |
| 19:00 | 331.03 | 236.35 | 293.12 |
| 20:00 | 317.58 | 215.10 | 281.63 |
| 21:00 | 309.47 | 206.04 | 270.43 |
| 22:00 | 284.40 | 201.27 | 255.02 |
| 23:00 | 269.97 | 199.99 | 240.64 |
| | | | |
| | 331.07 | | |
| | | 144.28 | |

Graph: National Demand for October, 2019




Annexure-II

Table: National Demand for November, 2019

| Nov-19 | Max | Min | Ava |
|---|---|---|---|
| 0:00 | 270.85 | 224.75 | 239.49 |
| 1:00 | 264.11 | 197.63 | 233.01 |
| 2:00 | 264.33 | 211.75 | 230.90 |
| 3:00 | 262.75 | 213.18 | 230.68 |
| 4:00 | 261.61 | 219.98 | 234.49 |
| 5:00 | 267.78 | 227.21 | 241.72 |
| 6:00 | 287.37 | 248.78 | 258.93 |
| 7:00 | 317.27 | 270.67 | 287.46 |
| 8:00 | 313.53 | 259.92 | 280.60 |
| 9:00 | 310.70 | 251.00 | 272.92 |
| 10:00 | 299.25 | 250.91 | 265.55 |
| 11:00 | 298.59 | 239.36 | 260.54 |
| 12:00 | 293.72 | 223.63 | 262.47 |
| 13:00 | 292.18 | 221.58 | 257.49 |
| 14:00 | 284.04 | 206.12 | 251.68 |
| 15:00 | 284.74 | 224.17 | 254.68 |
| 16:00 | 293.41 | 242.49 | 258.27 |
| 17:00 | 301.81 | 254.61 | 271.54 |
| 18:00 | 338.06 | 289.02 | 304.26 |
| 19:00 | 335.57 | 284.18 | 299.69 |
| 20:00 | 319.11 | 264.54 | 288.81 |
| 21:00 | 311.12 | 252.26 | 278.10 |
| 22:00 | 291.37 | 239.44 | 261.35 |
| 23:00 | 275.55 | 223.07 | 246.79 |
| | | | |
| | 338.06 | | |
| | | 197.63 | |

Graph: National Demand for November, 2019

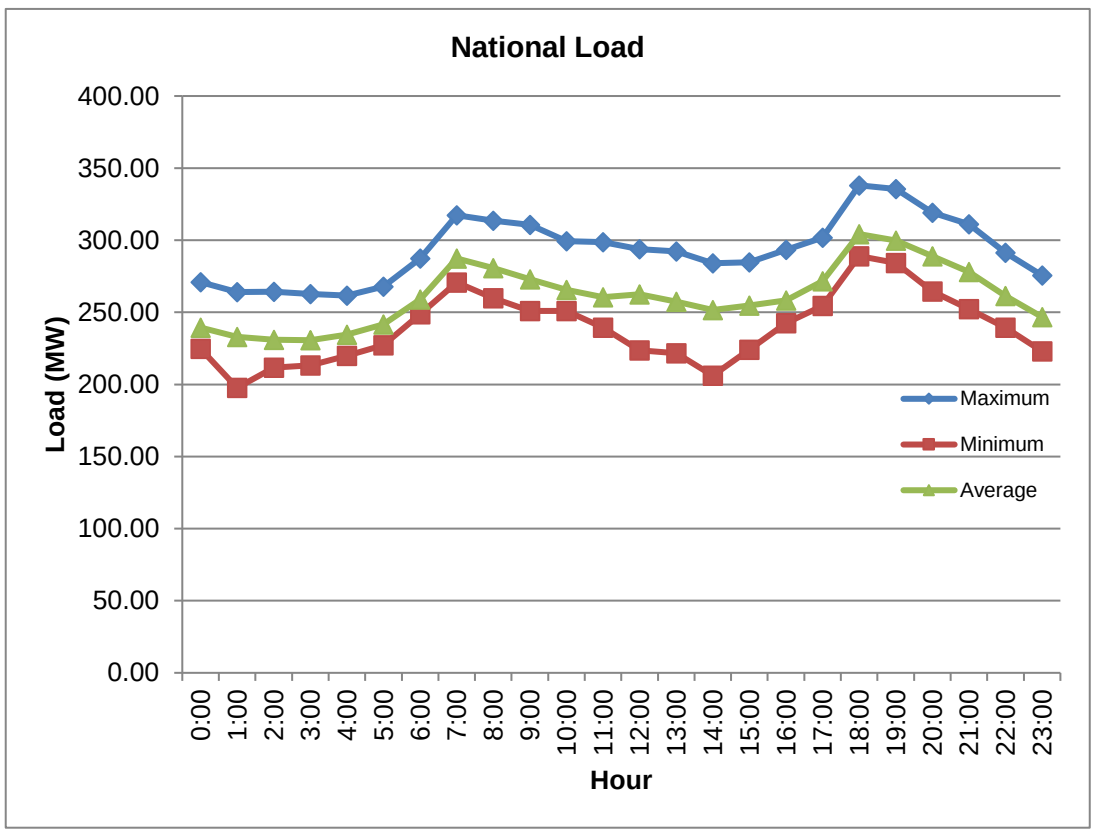
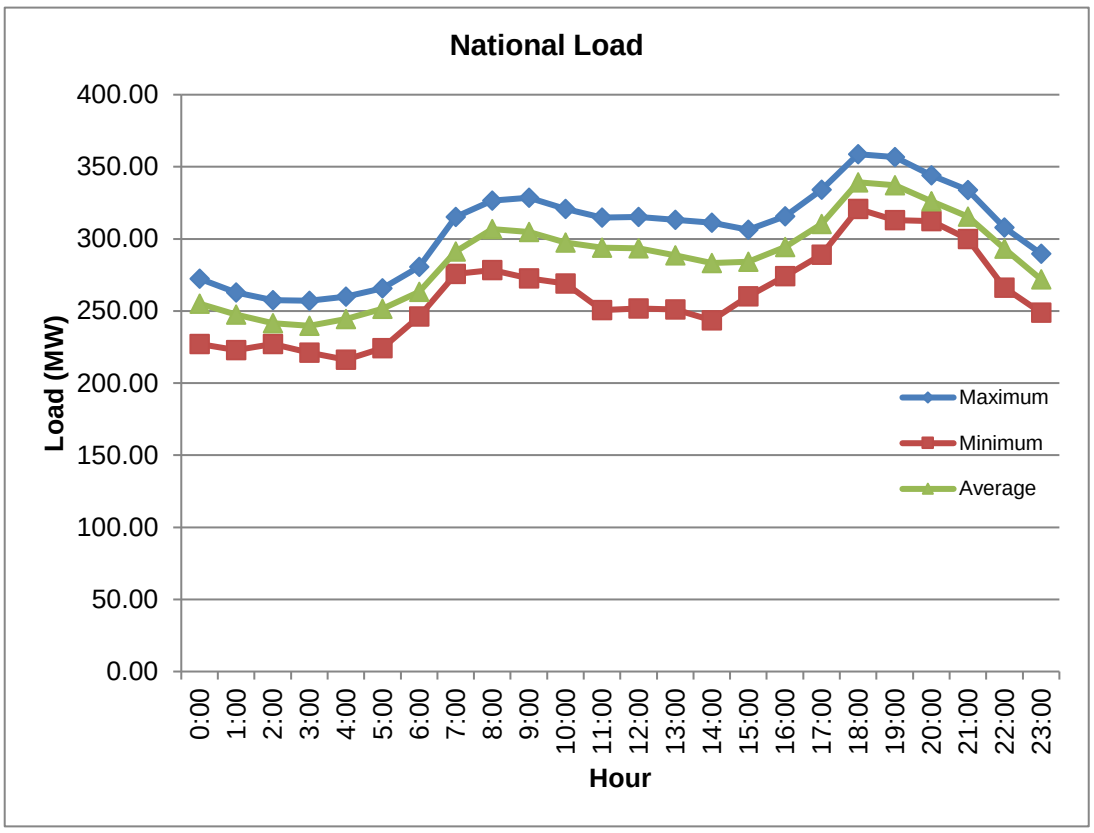


Table: National Demand for December, 2019

| Dec-19 | Max | Min | Ava |
|---|---|---|---|
| 0:00 | 272.29 | 227.17 | 255.15 |
| 1:00 | 262.89 | 222.85 | 247.61 |
| 2:00 | 257.54 | 227.02 | 241.56 |
| 3:00 | 257.13 | 221.08 | 239.74 |
| 4:00 | 259.89 | 216.22 | 244.46 |
| 5:00 | 265.79 | 224.29 | 251.52 |
| 6:00 | 280.53 | 246.23 | 263.21 |
| 7:00 | 315.33 | 275.61 | 291.36 |
| 8:00 | 326.57 | 278.30 | 306.84 |
| 9:00 | 328.61 | 272.69 | 304.88 |
| 10:00 | 320.81 | 269.02 | 297.53 |
| 11:00 | 314.88 | 250.68 | 293.89 |
| 12:00 | 315.22 | 251.67 | 293.38 |
| 13:00 | 313.33 | 251.12 | 288.65 |
| 14:00 | 311.21 | 243.55 | 283.31 |
| 15:00 | 306.25 | 260.16 | 284.17 |
| 16:00 | 315.71 | 274.17 | 294.38 |
| 17:00 | 334.07 | 288.94 | 310.41 |
| 18:00 | 358.73 | 320.75 | 339.25 |
| 19:00 | 356.75 | 312.94 | 337.11 |
| 20:00 | 344.16 | 312.35 | 326.03 |
| 21:00 | 333.84 | 299.91 | 315.36 |
| 22:00 | 307.85 | 266.10 | 293.22 |
| 23:00 | 289.81 | 248.96 | 271.90 |
| | | | |
| | **358.73** | | |
| | | **216.22** | |

Graph: National Demand for December, 2019



**Annexure-III**

Table: Daily maximum, minimum and average frequency for the month of October, 2019

| Oct-19 | Bus Frequency at Semtokha Substation | | | Bus Frequency at Kurichhu Hydropower Plant | | |
|---|---|---|---|---|---|---|
| Date | Max | Min | Ava | Max | Min | Ava |
| 1 | 50.00 | 49.80 | 49.95 | 50.08 | 49.87 | 50.00 |
| 2 | 50.00 | 49.70 | 49.95 | 50.12 | 49.77 | 50.01 |
| 3 | 50.00 | 49.90 | 49.98 | 50.08 | 49.91 | 50.01 |
| 4 | 50.00 | 49.90 | 49.95 | 50.06 | 49.89 | 50.00 |
| 5 | 50.00 | 49.90 | 49.99 | 50.12 | 49.97 | 50.04 |
| 6 | 50.00 | 49.90 | 49.98 | 50.07 | 49.97 | 50.02 |
| 7 | 50.10 | 49.90 | 49.98 | 50.14 | 49.95 | 50.04 |
| 8 | 50.00 | 49.90 | 49.99 | 50.15 | 49.95 | 50.04 |
| 9 | 50.10 | 49.90 | 49.98 | 50.12 | 49.92 | 50.03 |
| 10 | 50.00 | 49.80 | 49.95 | 50.09 | 49.86 | 50.00 |
| 11 | 50.00 | 49.80 | 49.95 | 50.07 | 49.89 | 50.00 |
| 12 | 50.00 | 49.90 | 49.98 | 50.07 | 49.95 | 50.02 |
| 13 | 50.00 | 49.90 | 49.98 | 50.07 | 49.95 | 50.02 |
| 14 | 50.00 | 49.80 | 49.94 | 50.07 | 49.89 | 50.00 |
| 15 | 50.00 | 49.90 | 49.96 | 50.11 | 49.89 | 50.01 |
| 16 | 50.00 | 49.80 | 49.96 | 50.07 | 49.88 | 50.00 |
| 17 | 50.00 | 49.80 | 49.95 | 50.14 | 49.91 | 50.01 |
| 18 | 50.00 | 49.80 | 49.95 | 50.50 | 49.89 | 50.02 |
| 19 | 50.00 | 49.80 | 49.95 | 50.09 | 49.88 | 49.99 |
| 20 | 50.00 | 49.90 | 49.96 | 50.10 | 49.93 | 50.01 |
| 21 | 50.00 | 49.80 | 49.94 | 50.09 | 49.87 | 50.02 |
| 22 | 50.00 | 49.80 | 49.95 | 50.10 | 49.90 | 50.01 |
| 23 | 50.00 | 49.90 | 49.98 | 50.08 | 49.93 | 50.02 |
| 24 | 50.00 | 49.90 | 49.97 | 50.17 | 49.85 | 50.02 |
| 25 | 50.00 | 49.80 | 49.96 | 50.11 | 49.91 | 50.02 |
| 26 | 50.00 | 49.90 | 49.98 | 50.10 | 49.98 | 50.04 |
| 27 | 50.00 | 49.80 | 49.96 | 50.15 | 48.88 | 49.97 |
| 28 | 50.00 | 49.90 | 49.97 | 50.80 | 49.91 | 50.04 |
| 29 | 50.00 | 49.80 | 49.95 | 50.10 | 49.84 | 50.01 |
| 30 | 50.00 | 49.80 | 49.94 | 50.08 | 49.77 | 49.99 |
| 31 | 50.00 | 49.80 | 49.95 | 50.09 | 49.92 | 50.00 |
| **Max** | **50.10** | | | **50.80** | | |
| **Min** | | **49.70** | | | **48.88** | |
| Source: TD (BPC), KHP (DGPC) | | | | | | |

Graph: Daily maximum, minimum and average frequency for the month of October, 2019

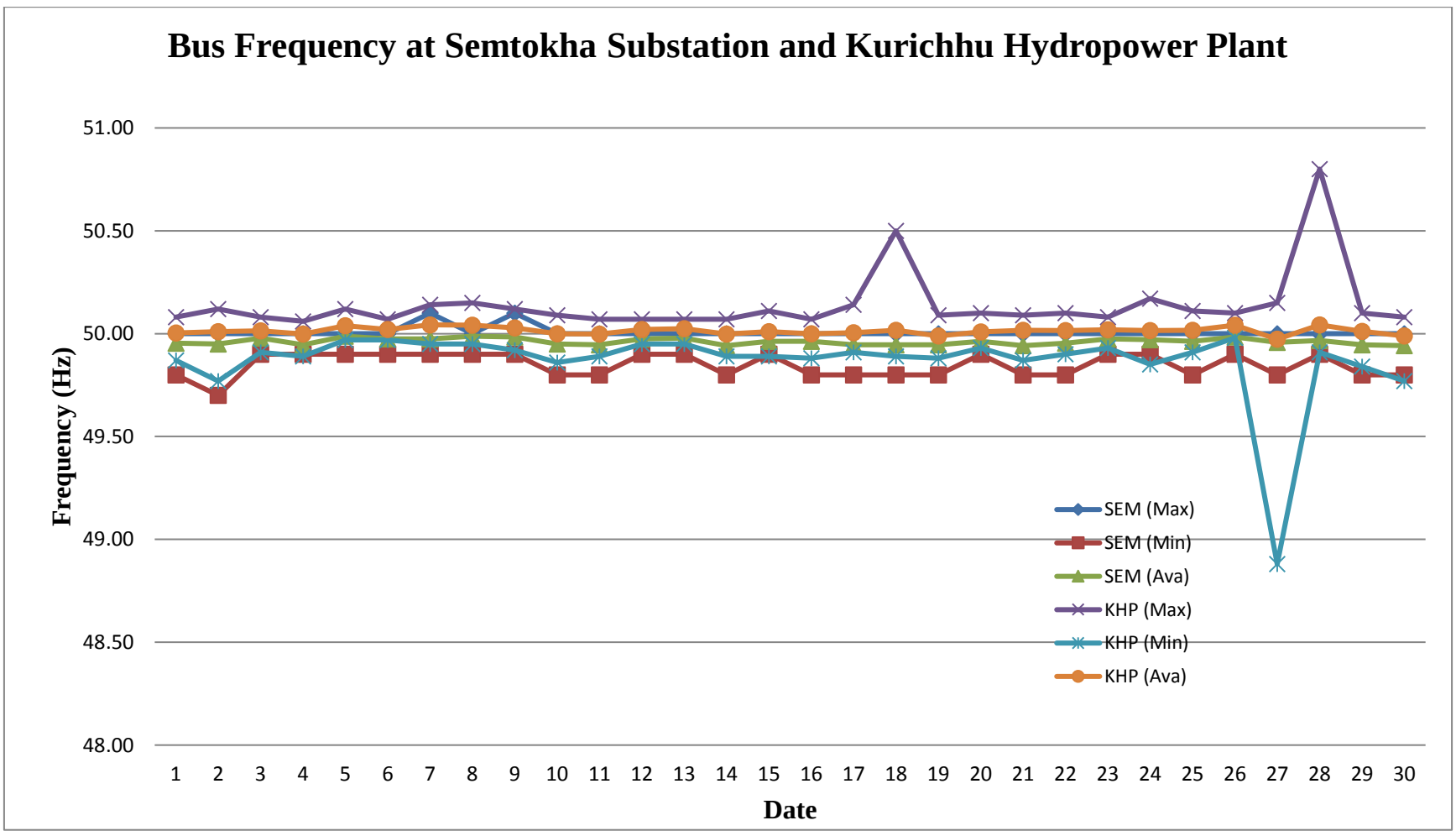


Table: Daily maximum, minimum and average frequency for the month of November, 2019

| Nov-19 | Bus Frequency at Semtokha Substation | | | Bus Frequency at Kurichhu Hydropower Plant | | |
|---|---|---|---|---|---|---|
| Date | Max | Min | Ava | Max | Min | Ava |
| 1 | 50.00 | 49.80 | 49.93 | 50.05 | 49.88 | 49.99 |
| 2 | 50.00 | 49.80 | 49.95 | 50.10 | 49.90 | 50.00 |
| 3 | 50.10 | 49.80 | 49.96 | 50.11 | 49.82 | 50.01 |
| 4 | 50.00 | 49.80 | 49.94 | 50.10 | 49.85 | 49.99 |
| 5 | 50.00 | 49.80 | 49.94 | 50.05 | 49.85 | 49.99 |
| 6 | 50.10 | 49.80 | 49.98 | 50.13 | 49.93 | 50.03 |
| 7 | 50.10 | 49.90 | 49.99 | 50.17 | 49.98 | 50.05 |
| 8 | 50.00 | 49.90 | 49.98 | 50.10 | 49.94 | 50.03 |
| 9 | 50.10 | 49.90 | 49.98 | 50.10 | 49.97 | 50.04 |
| 10 | 50.00 | 49.80 | 49.95 | 50.13 | 49.91 | 50.00 |
| 11 | 50.10 | 49.90 | 49.97 | 50.09 | 49.88 | 50.02 |
| 12 | 50.00 | 49.90 | 49.98 | 50.11 | 49.90 | 50.02 |
| 13 | 50.00 | 49.80 | 49.96 | 50.08 | 49.84 | 50.01 |
| 14 | 50.00 | 49.90 | 49.96 | 50.13 | 49.86 | 50.00 |
| 15 | 50.10 | 49.90 | 49.98 | 50.10 | 49.92 | 50.02 |
| 16 | 50.10 | 49.90 | 49.98 | 50.08 | 49.88 | 50.01 |
| 17 | 50.00 | 49.90 | 49.98 | 50.07 | 49.91 | 50.02 |
| 18 | 50.00 | 49.80 | 49.94 | 50.08 | 49.80 | 50.00 |
| 19 | 50.00 | 49.80 | 49.95 | 50.07 | 49.85 | 49.99 |
| 20 | 50.00 | 49.70 | 49.95 | 50.06 | 49.88 | 50.00 |
| 21 | 50.00 | 49.80 | 49.96 | 50.10 | 49.83 | 50.01 |
| 22 | 50.00 | 49.90 | 49.96 | 50.13 | 49.91 | 50.01 |
| 23 | 50.00 | 49.90 | 49.98 | 50.09 | 49.95 | 50.03 |
| 24 | 50.10 | 49.80 | 49.98 | 50.14 | 49.96 | 50.04 |
| 25 | 50.00 | 49.90 | 49.97 | 50.10 | 49.91 | 50.02 |
| 26 | 50.00 | 49.90 | 49.96 | 50.13 | 49.95 | 50.04 |
| 27 | 50.10 | 49.90 | 49.98 | 50.12 | 49.90 | 50.03 |
| 28 | 50.00 | 49.90 | 49.98 | 50.10 | 49.95 | 50.03 |
| 29 | 50.00 | 49.80 | 49.96 | 50.10 | 49.85 | 50.01 |
| 30 | 50.00 | 49.90 | 49.97 | 50.12 | 49.89 | 49.99 |
| 31 | 0.00 | Error | Error | 0.00 | Error | Error |
| **Max** | **50.10** | | | **50.17** | | |
| **Min** | | **49.70** | | | **49.80** | |
| Source: TD (BPC), KHP (DGPC) | | | | | | |

Graph: Daily maximum, minimum and average frequency for the month of November, 2019

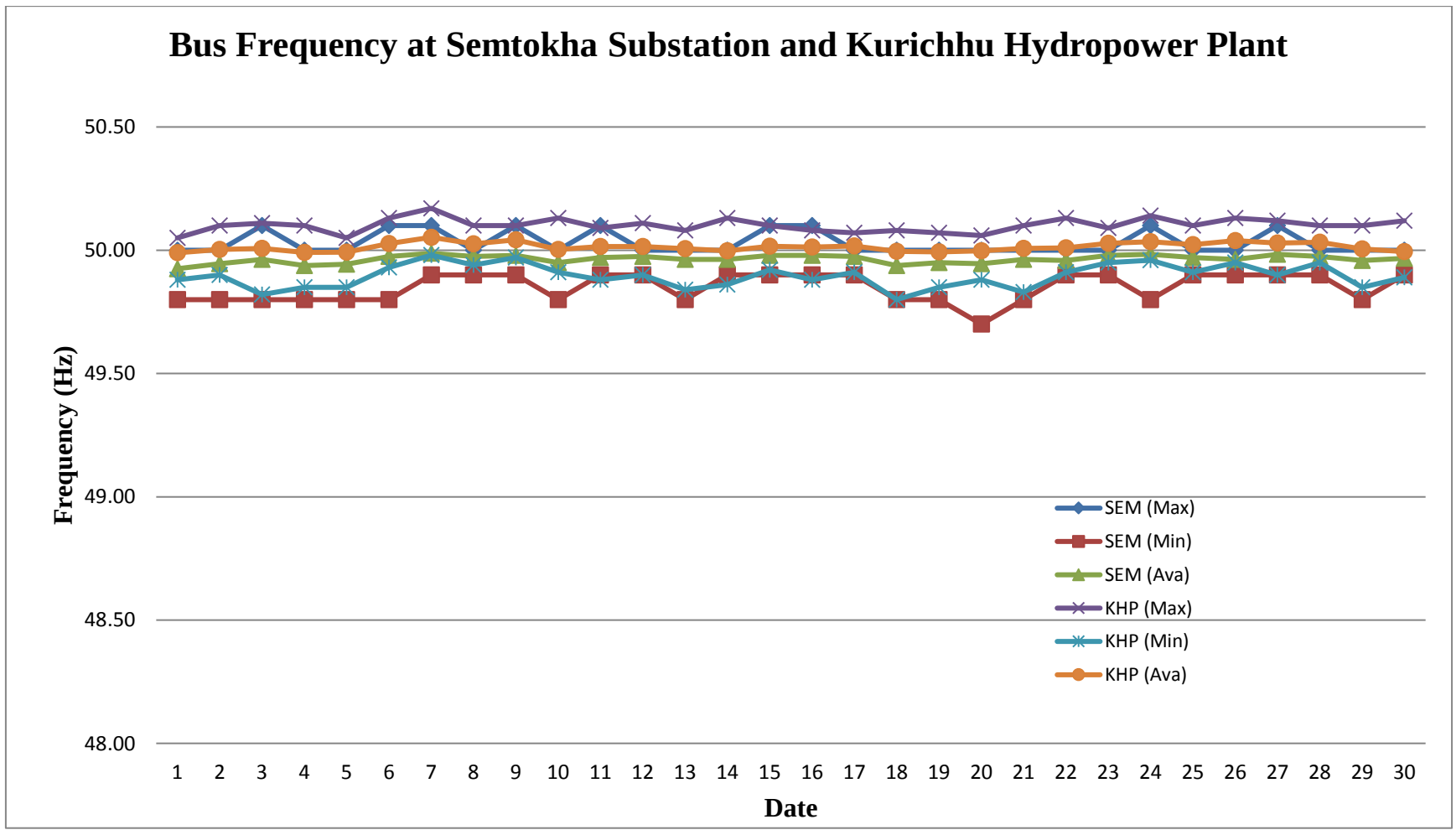
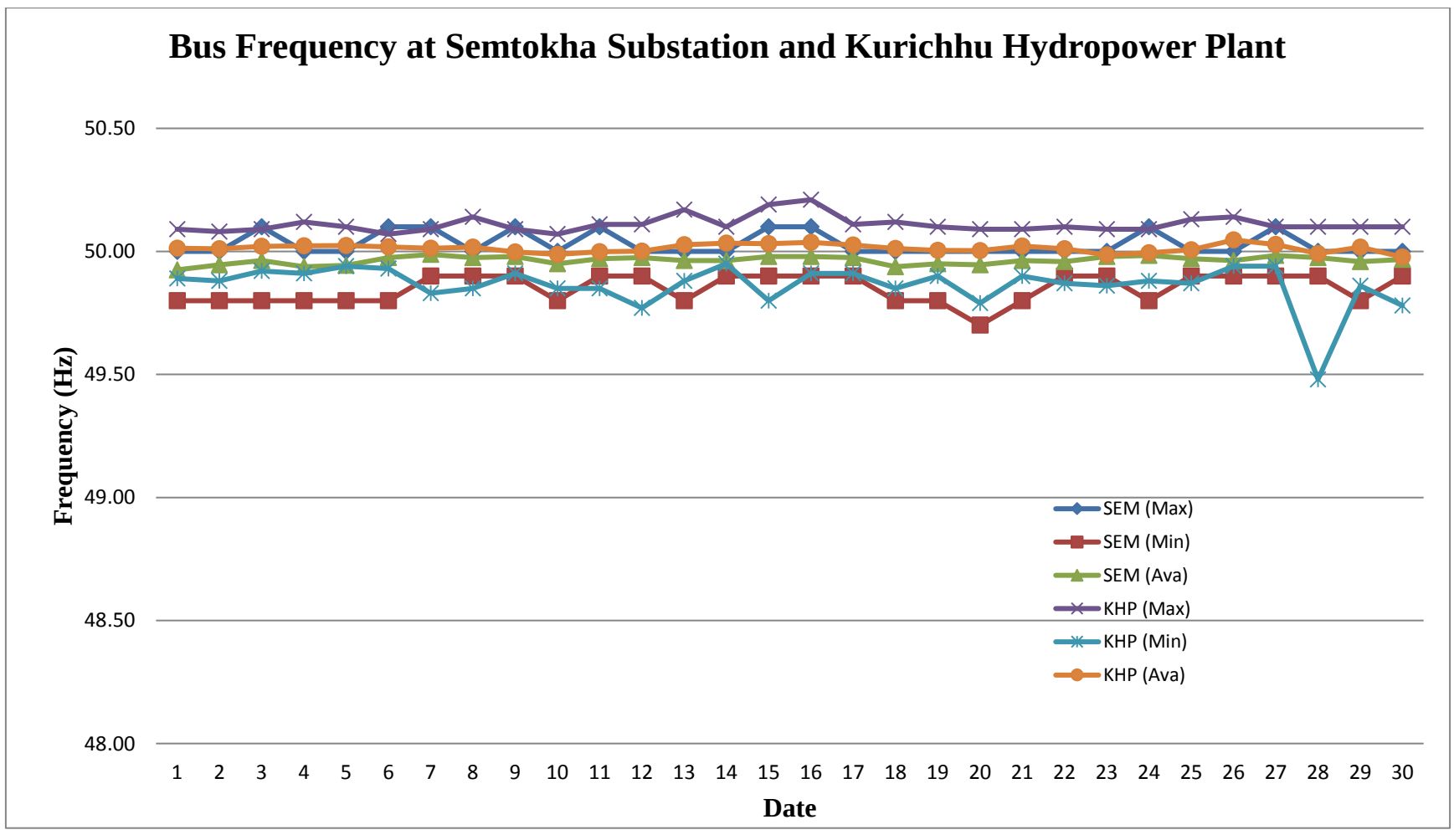


Table: Daily maximum, minimum and average frequency for the month of December, 2019

| Dec-19 | Bus Frequency at Semtokha Substation | | | Bus Frequency at Kurichhu Hydropower Plant | | |
|---|---|---|---|---|---|---|
| Date | Max | Min | Ava | Max | Min | Ava |
| 1 | 50.00 | 49.80 | 49.93 | 50.09 | 49.89 | 50.01 |
| 2 | 50.00 | 49.80 | 49.95 | 50.08 | 49.88 | 50.01 |
| 3 | 50.10 | 49.80 | 49.96 | 50.09 | 49.92 | 50.02 |
| 4 | 50.00 | 49.80 | 49.94 | 50.12 | 49.91 | 50.02 |
| 5 | 50.00 | 49.80 | 49.94 | 50.10 | 49.94 | 50.02 |
| 6 | 50.10 | 49.80 | 49.98 | 50.07 | 49.93 | 50.02 |
| 7 | 50.10 | 49.90 | 49.99 | 50.09 | 49.83 | 50.01 |
| 8 | 50.00 | 49.90 | 49.98 | 50.14 | 49.85 | 50.02 |
| 9 | 50.10 | 49.90 | 49.98 | 50.09 | 49.91 | 50.00 |
| 10 | 50.00 | 49.80 | 49.95 | 50.07 | 49.85 | 49.99 |
| 11 | 50.10 | 49.90 | 49.97 | 50.11 | 49.85 | 50.00 |
| 12 | 50.00 | 49.90 | 49.98 | 50.11 | 49.77 | 50.00 |
| 13 | 50.00 | 49.80 | 49.96 | 50.17 | 49.88 | 50.03 |
| 14 | 50.00 | 49.90 | 49.96 | 50.10 | 49.95 | 50.03 |
| 15 | 50.10 | 49.90 | 49.98 | 50.19 | 49.80 | 50.03 |
| 16 | 50.10 | 49.90 | 49.98 | 50.21 | 49.91 | 50.04 |
| 17 | 50.00 | 49.90 | 49.98 | 50.11 | 49.91 | 50.03 |
| 18 | 50.00 | 49.80 | 49.94 | 50.12 | 49.85 | 50.01 |
| 19 | 50.00 | 49.80 | 49.95 | 50.10 | 49.90 | 50.00 |
| 20 | 50.00 | 49.70 | 49.95 | 50.09 | 49.79 | 50.00 |
| 21 | 50.00 | 49.80 | 49.96 | 50.09 | 49.90 | 50.02 |
| 22 | 50.00 | 49.90 | 49.96 | 50.10 | 49.87 | 50.01 |
| 23 | 50.00 | 49.90 | 49.98 | 50.09 | 49.86 | 49.99 |
| 24 | 50.10 | 49.80 | 49.98 | 50.09 | 49.88 | 49.99 |
| 25 | 50.00 | 49.90 | 49.97 | 50.13 | 49.87 | 50.01 |
| 26 | 50.00 | 49.90 | 49.96 | 50.14 | 49.94 | 50.05 |
| 27 | 50.10 | 49.90 | 49.98 | 50.10 | 49.94 | 50.03 |
| 28 | 50.00 | 49.90 | 49.98 | 50.10 | 49.48 | 49.99 |
| 29 | 50.00 | 49.80 | 49.96 | 50.10 | 49.86 | 50.02 |
| 30 | 50.00 | 49.90 | 49.97 | 50.10 | 49.78 | 49.98 |
| 31 | 0.00 | Error | Error | 50.12 | 49.29 | 49.96 |
| **Max** | **50.10** | | | **50.21** | | |
| **Min** | | **49.70** | | | **49.29** | |
| Source: TD (BPC), KHP (DGPC) | | | | | | |

Graph: Daily maximum, minimum and average frequency for the month of December, 2019



**Annexure-IV**

Table: Daily maximum, minimum and average Voltage for the month of October, 2019

| Oct-19 | Malbase Substation | | | | | | | | | Nangkhor Substation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 400kV Bus Voltage (kV) | | | 220kV Bus Voltage (kV) | | | 66kV Bus Voltage (kV) | | | 132kV Bus Voltage (kV) | | |
| Date | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava |
| 1 | 412.00 | 406.50 | 410.17 | 227.00 | 222.50 | 224.71 | 67.00 | 66.00 | 66.58 | 136.70 | 130.30 | 134.59 |
| 2 | 410.50 | 401.00 | 407.50 | 225.50 | 219.00 | 222.75 | 67.00 | 64.00 | 65.58 | 136.90 | 131.30 | 134.03 |
| 3 | 409.50 | 401.50 | 405.69 | 223.50 | 220.00 | 222.17 | 66.00 | 65.00 | 65.38 | 137.50 | 131.50 | 133.50 |
| 4 | 406.50 | 400.00 | 403.83 | 222.50 | 219.50 | 221.08 | 66.00 | 64.00 | 65.21 | 134.80 | 130.00 | 132.73 |
| 5 | 407.50 | 404.50 | 405.46 | 225.00 | 221.50 | 222.75 | 66.00 | 64.00 | 65.13 | 136.30 | 131.90 | 134.42 |
| 6 | 414.00 | 403.00 | 408.52 | 225.50 | 220.00 | 222.65 | 67.00 | 64.00 | 65.17 | 135.80 | 131.12 | 134.36 |
| 7 | 413.50 | 407.50 | 410.88 | 226.00 | 223.00 | 224.63 | 67.00 | 65.00 | 66.08 | 136.31 | 132.10 | 134.48 |
| 8 | 412.50 | 406.50 | 410.69 | 225.00 | 222.50 | 224.40 | 67.00 | 65.00 | 66.13 | 136.20 | 132.50 | 134.68 |
| 9 | 413.00 | 407.50 | 410.42 | 226.00 | 223.00 | 224.92 | 67.00 | 66.00 | 66.42 | 135.40 | 131.95 | 134.13 |
| 10 | 412.50 | 405.00 | 409.25 | 226.00 | 222.00 | 223.96 | 67.00 | 66.00 | 66.38 | 136.30 | 131.12 | 134.27 |
| 11 | 413.50 | 404.50 | 408.96 | 227.00 | 221.50 | 224.29 | 67.00 | 65.00 | 66.17 | 136.50 | 131.12 | 134.28 |
| 12 | 414.50 | 405.50 | 410.81 | 227.50 | 222.00 | 224.77 | 68.00 | 66.00 | 66.58 | 137.70 | 131.90 | 134.10 |
| 13 | 415.50 | 405.50 | 410.79 | 227.00 | 222.00 | 224.96 | 67.00 | 66.00 | 66.50 | 135.70 | 131.50 | 134.18 |
| 14 | 414.50 | 407.00 | 411.40 | 226.00 | 222.00 | 224.67 | 67.00 | 65.00 | 66.08 | 135.70 | 130.00 | 133.40 |
| 15 | 415.50 | 405.50 | 411.19 | 228.00 | 222.00 | 224.52 | 67.00 | 66.00 | 66.38 | 135.90 | 130.60 | 133.64 |
| 16 | 415.50 | 403.50 | 410.88 | 228.00 | 221.50 | 225.00 | 68.00 | 65.00 | 66.42 | 135.60 | 130.29 | 133.70 |
| 17 | 415.50 | 405.50 | 410.60 | 227.00 | 221.00 | 224.08 | 67.00 | 65.00 | 66.00 | 136.11 | 130.20 | 133.69 |
| 18 | 415.50 | 404.00 | 411.42 | 227.00 | 220.50 | 224.42 | 67.00 | 65.00 | 66.00 | 136.70 | 130.20 | 134.06 |
| 19 | 416.50 | 404.50 | 411.10 | 228.00 | 221.00 | 224.81 | 67.00 | 65.00 | 66.04 | 135.90 | 131.50 | 134.33 |
| 20 | 414.50 | 405.50 | 411.75 | 226.00 | 219.50 | 224.40 | 66.00 | 65.00 | 65.79 | 135.40 | 131.50 | 134.13 |
| 21 | 417.50 | 405.50 | 412.96 | 228.00 | 221.00 | 225.33 | 67.00 | 65.00 | 66.21 | 136.30 | 132.37 | 135.02 |
| 22 | 416.50 | 408.50 | 413.42 | 227.00 | 222.50 | 225.56 | 67.00 | 65.00 | 66.17 | 135.80 | 131.32 | 134.18 |
| 23 | 417.00 | 405.50 | 413.08 | 227.00 | 221.50 | 225.38 | 67.00 | 66.00 | 66.38 | 135.90 | 131.74 | 134.64 |
| 24 | 418.50 | 409.50 | 414.02 | 228.00 | 223.50 | 225.90 | 67.00 | 65.00 | 66.29 | 135.90 | 132.50 | 134.75 |
| 25 | 419.00 | 408.50 | 414.17 | 228.50 | 222.00 | 225.83 | 67.00 | 65.00 | 66.00 | 136.50 | 132.90 | 135.17 |
| 26 | 417.50 | 409.50 | 414.42 | 229.00 | 223.00 | 226.38 | 67.00 | 65.00 | 66.13 | 137.10 | 131.33 | 134.67 |
| 27 | 416.50 | 409.50 | 414.33 | 228.00 | 224.00 | 226.71 | 67.00 | 65.00 | 66.33 | 135.90 | 132.10 | 134.43 |
| 28 | 418.00 | 410.00 | 415.54 | 229.00 | 224.00 | 227.67 | 67.00 | 66.00 | 66.83 | 135.70 | 131.70 | 134.39 |
| 29 | 418.00 | 408.00 | 413.96 | 230.00 | 224.50 | 227.23 | 68.00 | 66.00 | 66.71 | 136.10 | 133.40 | 134.89 |
| 30 | 414.50 | 406.50 | 412.04 | 228.00 | 224.00 | 226.35 | 67.00 | 66.00 | 66.71 | 135.90 | 131.33 | 133.87 |
| 31 | 416.00 | 406.00 | 411.79 | 228.00 | 222.50 | 225.79 | 68.00 | 65.00 | 66.42 | 136.20 | 130.70 | 134.37 |
| **Max** | **419.00** | | | **230.00** | | | **68.00** | | | **137.70** | | |
| **Min** | | **400.00** | | | **219.00** | | | **64.00** | | | **130.00** | |
| Source: TD, BPC | | | | | | | | | | | | |

Graph: Daily maximum, minimum and average Voltage for the month of October, 2019

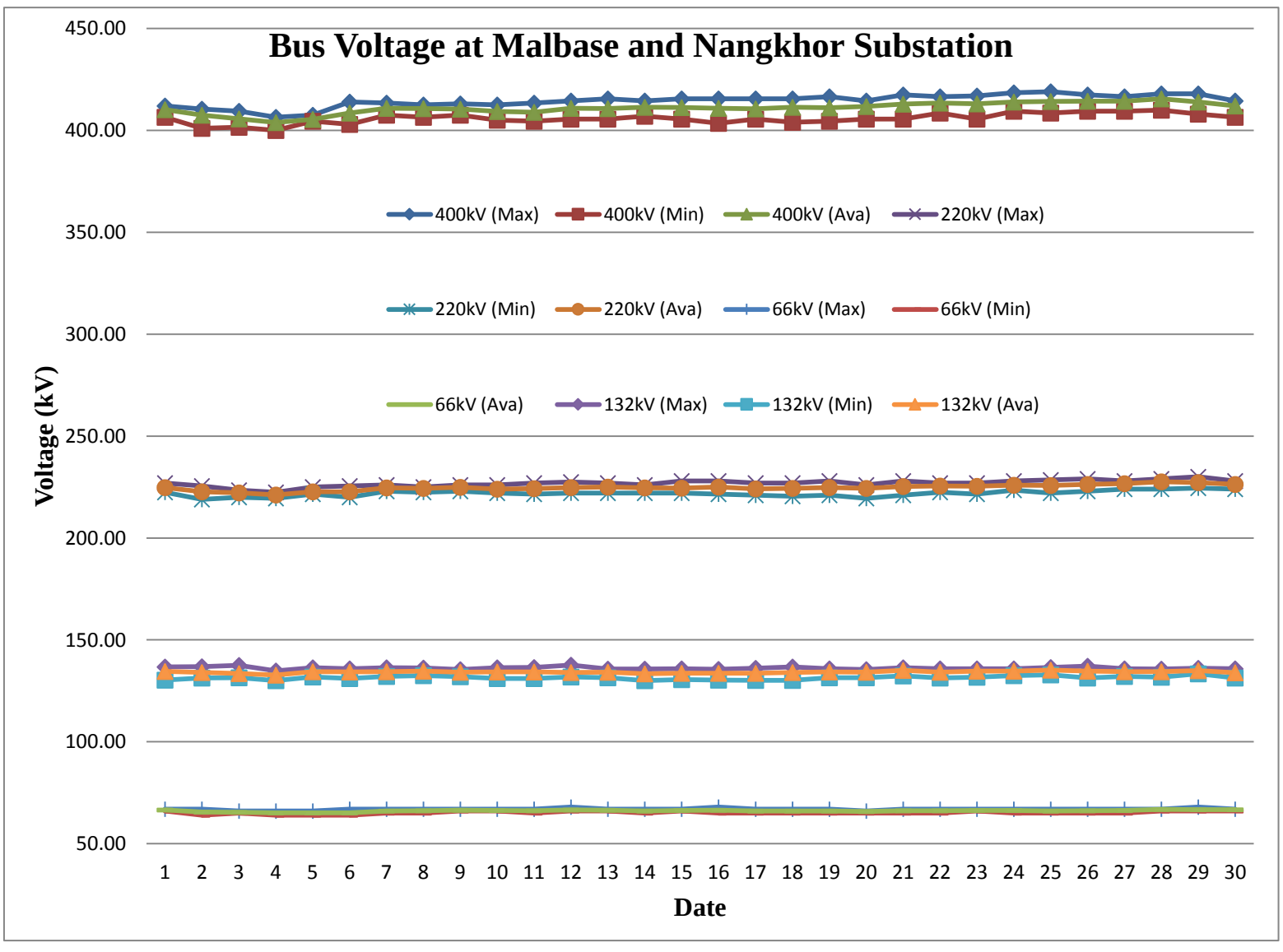


Table: Daily maximum, minimum and average Voltage for the month of November, 2019

| Nov-19 | Malbase Substation | | | | | | | | | Nangkhor Substation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 400kV Bus Voltage (kV) | | | 220kV Bus Voltage (kV) | | | 66kV Bus Voltage (kV) | | | 132kV Bus Voltage (kV) | | |
| Date | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava |
| 1 | 415.50 | 400.50 | 408.79 | 227.50 | 220.00 | 224.25 | 66.00 | 65.00 | 65.88 | 136.30 | 130.00 | 134.41 |
| 2 | 411.50 | 401.50 | 407.96 | 227.50 | 220.00 | 224.83 | 67.00 | 64.00 | 66.21 | 136.10 | 130.70 | 133.88 |
| 3 | 416.50 | 408.00 | 413.29 | 229.00 | 221.50 | 226.17 | 67.00 | 65.00 | 66.29 | 136.10 | 132.50 | 134.71 |
| 4 | 414.50 | 401.50 | 410.46 | 228.00 | 221.00 | 225.17 | 67.00 | 65.00 | 66.00 | 135.90 | 130.00 | 134.12 |
| 5 | 413.50 | 405.00 | 410.58 | 228.00 | 221.00 | 224.94 | 67.00 | 65.00 | 66.08 | 136.30 | 132.20 | 134.57 |
| 6 | 413.00 | 403.50 | 409.92 | 226.50 | 220.50 | 224.19 | 67.00 | 65.00 | 65.92 | 136.90 | 131.91 | 134.37 |
| 7 | 414.50 | 404.50 | 410.42 | 228.00 | 221.00 | 224.52 | 67.00 | 65.00 | 65.96 | 137.10 | 131.70 | 134.26 |
| 8 | 414.00 | 402.00 | 409.54 | 227.50 | 219.00 | 223.75 | 67.00 | 64.00 | 65.92 | 135.60 | 130.20 | 133.54 |
| 9 | 414.00 | 405.50 | 410.67 | 227.50 | 221.00 | 224.44 | 67.00 | 65.00 | 65.88 | 136.10 | 131.10 | 134.13 |
| 10 | 414.50 | 402.50 | 409.73 | 227.50 | 221.00 | 224.44 | 67.00 | 65.00 | 66.13 | 136.31 | 131.10 | 133.91 |
| 11 | 413.00 | 402.50 | 409.31 | 227.00 | 218.50 | 223.56 | 67.00 | 64.00 | 65.67 | 136.10 | 130.50 | 133.79 |
| 12 | 414.50 | 402.50 | 408.75 | 227.00 | 220.50 | 223.52 | 67.00 | 65.00 | 65.75 | 135.70 | 131.30 | 133.95 |
| 13 | 414.50 | 402.00 | 409.81 | 227.00 | 221.00 | 224.29 | 67.00 | 65.00 | 66.33 | 136.50 | 130.00 | 134.01 |
| 14 | 414.00 | 402.50 | 409.63 | 227.00 | 220.50 | 223.63 | 67.00 | 64.00 | 65.92 | 136.10 | 131.53 | 134.20 |
| 15 | 415.50 | 403.50 | 409.19 | 227.00 | 220.00 | 223.06 | 67.00 | 64.00 | 65.92 | 137.10 | 128.80 | 133.73 |
| 16 | 414.00 | 401.50 | 408.35 | 226.50 | 220.00 | 223.48 | 67.00 | 64.00 | 65.67 | 135.90 | 129.80 | 133.24 |
| 17 | 413.50 | 405.50 | 410.71 | 226.00 | 220.50 | 223.96 | 66.00 | 65.00 | 65.75 | 136.31 | 131.30 | 133.74 |
| 18 | 415.00 | 403.50 | 408.63 | 227.00 | 220.00 | 223.35 | 67.00 | 65.00 | 65.63 | 136.70 | 130.90 | 133.89 |
| 19 | 414.00 | 404.50 | 408.79 | 227.00 | 221.00 | 224.21 | 67.00 | 65.00 | 65.67 | 136.30 | 130.70 | 133.97 |
| 20 | 413.50 | 406.50 | 409.83 | 227.00 | 221.50 | 224.33 | 67.00 | 65.00 | 66.08 | 136.50 | 132.90 | 134.46 |
| 21 | 414.00 | 406.50 | 410.50 | 227.00 | 222.00 | 224.81 | 67.00 | 65.00 | 66.38 | 137.10 | 131.95 | 134.82 |
| 22 | 415.50 | 405.00 | 410.46 | 228.00 | 221.00 | 224.60 | 67.00 | 65.00 | 65.88 | 136.30 | 131.50 | 134.51 |
| 23 | 415.00 | 405.50 | 411.35 | 228.00 | 222.50 | 225.56 | 68.00 | 65.00 | 66.38 | 136.70 | 130.00 | 134.16 |
| 24 | 415.00 | 406.50 | 411.17 | 227.50 | 222.00 | 224.83 | 67.00 | 65.00 | 65.92 | 135.69 | 131.50 | 133.63 |
| 25 | 417.50 | 407.00 | 413.06 | 229.00 | 222.00 | 225.52 | 67.00 | 65.00 | 66.00 | 136.50 | 131.70 | 134.02 |
| 26 | 417.00 | 405.50 | 411.31 | 227.00 | 219.50 | 223.88 | 67.00 | 64.00 | 65.79 | 136.30 | 130.40 | 134.09 |
| 27 | 416.00 | 400.50 | 409.10 | 228.00 | 217.50 | 223.29 | 67.00 | 64.00 | 65.58 | 137.10 | 131.53 | 134.29 |
| 28 | 415.50 | 398.50 | 408.46 | 228.00 | 216.00 | 222.77 | 67.00 | 63.50 | 65.31 | 137.50 | 131.53 | 134.59 |
| 29 | 417.50 | 405.50 | 412.17 | 227.00 | 219.50 | 223.88 | 67.00 | 64.00 | 65.92 | 136.90 | 131.33 | 134.24 |
| 30 | 415.50 | 404.50 | 410.90 | 228.00 | 220.50 | 223.88 | 67.00 | 65.00 | 66.21 | 136.70 | 130.50 | 134.35 |
| 31 | 0.00 | Error | Error | 0.00 | Error | Error | 0.00 | Error | Error | 0.00 | Error | Error |
| **Max** | **417.50** | | | **229.00** | | | **68.00** | | | **137.50** | | |
| **Min** | | **398.50** | | | **216.00** | | | **63.50** | | | **128.80** | |
| Source: TD, BPC | | | | | | | | | | | | |

Graph: Daily maximum, minimum and average Voltage for the month of November, 2019

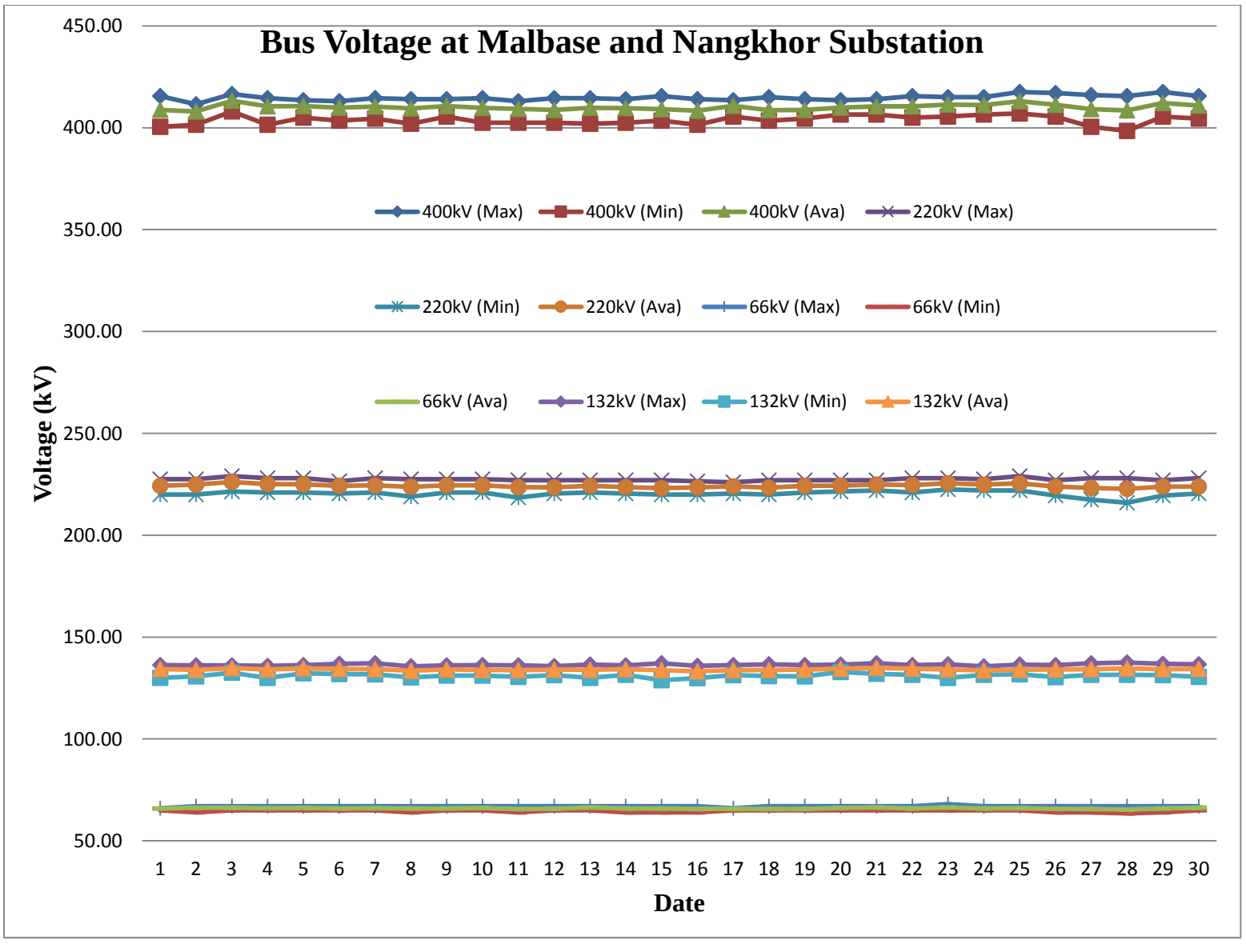
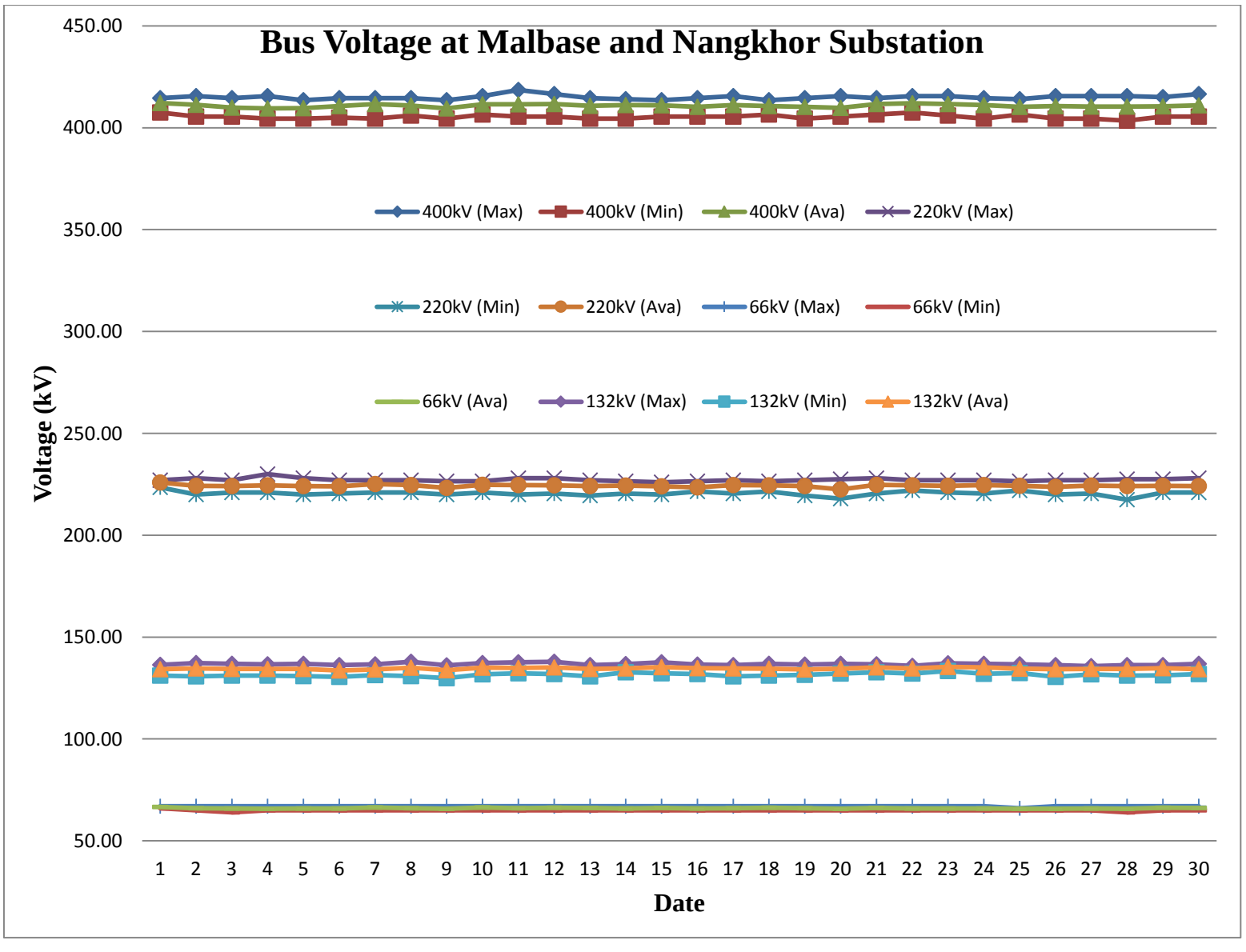


Table: Daily maximum, minimum and average Voltage for the month of December, 2019

| Dec-19 | Malbase Substation | | | | | | | | | Nangkhor Substation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 400kV Bus Voltage (kV) | | | 220kV Bus Voltage (kV) | | | 66kV Bus Voltage (kV) | | | 132kV Bus Voltage (kV) | | |
| Date | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava | Max | Min | Ava |
| 1 | 414.50 | 407.50 | 412.21 | 227.00 | 223.50 | 225.85 | 67.00 | 66.00 | 66.58 | 136.40 | 131.12 | 134.22 |
| 2 | 415.50 | 405.50 | 411.21 | 228.00 | 220.00 | 224.29 | 67.00 | 65.00 | 66.00 | 137.30 | 130.71 | 134.61 |
| 3 | 414.50 | 405.50 | 409.88 | 227.00 | 221.00 | 224.08 | 67.00 | 64.00 | 65.83 | 136.90 | 131.12 | 134.40 |
| 4 | 415.50 | 404.50 | 409.46 | 230.00 | 221.00 | 224.50 | 67.00 | 65.00 | 65.79 | 136.70 | 131.12 | 134.36 |
| 5 | 413.50 | 404.50 | 409.67 | 228.00 | 220.00 | 224.08 | 67.00 | 65.00 | 65.83 | 136.90 | 130.90 | 134.37 |
| 6 | 414.50 | 405.00 | 410.63 | 227.00 | 220.50 | 224.00 | 67.00 | 65.00 | 65.92 | 136.31 | 130.50 | 133.61 |
| 7 | 414.50 | 404.50 | 411.63 | 227.00 | 221.00 | 225.17 | 67.00 | 65.00 | 66.42 | 136.70 | 131.33 | 134.17 |
| 8 | 414.50 | 406.00 | 410.83 | 227.00 | 221.00 | 224.56 | 67.00 | 65.00 | 66.04 | 137.90 | 130.91 | 135.03 |
| 9 | 413.50 | 404.50 | 409.46 | 226.50 | 220.00 | 223.25 | 67.00 | 65.00 | 65.71 | 136.10 | 129.88 | 133.71 |
| 10 | 415.50 | 406.50 | 411.48 | 226.50 | 221.00 | 224.75 | 67.00 | 65.00 | 66.38 | 137.30 | 131.70 | 135.06 |
| 11 | 418.50 | 405.50 | 411.46 | 228.00 | 220.00 | 224.65 | 67.00 | 65.00 | 66.04 | 137.70 | 132.20 | 134.90 |
| 12 | 416.50 | 405.50 | 411.58 | 228.00 | 220.50 | 224.52 | 67.00 | 65.00 | 66.25 | 137.90 | 131.90 | 135.08 |
| 13 | 414.50 | 404.50 | 410.79 | 227.00 | 219.50 | 224.13 | 67.00 | 65.00 | 66.08 | 136.30 | 130.70 | 134.32 |
| 14 | 414.00 | 404.50 | 411.19 | 226.50 | 220.50 | 224.40 | 67.00 | 65.00 | 65.92 | 136.80 | 132.80 | 134.63 |
| 15 | 413.50 | 405.50 | 411.06 | 226.00 | 220.00 | 223.98 | 67.00 | 65.00 | 66.19 | 137.70 | 132.30 | 135.28 |
| 16 | 414.50 | 405.50 | 410.27 | 226.50 | 221.50 | 223.54 | 67.00 | 65.00 | 65.88 | 136.50 | 131.80 | 134.72 |
| 17 | 415.50 | 405.50 | 411.10 | 227.00 | 220.50 | 224.60 | 67.00 | 65.00 | 66.04 | 136.20 | 130.70 | 134.59 |
| 18 | 413.50 | 406.50 | 410.58 | 226.50 | 221.50 | 224.44 | 67.00 | 65.00 | 66.29 | 136.90 | 131.12 | 134.55 |
| 19 | 414.50 | 404.50 | 410.29 | 227.00 | 219.50 | 224.15 | 67.00 | 65.00 | 66.04 | 136.50 | 131.50 | 134.16 |
| 20 | 415.50 | 405.50 | 409.77 | 227.50 | 218.00 | 222.46 | 67.00 | 65.00 | 65.75 | 136.90 | 132.10 | 134.47 |
| 21 | 414.50 | 406.50 | 411.58 | 228.00 | 220.50 | 224.71 | 67.00 | 65.00 | 66.08 | 136.70 | 132.70 | 135.11 |
| 22 | 415.50 | 407.50 | 412.00 | 227.00 | 222.00 | 224.54 | 67.00 | 65.00 | 65.83 | 135.90 | 132.10 | 134.57 |
| 23 | 415.50 | 406.00 | 411.65 | 227.00 | 221.00 | 224.23 | 67.00 | 65.00 | 65.92 | 137.10 | 133.40 | 135.40 |
| 24 | 414.50 | 404.50 | 411.17 | 227.00 | 220.50 | 224.63 | 67.00 | 65.00 | 65.92 | 136.90 | 132.00 | 135.09 |
| 25 | 414.00 | 406.50 | 410.21 | 226.50 | 222.00 | 224.19 | 66.00 | 65.00 | 65.75 | 136.70 | 132.40 | 134.48 |
| 26 | 415.50 | 404.50 | 410.67 | 227.00 | 220.00 | 223.75 | 67.00 | 65.00 | 65.71 | 136.31 | 130.50 | 134.22 |
| 27 | 415.50 | 404.50 | 410.44 | 227.00 | 220.50 | 224.31 | 67.00 | 65.00 | 65.83 | 135.80 | 131.70 | 134.34 |
| 28 | 415.50 | 403.50 | 410.44 | 227.50 | 217.50 | 224.17 | 67.00 | 64.00 | 65.79 | 136.20 | 131.12 | 134.34 |
| 29 | 415.00 | 405.50 | 410.52 | 227.50 | 221.00 | 224.29 | 67.00 | 65.00 | 66.25 | 136.31 | 131.20 | 134.74 |
| 30 | 416.50 | 405.50 | 411.00 | 228.00 | 221.00 | 224.13 | 67.00 | 65.00 | 66.17 | 136.90 | 131.90 | 134.31 |
| 31 | 415.50 | 406.50 | 411.54 | 227.50 | 221.00 | 223.85 | 67.00 | 65.00 | 65.96 | 137.50 | 131.90 | 134.87 |
| **Max** | **418.50** | | | **230.00** | | | **67.00** | | | **137.90** | | |
| **Min** | | **403.50** | | | **217.50** | | | **64.00** | | | **129.88** | |
| Source: TD, BPC | | | | | | | | | | | | |

Graph: Daily maximum, minimum and average Voltage for the month of December, 2019



**Annexure-V**

## Eastern Grid Outages

**October, 2019**

**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 | 12.10.19 | 14:24 | 12.10.19 | 14:40 | 16 | 4.17 | 132kV Kurichu I/C | All O/G fdrs | Nill | Tingtibi | Grid fail | Grid fail at Tingtibi end. |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.10.2019 | 14:24 | 12.10.2019 | 14:40 | 0:16 | 2.68 | 132kV I/C | All Feeders | Nill | Tingtibi end | Grid fail | Grid fail from Tingtibi to Ngalam |

**132/33/11kV, Nangkhor 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 | 12.10.2019 | 14:24 hrs | 12.10.2019 | 14:40 hrs | 16 | -0.82 | Main Grid | All Feeders | - | Tintibi Substation | Grid fail | Supply failed from Tintibi Substation. |
| 2 | 12.10.2019 | 14:29 hrs | 12.10.2019 | 14:41 hrs | 12 | -0.82 | 132kV Nangkor-Nganglam | All Feeders | Start Ø AB, tripped Ø ABC,TOC start,SOTF TOR,AR lockout short>,50.18Hz, | Nangkor-Nganglam line | Tripped on fault | |
| 3 | 12.10.2019 | 14:29 hrs | 12.10.2019 | 15:12 hrs | 43 | 60.66 | 132kV Nangkor-Deothang | All Feeders | Start Ø AB, tripped Ø ABC,TOC start,SOTF TOR,AR lockout short>,50.18Hz | Nangkor-Nganglam line | Tripped on fault | |

**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 | 12.10.2019 | 14:21 | 12.10.2019 | 15:14 | 53 | -59.8 | 132kV Incomer Nangkor fdr | Deothang S/s | Nill | | | Grid fail |
| 2 | 12.10.2019 | 14:21 | 12.10.2019 | 15:14 | 53 | 57.64 | 132kV Motonga fdr | Deothang to Motongia line | Nill | | | Grid fail |

**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 | 12.10.2019 | 14:27 | 12.10.2019 | 14:38 | 11 | 2.44 | 132kV Nangkhor-Nganglam | Nangkhor-Nganglam | Grid fail | Nangkhor-Nganglam line | | |

**132kV, Motanga 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 | 12.10.2019 | 14:22 | 12.10.2019 | 15:14 | 52 | 57.7 | 132kV Deothang Fdr | All Feeders | Nill | Grid fail | | |

**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 | 7.10.2019 | 19:41 | 07.10.2019 | 20:07 | 26 | 136.710 | 400kV MHEP Line 1 | 400kV MHEP Line 1 and MHEP Generation | Bad weather | 86.1 & 86.2 optd. Distance relay 1 and distance relay 2 | main 1=30.9km main 2= 31km | |
| 2 | 7.10.2019 | 19:41 | 08.10.2019 | 19:33 | 52 | 135.990 | 400kV MHEP Line 2 | 400kV MHEP Line 2 | Bad weather | 86.1 & 86.2 optd. Distance relay 1 and distance relay 2 | Not available | |
| 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 | Distace relay main 1 and main 2. | Main1=59.1km main2= 58.2km | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No tripping | | | | | | | | | | | | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 | 10/12/2019 | 14:22 Hrs | 10/12/2019 | 14:29Hrs | 7 | 5.220 | 132kV Tingtibi-Nanglam Fdr. | 132kV Tingtibi-Nanglam Fdr. | Over current | Over current Relay:Start phase ABC,Trip phase:B,O/C trip > 1,IA-305.2,IB-331.4A,IC-307.6 A.IN Measured:7.640,IN derived:7.565A. | 132kV Tingtibi-Nanglam Fdr. | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**November, 2019**

**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 | 12.11.19 | 14:24 | 12.11.19 | 14:40 | 0:16 | 4.17 | 132kV Kurichu I/C | All O/G fdrs | NA | Nill | Tingtibi | Grid fail at Tingtibi end. |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.11.2019 | 14:24 | 12.11.2019 | 14:40 | 0:16 | 2.68 | 132kV I/C | All Feeders | Tripped on Fault | Nill | Tingtibi end | Grid fail from Tingtibi to Ngalam |

**132/33/11kV, Nangkhor 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 | 12.11.2019 | 14:24 hrs | 12.11.2019 | 14:40 hrs | 0:16 | -0.82 | Main Grid | All Feeders | Tripped on fault | - | Tintibi Substation | Supply failed from Tintibi Substation. |
| 2 | 12.11.2019 | 14:29 hrs | 12.11.2019 | 14:41 hrs | 0:12 | -0.82 | 132kV Nangkor-Nganglam | All Feeders | Tripped on fault | Start Ø AB, tripped Ø ABC,TOC start,SOTF TOR,AR lockout short>,50.18Hz | Nangkor-Nganglam line | |
| 3 | 12.11.2019 | 14:29 hrs | 12.11.2019 | 15:12 hrs | 0:43 | 60.66 | 132kV Nangkor-Deothang | All Feeders | Tripped on fault | Start Ø AB, tripped Ø ABC,TOC start,SOTF TOR,AR lockout short>,50.18Hz | Nangkor-Nganglam line | |

**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 | 12.11.2019 | 14:21 | 12.11.2019 | 15:14 | 0:53 | -59.8 | 132kV Incomer Nangkor fdr | Deothang S/s | Tripped on fault | Nill | Tingtibi end | Grid failed from Tingtibi S/s and at our end all breaker are in normal condition. |
| 2 | 12.11.2019 | 14:21 | 12.11.2019 | 15:14 | 0:53 | 57.64 | 132kV Motonga fdr | Deothang to Motongia line | Tripped on fault | Nill | Tingtibi end | Grid failed from Tingtibi S/s and at our end all breaker are in normal condition. |

**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 | 12.11.2019 | 14:27 | 12.11.2019 | 14:38 | 0:11 | 2.44 | 132kV Nangkhor-Nganglam | Nangkhor-Nganglam | Tripped on fault | 86opted. | Nangkhor-Nganglam line | Tripped Value; IA-69.34A IB-98.04A IC-156. |

**132kV, Motanga 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 | 12.11.2019 | 14:22 | 12.11.2019 | 15:14 | 0:52 | 57.7 | 132kV Deothang Fdr | All Feeders | Tripped on fault | Nill | Tingtibi end | Grid failed from Tingtibi end. |

**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<br>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<br>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 | Jigmling-Tsirang Line | 3Phase Fault | Main1: R,Y &Bph Trip<br>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<br>Main-2: Relay General trip | | |
| 6 | 13.11.2019 | 14:34hrs | 13.11.2019 | 15:15hrs | 41 | 0.71 | Jigmeling-Dagapela | Dagapela Substation | 3Phase Fault | Main1: R,Y &Bph Trip<br>Main-2: Relay General trip | | |
| 7 | 13.11.2019 | 15:58hrs | 13.11.2019 | 16:19hrs | 21 | -87.59 | Jigmeling-Tsirang | Jigmling-Tsirang Line | 3Phase Fault | Main1: R,Y &Bph Trip<br>Main-2: Relay General trip | | |
| 8 | 13.11.2019 | 15:58hrs | 13.11.2019 | 16:19hrs | 21 | 0.99 | Jigmeling-Dagapela | Dagapela Substation | 3Phase Fault | Main1: R,Y &Bph Trip<br>Main-2: Relay General trip | | |
| 9 | 13.11.2019 | 15:58hrs | 13.11.2019 | 19:48hrs | 50 | 15.31 | Jigmeling-Tingtibi | Tingtibi Substation | 3Phase Fault | Main1: R,Y &Bph Trip<br>Main-2: Relay General trip | main I= 27.8km | |

**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 | 13.11.2019 | 14:34hrs | 13.11.2019 | 15:03hrs | 29 | 17.5 | 220kV Tsirang-Jigmeling Line | Dhajay Subsation | Over Voltage | | Line segnment | |
| 2 | 13.11.2019 | 14:34hrs | 13.11.2019 | 15:03hrs | 29 | 37.4 | 220kV Tsirang-DHPC Line | Dhajay Subsation | Over Voltage | | Line segnment | |
| 3 | 13.11.2019 | 15:58hrs | 13.11.2019 | 16:17hrs | 19 | 87.4 | 220kV Tsirang-Jigmeling Line | Dhajay Subsation | Over Voltage | | Line segnment | |
| 4 | 13.11.2019 | 15:58hrs | 13.11.2019 | 16:15hrs | 17 | 61.9 | 220kV Tsirang-DHPC Line | Dhajay Subsation | Over Voltage | | Line segnment | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No tripping | | | | | | | | | | | | |

**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 | 11/13/2019 | 15:57 Hrs | 11/13/2019 | 16:04Hrs | 7 | 54.000 | 132kV Tingtibi-Nanglam Fdr. | 132kV Tingtibi-Nanglam Fdr. | Over current | Over current Relay:Start phase ABC,Trip phase:B | 132kV Tingtibi-Nanglam Fdr. | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No tripping | | | | | | | | | | | | |

**December, 2019**

**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 opperated | 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 opperated | 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 opperated | corlung | Tripped on fault |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17.12.2019 | 7:01 | 17.12.2019 | 7:25 | 0:24 | 4.98 | 132kV Incomer | Kanglung ss | incomer fail | Nill | Kurichu end | Tripped on fault |

**132/33/11kV, Nangkhor 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 | 08.12.2019 | 04:18 hrs | 08.12.2019 | 04:25 hrs | 7 | 8.89 | Main Grid | All 33kV & 11kV feeders | Tripped on fault | - | MHEP | Tripped on fault |

**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 | 03.12.2019 | 6:52 | 03.12.2019 | 6:57 | 5 | 1.12 | 132/33kV 5MVA Transformer I & II | All 33and 11kV Feeders | Tripped on fault | O/C&E/C | unknown | |
| 2 | 10.12.2019 | 16:45 | 10.12.2019 | 16:50 | 5 | 0.83 | 132/33 5MVA Transformer I & II | All 33and 11kV Feeders | Bamboo fall on the conductor | Only 86 relay opeted | S/Jongkhar Hig School | |

**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 | 31.12.2019 | 14:41 | 31.12.2019 | 14:44 | 3 | 0.378 | 5MVA Tr-I( HV side) | 5MVA Tr-I( HV side) | Conductor snapped | EF | 33kV Druk GYP Fdr | |
| 2 | 31.12.2019 | 14:41 | 31.12.2019 | 18:02 | 21 | 0.231 | 5MVA Tr-II( LV side) | 5MVA Tr-II( LV side) | Conductor snapped | EF | 33kV Druk GYP Fdr | |

**132kV, Motanga 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 | 5/12/2019 | 16:57hrs | 5/12/2019 | 18:34hrs | 37 | | MHPA Line-II | MHPA Line & Jigmeling ss | Over Voltage | Main-I & Main-II R, Y, Bph 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No tripping | | | | | | | | | | | | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No tripping | | | | | | | | | | | | |

**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 | 1 | 12/8/2019 | 04:15 Hrs | 12/8/2019 | 15:11Hrs | 56 | 4.000 | 132kV Grid Fail | 132kV Grid Fail | - | - | 132kV Gird |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**Annexure-VI**

## Western grid Outages

**October, 2019**

**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 | 14.10.2019 | 6:01 | 14.10.2019 | 6:18 | 17 | 13 | 200MVA ICT | 200MVA ICT | Tripped | 67(H.V), O/C Optd. | | |
| 2 | 14.10.2019 | 6:01 | 14.10.2019 | 6:21 | 20 | 154 | 220kV Malbase - Chhukha Feeder | 220kV Malbase - Chhukha Feeder | Tripped | Distance start,Distance Trip A,B,C.Zone 1 Trip, IL3=456.1A. | fault loop=L1-L2,Distance=13.68km | |

**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 | 04.10.2019 | 14:53 | 04.10.2019 | 15:02 | 9 | - | 66kv Bus Coupler | 66kv Bus Coupler | Tripped | Relay general trip, time overcurrent trip, IEp Trip.<br>Trip Values:<br>IL1 = 0.44kA<br>IL2 = 0.34A<br>IL3 = 0.29kA | | |
| 2 | 04.10.2019 | 14:53 | 04.10.2019 | 15:03 | 10 | 25 | 66kV Bhutan Concast Feeder | 66kV Bhutan Concast Feeder | Tripped | Relay general trip, Directional time overcurrent trip, IEp directional Trip.<br>Trip Values:<br>IL1 = 0.06kA<br>IL2 = 0.10kA<br>IL3 = 0.14kA | | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 07.10.2019 | 17:40 | 07.10.2019 | 17:54 | 14 | -6.67 | 66kV Chukha-Pling | 66kV Pling-Gedu section | Tripped | 186,86 | Substation | |
| 2 | 14.10.2019 | 6:03 | 14.10.2019 | 6:20 | 17 | 2.37 | 66kV Pling-Gomtu fdr | 66kV Pling-Gomtu fdr | Overcurrent | IA-280.2A, IB-280.7A, IC-25.94, VAB-52.1kV, VBC-62.70kV, VCA-59.08kV, 86 & 186. | Line | |

**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 | 14.10.2019 | 06:03 | 14.10.2019 | 06:20 | 17 | 1.27 | 66kV Pling feeder | Nil | Over current | 51 IDMT O/C | Line segment | |

**220/66/33kV Dhamdum 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Gedu 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 | 07.10.2019 | 17:38 | 07.10.2019 | 17:53 | 15 | 2.420 | 66kV Chukha-P/ling fdr. | Whole Gedu blackout. | Tripped from Chukha. | 1. Distance protection relay. 2.Master tripping relay 86. 3.General Zone-1. 4.PU time-82ms. 5.Trip time-0ms. 6.Distance-18.3km. 7.EF-pickup. | Line segment | |
| 2 | 10.10.2019 | 7:19 | 10.10.2019 | 7:20 | 1 | 0.340 | 8MVA 66/33kV transfomer | 33kV Gurungdara feeder-I | | Differential relay and tripping relay 86. | Line segment | |

**66/33/11kV Lobeysa 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No tripping | | | | | | | | | | | | |

**220/66/11kV Semtokha 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Dechenchholing 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33kV Olakha 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Jemina 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Paro 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/11kV Haa 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 | 04.10.2019 | 16:00 | 04:10.2 | 16:03 | 3minutes | -1.25 | 66kV Incomer | All feeders | Unknown | Nil | Chumdo switching station. | |
| 2 | 26.10.2019 | 11:20 | 26.10.2019 | 11:40 | 20minutes | -1.71 | 66kV Incomer | All feeders | Unknown | Nil | Chumdo switching station. | |
| 3 | 28.10.2019 | 9:54 | 28.10.2019 | 10:02 | 8minutes | -1.9 | 66kV Incomer | All feeders | Grid fail | Nil | Chhukha power house | |

**66/33kV Watsa 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 | 10/28/2019 | 9:53hrs | 10/28/2019 | 9:59hrs | 6min | .350MW | 66kV Incommer | Feeder I and II | 66kV incommer fail from chukha end | 66kV incommer fail from chukha end | 66kV incommer fail from chukha end | |

**November, 2019**

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**220/66/33kV Dhamdum 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Gedu 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 | 09.11.2019 | 10:15 | 09.11.2019 | 10:20 | | 5 | 0.640 | | 6MVA 66/11kV Tr-I | | | |
| 2 | 09.11.2019 | 10:15 | 09.11.2019 | 10:20 | | 5 | 0.640 | | 6MVA 66/11kV Tr-II | | | |

**66/33/11kV Lobeysa 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No tripping | | | | | | | | | | | | |

**220/66/11kV Semtokha 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Dechenchholing 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33kV Olakha 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 | 11/11/2019 | 14:33 | 11/11/2019 | 14:36 | 3 | 6.60 | 66/33kV 20MVA Transformer I | All 33KV out going feeder | Differential Protection ,Over current and Earth fault protection | | | |

**66/33/11kV Jemina 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 | 10.11.2019 | 1420hrs | 10.11.2019 | 1425hrs | 5min | 2.05MW | 66KV O/G Pangbasa Feeder | Pangbasa Substation | Transient Fault | C.B open, Main II optd | Chumdo substation | |
| 2 | | 1429hrs | | 1459hrs | 30min | | | | | | | |
| 3 | 16.11.2019 | 1429hrs | 16.11.2019 | 1434hrs | 5min | 1.94MW | | | | O/C on R,Y,B | | |
| 4 | | 1447hrs | | 1520hrs | 33min | | | | | | | |
| 5 | | 1544hrs | | 1550hrs | 6min | | | | | | | |
| 6 | | 1817hrs | | 1833hrs | 16min | 3.07MW | | | | | | |
| 7 | 19.11.2019 | 1806hrs | 19.11.2019 | 1823hrs | 17min | 3.27MW | | | | | | |

**66/33/11kV Paro 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/11kV Haa 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 | 19.11.2019 | 17:56 | 19.11.2019 | 18:00 | 4minutes | -1.54 | 66kV Incomer | All feeders | Unknown | O/C | Chumdo switching station. | |
| 2 | 19.11.2019 | 18:06 | 19.11.2019 | 18:23 | 17minutes | -2.75 | 66kV Incomer | All feeders | Unknown | O/C in R&BØ | Chumdo switching station. | |

**66/33kV Watsa 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 | 11/11/2019 | 14:01hrs | 11/11/2019 | 14:07hrs | 6min | .350MW | 66kV SF breaker | Feeder I and II | Over Current and Earth Fault ( Rand Y phase) | Over current & earth fault relay operated | Feeder II watsa and Damchu | |
| 2 | 26/11/2019 | 13:05hrs | 26/11/2019 | 13:08hrs | 3min | .300MW | 66kV SF breaker | Feeder I and II | Over Current and Earth Fault | Over current & earth fault relay operated | Feedre I Betikha | |

**December, 2019**

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11.12.2019 | 21:29 | 11.12.2019 | 21:32 | | 2.51 | 10MVA Trf (66/33kV) Votlamps | 10MVA Trf (66/33kV) Votlamps | Overcurrent | 50 RY&B phase, 86 | Line | |
| 2 | 11.12.2019 | 23:09 | 11.12.2019 | 23:14 | | 1.96 | 10MVA Trf (66/33kV) Votlamps | All 33kV feeders. | Overcurrent | 51 RY&B phase, 86 | Line | |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**220/66/33kV Dhamdum 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Gedu 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Lobeysa 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No tripping | | | | | | | | | | | | |

**220/66/11kV Semtokha 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Dechenchholing 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33kV Olakha 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/33/11kV Jemina 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**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 | | | | | | |
| 4 | 22.12.2019 | 1350hrs | 22.12.2019 | 1400hrs | 10min | 2.36MW | 66KV O/G Pangbasa Feeder | Pangbasa Substation | Transient Fault | O/C on B phase | Chumdo substation | |
| 5 | | 1437hrs | | 1450hrs | 13min | 2.22MW | | | | O/C on Y & B phase | | |
| 6 | | 1539hrs | | 1550hrs | 11min | 2.29MW | | | | | | |

**66/33/11kV Paro 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Tripping | | | | | | | | | | | | |

**66/11kV Haa 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 | 04.12.2019 | 13:01 | 04.12.2019 | 13:18 | 17minutes | -1.97 | 66kV Incomer | All feeders | Unknown | O/C | | |
| 2 | 04.12.2019 | 13:23 | 04.12.2019 | 13:57 | 39minutes | -1.97 | 66kV Incomer | All feeders | Unknown | O/C | | |
| 3 | 04.12.2019 | 14:38 | 04.12.2019 | 15:24 | 46minutes | -2.2 | 66kV Incomer | All feeders | Unknown | O/C | | |
| 4 | 22.12.2019 | 14:24 | 22.12.2019 | 14:50 | 26minutes | -1.51 | 66kV Incomer | All feeders | Unknown | O/C | Chumdo switching station. | |
| 5 | 22.12.2019 | 15:40 | 22.12.2019 | 15:51 | 11minutes | -1.59 | 66kV Incomer | All feeders | Unknown | O/C | | |

**66/33kV Watsa 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 | 20/12/2019 | 12:50hrs | 20/12/2019 | 12:58hrs | 8min | .400MW | 66kV SF breaker | Feeder I and II | Over Current on Y phase | Over Current relay operated | Feeder II Damchu | |
| 2 | 21/12/2019 | 13:05hrs | 21/12/2019 | 13:08hrs | 3min | .360MW | 66kV SF breaker | Feeder I and II | Earth Fault | Earth fault relay operated | Feedre II chapcha | |
| 3 | 21/12/2019 | 16:42hrs | 21/12/2019 | 16:45hrs | 3min | .460MW | 66kV SF breaker | Feeder I and II | Earth Fault | Earth fault relay operated | Feedre II chapcha | |
| 4 | 22/12/2019 | 12:24hrs | 22/12/2019 | 12:28hrs | 4min | .400MW | 66kV SF breaker | Feeder I and II | Earth fault | Earth fault relay operated | Feeder I Wanakha | |
| 5 | 23/12/2019 | 12:49hrs | 23/12/2019 | 12:52hrs | 3min | .189MW | 66kV SF breaker | Feeder I and II | Earth fault | Earth fault relay operated | Feeder I Wanakha | |
| 6 | 23/12/2019 | 15:27hrs | 23/12/2019 | 15:30hrs | 3min | .360MW | 66kV SF breaker | Feeder I and II | Earth Fault | Earth fault relay operated | Feedre II chapcha | |