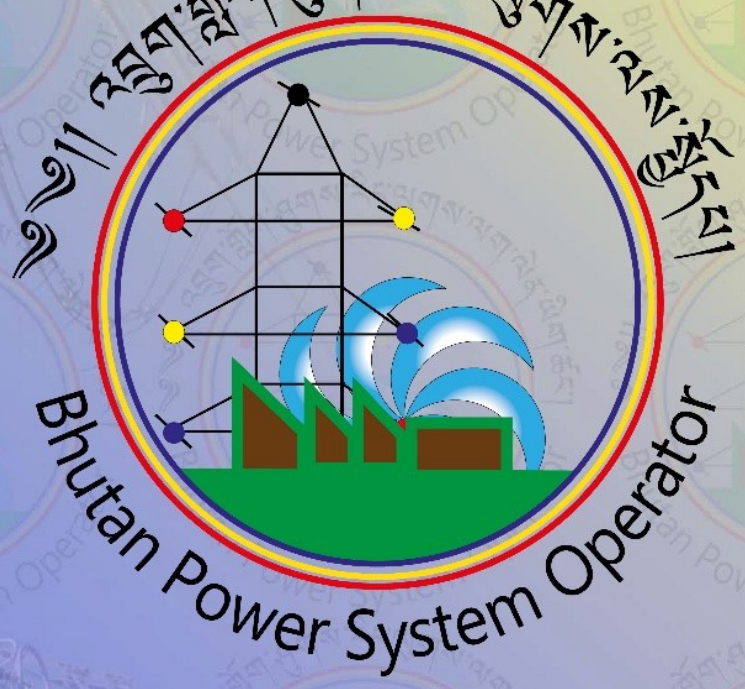
འབྲུག་གློག་ཁུག་རིང་ལུགས་ལས་སྡེ་དཔག།

Bhutan Power System Operator

གྲུས་ཁུག་དང་རང་བཞིན་ཐོག་སྐྱེད་ལྟན་ཁག

Ministry of Energy and Natural Resources

Power System Operation Division



Transmission Performance System Report

Second Quartely Report-2025

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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 Ministry of Energy and Natural Resource 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) 2024, clause 153, and "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. Total installed Capacity

1. Major Plants: 3142 MW
2. Mini & Micro: 8.1 MW
3. DG: 8.9 MW
4. Wind: 0.6 MW

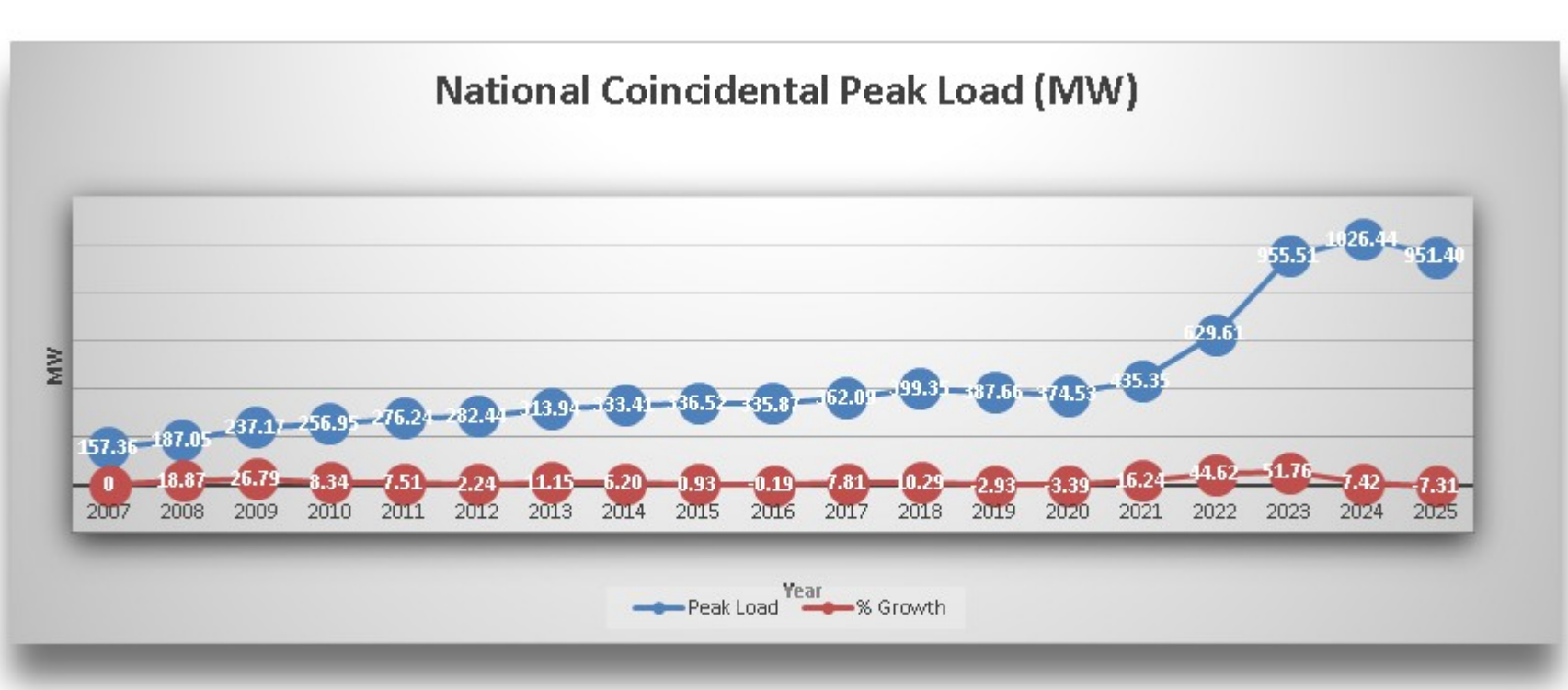
3. National Peak Demand

The national peak demand for Second Quarterly report for the year 2025 is recorded at **951.40 MW** which occurred on April 25th , 2025 at 18:38 hours. This is calculated by summation of Substation load.

Table 3.1. The National Peak Demand since 2007

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
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	374.53	435.35	629.61	955.51	1026.44	951.40
% 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	-3.39	16.24	44.62	51.76	7.42	-7.31

Graph 3.1. The growth in National Peak Demand since 2007



4. Power (MW) consumed by country

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

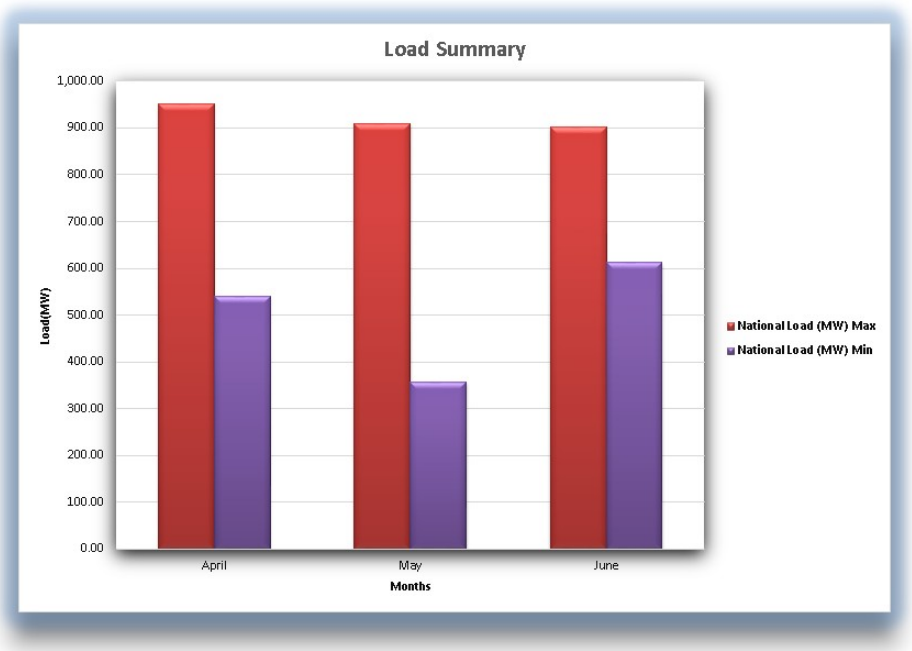
1. **National Demand** = (Sum of all total generation)- (Sum of all Export or Import)
2. **National Demand** = (Sum of all feeders loading at hydropower station) – (Sum of all Export/Import)
3. **National Demand** = (Sum of all substation loading)

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

Table 4.1 Bhutan's national demand load using method- 3

National Load		
Month	**Max**	**Min**
April	951.40	540.61
May	909.60	358.09
June	903.04	612.30

Graph 4.1 National Load using method- 3



5. Energy Availability and Requirement for the country

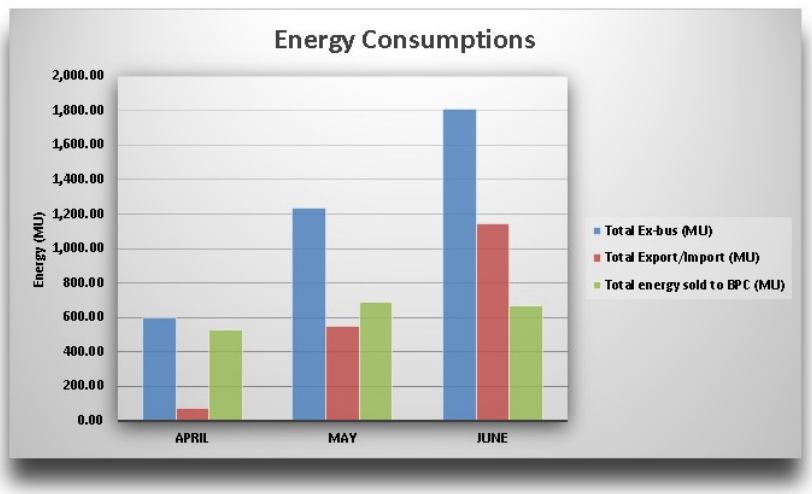
5.1. Energy (MU) consumed by Country

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

Table 5.1 Total Energy (MU) consumed

Month	Total Ex-bus (MU)	Total Export/Import (MU)	Total energy sold to BPC (MU)
April	595.41	72.20	524.09
May	1,235.92	551.46	685.58
June	1,810.02	1,145.94	670.22

Graph 5.1 Total Energy (MU) consumed



6. Performance of generating plants

6.1 Power and Energy Generation

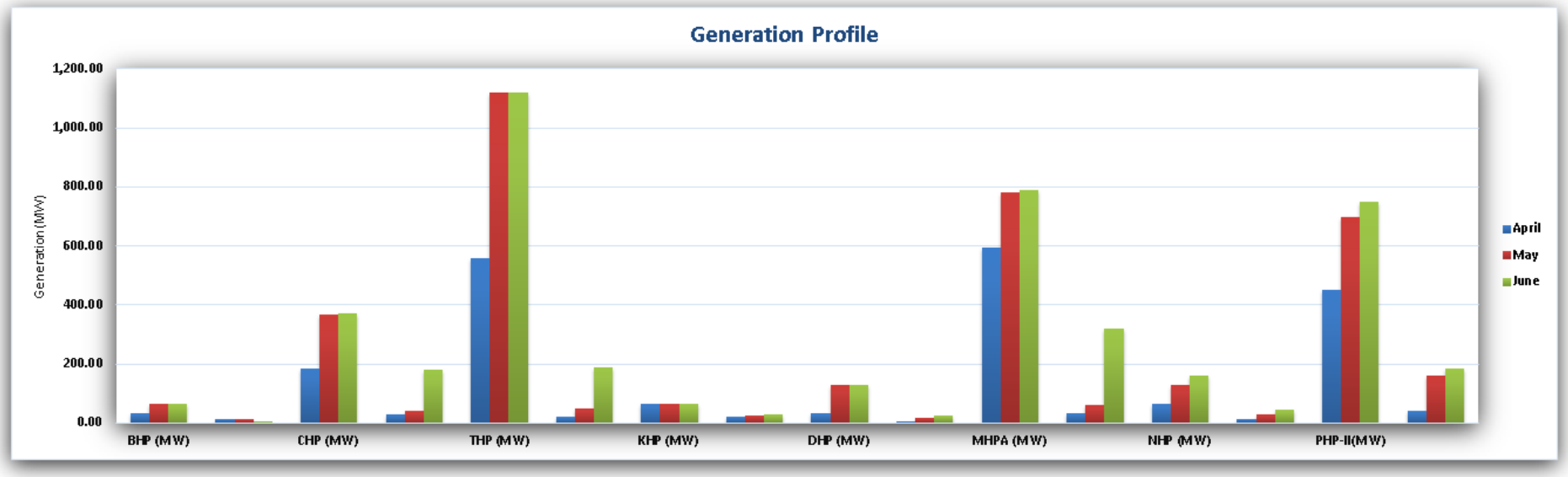
The maximum total generation for the Second quarter of year 2025 was 3,361.09 MW in month of May and minimum generation was 1,983.96 MW in the month of April.

Table: 6.1 Summary of maximum and minimum generation by various hydropower plant

Generation By	BHP (MW)		CHP (MW)		THP (MW)		KHP (MW)		DHP (MW)		MHPA (MW)		NHP (MW)		PHP-II(MW)		TOTAL (MW)	
Month	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
April	35.00	11.60	184.88	30.90	559.00	21.00	63.89	22.36	32.00	5.35	593.14	34.71	64.95	15.00	451.10	40.10	1,983.96	181.02
May	65.10	11.60	369.03	42.40	1,122.00	51.00	66.00	26.39	127.03	17.18	782.48	61.62	129.85	28.00	699.60	160.30	3,361.09	398.49
June	66.10	4.20	369.82	181.06	1,122.00	187.00	66.00	30.05	127.28	24.51	790.59	321.80	159.84	45.02	748.00	186.40	2,701.63	793.64

Source: Hydropower Plants (DGPC)

Graph: 6.1 Summary of maximum and minimum generation by various hydropower plants



6.2 Plant Capacity Factor

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

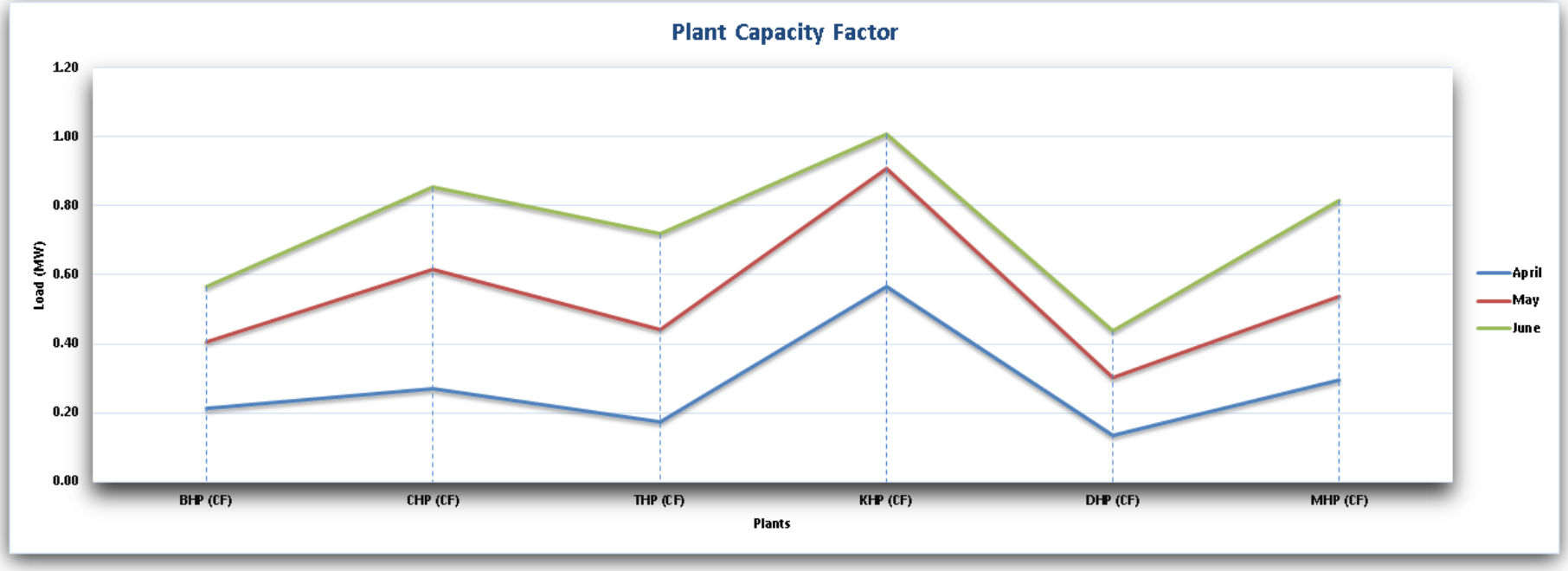
$$Capacity\ factor = \frac{Total\ energy\ plant\ has\ \frac{produce}{a}\ period}{Total\ energy\ plant\ would\ produce\ when\ operated\ at\ full\ capacity\ ¿}$$

Table 6.2 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)	MHP (MU)	MHP (CF)	NHP (MU)	NHP(CF)	PHP-II(MU)	PHP-II(CF)
April	9.90	0.21	66.54	0.27	136.30	0.17	24.99	0.57	12.05	0.13	155.90	0.29	16.29	0.18	173.46	0.68
May	20.82	0.40	153.49	0.62	337.50	0.44	40.23	0.91	26.64	0.30	303.00	0.54	42.84	0.47	311.40	1.19
June	25.94	0.57	212.83	0.86	520.58	0.72	44.76	1.01	39.83	0.44	437.50	0.81	67.65	0.76	460.93	1.81

Source: TD, BPC

Graph 6.2. Capacity factor of various hydropower plants



7. Export and Import of Electricity

Maximum export for the Second quarter of year 2025 was 1,395.44 MW to Alipurduar substation in India. The minimum export recorded was 0.05 MW to Salakoti and Rangai substation.

Table 7.1. Export of electricity to India

Export To	Binaguri (MW)		Birpara (MW)		Salakoti and Rangia (MW)		Alipurduar (MW)	
Month	Max	Min	Max	Min	Max	Min	Max	Min
April	288.98	1.16	0.00	0.00	46.72	0.05	356.37	0.00
May	948.13	0.03	120.91	0.36	89.44	0.08	792.16	0.46
June	932.08	0.83	170.36	0.60	125.64	9.44	1,395.44	125.99

Graph 7.1. Export of electricity to India

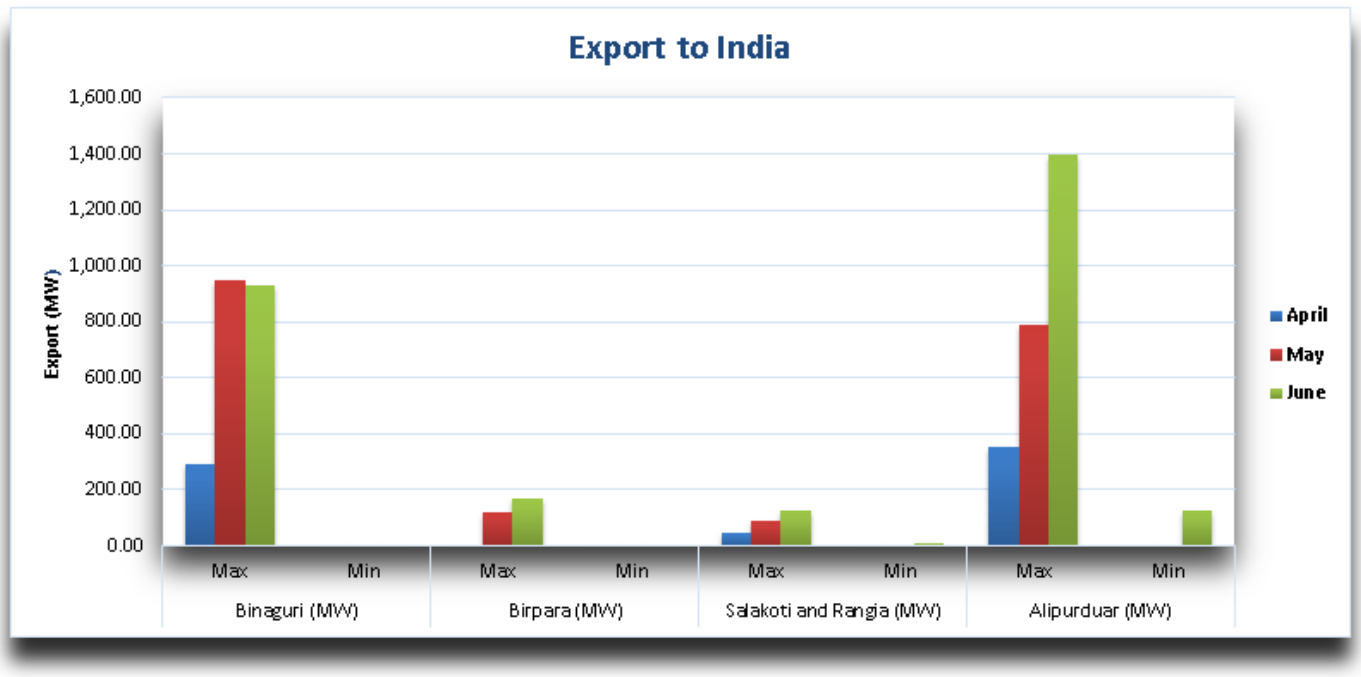
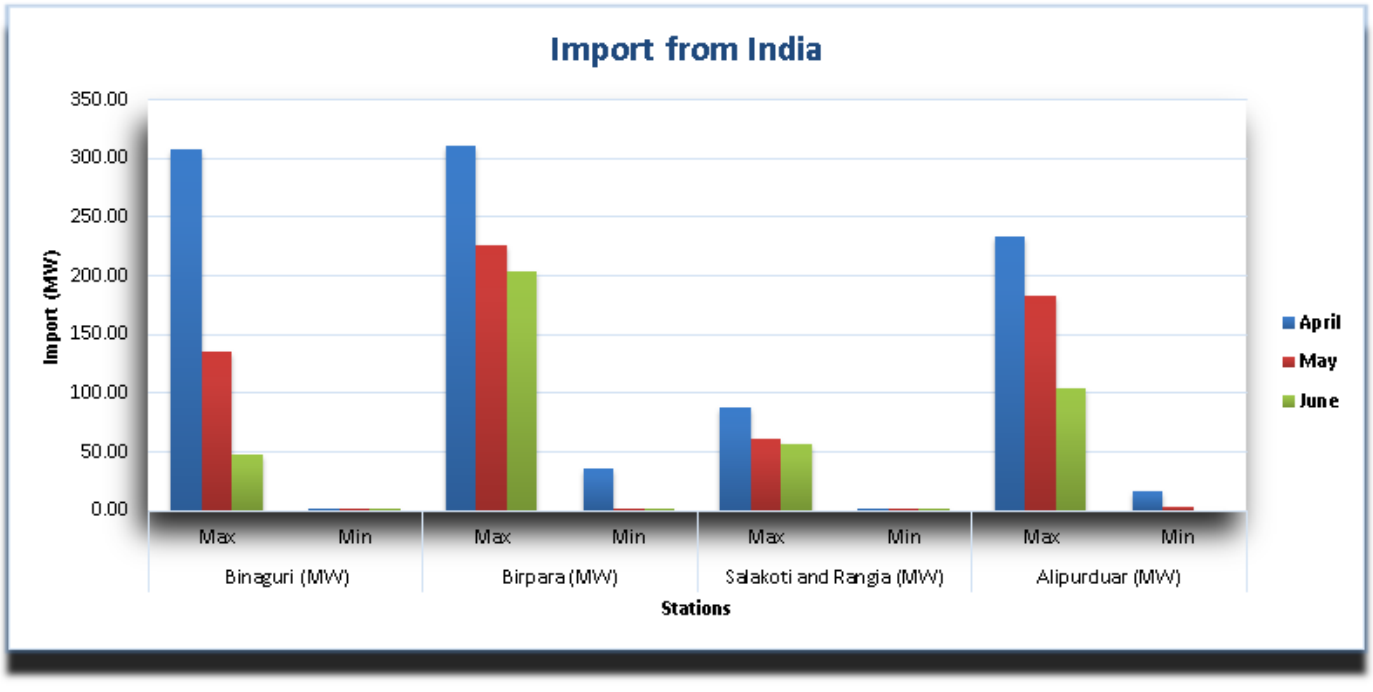


Table 7.2. Import of electricity from India

Import From	Binaguri (MW)		Birpara (MW)		Salakoti and Rangia (MW)		Alipurduar (MW)	
Month	Max	Min	Max	Min	Max	Min	Max	Min
April	307.68	0.96	311.45	35.81	88.12	0.00	233.08	16.82
May	135.57	0.33	226.13	0.06	61.52	0.11	182.54	3.78
June	48.17	1.09	203.74	0.18	56.35	0.70	103.91	0.00

Graph 7.2. Import of electricity from India



8. 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 limits under faulty condition.

As per the Grid Code 2024, 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 are below 49.0Hz.

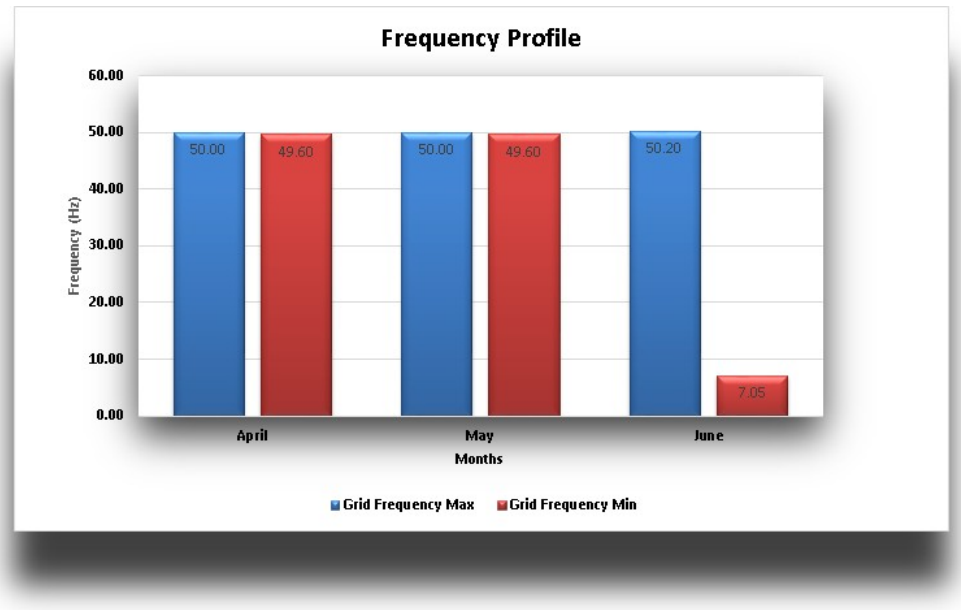
The national grid frequency for Bhutan is taken with reference to 220/66/11kV Semtokha substation.

8.1 Frequency Summary for the month of April to June 2025

Table 8.1 Frequency summary for the month of April to June 2025.

Grid Frequency		
Month	**Max**	**Min**
April	50.00	49.60
May	50.00	49.60
June	50.20	7.05

Graph 8.2 Frequency summary for the month of April to June 2025



9. Voltage Profile of selected substation

As per the Grid Code 2024, the voltage at all connection points is classified into three different bands as follows:

1. *Normal State*
   The voltage at all connection points is within the limits of 0.95 times and 1.05 times of the normal values
2. *Alert State*
   The voltage at all connection points is 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 the voltage level for 400kV, 220kV, and 66kV is taken with reference to 400/220/66/11kV Malbase substation and for 132kV voltage level with reference to 132/33/11kV Nangkhor substation, the voltage profile of these substations is considered.

9.1 Voltage Summary for the Month of April to June 2025

Table 9.1 Voltage Summary for the month of April to June 2025

Grid Voltage								
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
April	418.00	317.00	226.50	213.00	68.00	64.00	136.94	128.21
May	415.00	355.50	226.00	210.50	70.80	58.00	136.10	129.45
June	416.00	397.50	225.50	212.00	68.50	64.00	135.69	126.96

Graph 9.1 Voltage Summary for the month of April to June 2025