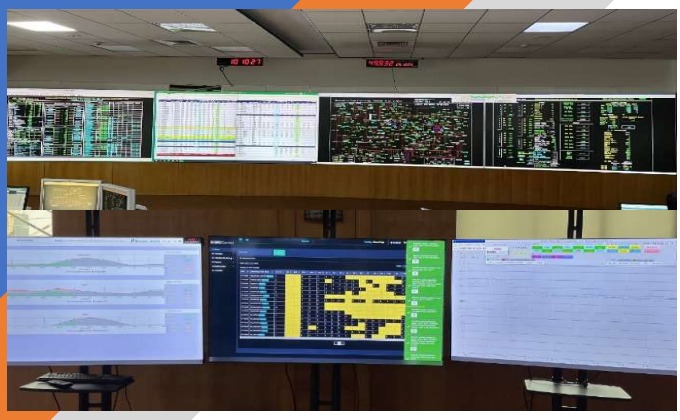
# Annual Operational Report



***CY: 2023***

***Maharashtra State Load Despatch Centre, Airoli***

# Contents

# 1.0. Introduction

Maharashtra State is synchronously connected with the National Grid through ISTS lines & Inter-State lines with other Western Region constituent States viz. Gujrat, Madhya Pradesh, Chhattisgarh, Goa etc. Also, the State has interconnection with the Southern Region through ISTS lines which includes interconnection through Chandrapur – Bhadrawati back-to-back HVDC link. Maharashtra State is bestowed with large pit-head coal fired power stations in North-eastern part, Gas-fired thermal stations and hydro stations are mainly located in Western part of Maharashtra. The inter-state transmission system is owned by POWERGRID (WRTS-1, WRTS-2) & various transmission companies under TBCB route. The Intra-State transmission network is owned by MSETCL (STU) and other licensees viz. JPTL, ATIL, MEGPTCL, APTCL, VIPL etc.

The State Load Despatch Centre is the nerve center for the operation, planning, monitoring, and control of the state power system. As electricity cannot be stored, it must be produced when it is needed. Hence, it is essential that Load-Generation balance must be created at every instance of time for smooth & reliable operation of the Grid that too optimally & economically.

## 1.1. Functions of State Load Despatch Centre (SLDC):

In accordance with the Section 32 of Electricity Act 2003, the functions of SLDC are as below:

1) The State Load Despatch Centre shall be the apex body to ensure integrated operation of the power system in a State.
2) The State Load Despatch Centre shall -
   a) be responsible for optimum scheduling and despatch of electricity within a State, in accordance with the contracts entered into with the licensees or the generating companies operating in that State;
   b) monitor grid operations;
   c) keep accounts of the quantity of electricity transmitted through the State grid;
   d) exercise supervision and control over the intra-State transmission system; and
   e) be responsible for carrying out real time operations for grid control and despatch of electricity within the State through secure and economic operation of the State grid in accordance with the Grid Standards and the State Grid Code.
3) The State Load Despatch Centre may levy and collect such fee and charges from the generating companies and licensees engaged in intra-State.

## 1.2. Maharashtra State Load Despatch Centre (MSLDC) & Salient features:

Maharashtra State Load Despatch Centre is responsible for secure and reliable operation of the Maharashtra State electricity grid. The Maharashtra Electricity Grid covers the geographical areas under control area of Maharashtra State which is part of the Western Regional Grid. The Maharashtra Electricity Grid comprises of various State entities comprising of Thermal, hydro, gas, RE generating stations, Distribution Licensees, Inter State & Intra-State transmission licensees, Qualified Co-ordinating Agencies (QCAs) etc.

The Maharashtra State electricity grid is a part of the synchronous 'NEWS' grid via western regional grid comprising of an area of 3,07,713 sq. kms and population of 126 million. It has the highest installed capacity of 43,694 MW, including Central, State, Private and Independent Power Plants and is 10.20 %of total installed capacity in India.

MSLDC is the apex body to ensure integrated operation of the power system in the Maharashtra State grid.

The main responsibilities of MSLDC are:

- Monitor system parameters and ensure grid security.
- To ensure integrated operation of the power system in the State.
- System studies, planning and contingency analysis.
- Daily scheduling and operational planning.
- Facilitate bilateral and intra state exchanges.
- Computation of energy despatch and drawal values using Interface meters installed at the points of interconnection with InSTS
- Augmentation of telemetry, computing and communication facilities.
- Integration of Renewable Energy (RE) generators and their performance monitoring in Maharashtra Grid.

Maharashtra State Load Despatch Centre as a Main control center operates from Airoli, Navi-Mumbai in coordination with its Area Load Despatch Centers, namely Area Load Despatch Centre, Ambazari (Nagpur) monitors system operations for Vidharbha, Khandesh and Marathwada region and designed as back-up control center to State Load Despatch Centre in respect of Disaster Management.

The salient features of Maharashtra State Grid are summarized below:

| Generation | Demand | |
|---|---|---|
| Conventional – 21170 MW | Peak Demand met: 28,584 MW | 39.4 % of WR Demand |
| Hydro –2941 MW | | 12 % of National Demand |
| Wind – 5145 MW | | 64 % Demand met through internal generation |
| Solar – 3127 MW | | |
| Other RE – 3120 MW | | |
| Central Sector Share -8083 MW | | |

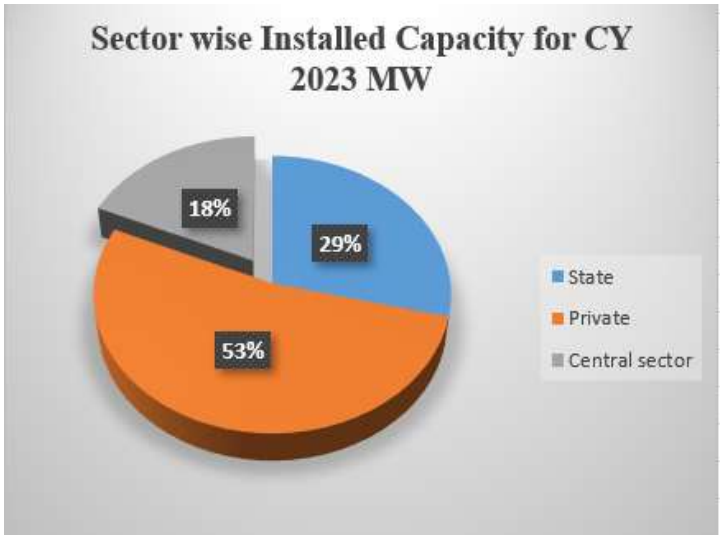
| Transmission | Market |
|---|---|
| Substations – 751 Nos | Major Distribution licensees – 4 |
| Lines – 54450 km | Deemed Distribution Licensees – 11 |
| Transformation capacity -154205 MVA | Sellers – 148 |
| | Transmission Licensees - 9 |

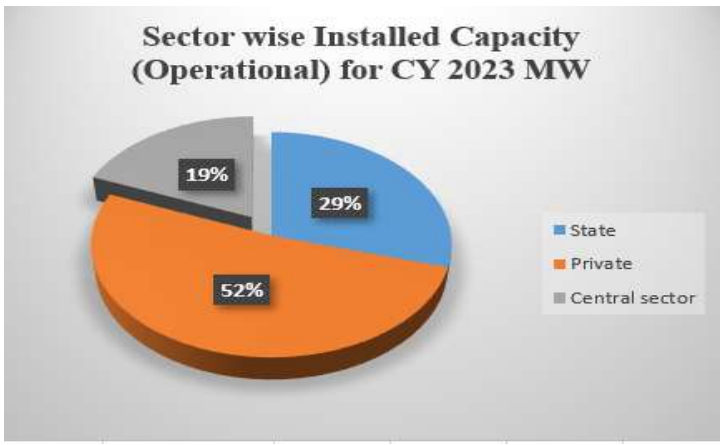
# 2.0. Installed Capacity of Maharashtra:

## 2.1. Generation Installed Capacity:

### 2.1.1. Sector wise Installed Capacity:

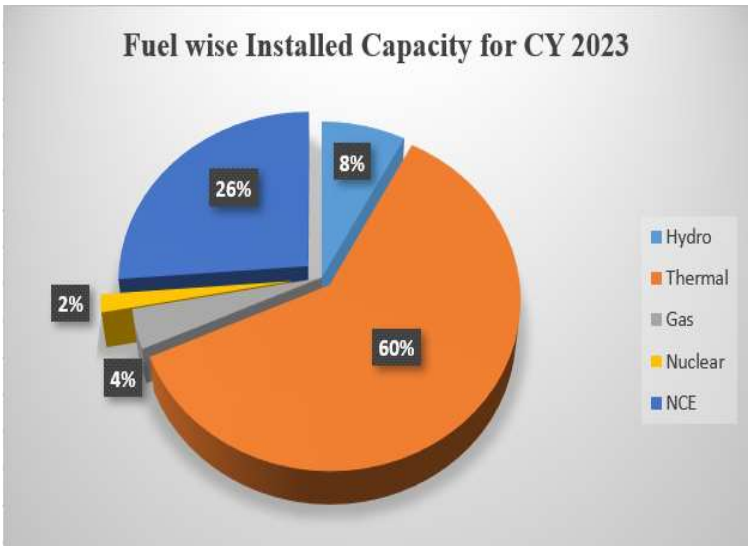
| Sector wise Installed Capacity | | | | |
|---|---|---|---|---|
| Sector | CY: 2023 | | CY: 2023 (Operational) | |
| | MW | % | MW | % |
| State Sector | 12662 | 28.81 | 12662 | 28.81 |
| Private Sector | 23205 | 52.80 | 22217 | 52.80 |
| Central sector Share | 8083 | 18.39 | 8083 | 18.39 |
| **Total Installed Capacity** | **43950** | | **42962** | |



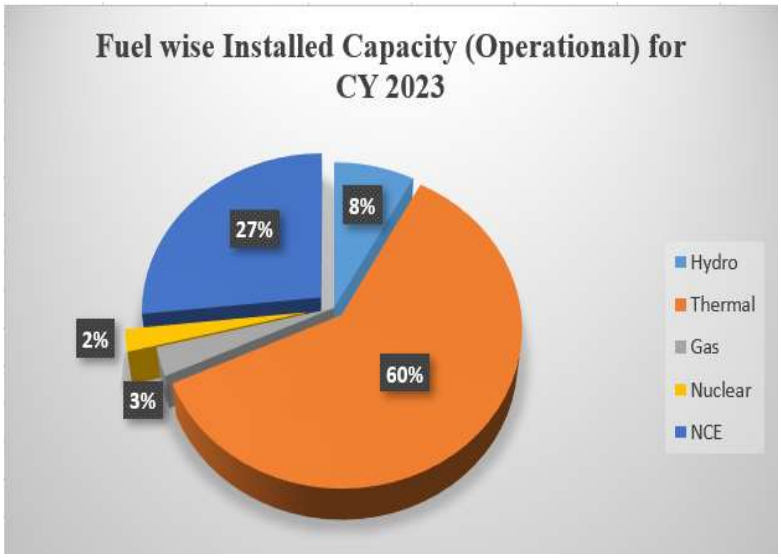



### 2.1.2. Fuel wise Installed Capacity:

| | Hydro | Thermal | Gas | Nuclear | NCE |
|---|---|---|---|---|---|
| **CY: 2023** | 3386 | 26467 | 1645 | 740 | 11456 |
| | 8 % | 60 % | 4 % | 2 % | 26 % |




| | Hydro | Thermal | Gas | Nuclear | NCE |
|---|---|---|---|---|---|
| **CY 2023 (Operational)** | 3386 | 25898 | 1257 | 966 | 11456 |
| | 8 % | 60 % | 3 % | 2 % | 27 % |



### 2.1.3. Installed Capacity addition in CY 2023:

| Sr. No. | ISGS/IPP | Station Name | Unit No. | Date of COD | Capacity added | Share Capacity added |
|---|---|---|---|---|---|---|
| 1. | ISGS | Kakrapar Atomic Power Station | 3 | 30.06.2023 | 700 | 223 |
| 2. | IPP | Jindal Power Ltd. | 1 | 2017 | 150 | 150 |
| 3. | IPP | Jindal Power Ltd. | 2 | 22.11.2023 | 150 | 150 |
| **Total Installed Capacity addition** | | | | | | 523 |

## 2.2. Transmission Infrastructure:

During CY: 2023, 26 Nos of EHV substations, 2,440 MVA of transformation Capacity and 556 Ckt. km of transmission lines was added in Maharashtra State Transmission System. The transmission infrastructure of Maharashtra State for CY: 2023 is tabulated below:

| Transmission Licensee | CY 2023 | | |
|---|---|---|---|
| | EHV Substation | Transformation Capacity (MVA) | EHV Lines (Ckt km) |
| Maharashtra State Electricity Transmission Company Ltd. (MSETCL) | 738 | 1,37,198 | 51,117 |
| Tata Power Company Ltd. (TPCL) | 25 | 10,422 | 1,213 |
| Adani Electricity Mumbai Ltd. (AEML) | 8 | 3,250 | 572 |
| Jaigad Power Transmission Co. Ltd. (JPTL) | 1 | 0 | 330 |
| Adani Transmission India Ltd. (ATIL) | 0 | 0 | 436 |
| Amravati Power Transmission Co. Ltd. (APTCL) | 1 | 0 | 220 |
| Sinnar Power Transmission Co.Ltd. (SPTCL) | 1 | 0 | 104 |
| Maharashtra Eastern Grid Power Transmission Co. Ltd. (MEGPTCL) | 3 | 6,000 | 1,220 |
| Vidarbha Industries Pvt. Ltd (VIPL) | 1 | 0 | 6 |
| Kharghar Vikhroli Transmission Ltd. (KVTL) | 1 | 0 | 43.4 |
| **Total** | **779** | **1,56,870** | **55,261.4** |

## 2.3. Network Addition in CY 2023:

| Sr. No. | Name of substation | Lines Details | Synchronization Date |
|---|---|---|---|
| 1 | 132kV Shaha | 132kV Shaha substation first time charged at 18:45 hrs. | 11.01.2023 |
| 2 | 400kV Chandrapur | 50 MVAr line reactor of 400kV Chandrapur Parly ckt. 3 at Chandrapur end first time charged at 20:11 hrs. | 13.01.2023 |
| 3 | 132kV Satara MIDC | 132kV Satara MIDC - Satara TSS line at 20:25 hrs | 13.01.2023 |
| 4 | 132kV Kharepatan | 132kV Kharepatan - Kharepatan TSS line and 132kV Kankawali llne charged at 15:15 hrs. | 16.01.2023 |
| 5 | 220KV Nandgaonpeth | 132KV RENEW SOLAR AT NANDGAONPETH synchronised at 16:15 Hrs. | 03-02-2023 |
| 6 | 132kV Yeola | 132kV Hybrid Bay Charged at 16:50 Hrs | 04.02.2023 |
| 7 | 400kV Akola | Main Bay (416) of 400kV 125MVAR Bus Shunt Reactor charged at 18:08Hrs | 11.02.2023 |
| 8 | 400kV Akola | Main Bay (419) of 400/220/33kV 501MVA ICT-3 charged at 18:34Hrs | 11.02.2023 |
| 9 | 220KV GRACE SS | At 132kV level Balance 25MW Thermal CPP of M/S Sunvijay Alloy and Power Ltd (of Total 33MW, 8MW already Synchronised and COD on 28-07-2017) previously known as Grace Industries Ltd at 21:32Hrs | 21-02-2023 |
| 10 | 132 KV ROTEGAON TSS | 132KV VAIJAPUR -ROTEGAON CKT ALONG WITH VAIJAPUR BAY AT ROTEGAON TSS SS CHARGED AT 19:43 Hrs | 02.03.2023 |
| 11 | 110kV Kavathemahankal | 132kV Line Bay charged at 14:30 Hrs | 15.03.2023 |
| 12 | 132KV GARWARE SS | 132KV WALUJ GARWARE LINE CHARGED ALONG WITH END BAYS AT 132KV GARWARE SS charged at 21:55 Hrs | 20.03.2023 |
| 13 | 220kV Karanjade TSS | 220kV Karanjade S/s LILO on 220kV Panvel TSS & 220kV ONGC S/s charged at 21:05 Hrs | 22.03.2023 |
| 14 | 400KV AKOLA SS | 400/220KV 315 MVA ICT 2 LV SIDE CHARGED ON NEW REORIENTED BAY CHARGED AT 19:08 Hrs | 22.03.2023 |
| 15 | 400KV AKOLA SS | 400KV AKOLA S/STN 400/220KV 500MVA ICT-3 CHARGED ON HV SIDE CHARGED AT 21:58 Hrs | 22.03.2023 |
| 16 | 220 kV MALEGAON (ZODGA S/STN) | 220/132KV, 100 MVA ICT-III OF 220KV MALEGAON (ZODGA) S/STN Charged at 15:09 Hrs | 24.03.2023 |
| 17 | 220kV Kalwa | 220kV Kalwa Salsette-5 line bay charged at 19:30 Hrs | 26.03.2023 |
| 18 | 220kV Kalwa | 220kV Kalwa Salsette-5 charged at 23:37 Hrs | 26.03.2023 |
| 19 | 220kV Panchali TSS | 220kV Panchali TSS LILO on 220kV Nalasopara Boisar PG Line charged at 23:58 Hrs | 26.03.2023 |

| | | | |
|---|---|---|---|
| 20 | 132KV HINGNA-1 | 16MVA, 132/11KV TF CHARGED FIRST TIME ON NO LOAD at 19:13 Hrs | 28.03.2023 |
| 21 | 220kV ANJANGAON | NEW 100MVA ICT 2 CHARGED FROM HV SIDE ONLY CHARGED at 22:31 Hrs | 29.03.2023 |
| 22 | 132KV UMARI TSS | 132KV UMARI TSS METERING BAY (132KV CT & PT) CHARGED at 18:01 Hrs | 29.03.2023 |
| 23 | 400 KV CHANDRAPUR II S/S | AT 400 KV CHANDRAPUR II S/S 50 MVAR L/R OF NANDED CKT I FIRST TIME CHARGED at 22:23 Hrs | 30.03.2023 |
| 24 | 400 KV AKOLA S/STN | 400/220 kV 501 MVA ICT-3 charged at 02:30 HRS from HV side & at 02:40 HRS from LV side. | 30.03.2023 |
| 25 | 220kV Palghar | 220kV Palghar S/s LILO on 220kV Nalasopara Boisar PG line charged at 04:31 Hrs | 31.03.2023 |
| 26 | 110kV Jayasingpur | 110kV Miraj Jayasingpur 14.5Km Line charged at 19:55 Hrs | 31.03.2023 |
| 27 | 400kV New Koyna | 400/220kV 315MVA ICT-III charged at 23:58 Hrs | 31.03.2023 |
| 28 | 400 kV Chandrapur-II | 50 MVAR L/R charged on 400kV Chandrapur II-Nanded Ckt-II at 16:32 Hrs | 02-04-2023 |
| 29 | 220 kV Panchali | 220kV Panchali - Boisar PG line charged at 11:55 Hrs | 10-04-2023 |
| 30 | 220 kV Yavatmal | 220kV Yavatmal- Wardha PG Ckt-I charged at 20:00 Hrs | 13-04-2023 |
| 31 | 220 kV Yavatmal | 220kV Yavatmal- Wardha PG Ckt-II charged at 20:20 Hrs | 13-04-2023 |
| 32 | 132 kV Mankapur | 132/33 kV 25MVA T/F-I charged at 19:31 Hrs | 14-04-2023 |
| 6 | 132 kV Himayatnagar | 33kV Sai Purnanand Solar Metering Bay charged at 09:30 Hrs | 22-04-2023 |
| 7 | 220 kV Aarey | 220kV GIS Main Bus charged at 04:54 Hrs | 24-04-2023 |
| 8 | 132 kV Dharangaon | 2 X 15 Mvar capacitor bank charged at 11:00 Hrs | 26-04-2023 |
| 9 | 132 kV Inox | 132kV Inox S/s charged on LILO 132kV Hyosung -Sterlite at 20:36 Hrs | 26-04-2023 |
| 10 | 132 kV Visarwadi | 2 X 15 Mvar capacitor bank charged at 15:30 Hrs | 26-04-2023 |
| 11 | 132 kV Parola | 2 X 15 Mvar capacitor bank charged at 12:10 Hrs | 27-04-2023 |
| 12 | 400 kV Parli | 400/220 kV, 105 MVA spare ICT charged at 15:10 Hrs | 27-04-2023 |
| 13 | 220 kV Urse | 220kV Hybrid Pass charged at 16:56 Hrs | 27-04-2023 |
| 14 | 400 kV Akola | 125 Mvar Bus Reactor charged at 20:28 Hrs | 27-04-2023 |
| 15 | 220 kV Jamde | 220kV Jamde- Valve Ckt-II hybrid pass bay charged at 18:07 Hrs | 28-04-2023 |
| 16 | 400 kV Akola | 125 MVAr bus reactor charged at 20:28 Hrs | 27.04.2023 |
| 17 | 400kV Nanded | 125 MVAr bus reactor charged at 23:47 Hrs | 12.05.2023 |
| 18 | 220kV Parvati | 132kV U G Cable for 132kV Parvati Kothrud charged at 18:42 Hrs | 31.05.2023 |
| 19 | 132 kV Nimboni | 33 kV Precision Camshaft Pvt Ltd Solar Bay Charged at 18:41 Hrs | 02.06.2023 |
| 20 | 132 KV Himayatnagar | New 132 KV bay and line of M/s TATA Power renewable Energy (70 MW Solar) test charged at 01:00 hrs. | 06.06.2023 |

| | | | |
|---|---|---|---|
| 21 | 132KV HIMAYATNAGAR-TATA POWER | 132KV HIMAYATNAGAR-TATA POWER CKT CHARGED FROM HIMAYATNAGAR END AT 22:32HRS 132KV TATA POWER BUS CHARGED AT 22:36HRS. 132/33KV 50MVA T/F CHARGED FROM HV SIDE AT 23:10HRS AT 132KV TATA POWER SOLAR | 07.06.2023 |
| 22 | 220KV Narangwadi | At 220 kV Narangwadi s/st. 132kV Suyog Urja (125 MW Wind Power)Bay along with line first time charged at 18:56 Hrs | 07.06.2023 |
| 23 | 132KV Chudawa TSS | NEW CHARGING , 132KV Chudawa TSS : METERING BAY CHARGED AT 17:34HRS | 15.06.2023 |
| 24 | 220 kV Shendra | 132 kV Kumbephal TSS Line & Bay Charged at 18:20 Hrs | 20.06.2023 |
| 25 | 132 SATARA (Deolai) | 132KV SATARA (DEOLAI), 132/33KV 50MVA TF FIRST TIME CHARGED AT 19:48 hrs. WITH HV AND LV BAY ON NO-LOAD | 23.06.2023 |
| 26 | 220 kV Colorchem | 220 kV Colorchem DCHI line charged at 13:45 Hrs | 28.06.2023 |
| 27 | 220 kV Kalwa | 220 kV Kalwa DCHI line charged at 14:01 Hrs | 28.06.2023 |
| 28 | 220 kV DCHI | 220 kV DCHI S/s charged at 13:45 Hrs LILO on 220 kV Colorchem Kalwa line | 28.06.2023 |
| 29 | 400 kV Kharghar | 400kV Kharghar Vikhroli bay-1 at 18:17 hrs. | 21.07.2023 |
| | | 400kV Kharghar Vikhroli bay-2 at 18:58 hrs. | 21.07.2023 |
| 30 | 220 kV NTT Global Data Centre GIS substation. | Substation charged with 2500 sq.mm power cable at 23:44 hrs. data. | 12.07.2023 |
| | | 220 kV Bus1, Bus 2 and Bus coupler at GIS NTT ss charged at 20.23 hrs. | 12.07.2023 |
| 31 | 400 kV Vikhroli GIS | 220 kV Trombay - Salsette Ckt-I charged at 04:49 Hrs. | 07.08.2023 |
| 32 | 132 kV Kalamb Road TSS | 132kV Kalamb Road TSS charged at 18:41 Hrs on 132 kV Paranda Kalamb line by LILO arrangement. | 08.08.2023 |
| 33 | 132 kV Borvihir TSS | 132kV TSS (MSETCL) SS : 132/25kV 21.6 MVA TSS T/F-I & II charged at 19:57 Hrs & 19:58 Hrs respectively. | 10.08.2023 |
| 34 | 132 kV Vadgaon Nila TSS | 132 kV Nila TSS charged TAP on 132 kV Gangakhed - Sonpeth Ckt-II at 19:53 Hrs with 2 end bays. | 10.08.2023 |
| 35 | 132 kV Badnapur TSS | 132 kV Badnapur - TSS charged at 14:27 Hrs | 25.08.2023 |
| 36 | 220 kV Waghivali GIS | 220 kV Waghivali GIS charged at 14:15 Hrs (Tap on 220kV Uran Kharghar Ckt-II) | 01.09.2023 |
| 37 | 132 kV Gosekhurd | 33 kV Gose LIS charged at 15:23 Hrs | 01.09.2023 |
| 38 | 132 kV Seloo | 132 kV Bhugaon Ckt-II new Bay charged at 14:20 Hrs | 06.09.2023 |
| 39 | 132 kV Igatpuri | 132 kV Igatpuri TSS Ckt- I and end bays charged at 16:45 Hrs | 23.09.2023 |
| 40 | 400 kV Kharghar | 400 kV Kharghar Vikhroli Ckt-I charged at 20:19 Hrs | 26.09.2023 |

| | | | |
|---|---|---|---|
| 41 | 400 kV Kharghar | 400 kV Kharghar Vikhroli Ckt-II charged at 21:30 Hrs | 26.09.2023 |
| 42 | 400 kV Vikhroli | Bay 406 and Bus sectionaliser -I charged at 22:22 Hrs | 26.09.2023 |
| 43 | 400 kV Vikhroli | Bay 407 and Bus sectionaliser -II charged at 23:02 Hrs | 26.09.2023 |
| 44 | 400 kV Vikhroli | 400/220 kV , 500 MVA ICT-I charged at 02:28 Hrs | 28.09.2023 |
| 45 | 400 kV Vikhroli | 125 MVAR Bus reactor charged at 20:19 Hrs | 28.09.2023 |
| 46 | Jindal Power Limited | JPL Unit-II 150 MW Synchronised at 01:56 Hrs | 29.09.2023 |
| 47 | 132 kV Ashti | 132kv Ashti-Kharda D/C (new charging) are taken in grid at 17:05hrs dtd. 06.10.2023 and 12:30hrs dtd. 07.102023 respectively. | 06-10-2023 and 07-10-2023 |
| 48 | 132 kV Hingna | At 132kv Hingna-1:- 132kv Kalmeshwar bay charged at 12:39hrs. At 132kv Hingna-2:- 132kv Kalmeshwar bay charged at 13:28hrs. | 07-10-2023 |
| 49 | 220KV YAWATMAL | 220KV YAWATMAL SS: 220KV YAWATMAL - WARDHA PG CKT I CHARGED FOR THE FIRST TIME AT 17:40HRS AND 220KV YAWATMAL - WARDHA PG CKT II CHARGED FOR THE FIRST TIME AT 17:48HRS.on dt 07-10-2023 | 07-10-2023 |
| 50 | 400 kV Bableshwar | 400KV MAIN BAY(419) & 400 kV Bableshwar-Kudus Ckt-II upto location 32 (9.74Km) Anti theft charged at 20:25 Hrs | 12.10.2023 |
| 51 | 132 kV Daund | 64 MW additional Co-generation charged at 19:28 Hrs Through Daund Alegaon DC line (9.67Km) (Total 82MW) | 18.10.2023 |
| 52 | 220KV BUTIBORI 3 | AT 220KV BUTIBORI 3 SS, NEW 33KV BAY TEST CHARGE AT 17:27HRS | 19.10.2023 |
| 53 | 220 kV Baramati Agro | Additional 30 MW Co-generation synchronised on 220kV Baramati- Bhigwan line with metering and T/f Bay (Total 70MW) at 17:05 Hrs | 26.10.2023 |
| 54 | 132KV Tamsa-Umarkhed line | On completion of LILO arrangement of 132KV Tamsa- Umarkhed line at SHRI SUBHASH SUGAR Pvt. Ltd. Nanded (14.9MW Co-gen plant) , 132 KV Tamsa - Subhash Sugar line & 132KV Subhash Sugar - Umerkhed line charged upto 132 KV SHRI. SUBHAS SUGAR -BUS only at 18.55 hrs and stood ok. | 27.10.2023 |
| 55 | 132 kV Subhash sugar | 132 kV Subhash sugar synchronised by making lilo of 132 kV Tamsa Umerkhed ckt at 18:30 Hrs | 02.11.2023 |
| 56 | 400 kV Deepnagar | 400 KV Deepanagar SS 400/11/11.5kV,110MVA STATION TF 6A first time time charged at 17:34 Hrs, along with Main Bay (425) at 17:34 Hrs and Tie Bay (424) at 17:38 Hrs. | 07.11.2023 |
| 57 | 132 kV Risod | At 132 kV Risod ss, 25MVA 132/33 kV TF 3 Charge on No-load at 17.40 Hrs | 23.11.2023 |
| 58 | 132 kV Harsool | 132 kV Harsool Stn, 50MVA 132/33 kV TF III Charge on No-load at 19.21 Hrs | 23.11.2023 |

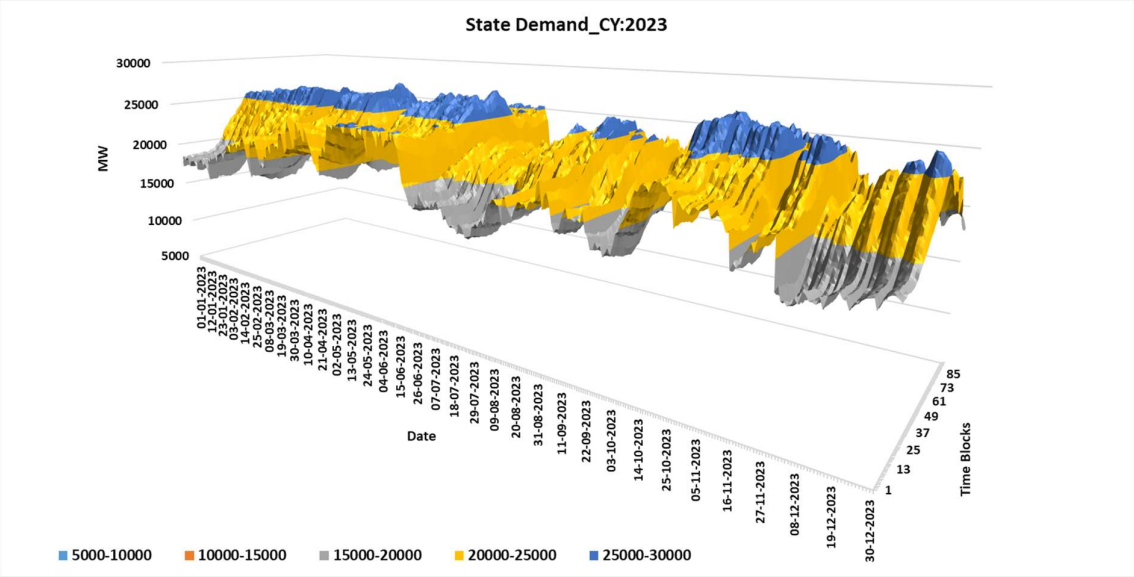
| | | | |
|---|---|---|---|
| 59 | 400 kV Waluj | At 400 kV Waluj s/s 220/33 kV 50MVA TF-3 charged on No load from HV sideat 12:40 Hrs | 30.11.2023 |
| 60 | 132 kV Himayatnagar | 132kV Himayatnagar-Kinwat-II 132kV Bay is charged at 15.57 Hrs at 132kV Himayatnagar s/s | 30.11.2023 |
| 61 | 220 kV Print House | 220/22kV 90MVA T/F-I charged at 19:35 Hrs | 20.12.2023 |
| 62 | 220 kV Print House | 220/22kV 90MVA T/F-II charged at 20:01 Hrs | 20.12.2023 |
| 63 | 132 kV Kinwat | At 132 kV Kinwat s/s Himayatnagar Bay & Kinwat Himayatnagar ckt charged on no load at 15:10 Hrs | 23.12.2023 |
| 64 | 132 kV Ida | 132kv LILO (Tap) on 132kv Bhoom -Paranda line for 132/33kv Ida SUBSTATION charged successfully at 19.42 hrs and stood ok. 132kv Bhoom Line bay at 132/33kv Ida ss is charged successfully at 20.14 hrs and stood ok. 132kv Aayan bay at 132/33 kv Ida ss charged successfully at 20.21 hrs and stood ok | 29.12.2023 |
| 65 | 132 kV Shirpur | 132 kV End bay of Velapur charged at 17:44 Hrs | 30.12.2023 |
| 66 | 132 kV Purandwade | 132 kV End bay of Walchandnagar charged at 17:44 Hrs | 30.12.2023 |

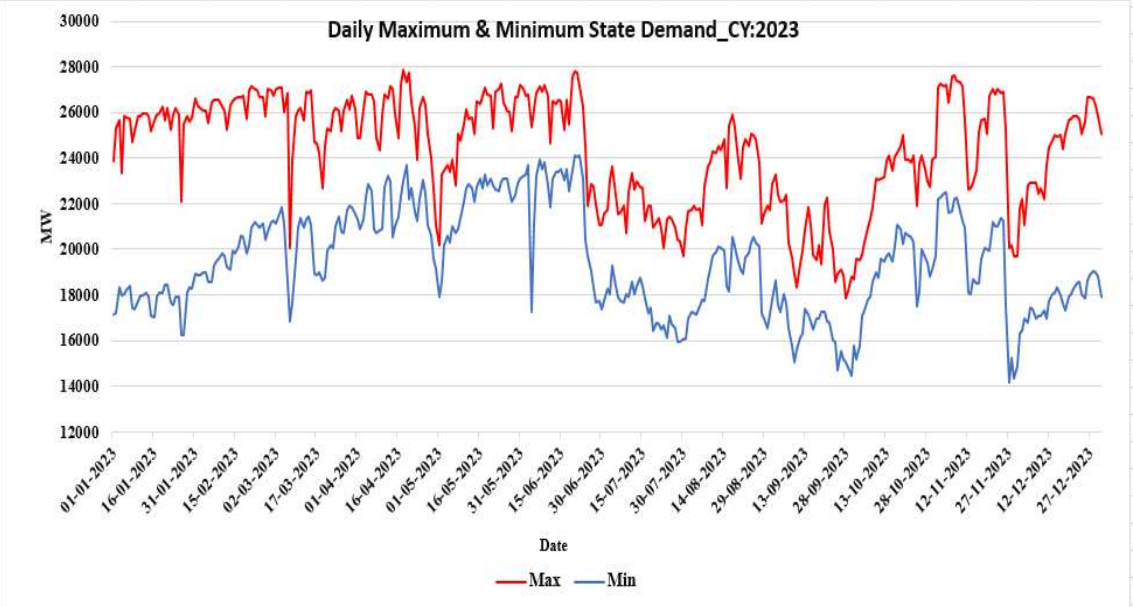
## 3.0. Demand & Energy Profile of the State:

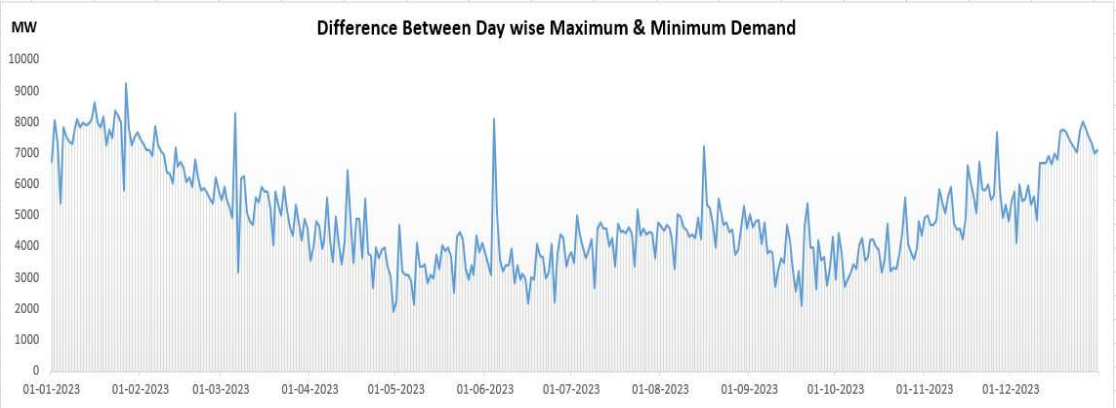
### 3.1. Demand Profile for the State:

Maharashtra is the only State in the Country which has highest demand which is around 41 % of the Western Region and 20 % of the National Demand.

The following graphs indicates the daily & seasonal variations in the State Demand for the complete year.

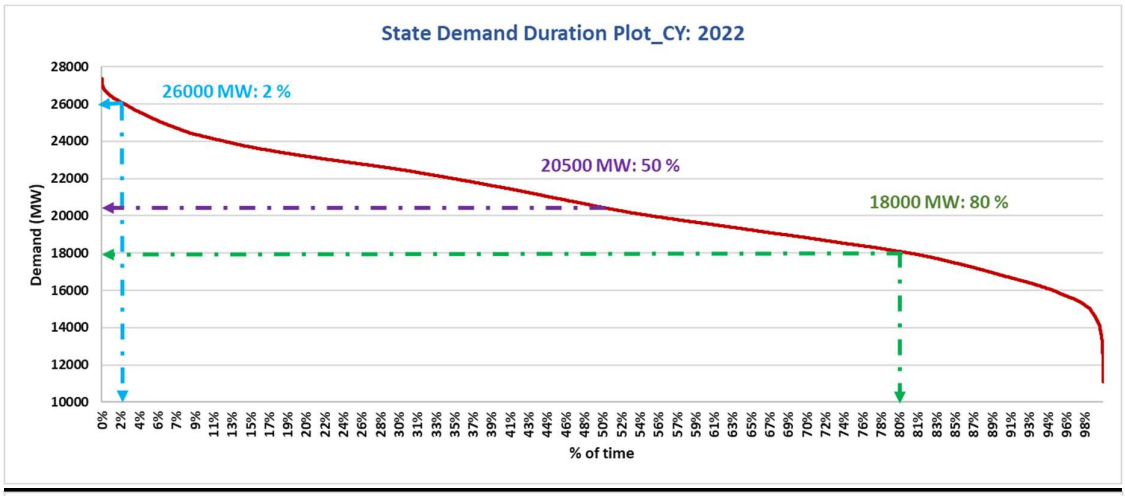


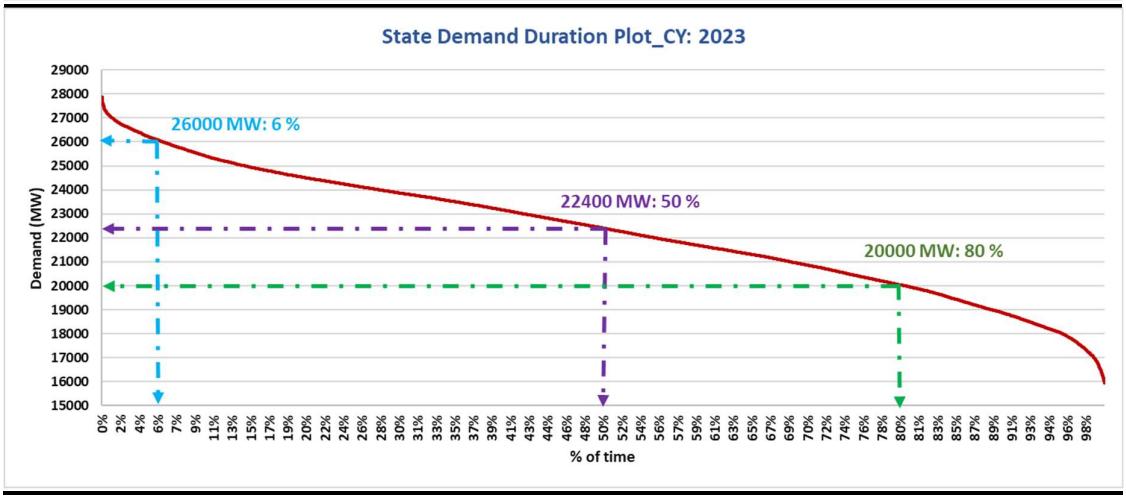



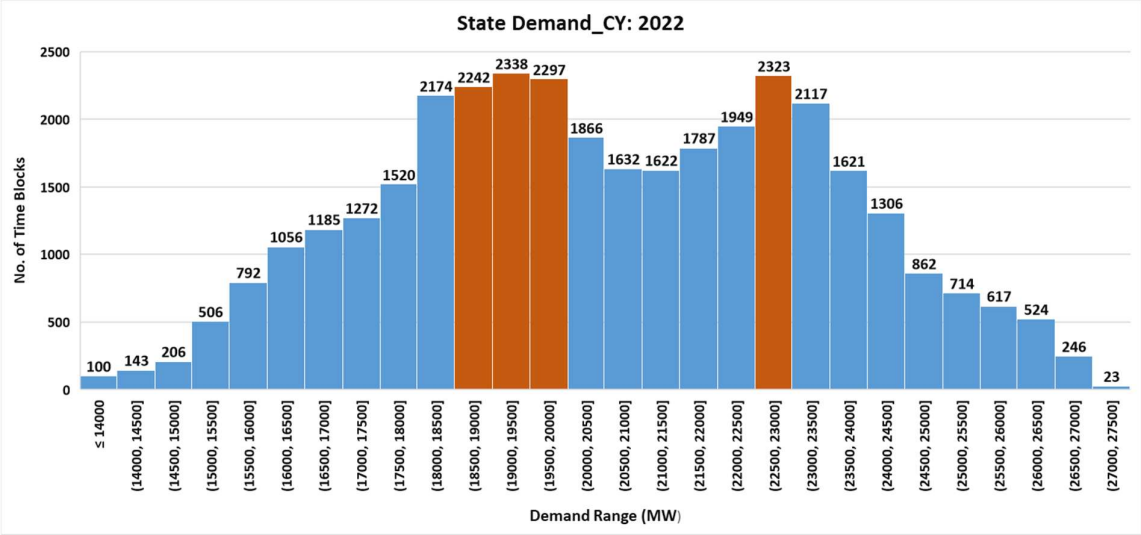


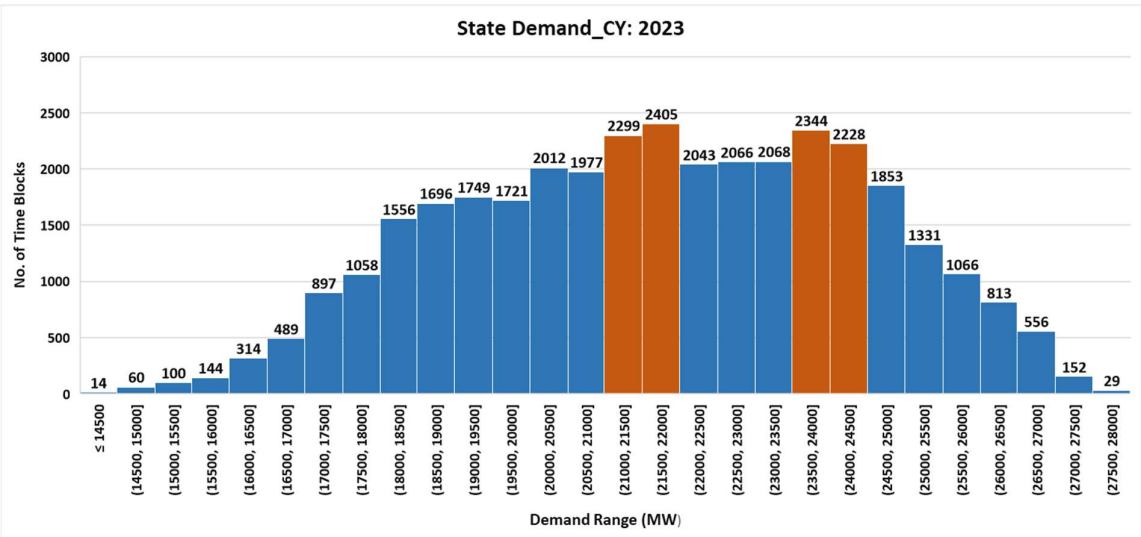

From the above graphs, it is observed that there are variations in State Demand throughout the day as well as seasonal. The maximum seasonal demand variation in the State is to the tune of around 12000 MW whereas the maximum daily demand variation is around 9000 MW.

The duration plots of the State Demand for CY: 2022 & CY: 2023 are shown below.






Upon comparing demand plots for both the years, some key observations are as below:

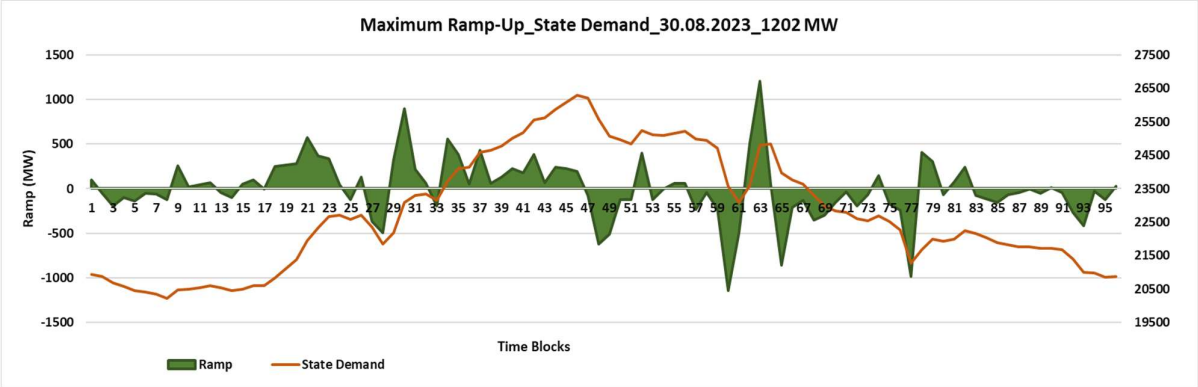
a) For 80 % of the period, State demand was 18000 MW in CY: 2022 which increased to 20000 MW in CY: 2023.

b) In CY: 2023, State demand increased to 22400 MW from 20500 MW from CY: 2022 with increment of around 1900 MW and the demand was for 50 % of the period.

c) In CY: 2022, State demand was above 26000 MW only for 2 % of the period whereas in CY: 2023, it was for 6 % of the period.

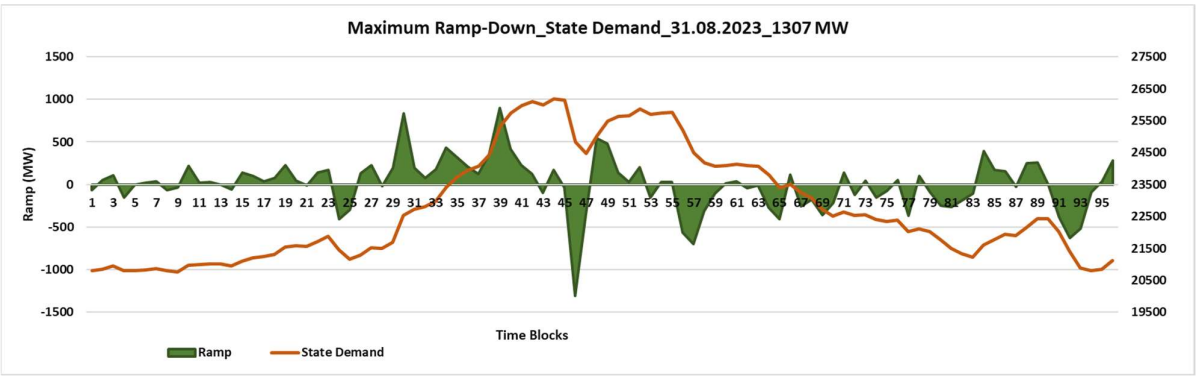
**State Demand Ramping-Up/Down Requirements:**

It is observed that the State Demand Ramping Up & Ramping Down requirements for CY: 2023 was within a range of 1202 MW to 1307 MW respectively. The maximum Ramping-Up requirement of 1202 MW was observed on 30.08.2023 at 63$^{rd}$ time block i.e. between 15:30 to 15:45 hrs. During this time, the State Demand increased from 23589 MW to 24791 MW. On the same day, a Ramp-Down of 1143 MW was observed at 59$^{th}$ time block, when State demand reduced from 24718 MW to 23575 MW.




Thus, within 45 minutes, State Demand ramped down by 1865 MW and within next 45 minutes, State Demand Ramped-Up by 1758 MW. Total variations in demand were from 24718 MW to 23081 MW & again back to 24839 MW. It is observed that the said demand ramping requirements were mainly managed through ISTS drawl. The variations in ISTS drawl were from 9652 MW to 8498 MW & again back to 9970 MW. Thus, ISTS drawl ramping down of 1154 MW & ramping-up of 1472 MW was observed during this period.

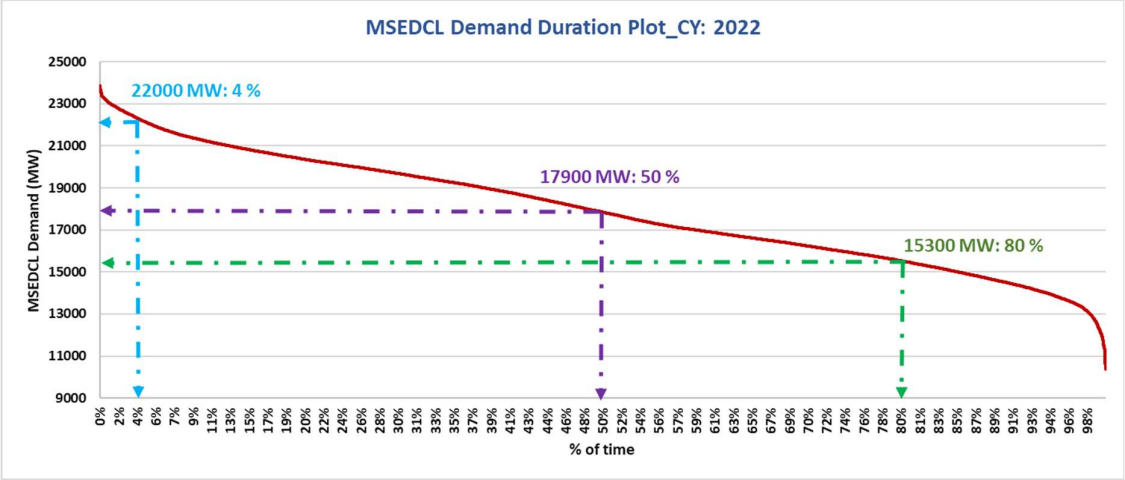
The maximum Ramping-Down requirement of 1307 MW was observed on 31.08.2023 at 46$^{th}$ time block i.e. between 10:30 to 10:45 hrs. During this time, the State Demand decreased from 26134 MW to 24827 MW.

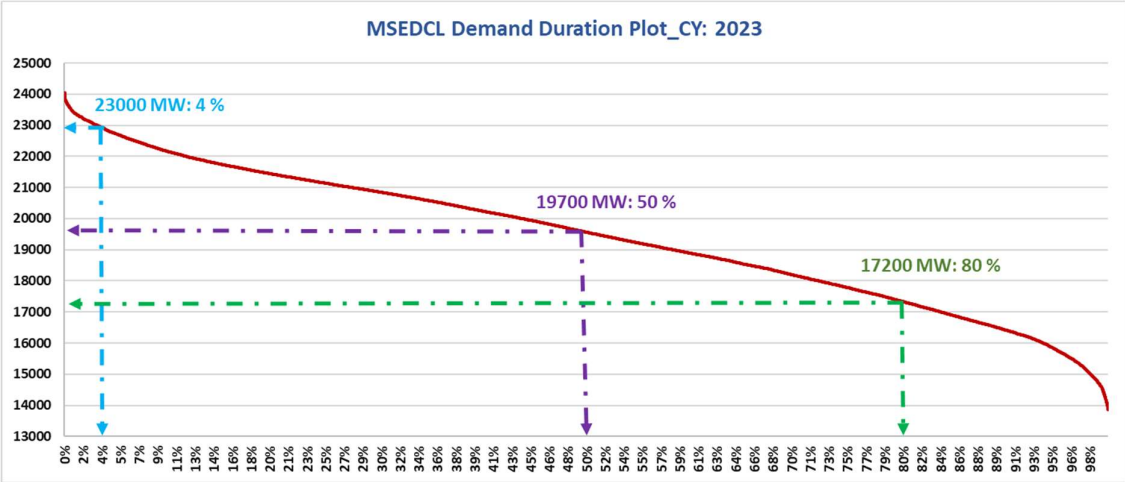


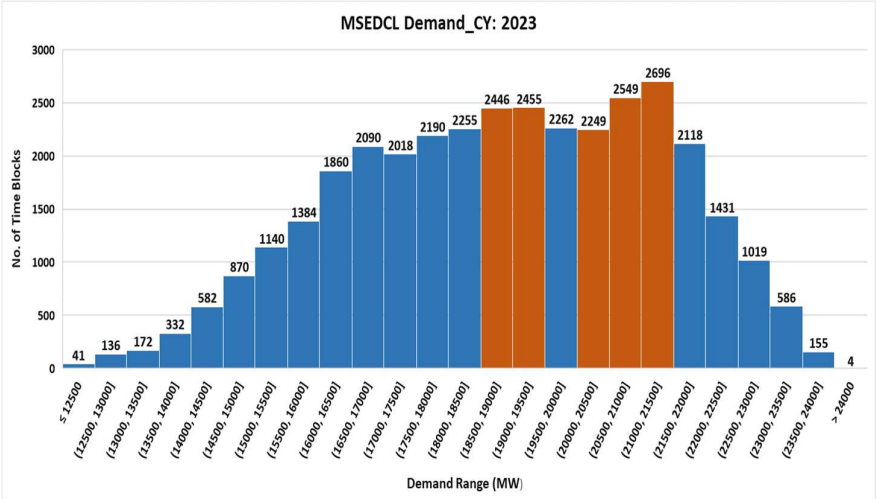

Thus, within 15 minutes, State Demand ramped down by 1307 MW. It is observed that the said demand ramping down requirement was mainly managed through ISTS drawl. The ISTS drawl decreased by 1010 MW, from 10535 MW to 9524 MW.

### 3.2. Demand Profile of MSEDCL:

MSEDCL is the largest Distribution Licensee in the State which contributes to more than 70 % of the total State Demand.




Upon comparing demand plots for both the years, some key observations are as below:

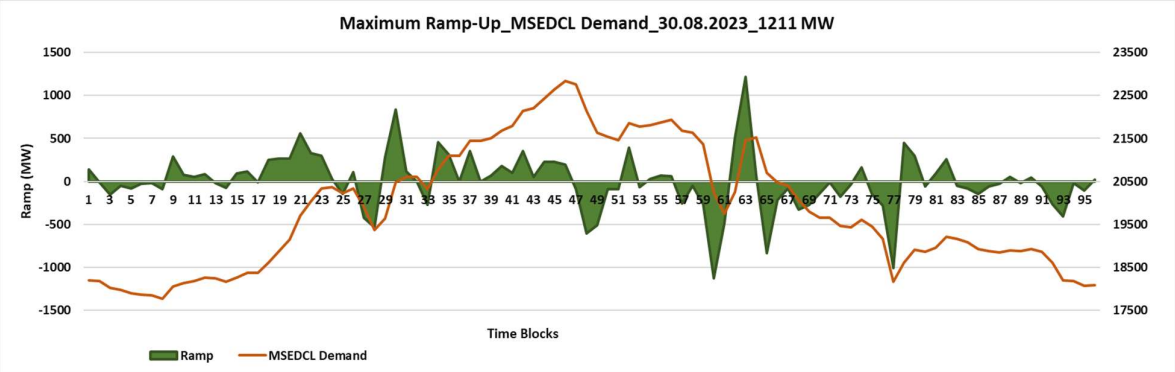
a) For 80 % of the period, MSEDCL demand was 15300 MW in CY: 2022 which increased to 17200 MW in CY: 2023.

b) In CY: 2023, MSEDCL demand increased to 19700 MW from 17900 MW from CY: 2022 with increment of around 1800 MW and the demand was for 50 % of the period.

c) For 4 % of the period, MSEDCL demand was above 22000 MW in CY: 2022 which increased by 1000 MW in CY: 2023.

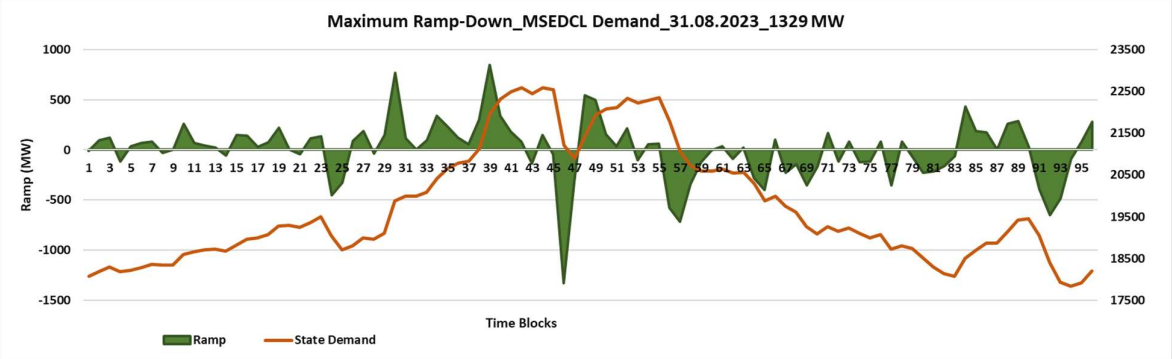
**MSEDCL Demand Ramping-Up/Down Requirements:**

It is observed that the MSEDCL Demand Ramping Up & Ramping Down requirements for CY: 2023 was within a range of 1211 MW to 1329 MW respectively. The maximum Ramping-Up requirement of 1211 MW was observed on 30.08.2023 at 63rd time block i.e. between 15:30 to 15:45 hrs. During this time, the State Demand increased from 20253 MW to 21464 MW. On the same day, a Ramp-Down of 1130 MW was observed at 59th time block, when MSEDCL demand reduced from 21363 MW to 20233 MW.




Thus, within 45 minutes, MSEDCL Demand ramped down by 1881 MW and within next 45 minutes, State Demand Ramped-Up by 1784 MW. Total variations in demand were from 21363 MW to 19745 MW & again back to 21464 MW. It is observed that the said demand ramping requirements were mainly managed through ISTS drawl. The variations in ISTS drawl were from 9652 MW to 8498 MW & again back to 9970 MW. Thus, ISTS drawl ramping down of 1154 MW & ramping-up of 1472 MW was observed during this period.

The maximum Ramping-Down requirement of 1329 MW was observed on 31.08.2023 at 46th time block i.e. between 10:30 to 10:45 hrs. During this time, the MSEDCL Demand decreased from 22541 MW to 21212 MW.

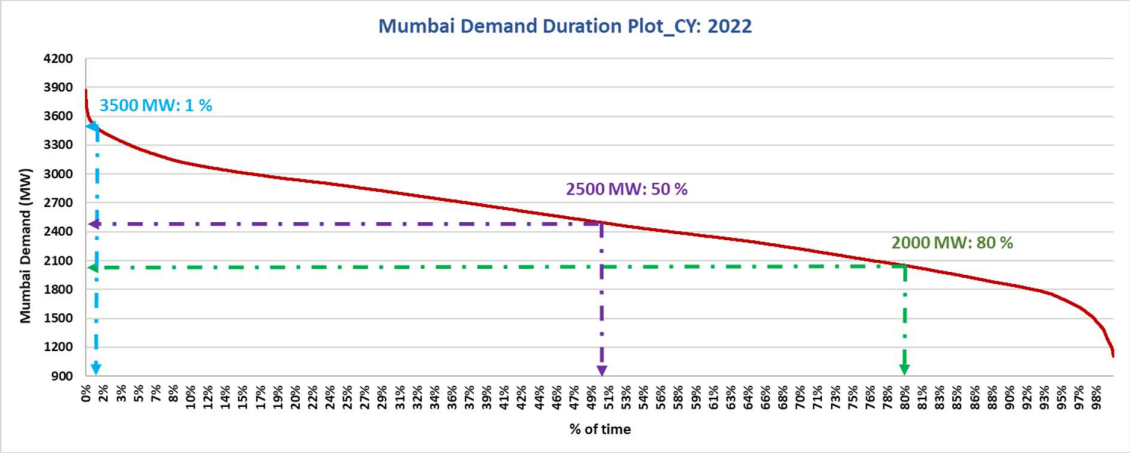


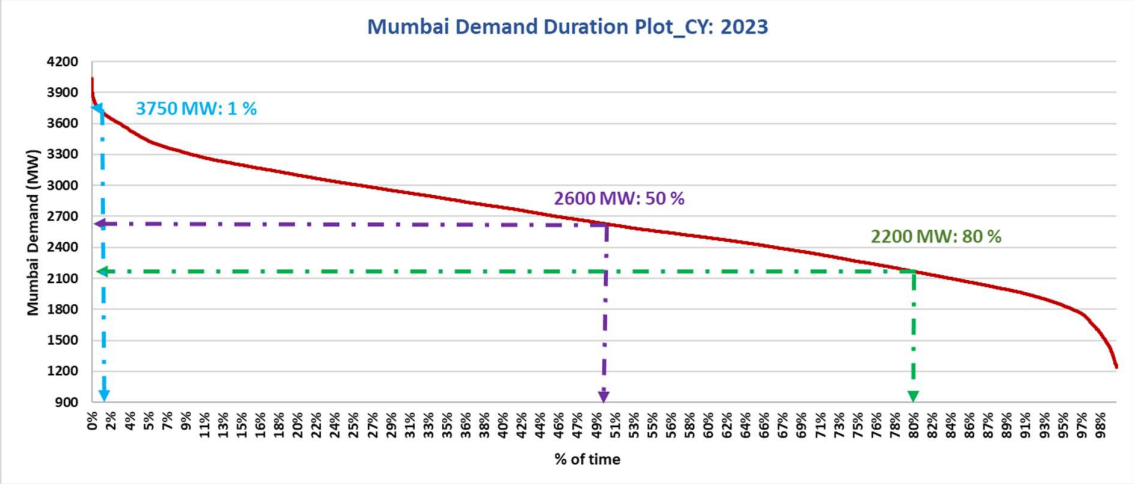

Thus, within 15 minutes, State Demand ramped down by 1329 MW. It is observed that the said demand ramping down requirement was mainly managed through ISTS drawl. The ISTS drawl decreased by 1010 MW, from 10535 MW to 9524 MW.

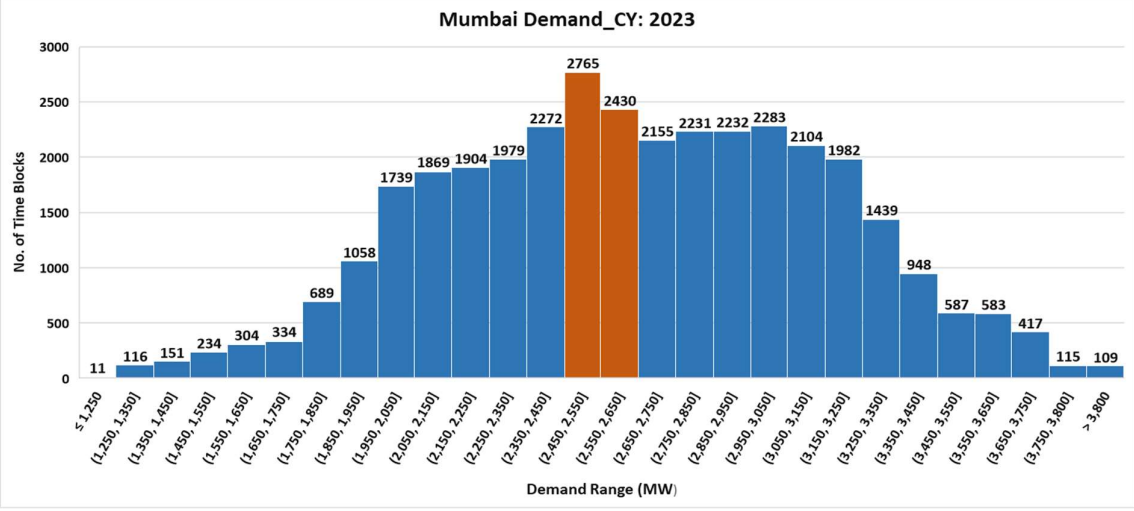
### 3.3. Demand Profile of Mumbai Area:

Mumbai is a financial capital of India. The loads in Mumbai are catered by three Distribution licensees viz. TPC, AEML & BEST. Small quantum of load is fed by MSEDCL. Also, Indian Railways also fed supercritical traction load in Mumbai area.

The overall load pattern of Mumbai is different due to large commercial establishments & residential loads.



Upon comparing demand plots for both the years, some key observations are as below:

a) For 80 % of the period, Mumbai demand was 2000 MW in CY: 2022 which increased to 2200 MW in CY: 2023.

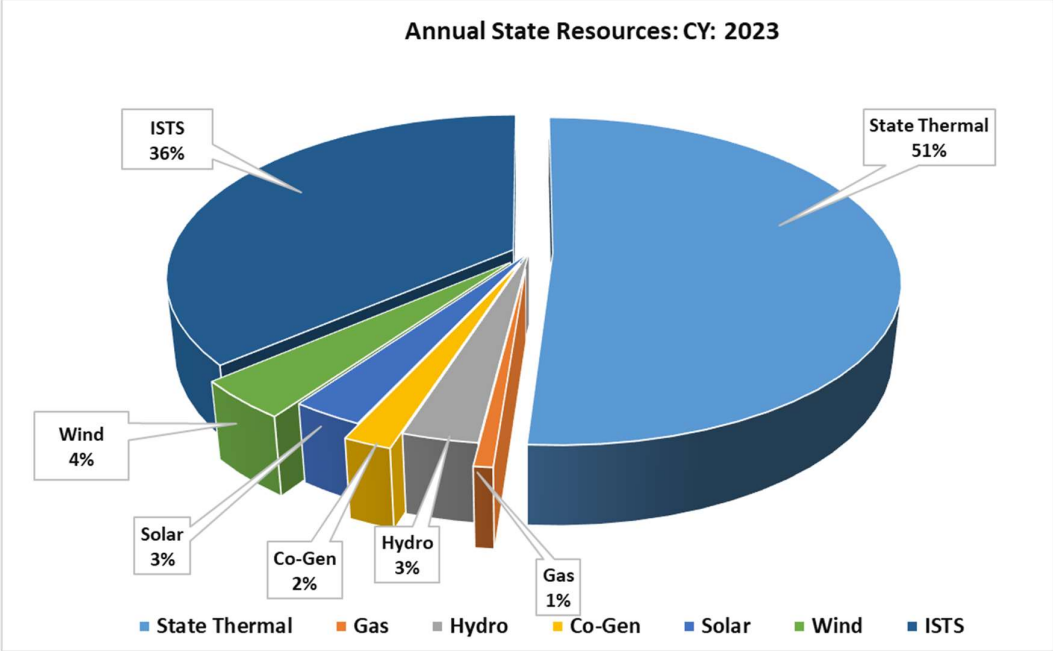
b) In CY: 2023, Mumbai demand increased to 2600 MW from 2500 MW from CY: 2022 with increment of around 100 MW and the demand was for 50 % of the period.

c) For 1 % of the period, Mumbai demand was above 3500 MW in CY: 2022 which increased by 250 MW in CY: 2023.

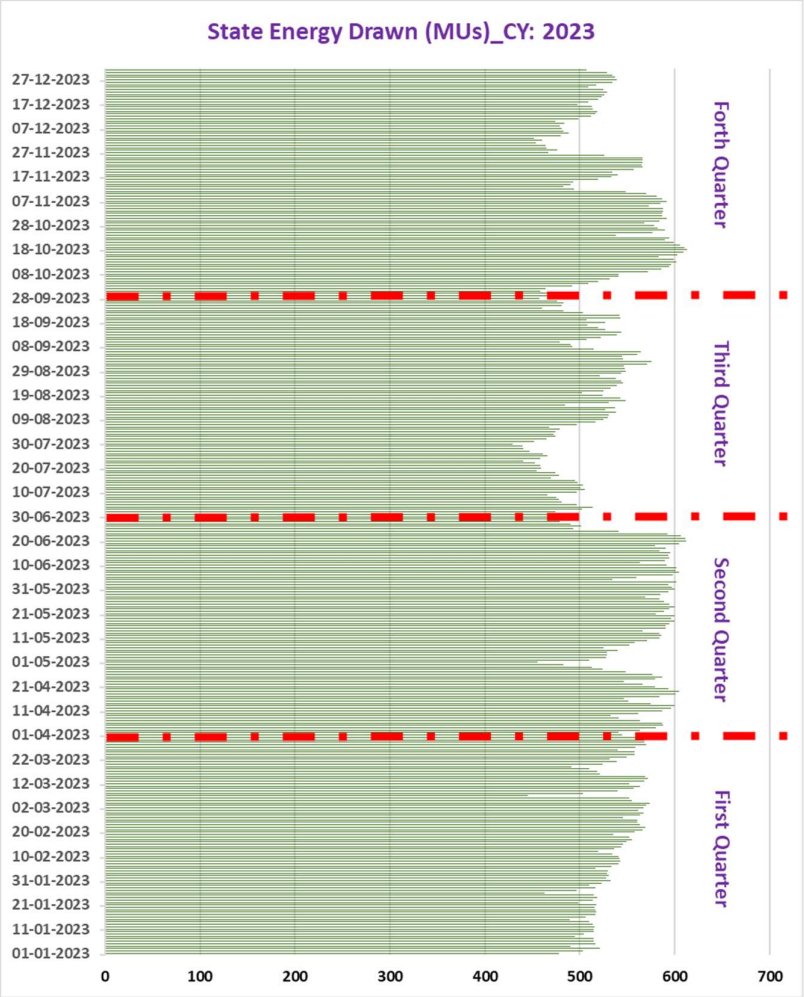
### 3.4. Energy Profile of the State:

The total Energy catered by the State for the CY: 2023 and its contribution through different sources of generation is shown below:

| | Source | Hydro | Thermal | Gas | Wind | Co gen | Solar | ISGS |
|---|---|---|---|---|---|---|---|---|
| CY 2023 | MUs | 5940 | 99927 | 1487 | 7623 | 3762 | 5596 | 70886 |
| | % | 3 | 51 | 1 | 4 | 2 | 3 | 36 |




From the above graph, it is observed that the total annual contribution of Thermal generation in mitigating State Energy requirements is 51 % which excludes the thermal energy used from ISGS resources. The contribution of VRE i.e. Wind & Solar generation is only 7 %.




Maximum energy to the tune of around 51638 MUs was catered in the 2nd quarter of the CY: 2023 followed by Forth quarter with 49509 MUs.

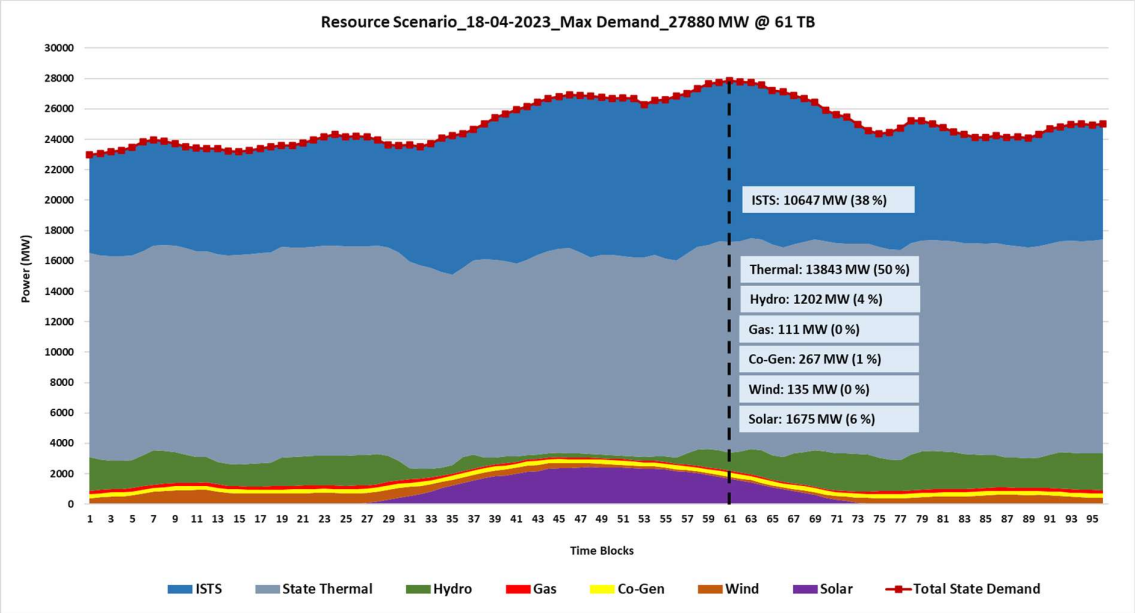
### 3.5. Resources Mix at different Demands:

#### 3.5.1. State Peak Demand Scenario:

The maximum Demand catered by the State was 27880 MW on 18.04.2023 at 61st time block i.e. at 15:15 hrs. This demand was met by various Intra as well as Inter-State resources.

The source-wise contribution in meeting maximum demand is tabulated below.

| Source | Injection (MW) | Contribution (%) |
|---|---|---|
| State Thermal | 13843 | 50% |
| Gas | 111 | 0% |
| Hydro | 1202 | 4% |
| Co-Gen | 267 | 1% |
| Solar | 1675 | 6% |
| Wind | 135 | 0% |
| ISTS | 10647 | 38% |




From the above, it is seen that the contribution of VRE in mitigating State Peak Demand is only 6 % and State is mainly relying on the thermal generation for meeting peak demand.

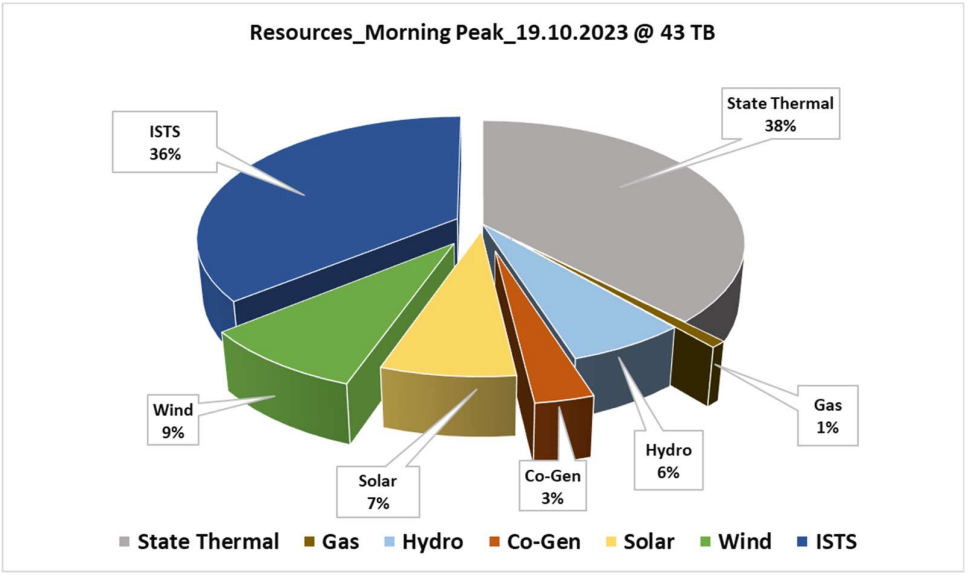
### 3.5.2. State Demand Resources at 4 cardinal points:

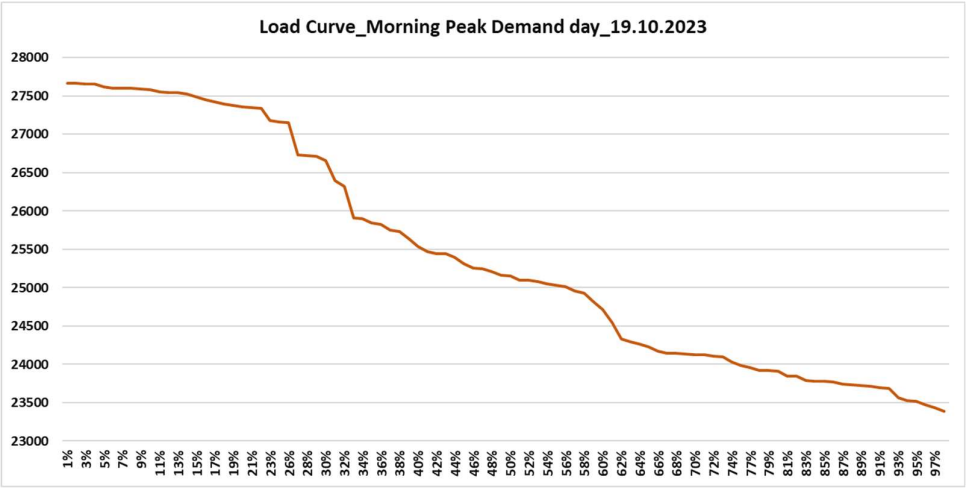
State Demand varies throughout the day. Hence, it is pertinent to check the Load-Generation resources at four cardinal points viz. Solar Peak (Day Peak), Morning Peak, Non-Solar Peak (Evening) & Non-Solar Off-Peak. Hence, based on such cardinal points, the maximum demand resources for Peak scenarios of Solar/Morning & Non-Solar hours and minimum demand during night off-peak hours is shown below.

The timing for selection of 4 cardinal points are tabulated below:

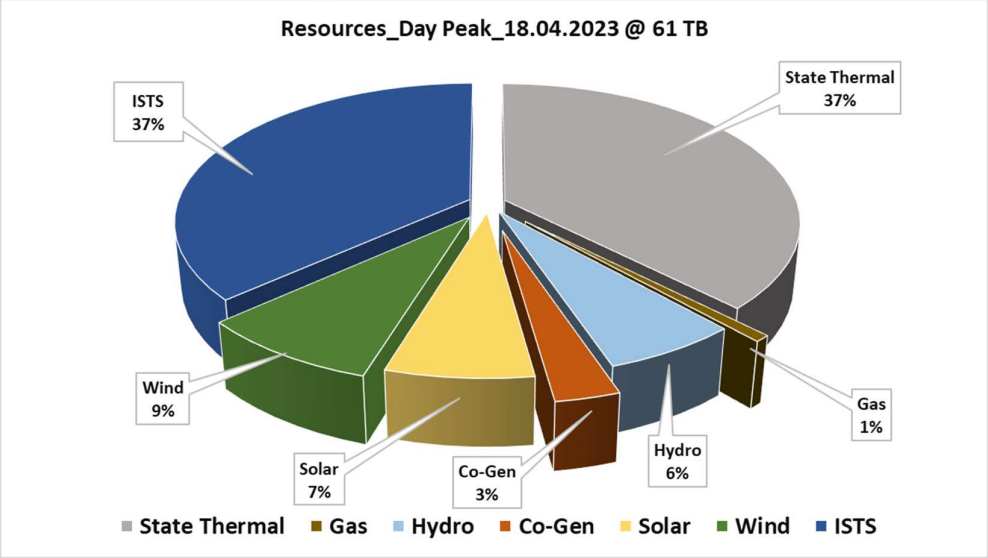
| Scenario/Time | From Hrs | To Hrs | From TB | To TB |
|---|---|---|---|---|
| **Morning Peak** | 7:00 | 13:00 | 29 | 52 |
| **Day Peak (Solar)** | 13:00 | 18:00 | 53 | 72 |
| **Evening Peak (Non-Solar)** | 18:00 | 22:00 | 73 | 88 |
| **Night Off-Peak** | 23:00 | 06:00 | 89 | 28 |

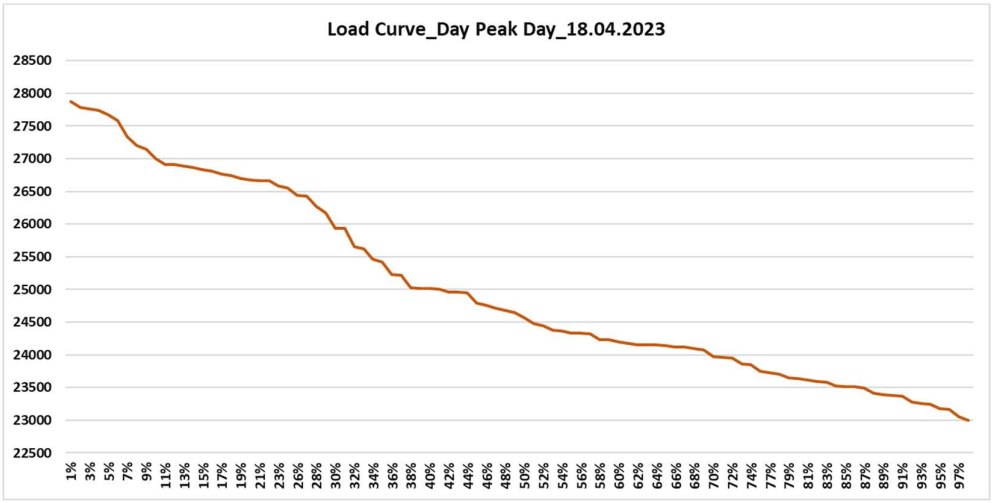
## a) State Demand Scenario_Morning Peak:



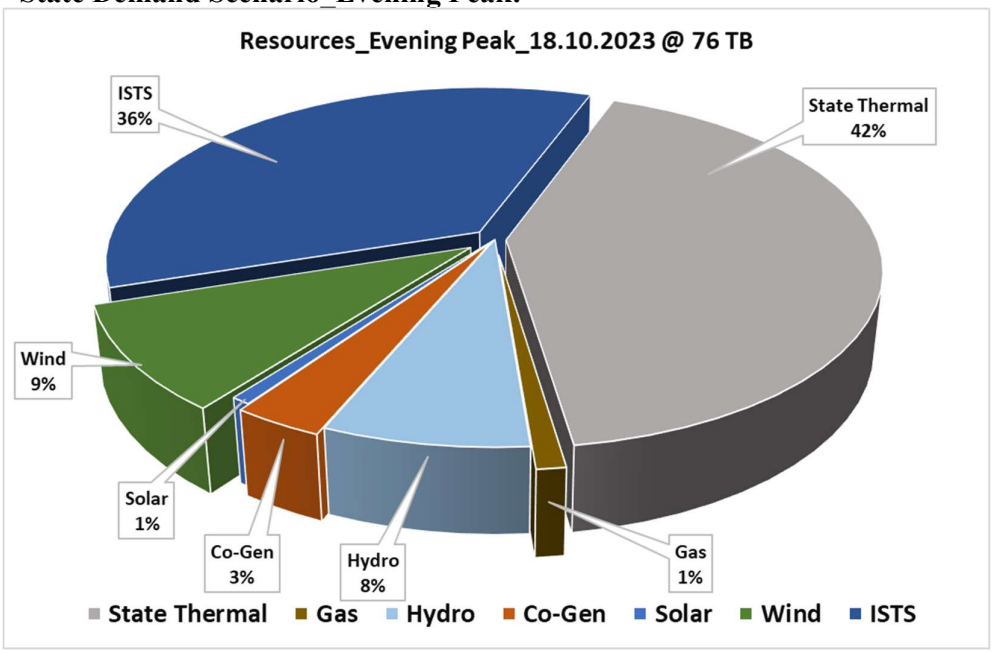



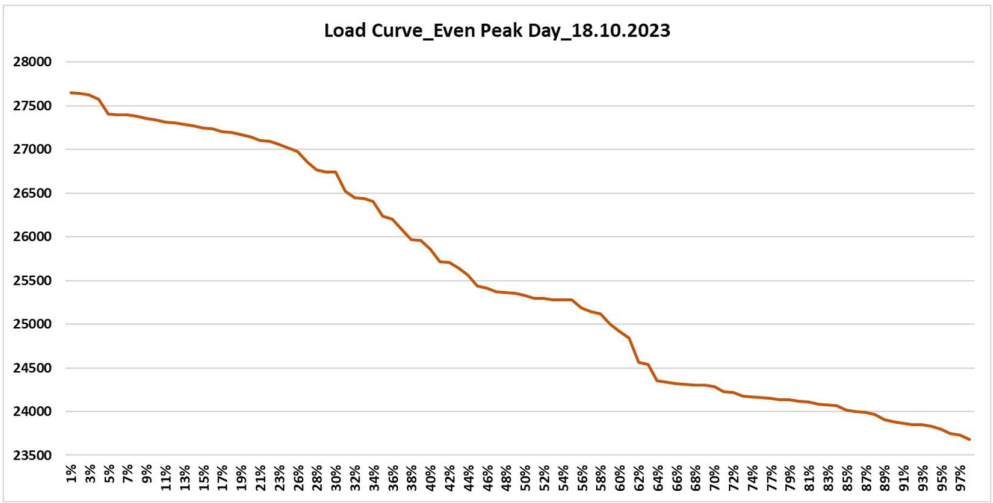

## b) State Demand Scenario_Solar Peak:



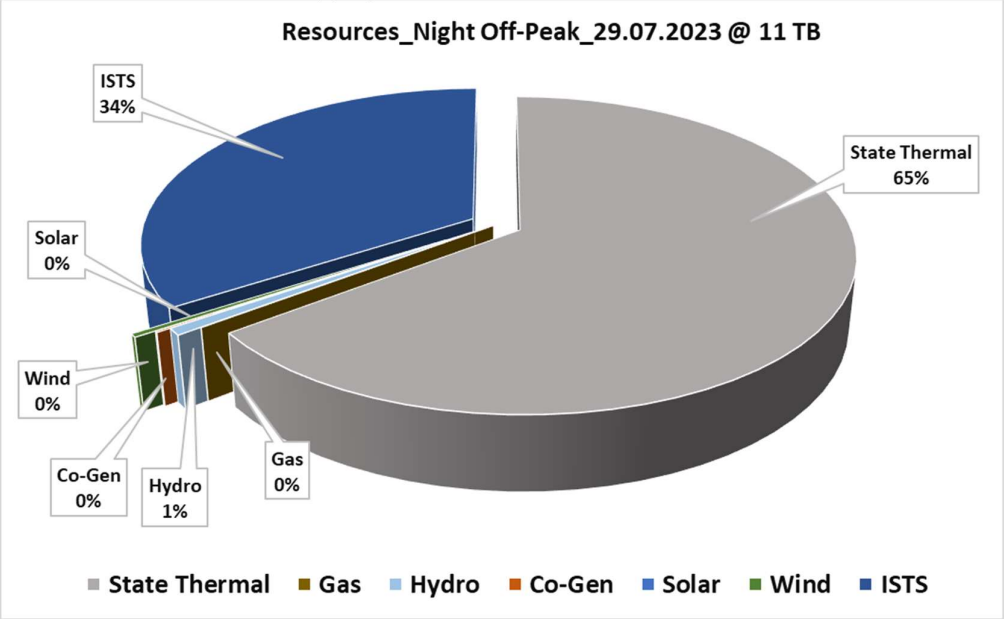


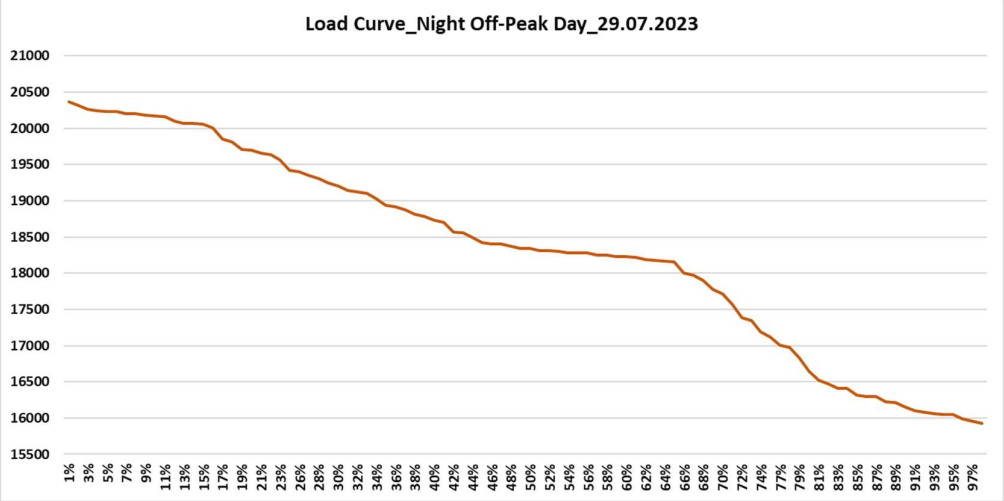

## c) State Demand Scenario_Evening Peak:



## d) State Demand Scenario_Night Off-Peak:



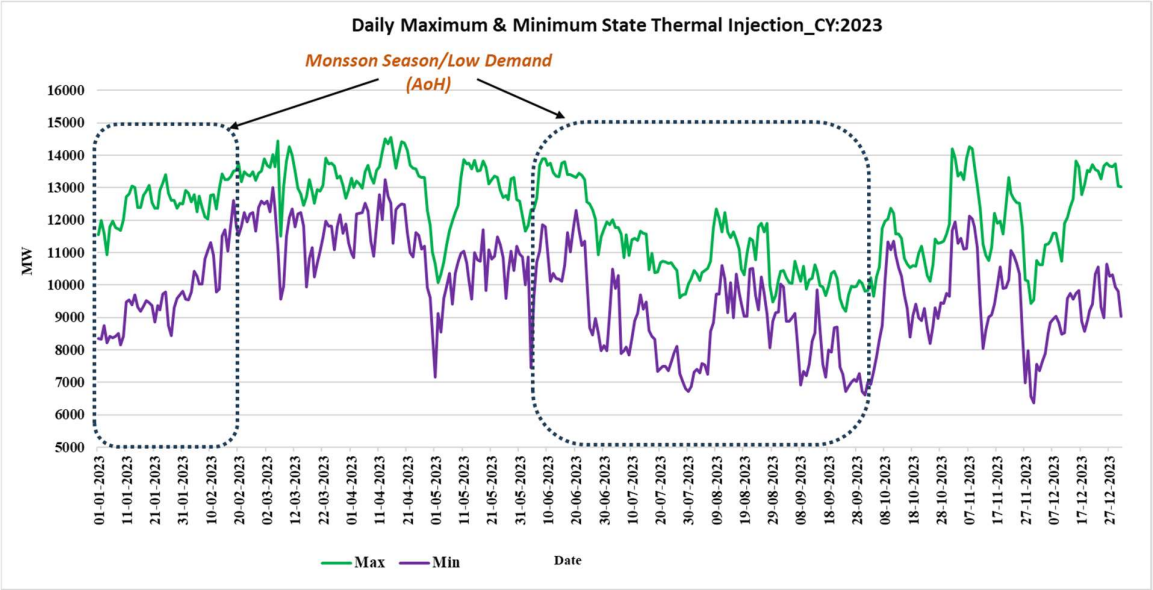
## 4.0. Generation Profile of the State:

### 4.1. Thermal Generation:

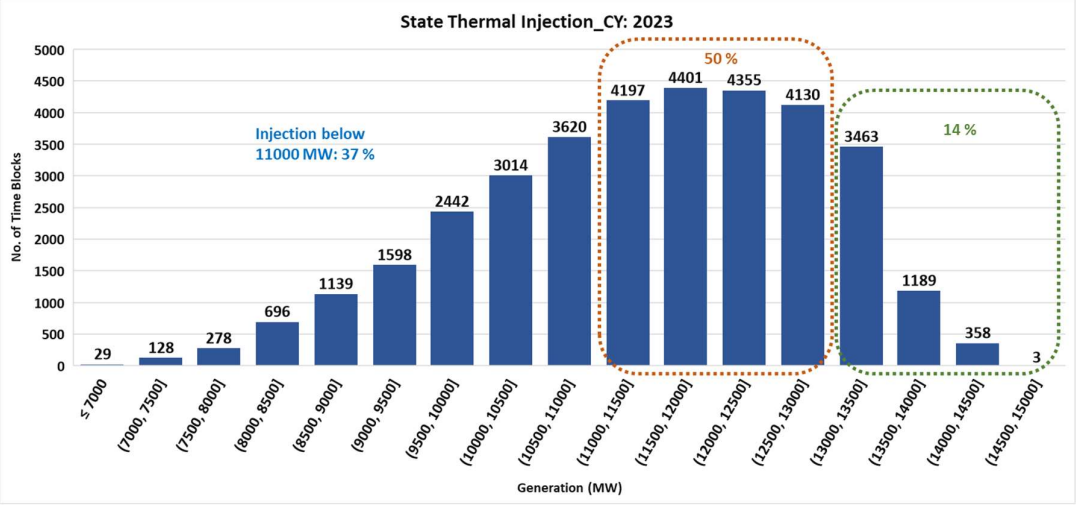
### 4.1.1. Injection Patterns:

Maharashtra is the only State in the Country which is having highest State-owned Thermal Generation. Maharashtra State Power Generation Company Ltd. (MSPGCL) is the major Generation Utility having total Thermal generation installed capacity of 9540 MW. There are other Private generating companies in the State having total installed capacity of 10090 MW.

The Daily Maximum & Minimum injection pattern of the thermal generation in the State is shown below.



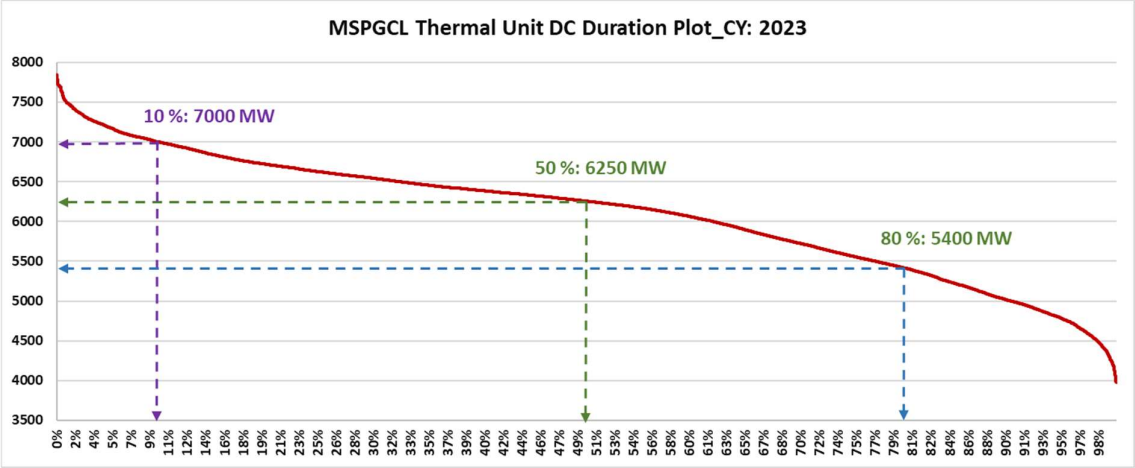

Fron the above, it is observed that the total injection from Thermal units is ranging from 14555 MW to 6355 MW. Further, maximum daily variation is 4876 MW.

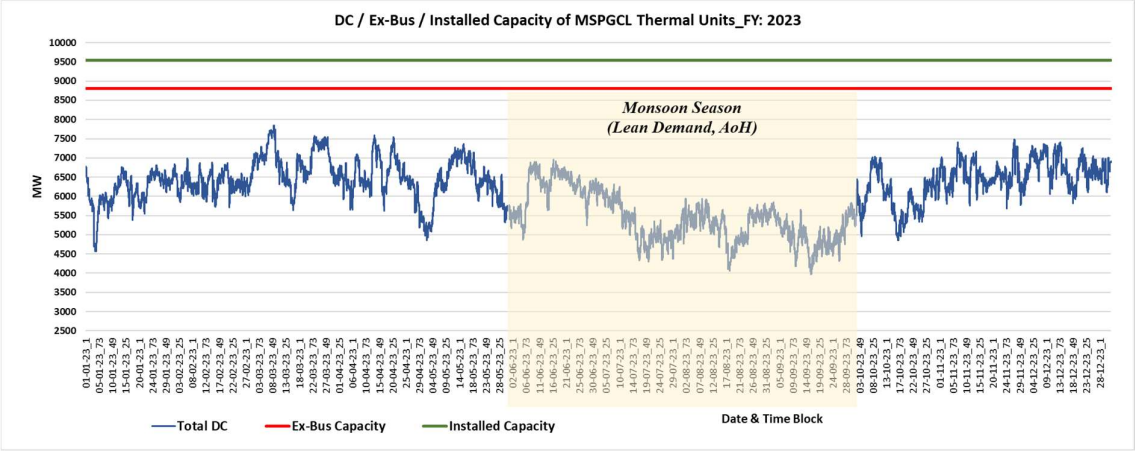


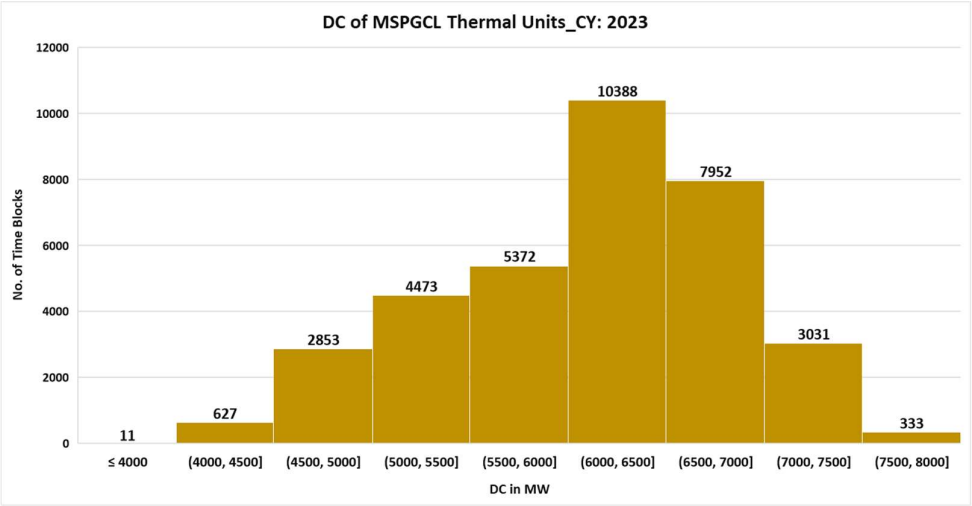
From the above, graph, it is observed that for 37 % of the period, injection from Thermal generation is below 11000 MW. Similarly, injection is above 13000 MW only for 14 % of the period. For remaining 50 % of the period, thermal injection is between 11000 MW to 13000 MW.

### 4.1.2. Declared Capacity (DC) of MSPGCL Thermal Generation:

The total installed capacity of Thermal units of MSPGCL is 9540 MW. After deduction of auxiliary consumption, the Ex-Bus Capacity is 8811 MW.



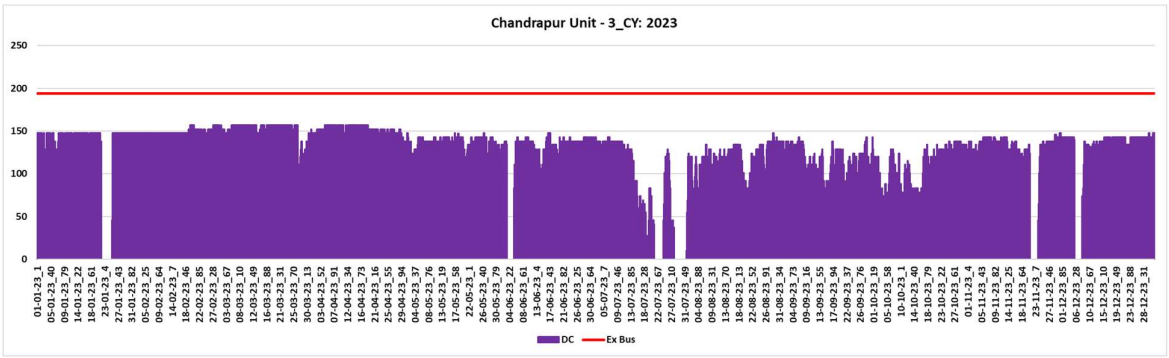



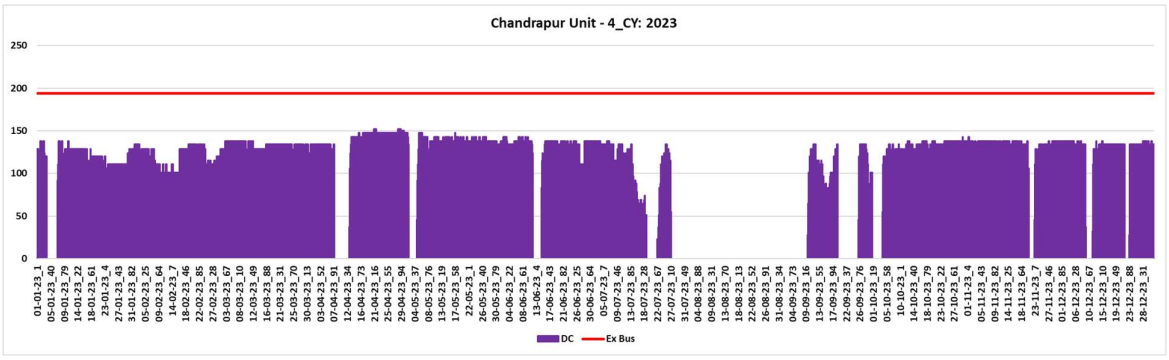
| DC against Ex-Bus Capacity | No. of Time Blocks | No. of Days | % in Year |
|---|---|---|---|
| No. of Time Blocks DC below 50 % (4400 MW) | 384 | 4 | 1% |
| No. of Time Blocks DC below 70 % (6200 MW) | 16291 | 170 | 46% |
| No. of Time Blocks DC below 75 % (6600 MW) | 25855 | 269 | 74% |
| No. of Time Blocks DC below 80 % (7000 MW) | 31671 | 330 | 90% |
| No. of Time Blocks DC above 70 % (6200 MW) | 18745 | 195 | 53% |
| No. of Time Blocks DC above 80 % (7000 MW) | 3364 | 35 | 10% |
| No. of Time Blocks DC above 90 % (8000 MW) | 0 | 0 | 0% |

From the above graph & table, it is observed that the for 50% of the period, DC is above 6250 MW. Further, only for 10 % of the period, DC is above 7000 MW against total Ex-Bus capacity of 8811 MW. This indicates that the DC is at much side compared to the Ex-Bus (Installed) Capacity.

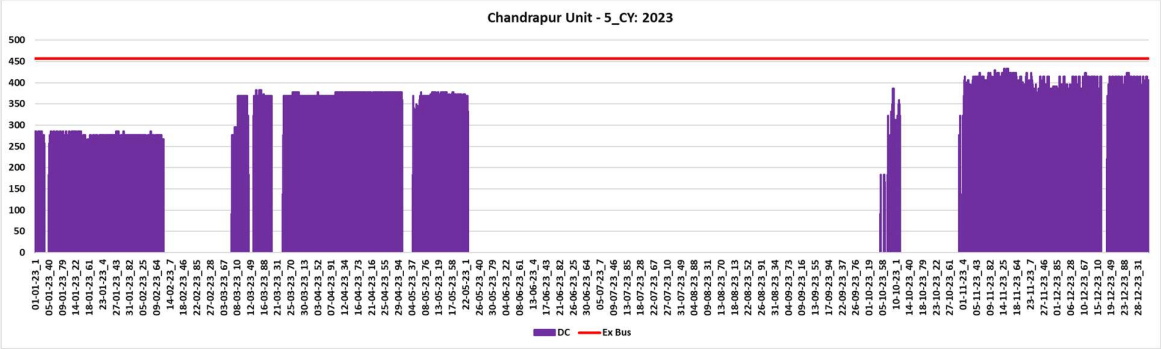
**The unit-wise DC analysis for the CY: 2023 is as below:**

- **Chandrapur Thermal Power Complex: (2920 MW)**
  U-3 to 4: 210 MW each
  U-5 to 9: 500 MW each

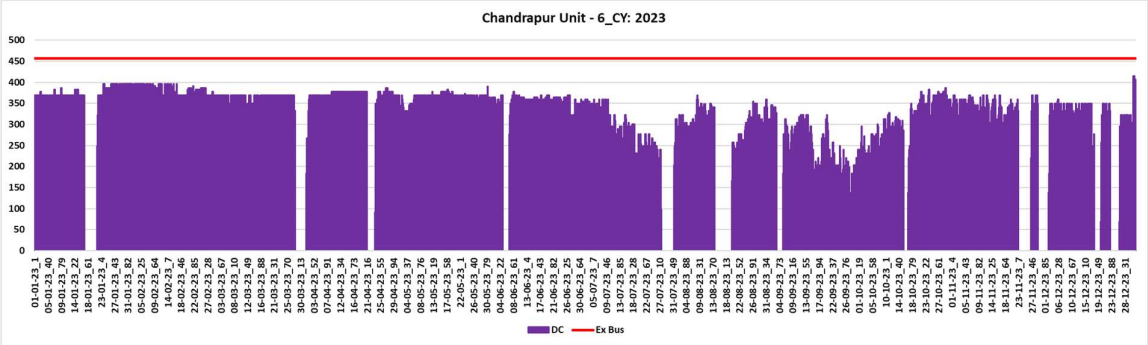


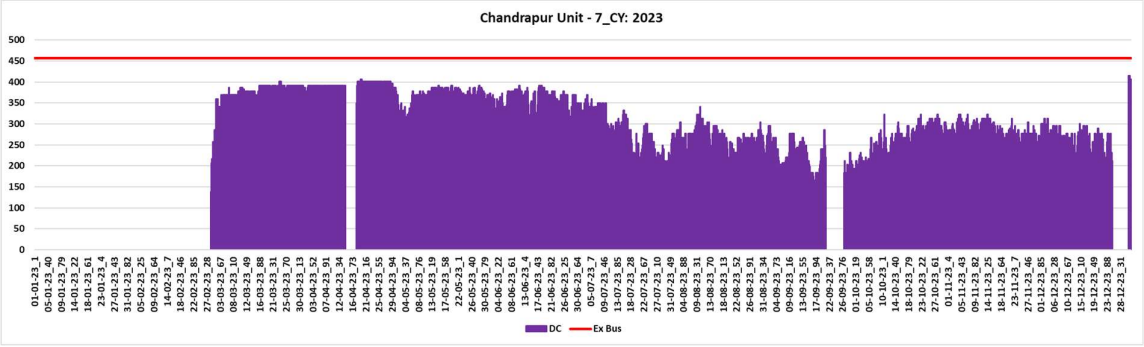




*Unit-4 was under AoH for the period 27.07.2023 to 09.09.2023.*

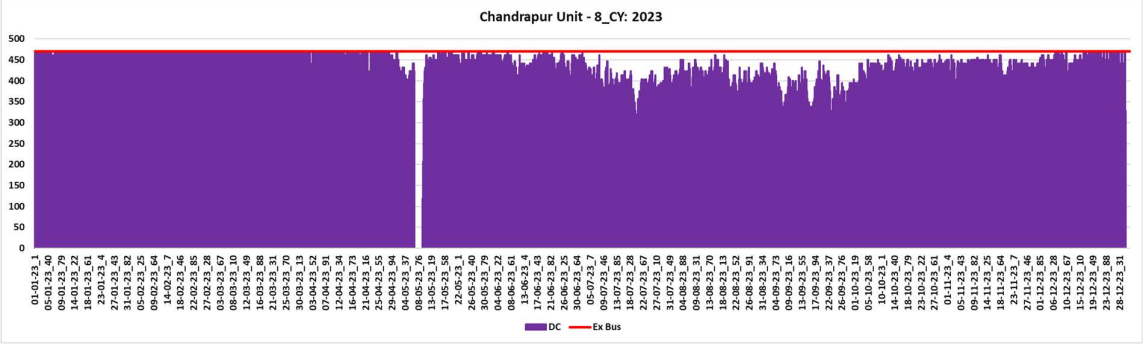


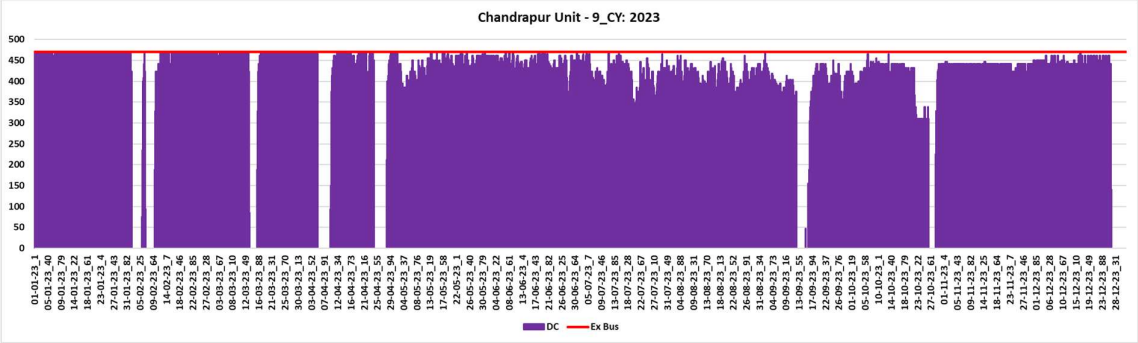

*Unit-5 was out from 12.02.2023 to 06.03.2023 for Boiler Validation. Further, Unit-5 tripped on 22.05.2023 due to Stator earth fault which was converted in to AoH for the period 27.07.2023 to 04.10.2023. Unit was out from 11.10.2023 to 30.10.2023 due to high turbine vibration.*



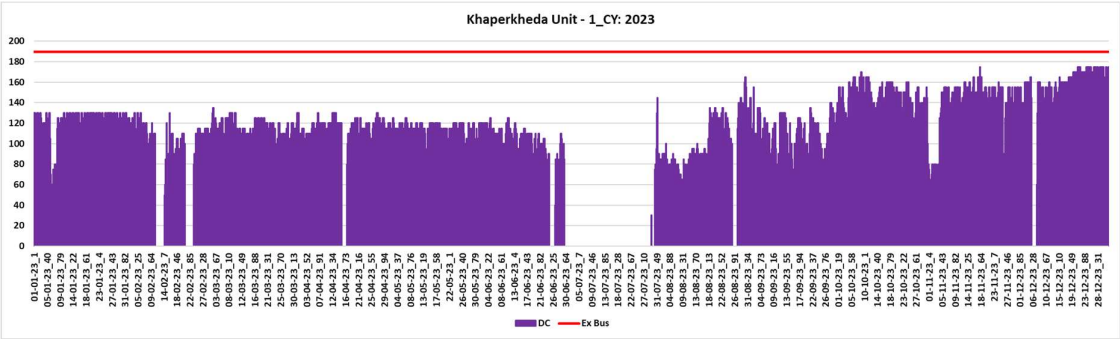

*Unit-7 was out from 29.11.2022 to 28.02.2023 due to high main turbine gland sealing pressure.*



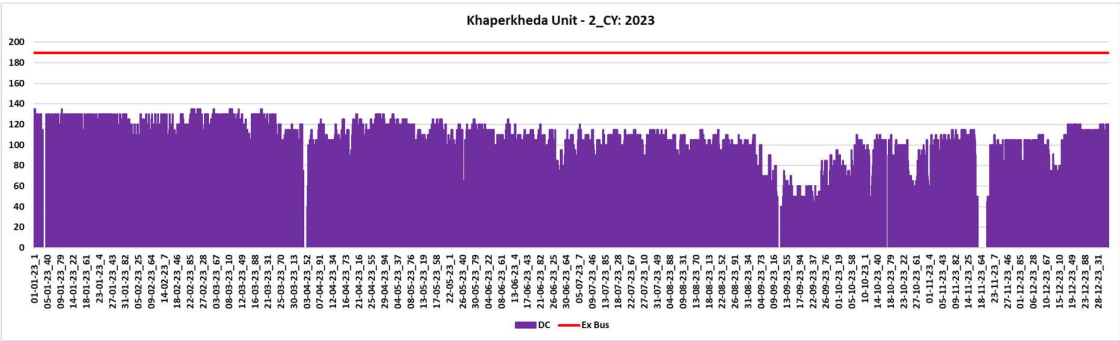


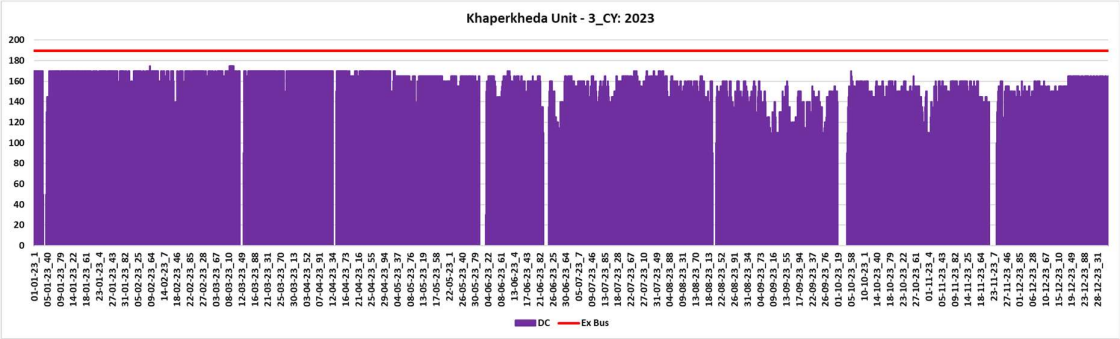

- **Khaperkheda Thermal Power Complex: (1340 MW)**

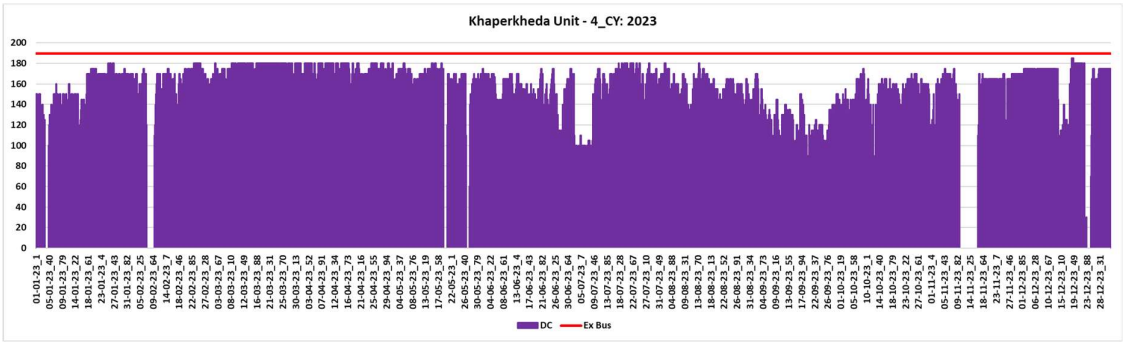
  U-1 to 4: 210 MW each
  U-5: 500 MW each

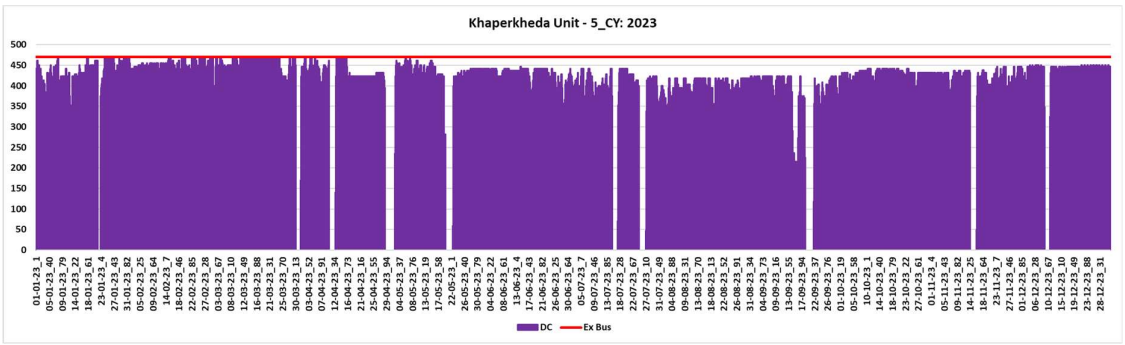



*Unit-1 was under AoH for the period 30.06.2023 to 29.07.2023.*



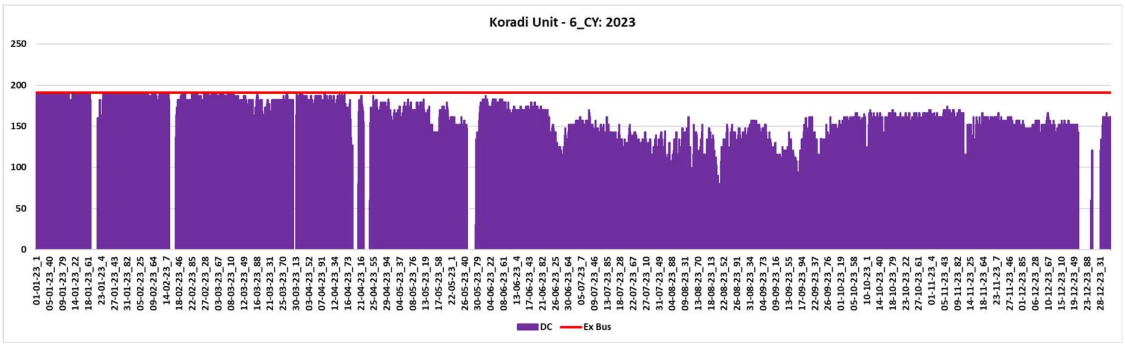



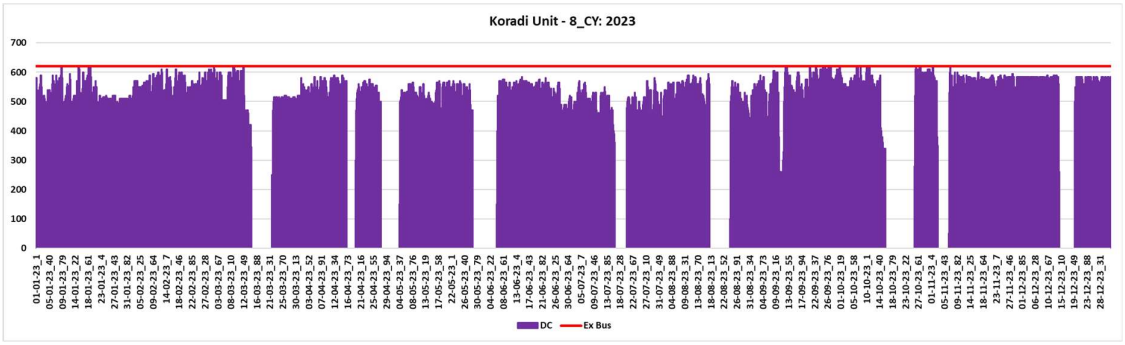


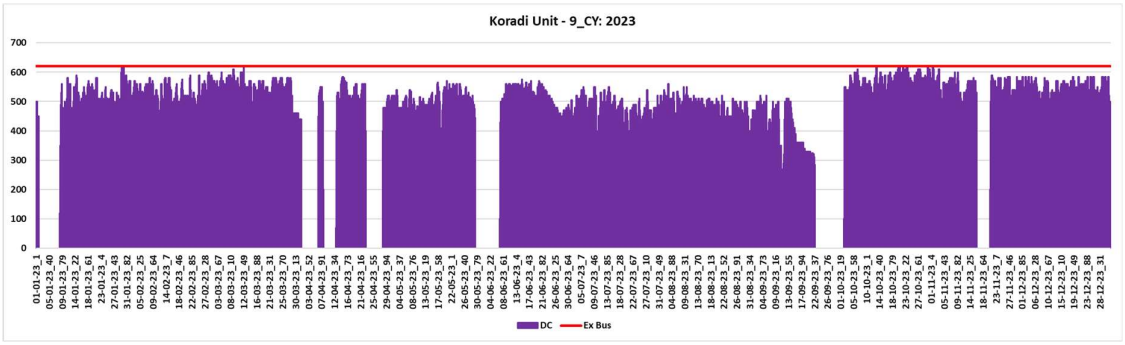



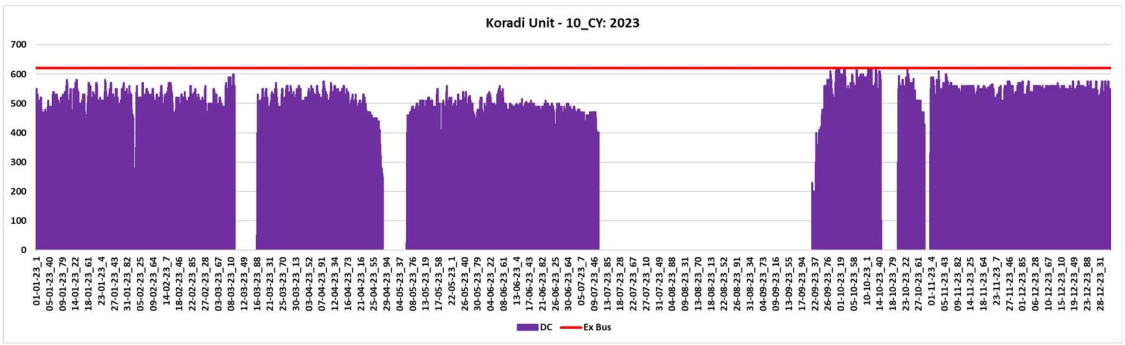

- **Koradi Thermal Power Complex: (2190 MW)**

  U-6: 210 MW each
  U-8 to 10: 660 MW each



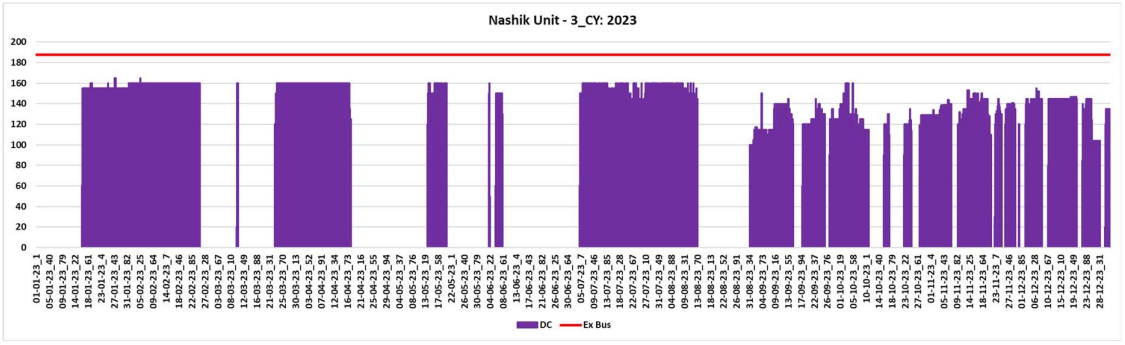


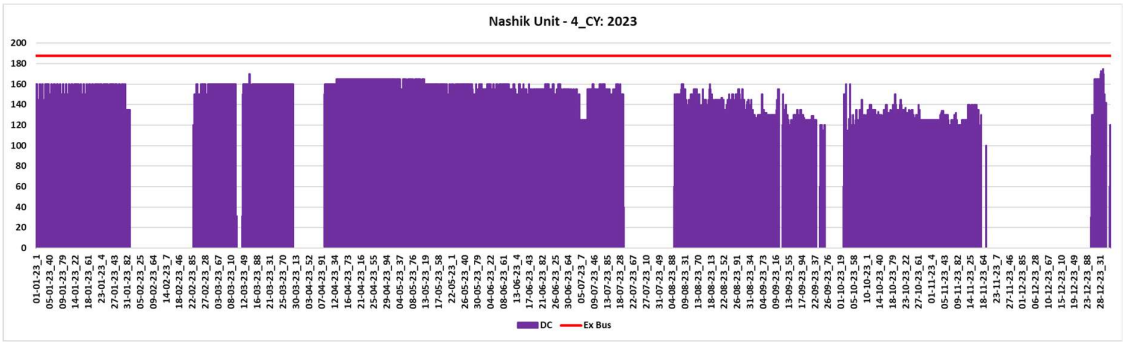

*Unit-10 was under AoH for the period 11.07.2023 to 21.09.2023.*

- **Nashik Thermal Power Complex: (630 MW)**

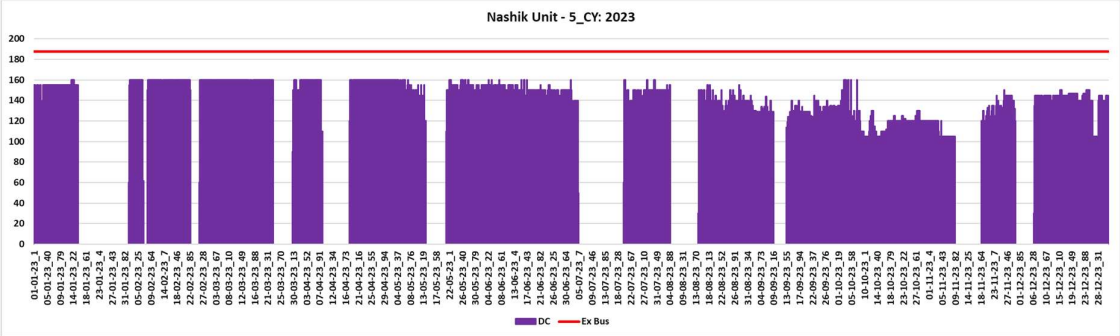
  U-3 to 5: 210 MW each




Unit-3 was under tolling agreement with IEPL for 70 days during the year.



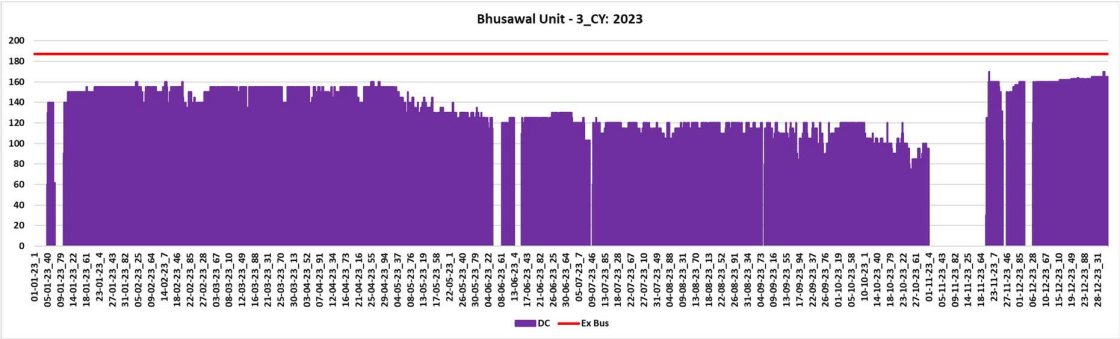

Unit-4 was under tolling agreement with IEPL for 38 days during the year. Further, Unit tripped on Stator Earth Fault on 19.11.2023 & it was converted to AoH for the period 19.11.2023 to 25.12.2023.



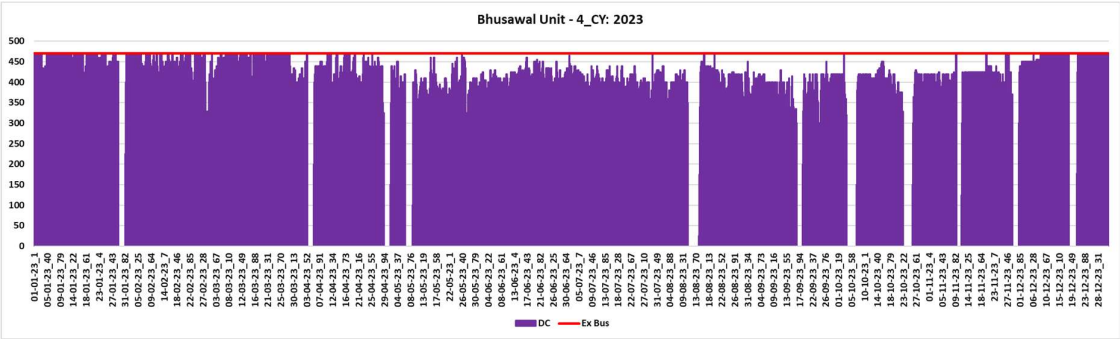

Unit-5 was under tolling agreement with IEPL for 39 days during the year.

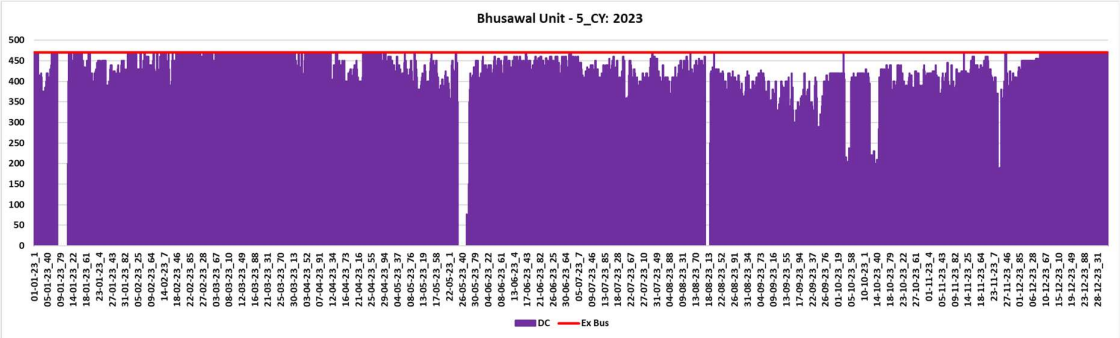
- **Bhusawal Thermal Power Complex: (1210 MW)**

  U-3: 210 MW
  U-4 & 5: 500 MW each



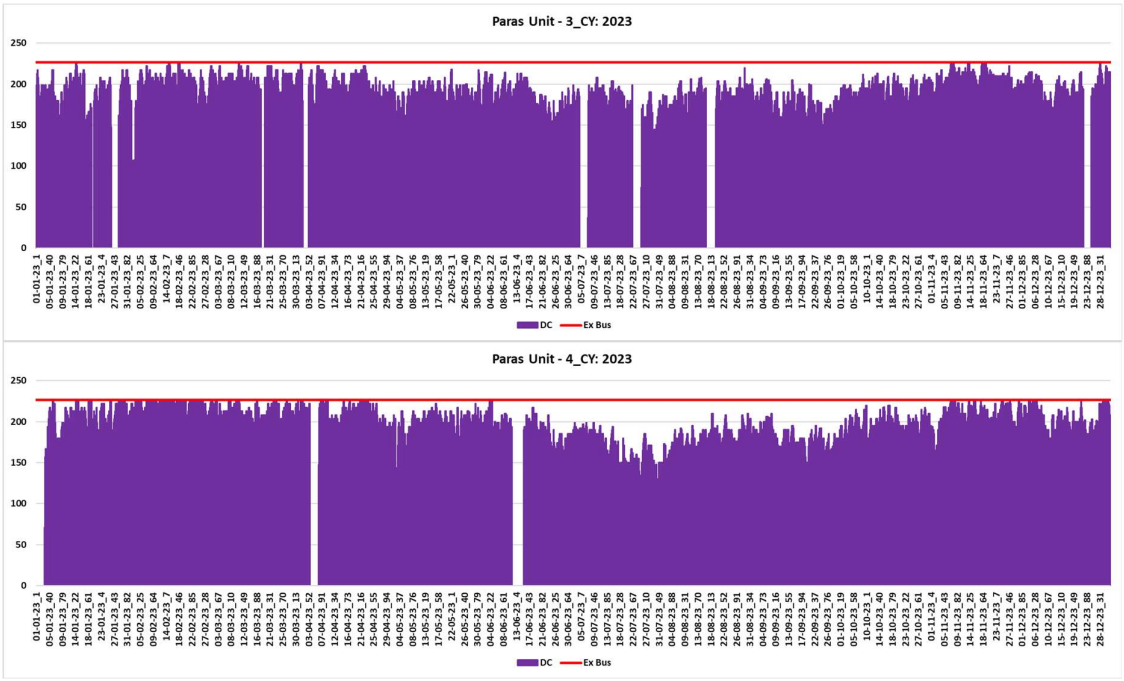

Unit-5 was out due to ID Fan problem for the period 31.10.2023 to 20.11.2023.



- **Paras Thermal Power Complex: (500 MW)**

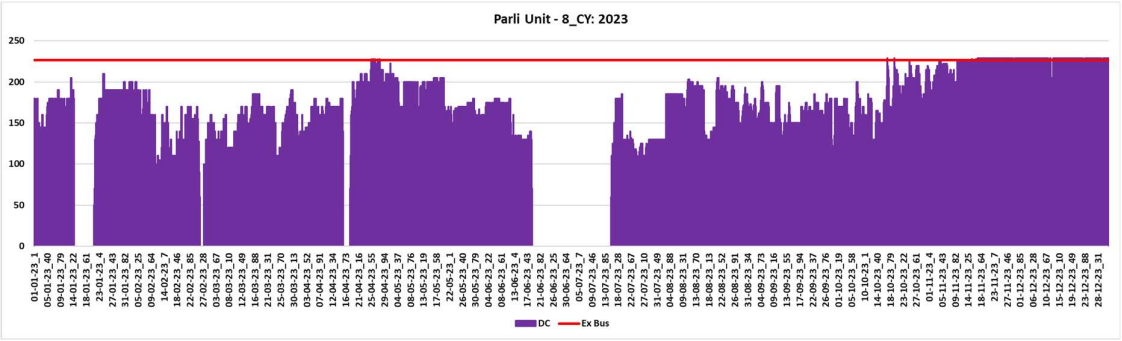
  U-3 & 4: 250 MW each




- **Parli Thermal Power Complex: (750 MW)**

  U-6 to 8: 250 MW each


*Unit-7 was under AoH for the period 03.01.2023 to 04.02.2023.*

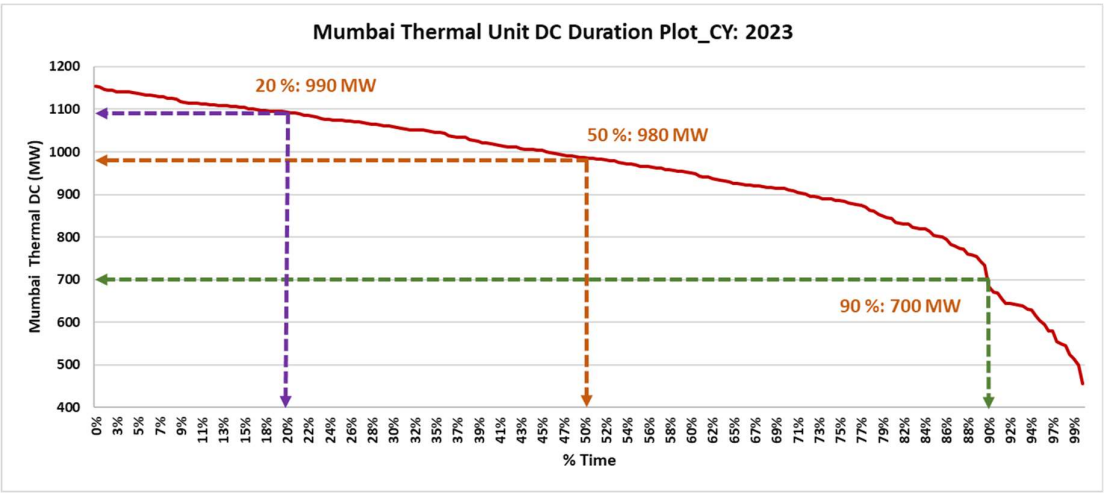


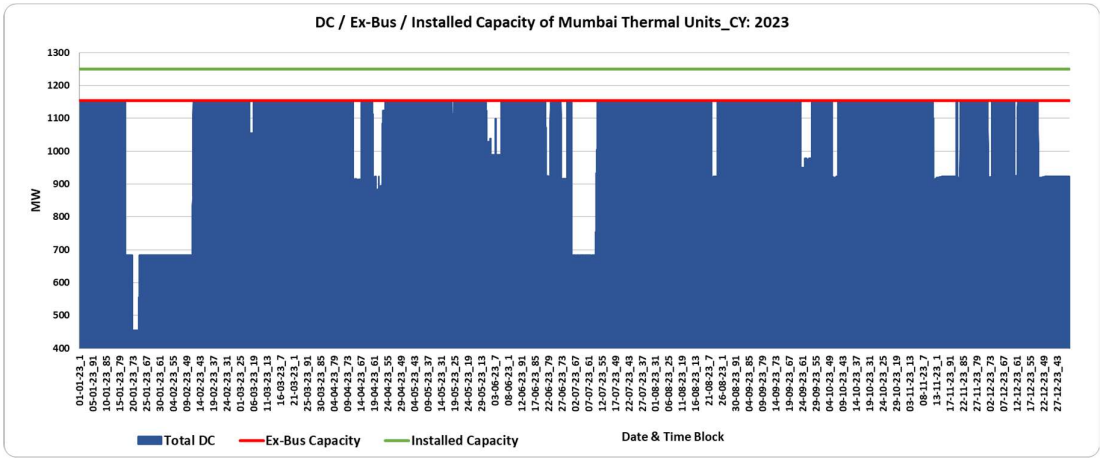

*Unit-8 was under AoH for the period 18.06.2023 to 15.07.2023.*

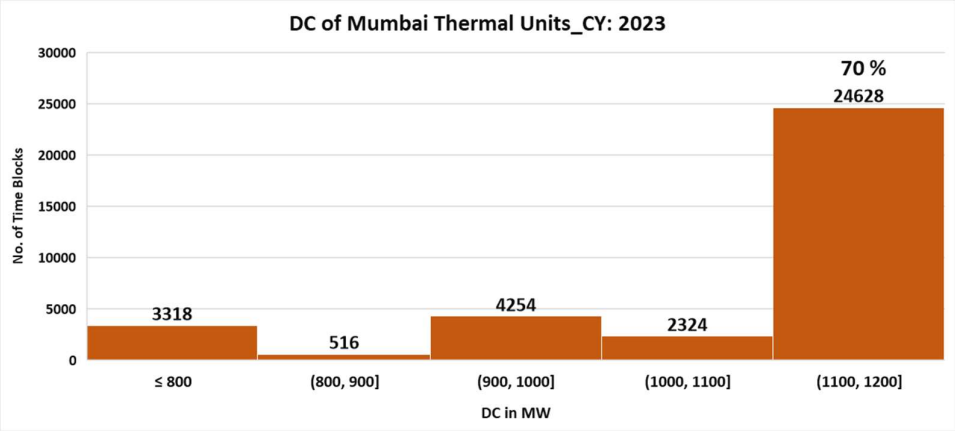
*Parli Unit-6, 7 & 8 were issued Zero Schedule for 40, 37 & 22 days respectively during the year.*

### 4.1.3. Declared Capacity (DC) of Mumbai Thermal Generation:

The total installed capacity of Thermal units embedded in Mumbai is 1250 MW. After deduction of auxiliary consumption, the Ex-Bus Capacity is 1153 MW.



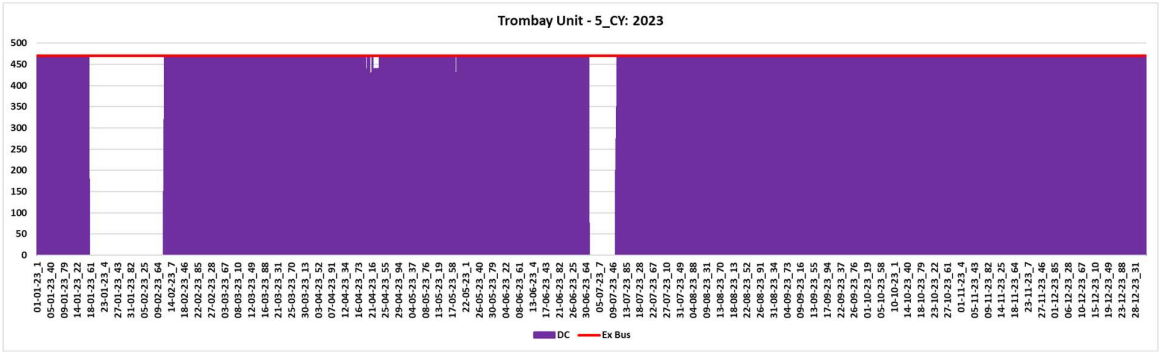



| DC against Ex-Bus Capacity | No. of Time Blocks | No. of Days | % in Year |
|---|---|---|---|
| No. of Time Blocks DC below 50 % (576 MW) | 247 | 3 | 1% |
| No. of Time Blocks DC below 70 % (800 MW) | 3318 | 35 | 9% |
| No. of Time Blocks DC below 75 % (865 MW) | 3529 | 37 | 10% |
| No. of Time Blocks DC below 80 % (923 MW) | 6778 | 71 | 19% |
| No. of Time Blocks DC above 70 % (800 MW) | 31722 | 330 | 91% |
| No. of Time Blocks DC above 80 % (923MW) | 28262 | 294 | 81% |
| No. of Time Blocks DC above 90 % (1038 MW) | 26715 | 278 | 76% |

From the above graph & table, it is observed that the DC of Mumbai embedded thermal generators is above 1100 MW for 70 % of the time.

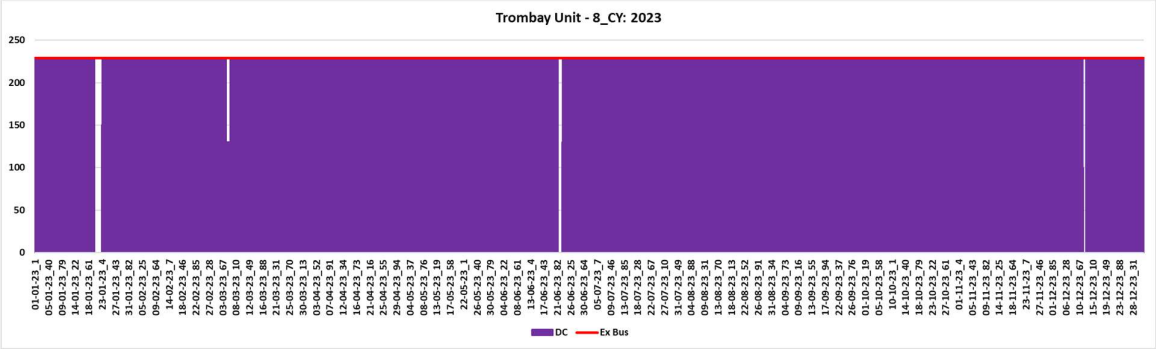
The individual unit-wise DC is shown below:

- **Trombay Unit-5 (500 MW)**

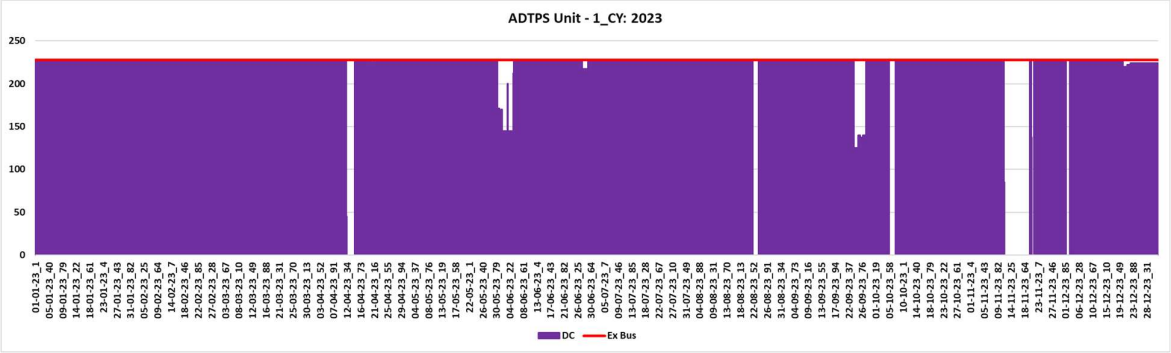



*Unit-5 was under AoH for the period 18.01.2023 to 15.02.2023.*

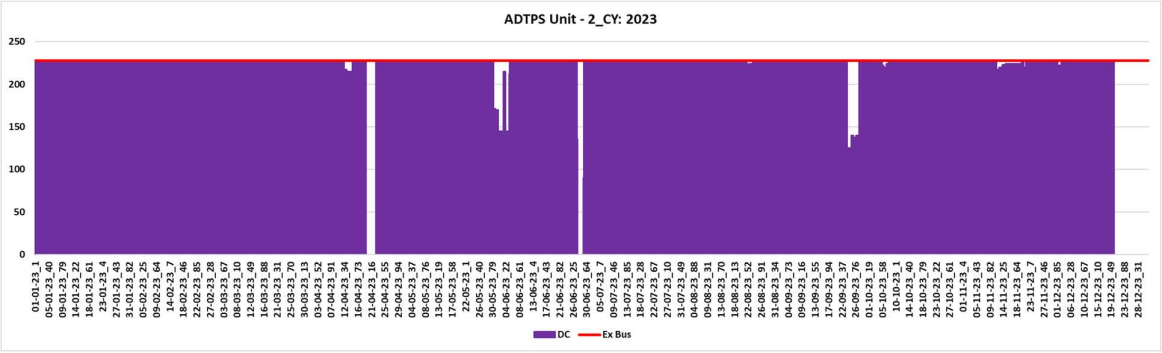
- **Trombay Unit-8 (250 MW)**




- **Dahanu Unit-1 (250 MW)**

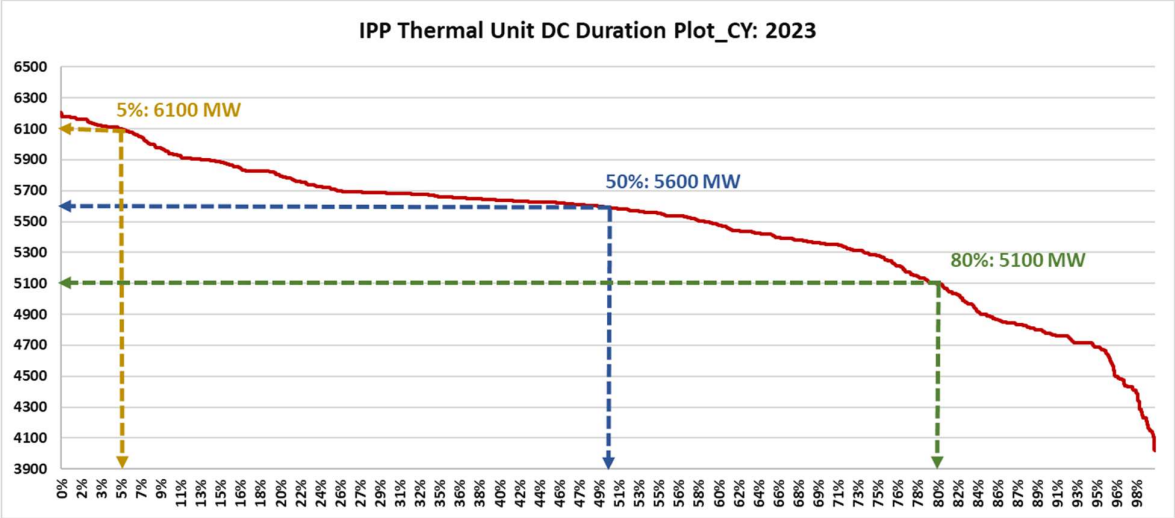


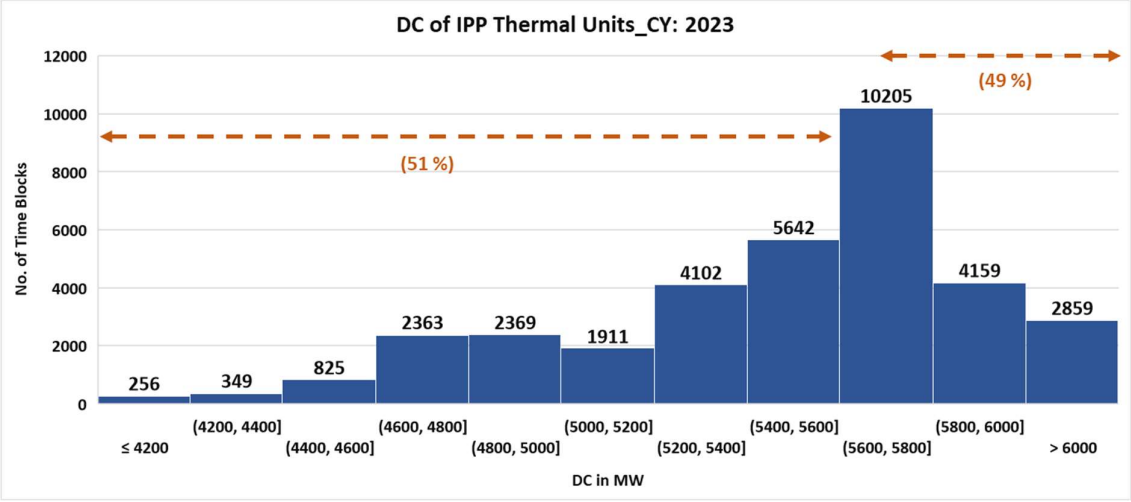

- **Dahanu Unit-2 (250 MW)**

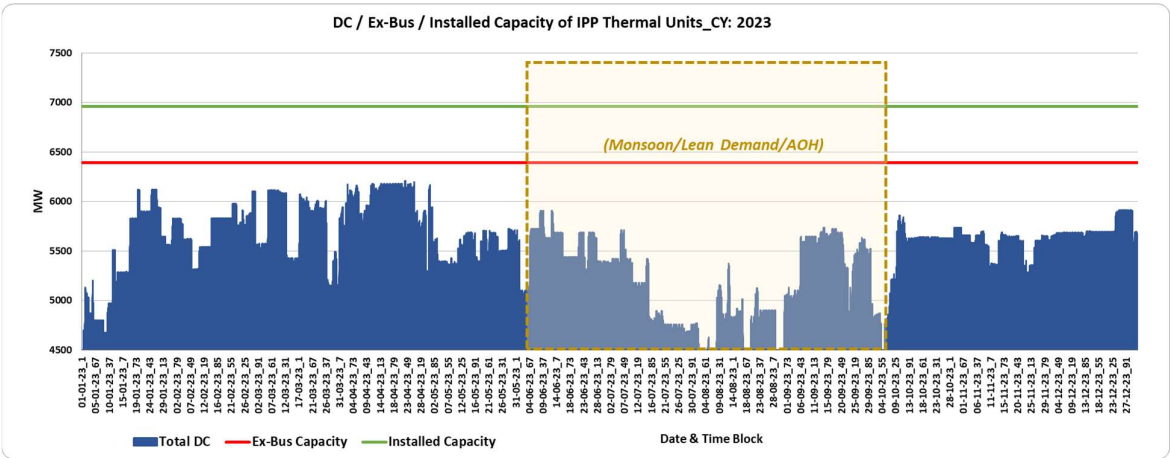



### 4.1.4. Declared Capacity (DC) of IPP Thermal Generators:

The total installed capacity of IPP Thermal Generating units is 6960 MW. After deduction of auxiliary consumption, the Ex-Bus Capacity is 6394 MW.



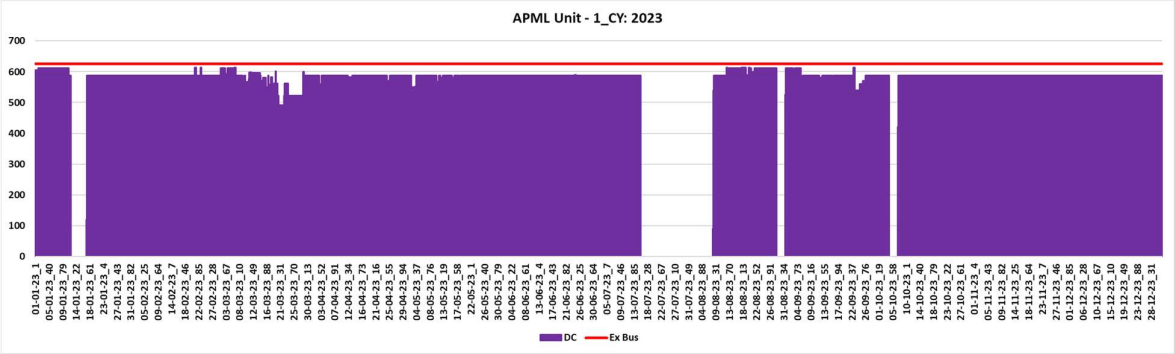

| DC against Ex-Bus Capacity | No. of Time Blocks | No. of Days | % in Year |
|---|---|---|---|
| No. of Time Blocks DC below 50 % (3200 MW) | 0 | 0 | 0% |
| No. of Time Blocks DC below 70 % (4500 MW) | 1263 | 13 | 4% |
| No. of Time Blocks DC below 75 % (4800 MW) | 3649 | 38 | 10% |
| No. of Time Blocks DC below 80 % (5100 MW) | 7043 | 73 | 20% |
| No. of Time Blocks DC above 70 % (4500 MW) | 33777 | 352 | 96% |

| | | | |
|---|---|---|---|
| No. of Time Blocks DC above 80 % (5100MW) | 27997 | 292 | 80% |
| No. of Time Blocks DC above 90 % (5800 MW) | 7018 | 73 | 20% |

From the above, it is observed that for 50% of the period, DC of IPP Thermal units is above 5600 MW. For 5% of the period, DC is above 6100 MW against the Ex-Bus capacity of 6394 MW.

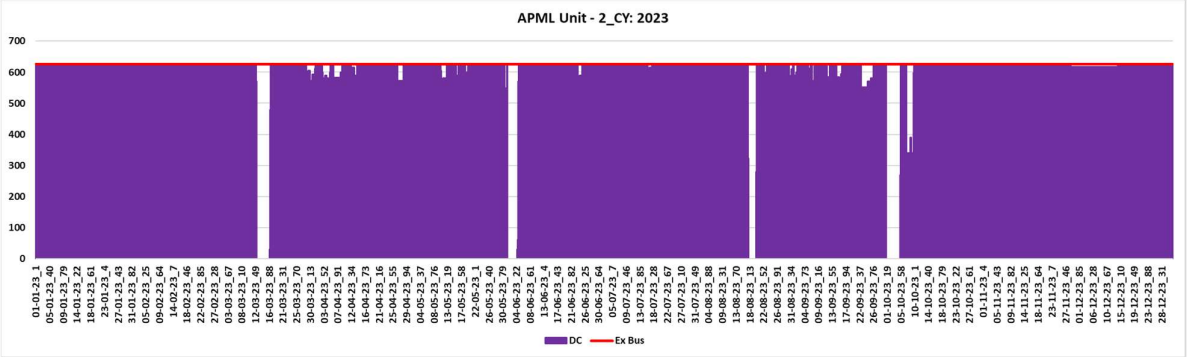
The individual unit-wise analysis is sown below:

- **APML Unit-1 (660 MW)**



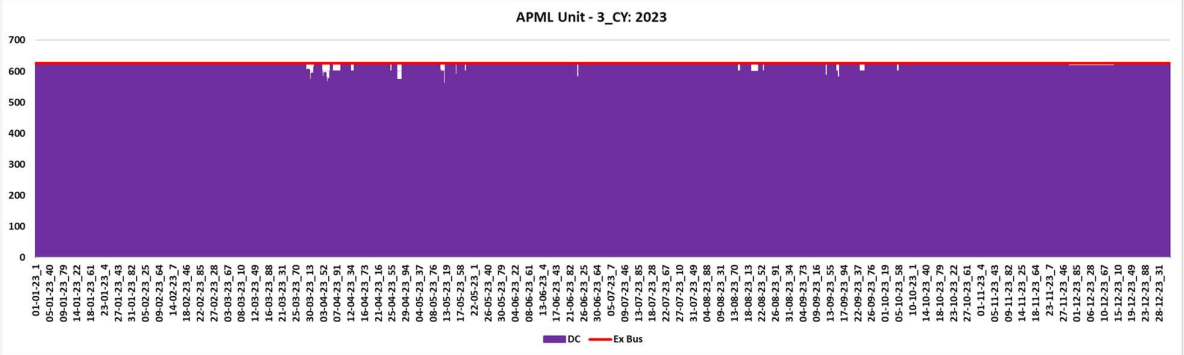

*Unit-1 was under Zero Schedule for 26 days during the year.*

- **APML Unit-2 (660 MW)**



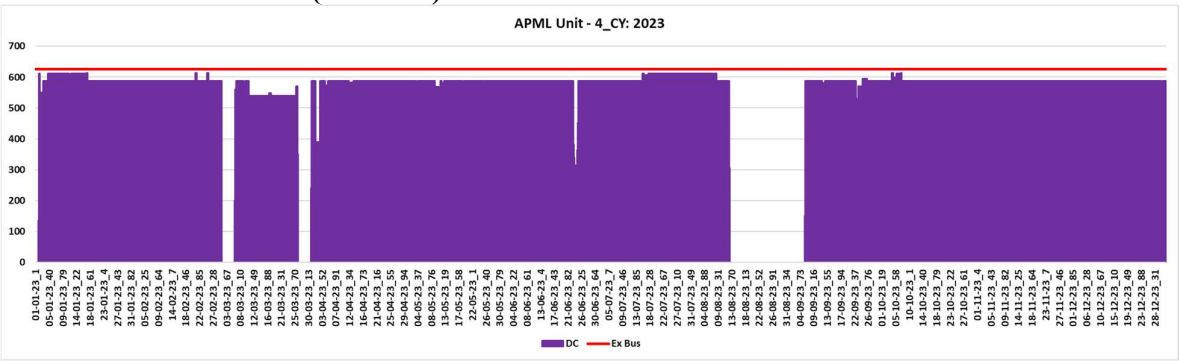

*Unit-2 was under Zero Schedule for 15 days during the year.*

- **APML Unit-3 (660 MW)**



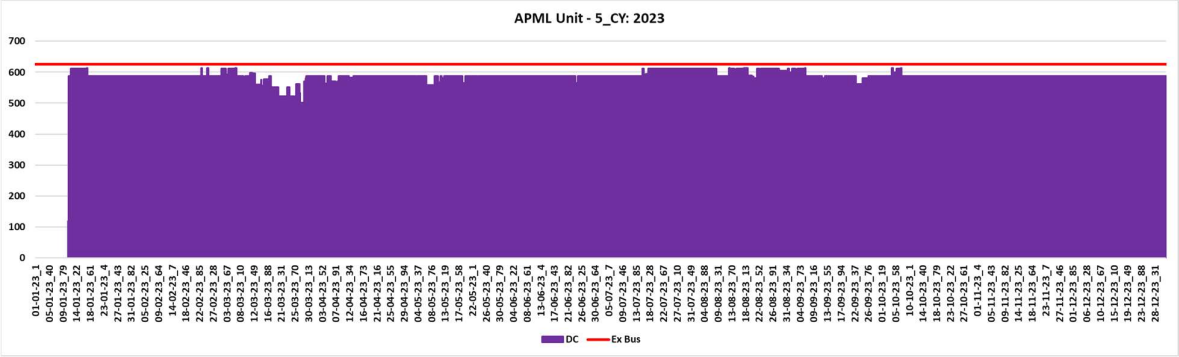

*Unit-3 was under Zero Schedule for 15 days during the year.*

- **APML Unit-4 (660 MW)**



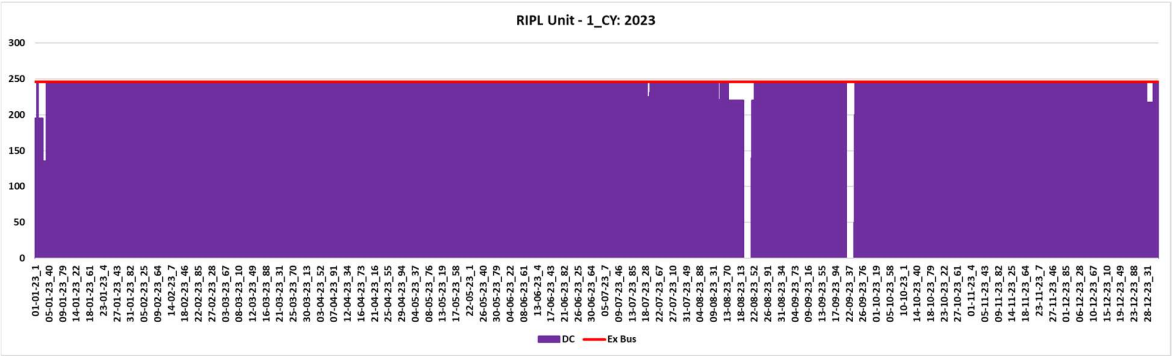

*Unit-4 was under Zero Schedule for 18 days during the year.*

- **APML Unit-5 (660 MW)**

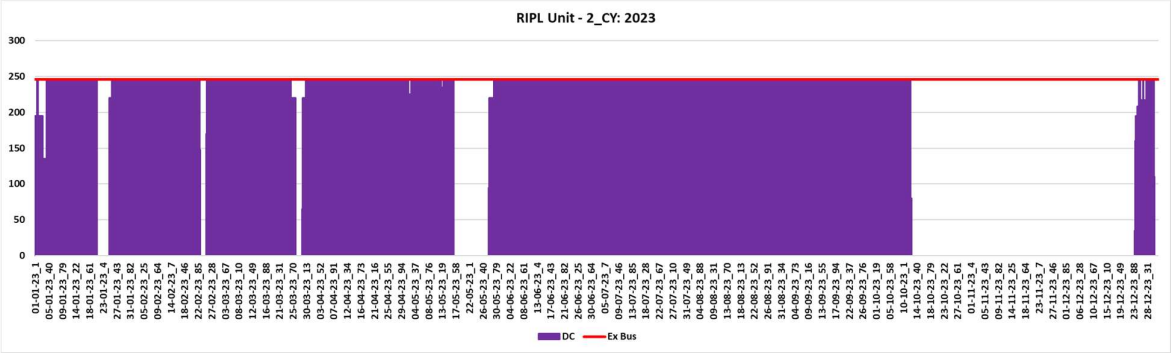



*Unit-5 was under Zero Schedule for 28 days during the year.*

- **RIPL Unit-1 (270 MW)**

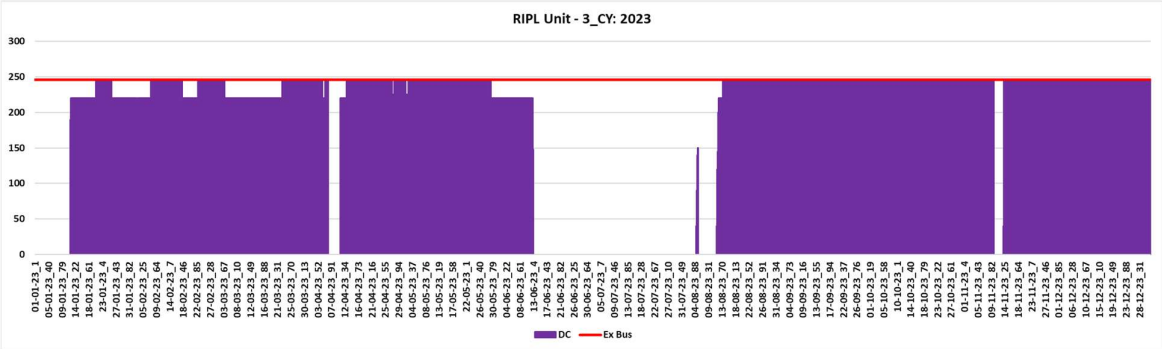


- **RIPL Unit-2 (270 MW)**



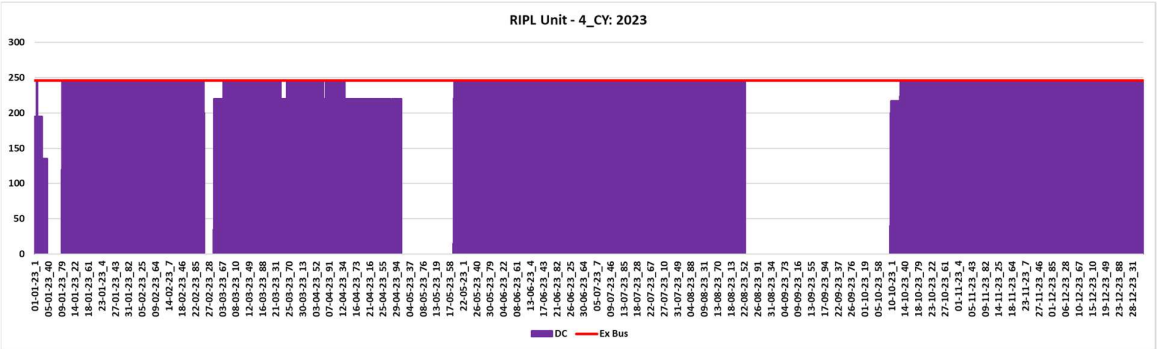

*Unit-2 was tripped on 12.10.2023 due to operation of electrical protection and unit was synchronized on 24.12.2023.*

- **RIPL Unit-3 (270 MW)**



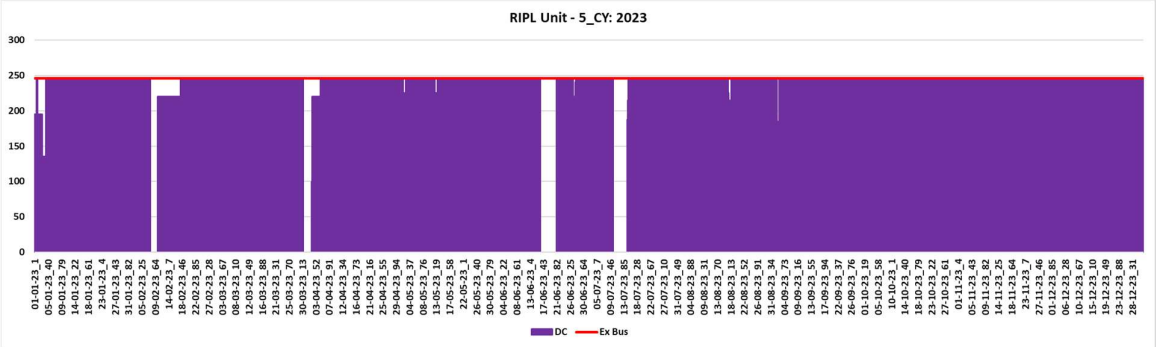

*Unit-3 was under AoH for the period 13.06.2023 to 05.08.2023.*

- **RIPL Unit-4 (270 MW)**

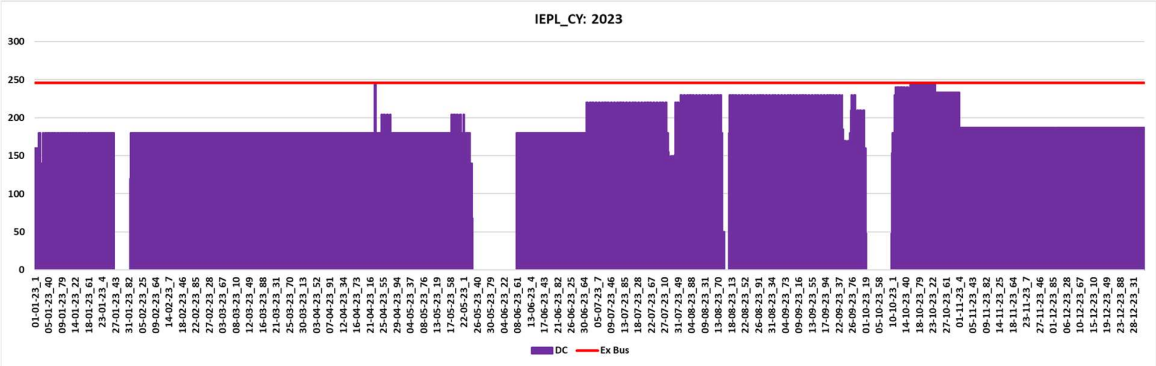



*Unit-4 was out for the period 01.05.2023 to 18.05.2023 due to non-availability of coal. Further, Unit tripped on 22.08.2023 due to Stator Earth Fault & synchronized back on 09.10.2023.*

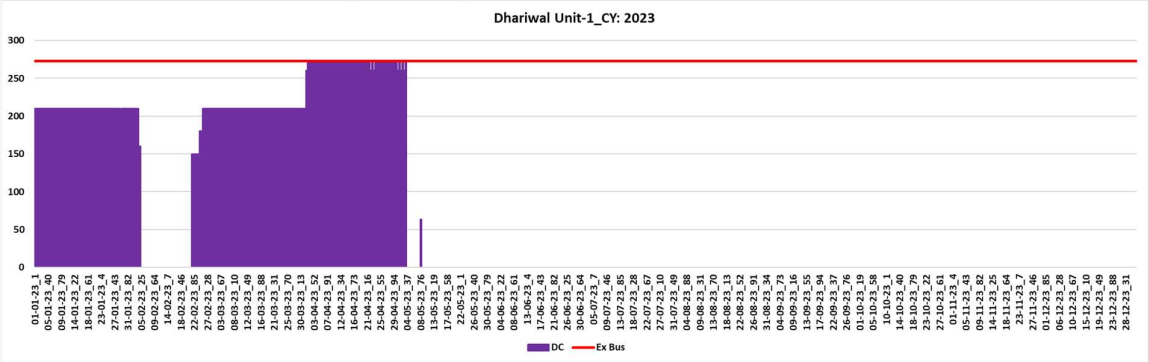
- **RIPL Unit-5 (270 MW)**




- **IEPL (300 MW)**

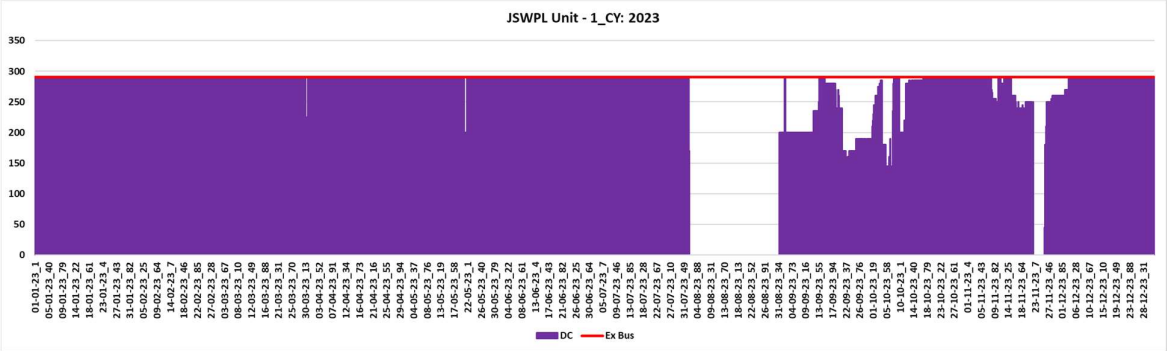



- **Dhariwal Unit-1 (300 MW)**



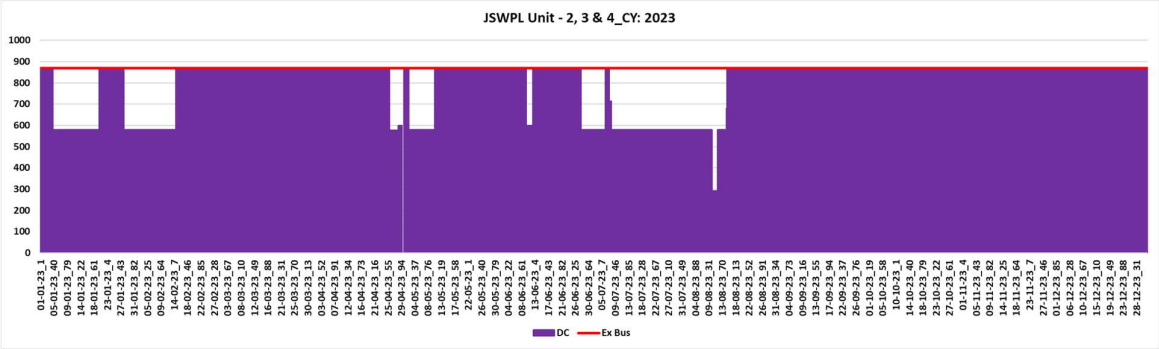

*Note: Scheduling of Dhariwal unit is migrated with WRLDC due to inter-connection at CTU network from May'2023. Hence, DC is not submitted to MSLDC for this unit from May' 2023.*

- **JSW Unit-1 (300 MW)**

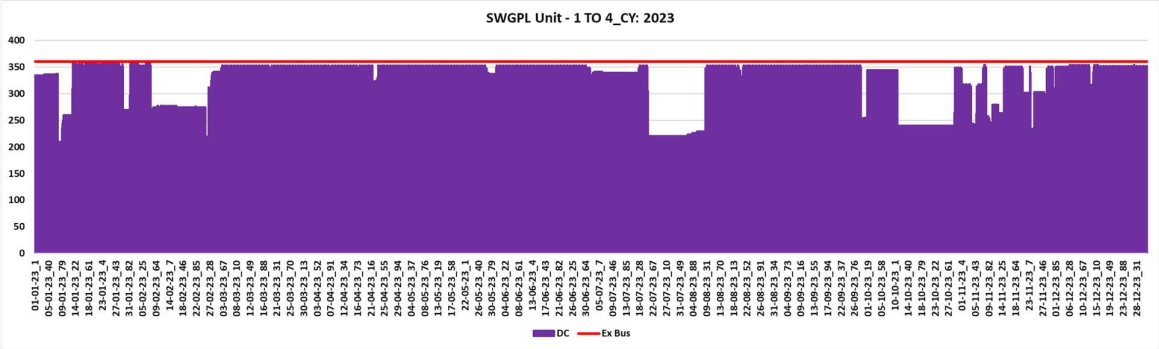



*Unit-1 was out from 02.08.2023 due to heavy leakage in Condenser Water & synchronized on 31.08.2023.*

- **JSW Unit-2, 3 & 4 (900 MW)**




- **SWGPL Unit-1 to 4 (540 MW)**




### 4.1.5. Yearly % Availability of Thermal Units:

- In accordance with the MERC MYT Regulations, 2019, all the Thermal Generating Units are required to maintain yearly availability. The relevant regulations are reproduced below:

**46 Operational Norms for Thermal Generating Stations**

46.1 Target Availability for full recovery of Annual Fixed Charges shall be **85 per cent for all thermal Generating Stations**, except those covered under Regulation 46.2.

46.2 Target Availability for full recovery of Annual Fixed Charges for the following Generating Stations of Maharashtra State Power Generation Company Ltd. (MSPGCL) shall be:

| Particulars | Target Availability (%) |
|---|---|
| Koradi TPS excluding Unit No. 8, 9 and 10 | 72.00 |
| Chandrapur TPS excluding Unit No. 8 and 9 | 80.00 |
| Nashik TPS | 80.00 |

| Particulars | Target Availability (%) |
|---|---|
| Bhusawal TPS excluding Unit No. 4 and 5 | 80.00 |
| Parli TPS excluding Unit No. 6, 7 and 8 | 80.00 |

Provided that the Commission may revise the Availability norms for these Generating Stations in case any Renovation & Modernisation is undertaken.

46.3 Target Plant Load Factor for incentive for thermal Generating Stations/Units shall be **85 per cent**.

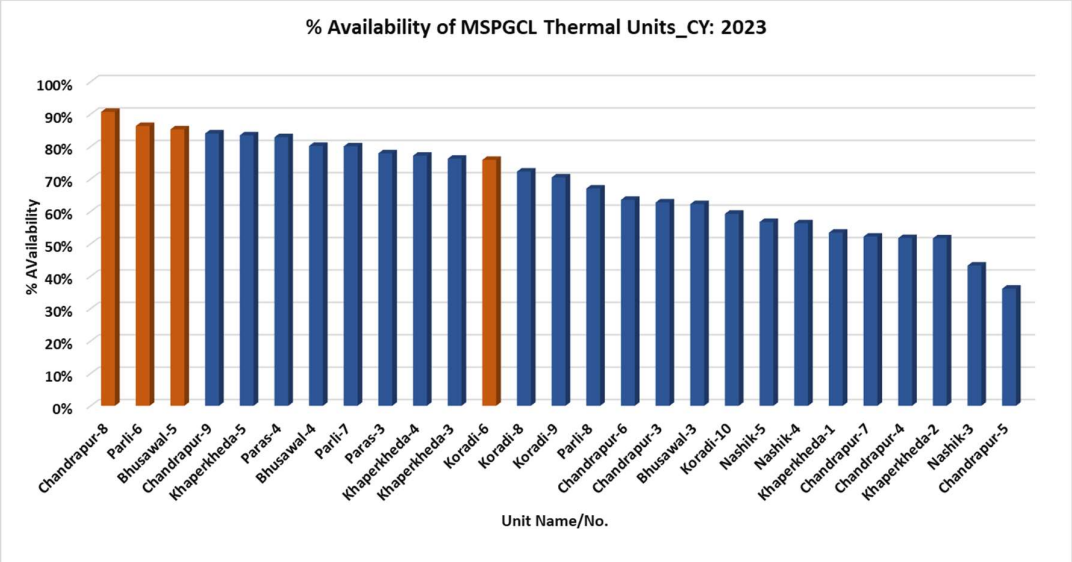
- Thus, it is necessary for all the thermal units to maintain the availability as per the MYT Regulations, 2019. Hence, the availability of various thermal units was calculated for the period CY: 2023. The details are as below:

- **Availability of MSPGCL Thermal Units:**

| Unit Name/No. | % Availability |
|---|---|
| Chandrapur-8 | 91% |
| Parli-6 | 86% |
| Bhusawal-5 | 85% |
| Chandrapur-9 | 84% |
| Khaperkheda-5 | 83% |
| Paras-4 | 83% |
| Bhusawal-4 | 80% |
| Parli-7 | 80% |
| Paras-3 | 78% |
| Khaperkheda-4 | 77% |
| Khaperkheda-3 | 76% |
| Koradi-6 | 76% |
| Koradi-8 | 72% |
| Koradi-9 | 70% |

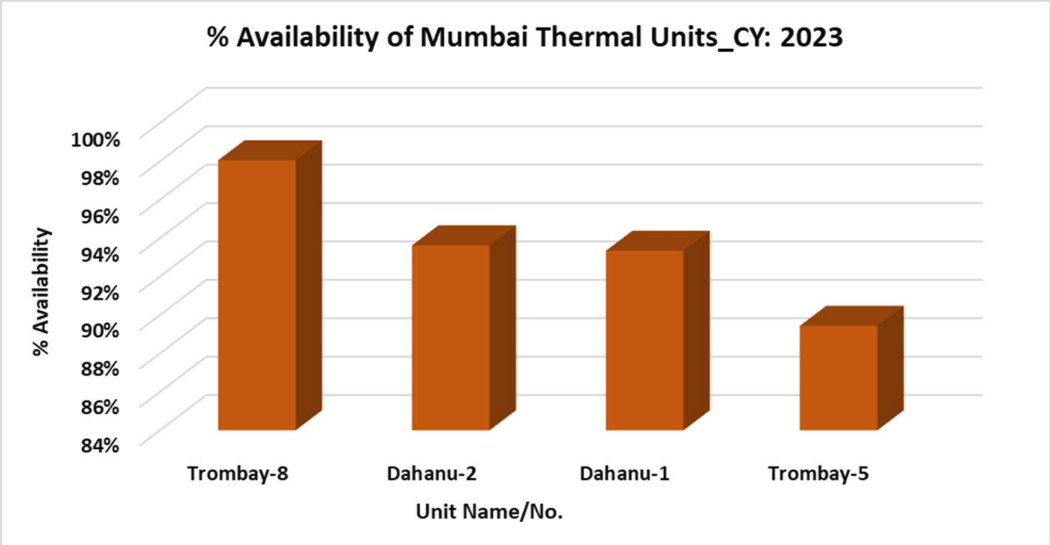
| Unit Name/No. | % Availability |
|---|---|
| Parli-8 | 67% |
| Chandrapur-6 | 64% |
| Chandrapur-3 | 63% |
| Bhusawal-3 | 62% |
| Koradi-10 | 59% |
| Nashik-5 | 57% |
| Nashik-4 | 56% |
| Khaperkheda-1 | 53% |
| Chandrapur-7 | 52% |
| Chandrapur-4 | 52% |
| Khaperkheda-2 | 52% |
| Nashik-3 | 43% |
| Chandrapur-5 | 36% |

From the above, it is observed that the availability of MSPGCL Thermal units is much lower compared to the target as per the MYT Regulations.




- **Availability of Mumbai Thermal Units:**

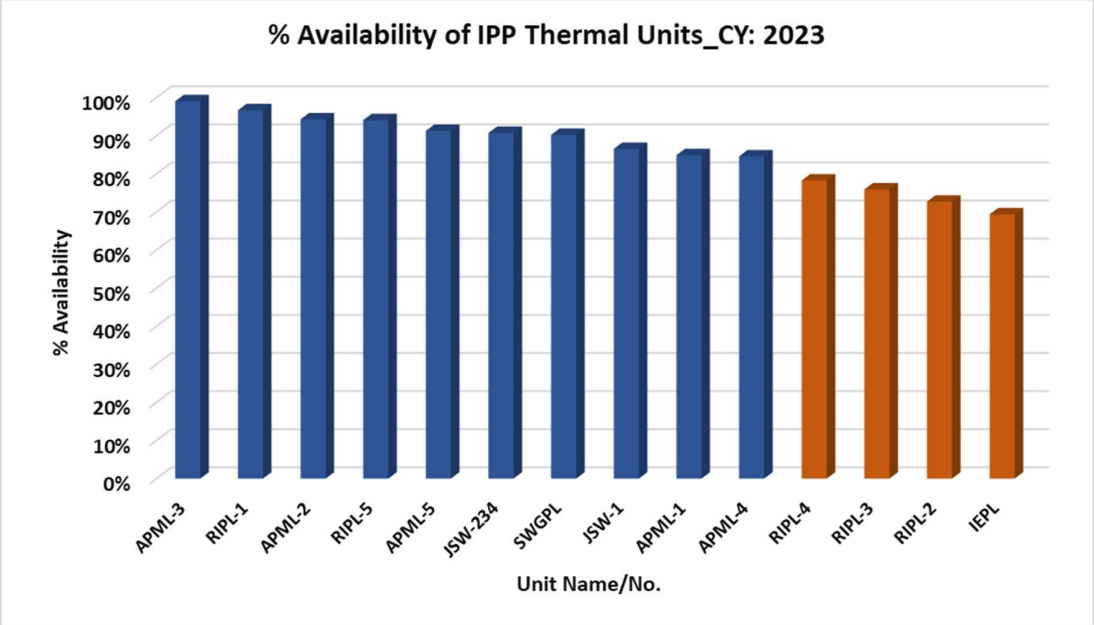
| Unit Name/No | % Availability |
|---|---|
| Trombay-8 | 98% |
| Dahanu-2 | 94% |
| Dahanu-1 | 93% |
| Trombay-5 | 89% |




From the above, it is observed that the availability of Mumbai embedded Thermal units is above the target as per the MYT Regulations.

- **Availability of IPP Thermal Units:**

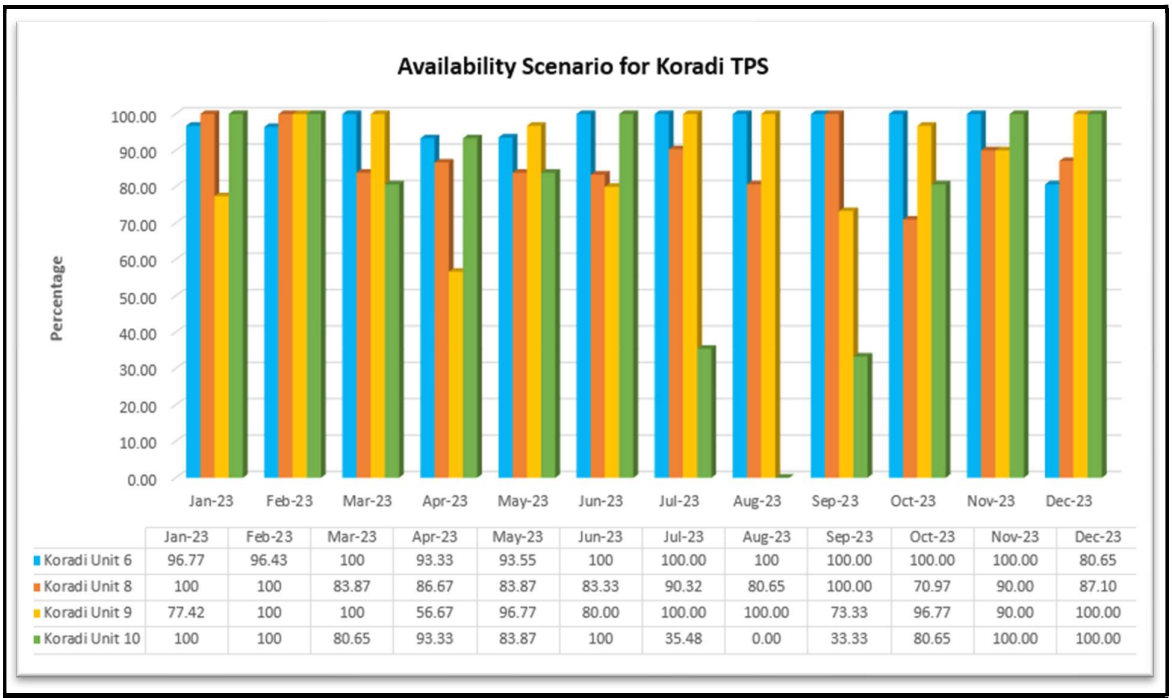
| Unit Name/No | % Availability |
|---|---|
| APML-3 | 99% |
| RIPL-1 | 97% |
| APML-2 | 94% |
| RIPL-5 | 94% |
| APML-5 | 91% |
| JSW-234 | 91% |
| SWGPL | 90% |
| JSW-1 | 87% |
| APML-1 | 85% |
| APML-4 | 85% |
| RIPL-4 | 78% |
| RIPL-3 | 76% |
| RIPL-2 | 73% |
| IEPL | 69% |



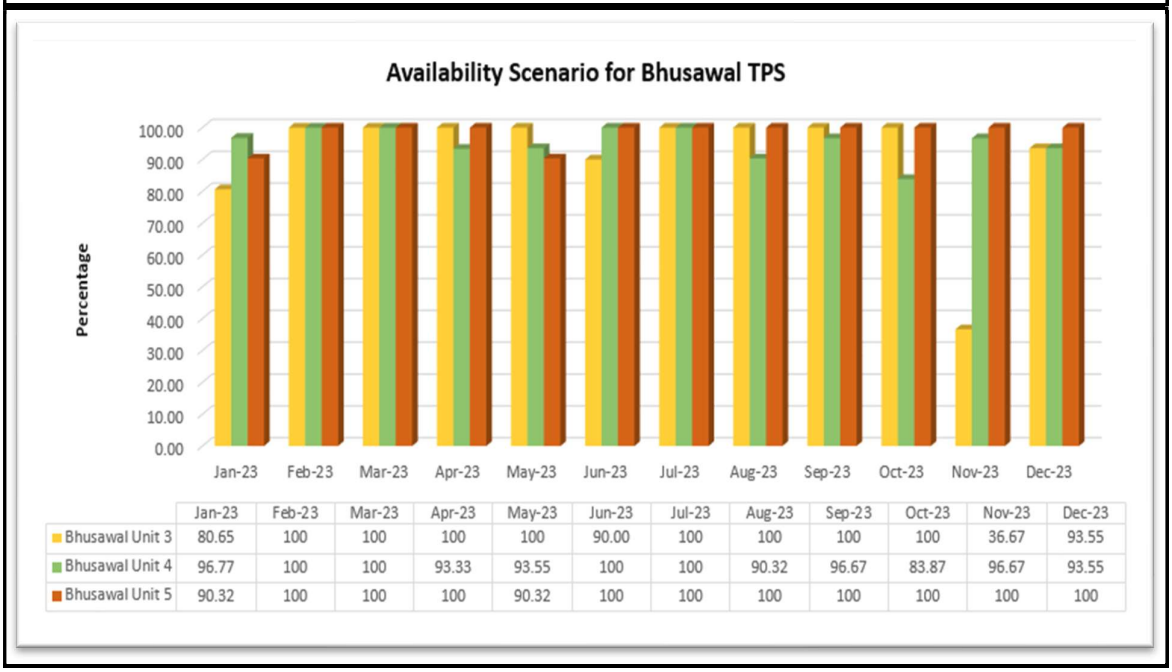

From the above, it is observed that RIPL U-2 to 4 & IEPL are not maintaining the availability as per the MYT Regulations.

### 4.1.6. Monthly Availability of Thermal Generators:

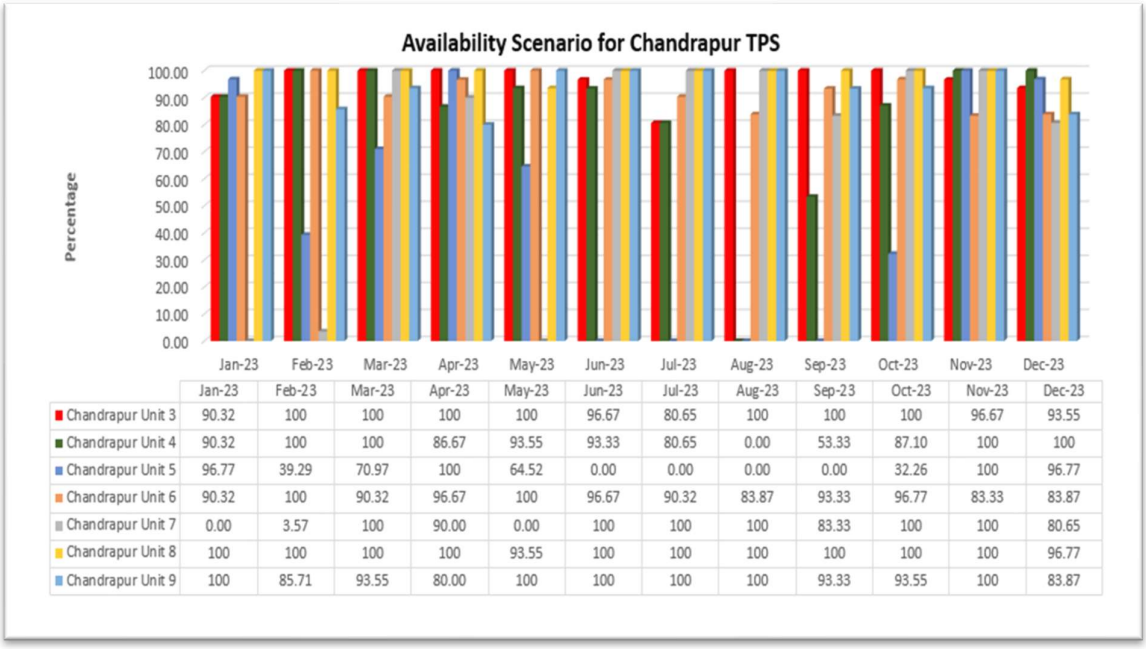
Availability of Thermal units is an important requirement from reliable Grid Operations, hence, unit-wise monthly availability is shown below:



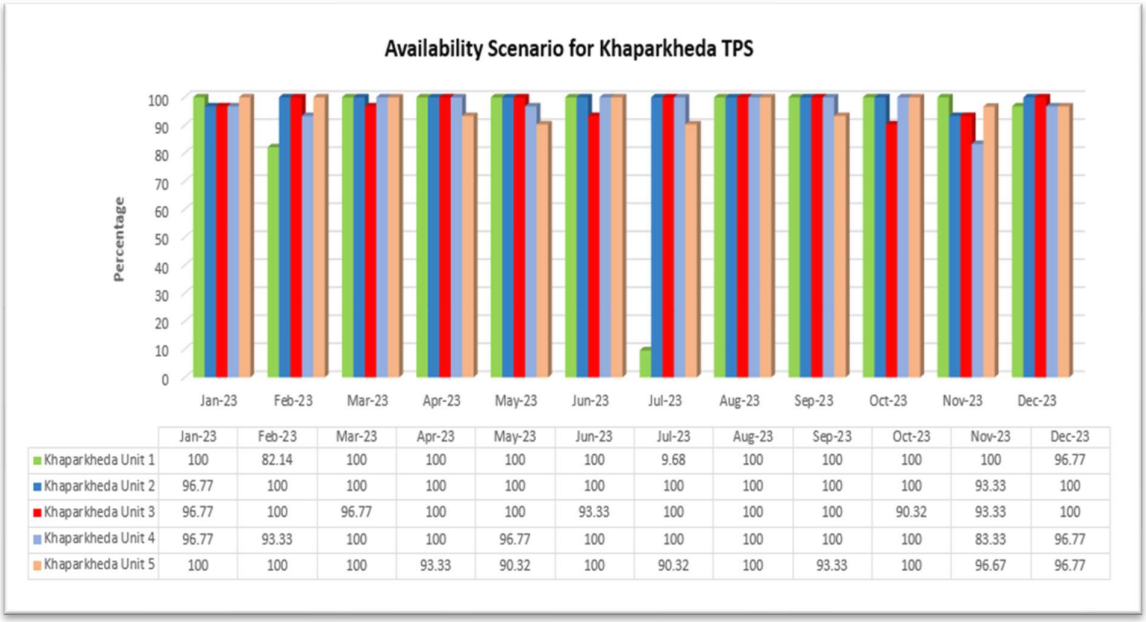

| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Koradi Unit 6 | 96.77 | 96.43 | 100 | 93.33 | 93.55 | 100 | 100.00 | 100 | 100.00 | 100.00 | 100.00 | 80.65 |
| Koradi Unit 8 | 100 | 100 | 83.87 | 86.67 | 83.87 | 83.33 | 90.32 | 80.65 | 100.00 | 70.97 | 90.00 | 87.10 |
| Koradi Unit 9 | 77.42 | 100 | 100 | 56.67 | 96.77 | 80.00 | 100.00 | 100.00 | 73.33 | 96.77 | 90.00 | 100.00 |
| Koradi Unit 10 | 100 | 100 | 80.65 | 93.33 | 83.87 | 100 | 35.48 | 0.00 | 33.33 | 80.65 | 100.00 | 100.00 |



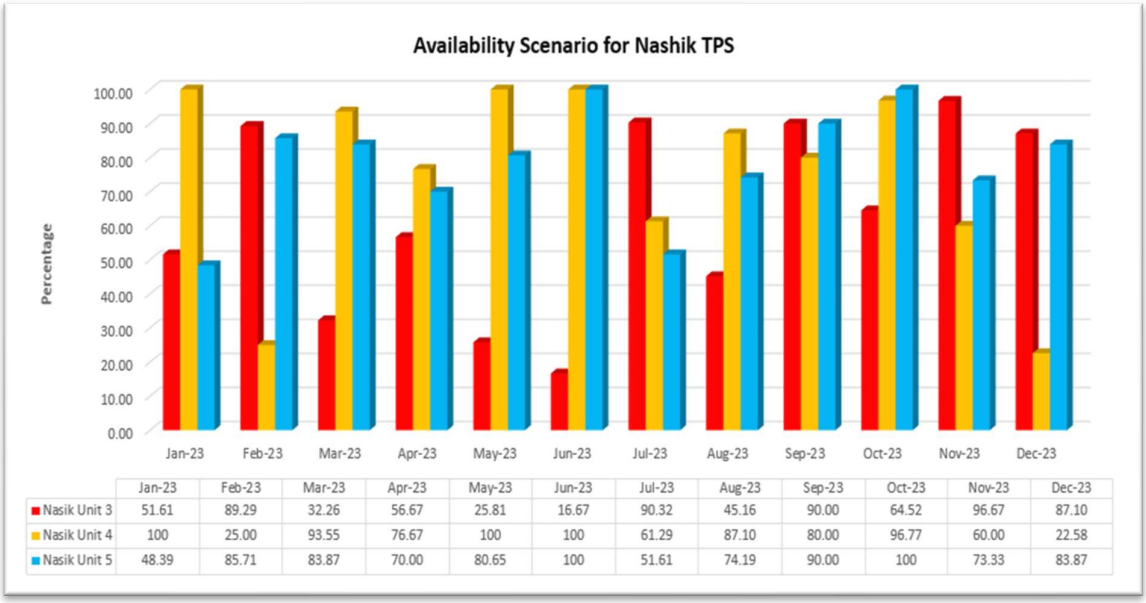

| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bhusawal Unit 3 | 80.65 | 100 | 100 | 100 | 100 | 90.00 | 100 | 100 | 100 | 100 | 36.67 | 93.55 |
| Bhusawal Unit 4 | 96.77 | 100 | 100 | 93.33 | 93.55 | 100 | 100 | 90.32 | 96.67 | 83.87 | 96.67 | 93.55 |
| Bhusawal Unit 5 | 90.32 | 100 | 100 | 100 | 90.32 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |



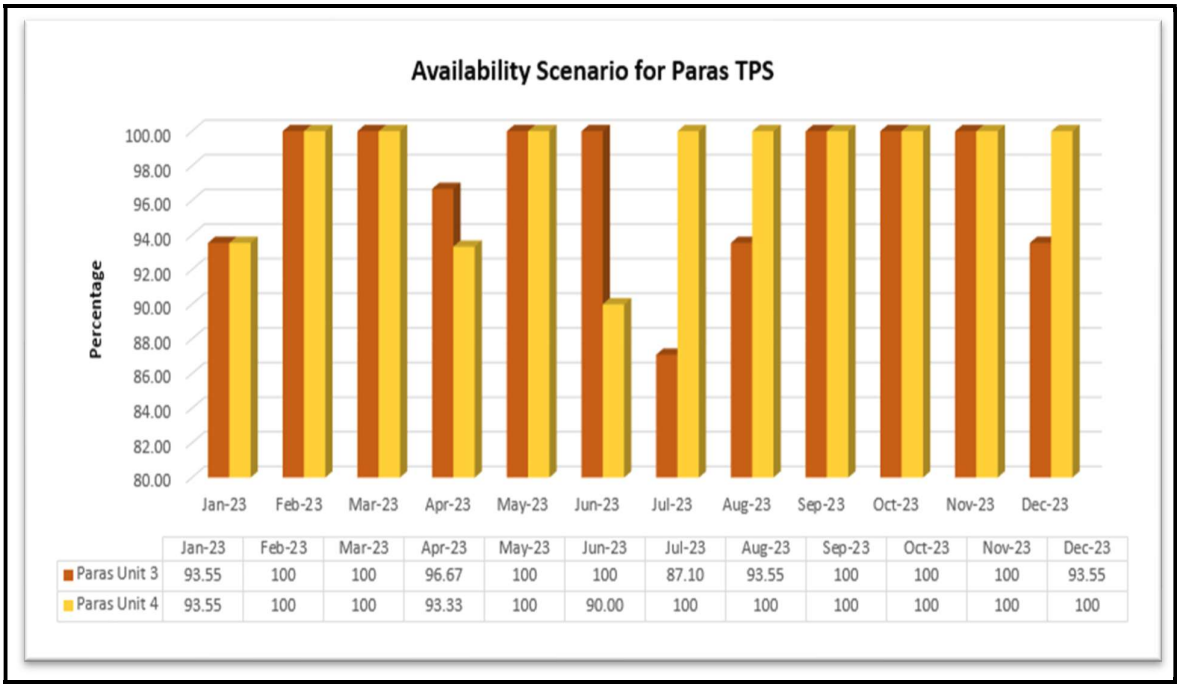

| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chandrapur Unit 3 | 90.32 | 100 | 100 | 100 | 100 | 96.67 | 80.65 | 100 | 100 | 100 | 96.67 | 93.55 |
| Chandrapur Unit 4 | 90.32 | 100 | 100 | 86.67 | 93.55 | 93.33 | 80.65 | 0.00 | 53.33 | 87.10 | 100 | 100 |
| Chandrapur Unit 5 | 96.77 | 39.29 | 70.97 | 100 | 64.52 | 0.00 | 0.00 | 0.00 | 0.00 | 32.26 | 100 | 96.77 |
| Chandrapur Unit 6 | 90.32 | 100 | 90.32 | 96.67 | 100 | 96.67 | 90.32 | 83.87 | 93.33 | 96.77 | 83.33 | 83.87 |
| Chandrapur Unit 7 | 0.00 | 3.57 | 100 | 90.00 | 0.00 | 100 | 100 | 100 | 83.33 | 100 | 100 | 80.65 |
| Chandrapur Unit 8 | 100 | 100 | 100 | 100 | 93.55 | 100 | 100 | 100 | 100 | 100 | 100 | 96.77 |
| Chandrapur Unit 9 | 100 | 85.71 | 93.55 | 80.00 | 100 | 100 | 100 | 100 | 93.33 | 93.55 | 100 | 83.87 |



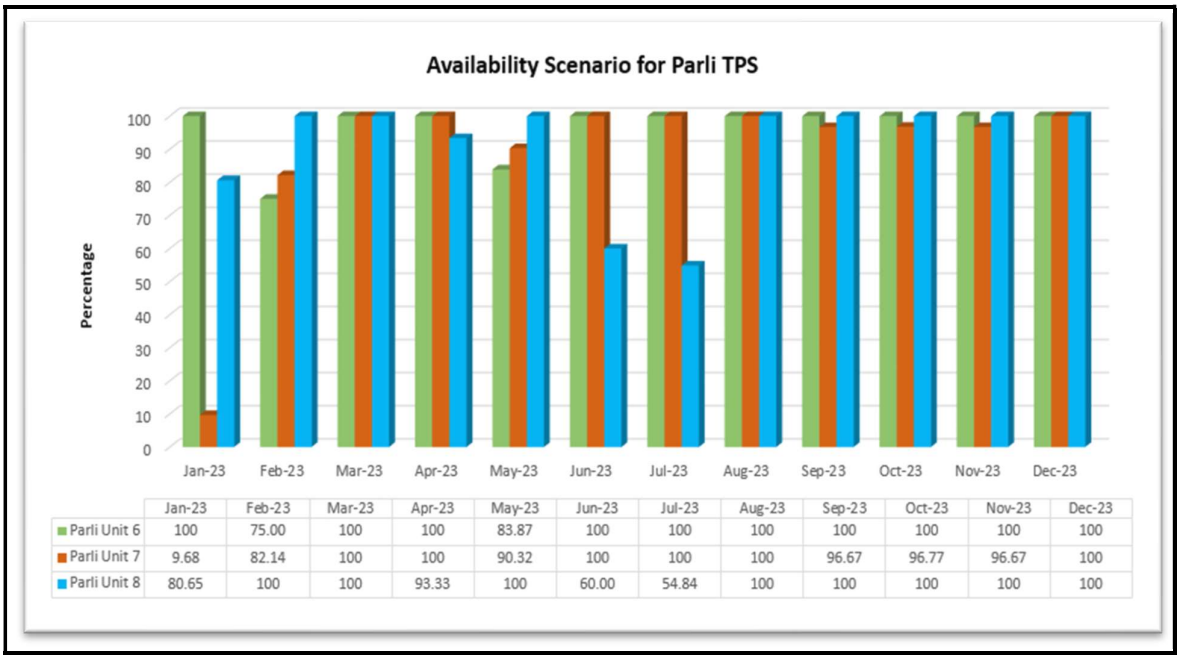

| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Khaparkheda Unit 1 | 100 | 82.14 | 100 | 100 | 100 | 100 | 9.68 | 100 | 100 | 100 | 100 | 96.77 |
| Khaparkheda Unit 2 | 96.77 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 93.33 | 100 |
| Khaparkheda Unit 3 | 96.77 | 100 | 96.77 | 100 | 100 | 93.33 | 100 | 100 | 100 | 90.32 | 93.33 | 100 |
| Khaparkheda Unit 4 | 96.77 | 93.33 | 100 | 100 | 96.77 | 100 | 100 | 100 | 100 | 100 | 83.33 | 96.77 |
| Khaparkheda Unit 5 | 100 | 100 | 100 | 93.33 | 90.32 | 100 | 90.32 | 100 | 93.33 | 100 | 96.67 | 96.77 |



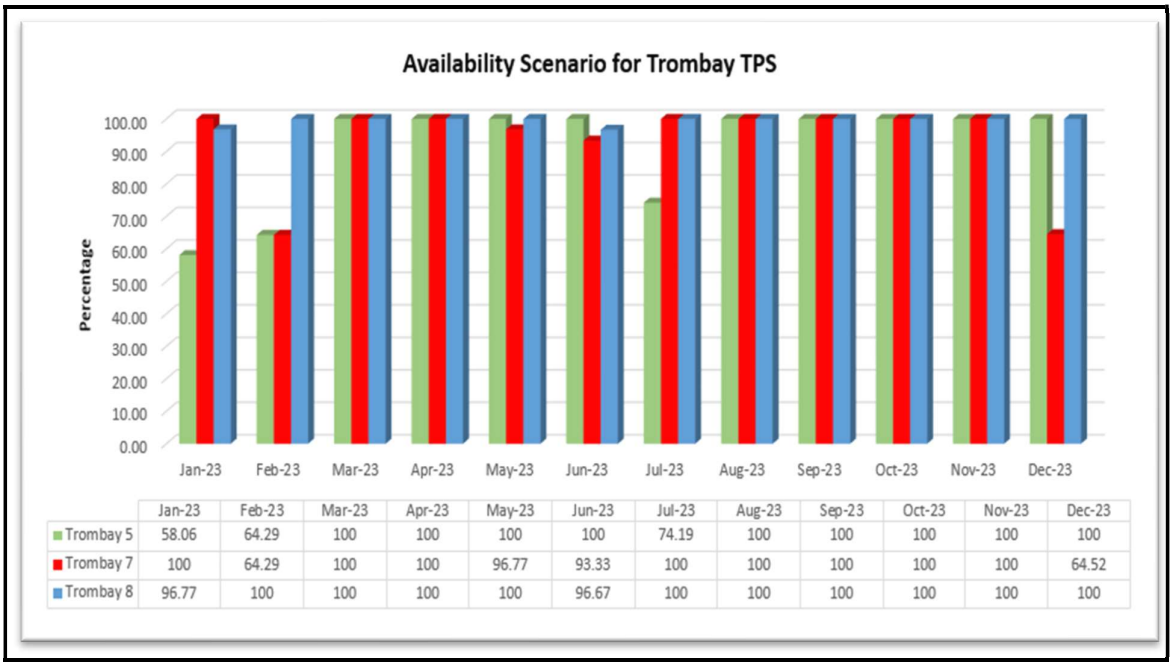

| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nasik Unit 3 | 51.61 | 89.29 | 32.26 | 56.67 | 25.81 | 16.67 | 90.32 | 45.16 | 90.00 | 64.52 | 96.67 | 87.10 |
| Nasik Unit 4 | 100 | 25.00 | 93.55 | 76.67 | 100 | 100 | 61.29 | 87.10 | 80.00 | 96.77 | 60.00 | 22.58 |
| Nasik Unit 5 | 48.39 | 85.71 | 83.87 | 70.00 | 80.65 | 100 | 51.61 | 74.19 | 90.00 | 100 | 73.33 | 83.87 |



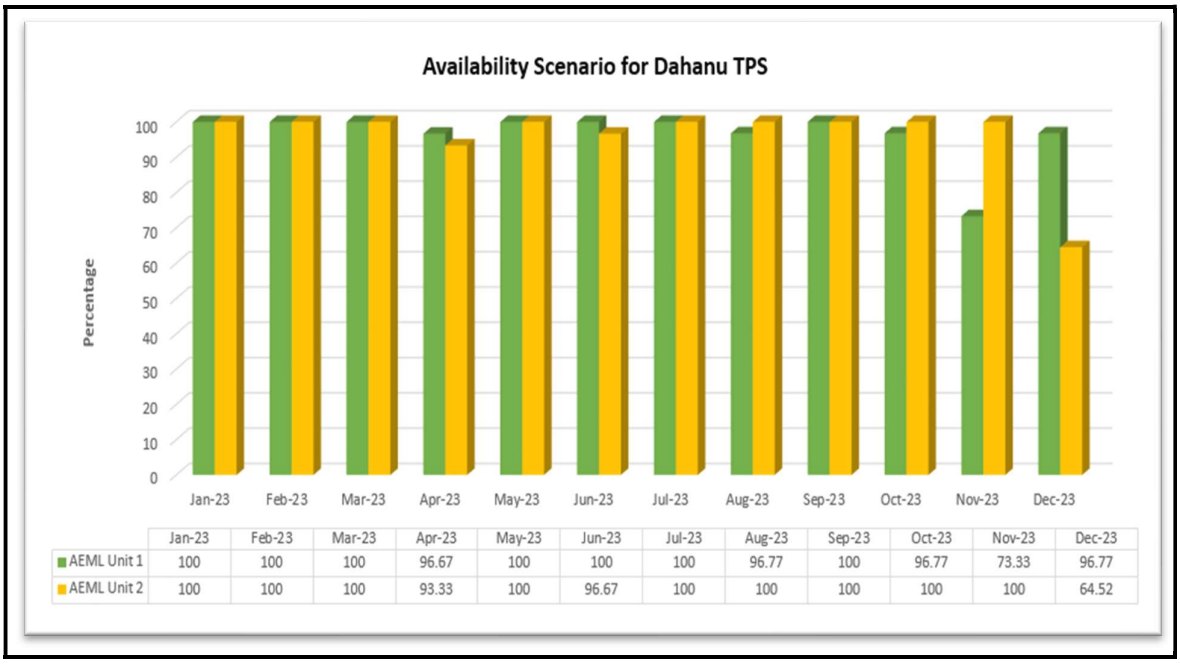

| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paras Unit 3 | 93.55 | 100 | 100 | 96.67 | 100 | 100 | 87.10 | 93.55 | 100 | 100 | 100 | 93.55 |
| Paras Unit 4 | 93.55 | 100 | 100 | 93.33 | 100 | 90.00 | 100 | 100 | 100 | 100 | 100 | 100 |



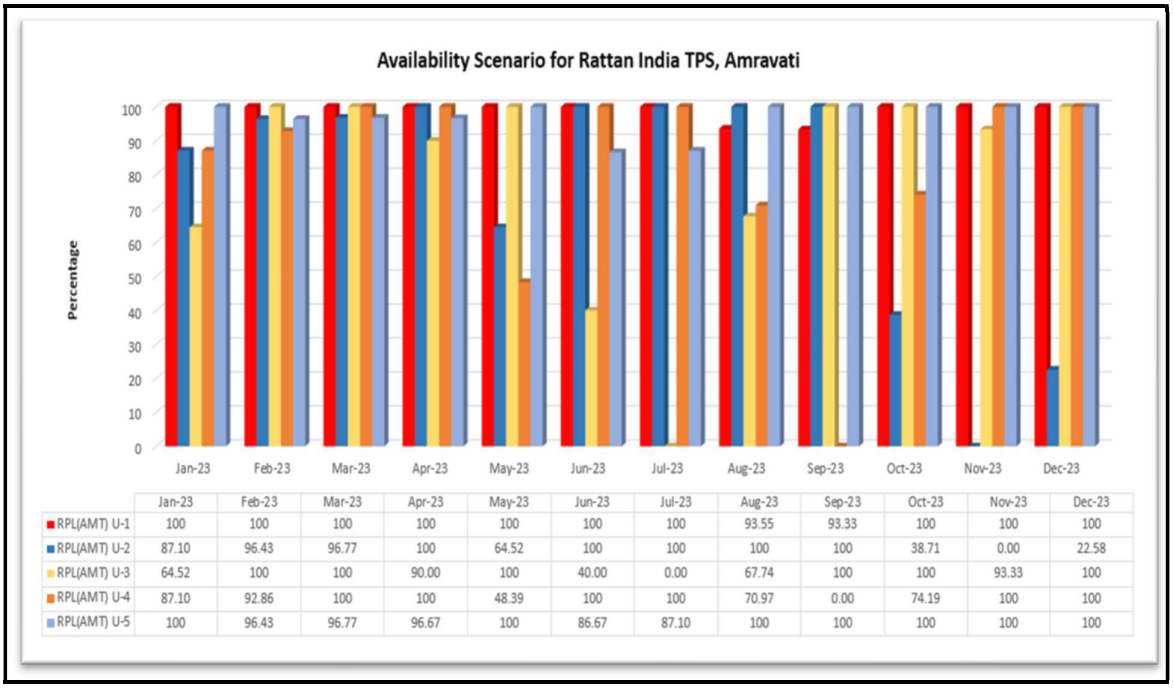

| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parli Unit 6 | 100 | 75.00 | 100 | 100 | 83.87 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Parli Unit 7 | 9.68 | 82.14 | 100 | 100 | 90.32 | 100 | 100 | 100 | 96.67 | 96.77 | 96.67 | 100 |
| Parli Unit 8 | 80.65 | 100 | 100 | 93.33 | 100 | 60.00 | 54.84 | 100 | 100 | 100 | 100 | 100 |



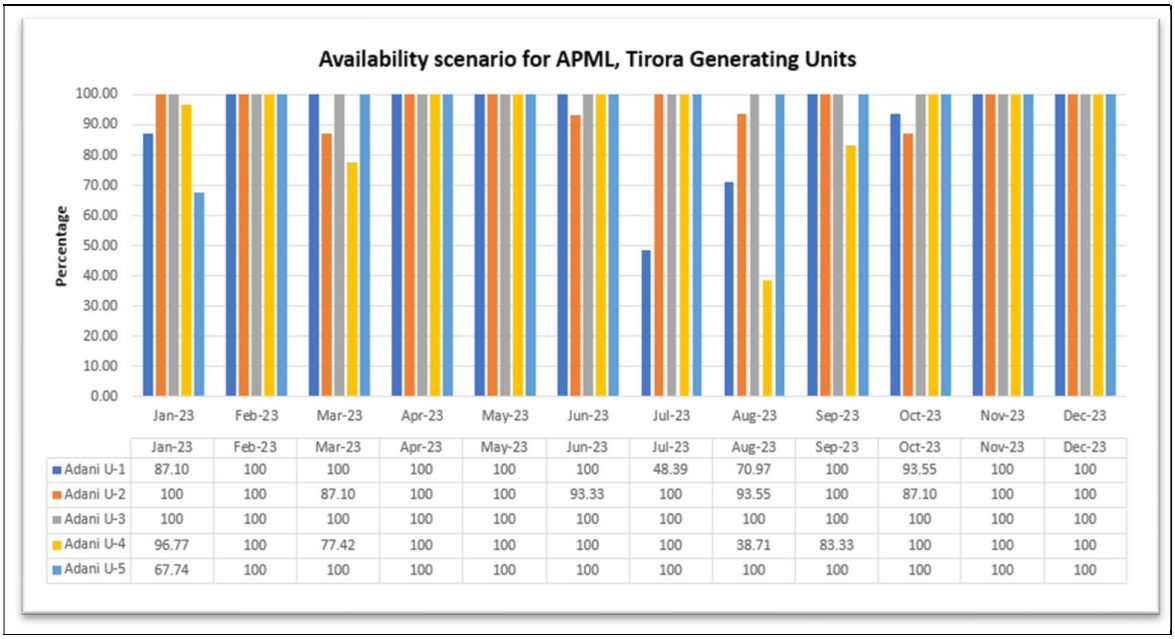

| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trombay 5 | 58.06 | 64.29 | 100 | 100 | 100 | 100 | 74.19 | 100 | 100 | 100 | 100 | 100 |
| Trombay 7 | 100 | 64.29 | 100 | 100 | 96.77 | 93.33 | 100 | 100 | 100 | 100 | 100 | 64.52 |
| Trombay 8 | 96.77 | 100 | 100 | 100 | 100 | 96.67 | 100 | 100 | 100 | 100 | 100 | 100 |




| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AEML Unit 1 | 100 | 100 | 100 | 96.67 | 100 | 100 | 100 | 96.77 | 100 | 96.77 | 73.33 | 96.77 |
| AEML Unit 2 | 100 | 100 | 100 | 93.33 | 100 | 96.67 | 100 | 100 | 100 | 100 | 100 | 64.52 |




| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RPL(AMT) U-1 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 93.55 | 93.33 | 100 | 100 | 100 |
| RPL(AMT) U-2 | 87.10 | 96.43 | 96.77 | 100 | 64.52 | 100 | 100 | 100 | 100 | 38.71 | 0.00 | 22.58 |
| RPL(AMT) U-3 | 64.52 | 100 | 100 | 90.00 | 100 | 40.00 | 0.00 | 67.74 | 100 | 100 | 93.33 | 100 |
| RPL(AMT) U-4 | 87.10 | 92.86 | 100 | 100 | 48.39 | 100 | 100 | 70.97 | 0.00 | 74.19 | 100 | 100 |
| RPL(AMT) U-5 | 100 | 96.43 | 96.77 | 96.67 | 100 | 86.67 | 87.10 | 100 | 100 | 100 | 100 | 100 |




| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adani U-1 | 87.10 | 100 | 100 | 100 | 100 | 100 | 48.39 | 70.97 | 100 | 93.55 | 100 | 100 |
| Adani U-2 | 100 | 100 | 87.10 | 100 | 100 | 93.33 | 100 | 93.55 | 100 | 87.10 | 100 | 100 |
| Adani U-3 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Adani U-4 | 96.77 | 100 | 77.42 | 100 | 100 | 100 | 100 | 38.71 | 83.33 | 100 | 100 | 100 |
| Adani U-5 | 67.74 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |


| | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JSW (J) U1 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 9.68 | 100 | 100 | 90.00 | 100 |

### 4.1.7. Non-availability of Thermal Generating units in CY 2023:

There are 2 main reasons for non-availability of any Generating units, Technical and Commercial. Commercially, the unit can be withdrawn from the Grid either by SLDC under 'RSD' or under Zero Schedule by contracted Discom. Hence, the unit-wise & reason-wise Non-availability of generating units is tabulated below:

**MSPGCL Thermal Units**

| Owner | Station | Name of Unit | No. of Times under shut down | No. of Days not available | No. of Days under zero schedule |
|---|---|---|---|---|---|
| MSPGCL | Bhusawal TPS | Bhusawal Unit 3 | 16 | 37 | 0 |
| | | Bhusawal Unit 4 | 16 | 30 | 0 |
| | | Bhusawal Unit 5 | 11 | 9 | 0 |
| | Chandrapur TPS | Chandrapur Unit 3 | 7 | 17 | 0 |
| | | Chandrapur Unit 4 | 18 | 83 | 0 |
| | | Chandrapur Unit 5 | 16 | 194 | 0 |
| | | Chandrapur Unit 6 | 20 | 43 | 0 |
| | | Chandrapur Unit 7 | 4 | 24 | 0 |
| | | Chandrapur Unit 8 | 3 | 5 | 0 |
| | | Chandrapur Unit 9 | 12 | 30 | 0 |
| | Khaparkheda TPS | Khaparkheda Unit 1 | 17 | 44 | 0 |
| | | Khaparkheda Unit 2 | 16 | 11 | 0 |
| | | Khaparkheda Unit 3 | 26 | 21 | 0 |
| | | Khaparkheda Unit 4 | 16 | 18 | 0 |
| | | Khaparkheda Unit 5 | 10 | 22 | 0 |
| | Koradi TPS | Koradi Unit 6 | 12 | 19 | 0 |
| | | Koradi Unit 8 | 11 | 53 | 0 |
| | | Koradi Unit 9 | 12 | 47 | 0 |
| | | Koradi Unit 10 | 12 | 97 | 0 |
| | Nashik TPS | Nasik Unit 3 | 22 | 132 | 0 |
| | | Nasik Unit 4 | 12 | 103 | 0 |
| | | Nasik Unit 5 | 18 | 92 | 0 |
| | Paras TPS | Paras Unit 3 | 11 | 20 | 0 |
| | | Paras Unit 4 | 5 | 8 | 0 |
| | Parli TPS | Parli Unit 6 | 18 | 19 | 40 |
| | | Parli Unit 7 | 17 | 43 | 37 |
| | | Parli Unit 8 | 8 | 38 | 22 |

**Mumbai Generating Units**

| Owner | Station | Name of Unit | No. of Times under shut down | No. of Days not available | No. of Days under zero schedule |
|---|---|---|---|---|---|
| Adani, Dahanu | ADTPS | AEML Unit 1 | 9 | 21 | 0 |
| | | AEML Unit 2 | 4 | 16 | 0 |

| Owner | Station | Name of Unit | No. of Times under shut down | No. of Days not available | No. of Days under zero schedule |
|---|---|---|---|---|---|
| TPC-G | TPC | Trombay 5 | 2 | 33 | 0 |
| | | Trombay 7A | 14 | 35 | 1 |
| | | Trombay 7B | 12 | 37 | 1 |
| | | Trombay 8 | 4 | 5 | 0 |

**IPP Thermal Units**

| Owner | Station | Name of Unit | No. of Times under shut down | No. of Days not available | No. of Days under zero schedule |
|---|---|---|---|---|---|
| Adani, Tirora | APML | Adani U-1 | 6 | 37 | 26 |
| | | Adani U-2 | 6 | 25 | 15 |
| | | Adani U-3 | 1 | 0 | 15 |
| | | Adani U-4 | 4 | 33 | 18 |
| | | Adani U-5 | 1 | 0 | 28 |
| Jaigad TPS | JSWEL | JSW (J) U1 | 6 | 35 | 11 |
| | | JSW (J) U2 | 0 | 0 | 8 (No sch) |
| | | JSW (J) U3 | 2 | 36 | 17 (No Sch) |
| | | JSW (J) U4 | 3 | 4 | 23 (No sch) |
| Rattan India, Amravati | RPL AMT | RPL(AMT) U-1 | 2 | 6 | 0 |
| | | RPL(AMT) U-2 | 8 | 125 | 0 |
| | | RPL(AMT) U-3 | 4 | 67 | 0 |
| | | RPL(AMT) U-4 | 5 | 80 | 0 |
| | | RPL(AMT) U-5 | 6 | 16 | 0 |
| Sai wardha | SWPGPL | SWPGPL U-1 | 9 | 25 | 0 |
| | | SWPGPL U-2 | 6 | 31 | 0 |
| | | SWPGPL U-3 | 6 | 53 | 0 |
| | | SWPGPL U-4 | 3 | 31 | 0 |

### 4.1.8. Coal position in CY 2023:

The CEA Coal Stock norms for Coal-based plants dated 06.12.2021, mandates every thermal Generating Company to maintain coal stock. Accordingly, MSLDC is monitoring the Coal Positions maintained at every plants. The details of month-wise coal position is tabulated below:

| Coal stock less than 3 Days | |
|---|---|
| Power Station | CY 2023 No. of days |
| ADTPS | 297 |
| RPL (AMT) | 145 |
| Bhusawal Unit 4 | 131 |
| Bhusawal Unit 5 | 131 |
| Chandrapur Unit 3 to 7 | 129 |
| Chandrapur Unit 8 and 9 | 129 |
| Khaparkheda Unit 1 to 4 | 100 |
| Bhusawal Unit 3 | 72 |
| Paras | 64 |
| Parli Unit 6 and 7 | 59 |
| Nasik | 49 |
| Khaparkheda Unit 5 | 43 |
| Parli Unit 8 | 39 |
| APML, TIRORA | 27 |
| Koradi Unit 8 to 10 | 2 |
| Koradi Unit 6 | 0 |
| JSWEL | 0 |
| SWPGPL | 0 |
| TPCL | 0 |

| Coal stock less than 7 Days | |
|---|---|
| Power Station | CY 2023 No. of days |
| Bhusawal Unit 4 | 198 |
| Bhusawal Unit 5 | 198 |
| Paras | 175 |
| Parli Unit 6 and 7 | 150 |
| Parli Unit 8 | 148 |
| Koradi Unit 8 to 10 | 135 |
| Chandrapur Unit 3 to 7 | 129 |
| Chandrapur Unit 8 and 9 | 129 |
| Nasik | 122 |
| Bhusawal Unit 3 | 112 |
| Khaparkheda Unit 5 | 96 |
| Khaparkheda Unit 1 to 4 | 77 |
| ADTPS | 68 |
| APML, TIRORA | 53 |
| RPL (AMT) | 45 |
| JSWEL | 13 |
| SWPGPL | 4 |
| Koradi Unit 6 | 1 |
| TPCL | 0 |

| Coal stock less than 15 Days | |
|---|---|
| Power Station | CY 2023 No. of days |
| APML, TIRORA | 230 |
| Koradi Unit 8 to 10 | 228 |
| Bhusawal Unit 3 | 174 |
| Khaparkheda Unit 5 | 153 |
| Parli Unit 8 | 147 |
| RPL (AMT) | 145 |
| Nasik | 125 |
| Paras | 124 |
| Parli Unit 6 and 7 | 124 |
| Chandrapur Unit 3 to 7 | 107 |
| Chandrapur Unit 8 and 9 | 107 |
| JSWEL | 85 |
| SWPGPL | 84 |
| TPCL | 62 |
| Khaparkheda Unit 1 to 4 | 60 |
| Koradi Unit 6 | 54 |
| Bhusawal Unit 4 | 36 |
| Bhusawal Unit 5 | 36 |
| ADTPS | 0 |

In case of default, notices are being issued to such generating companies. Accordingly, MSLDC has issued 94 Nos. of notices to MSPGCL for improvement in Coal stock

position. Also, 51 Nos. & 7 Nos. of notices have been issued to AEML (Dahanu) & APML (Tiroda) plants for maintaining Coal Stock as per norms.

## 4.2. Hydro Generation:

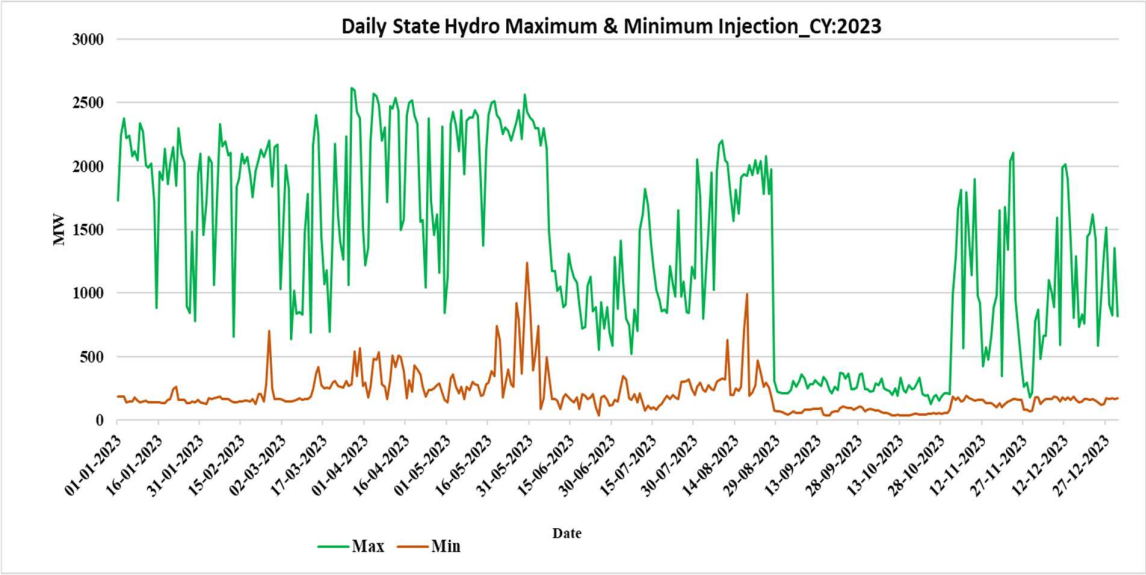
### 4.2.1. Injection Patterns:

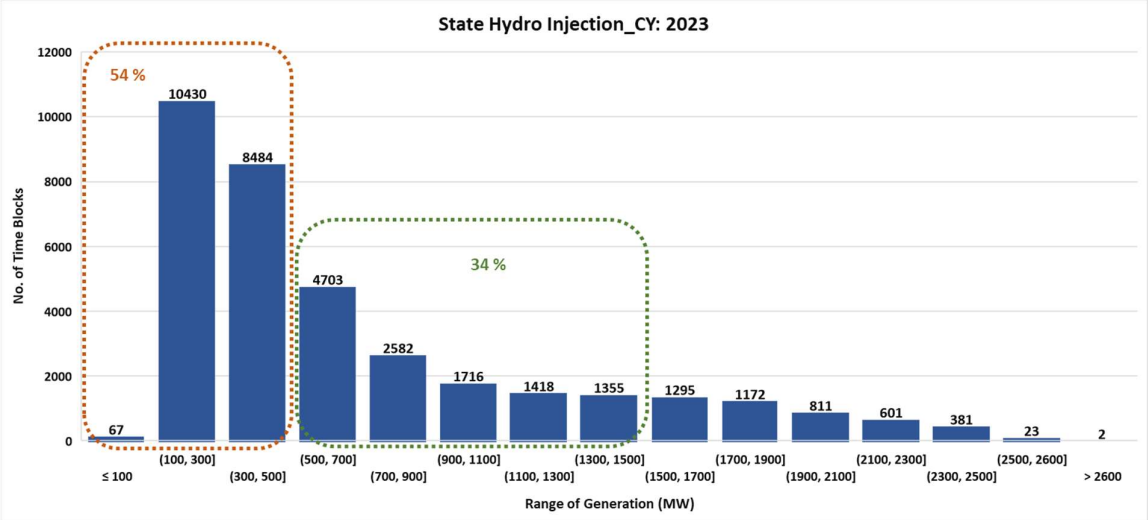
Koyna is the largest hydro-electric plant in the State owned by MSPGCL having total installed capacity of 1920 MW having 4 stages viz. Stage-I (MW), Stage-II (MW), Stage-III (MW) & Stage-IV (1000 MW). MSPGCL is having 250 MW (2 x 125 MW) Pumped Storage Units at Ghatghar.

Also, TPCL is having 3 hydro plants viz. Bhira (150 MW), Bhivpuri (74 MW) & Khopoli (74 MW) and one Pumped Storage Plant at Bhira (150MW).

Apart from above capacity, there are small hydal plants across the State such as Vaitarna, Bhira Tailrace, Mahati, Bhandardara, Tillari, Ujani, Paithan, Bhatsa, etc. Thus, total installed capacity of Hydro Plants is 2941 MW including Koyna Generation.

The Daily Maximum & Minimum injection pattern of the Hydro generation in the State is shown below.






From the above, it is observed that the hydro generation is used as a peaking generation. For 88 % of time period, hydro generation is used below 1500 MW, whereas only for 12 % of the period, hydro generation is used above 1500 MW capacity.

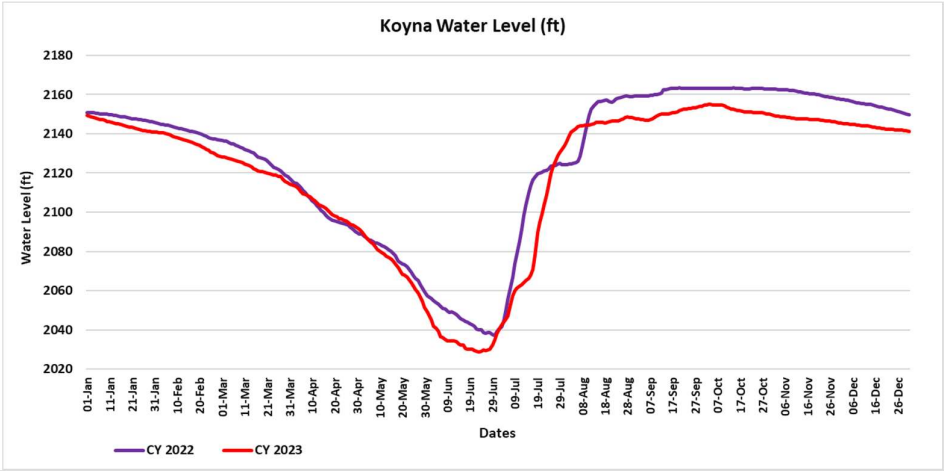
### 4.2.2. Non-availability of Hydro Generating units in CY 2023:

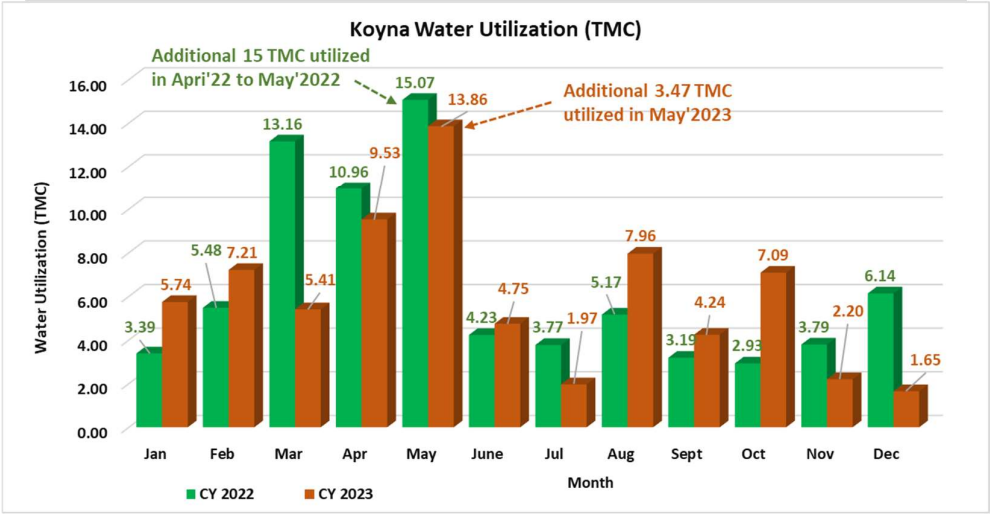
| Owner | Station | Name of Unit | No. of Times under shut down | No. of Days not available |
|---|---|---|---|---|
| MSPGCL | Ghatghar HPS | Ghatghar Unit-2 | 13 | 127 |
| | Koyna HPS | Koyna STG-IV Unit-1 | 6 | 104 |
| | | Koyna STG-IV Unit-2 | 8 | 37 |
| | | Koyna STG-IV Unit-3 | 10 | 83 |
| | | Koyna STG-IV Unit-4 | 10 | 40 |
| | | Koyna Unit 1 | 9 | 12 |
| | | Koyna Unit 2 | 6 | 0 |
| | | Koyna Unit 3 | 6 | 0 |
| | | Koyna Unit 4 | 7 | 3 |
| | | Koyna Unit 5 | 7 | 0 |
| | | Koyna Unit 6 | 7 | 3 |
| | | Koyna Unit 7 | 9 | 39 |
| | | Koyna Unit 8 | 8 | 74 |
| | | Koyna Unit 9 | 3 | 0 |
| | | Koyna Unit 10 | 5 | 2 |
| | | Koyna Unit 11 | 2 | 174 |
| | | Koyna Unit 12 | 5 | 0 |

### 4.2.3. Koyna Lake level:

The Water allocation for Maharashtra Koyna Generating Plant is 67.5 TMC for a Water year starting from June to May. The water utilized by Koyna St-I & II and Stage-IV is utilized for generation at Koyna Stage-III. Hence, the water utilized at Koyna Stage-III is not considered in the TMC utilization quota.

The comparison of Lake level of Koyna in feet for CY: 2022 & CY: 2023 is shown below:




Additional 15 TMC was allotted vide Letter No. SIC/Section- 3/No.1457 dated 01.04.2022 & 27.04.2022 for utilization in the month of April'22 & May'22 which was utilized completely in April & May' 2022 as Water year ends in May month.

Further, additional 7 TMC was allotted vide Letter No. 50/22 from CE Water resources Dept dated 24.05.2023 & Letter No.1649 from CE MAHAGENCO dated 24.05.2023 for water year 2022-23, out of which 3.47 TMC was utilized in CY: 2023.

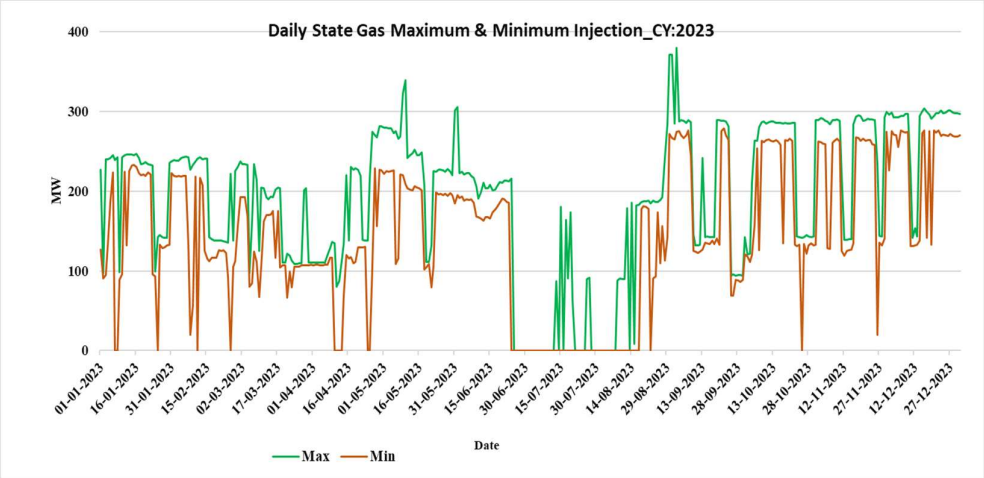
## 4.3. Gas Generation:

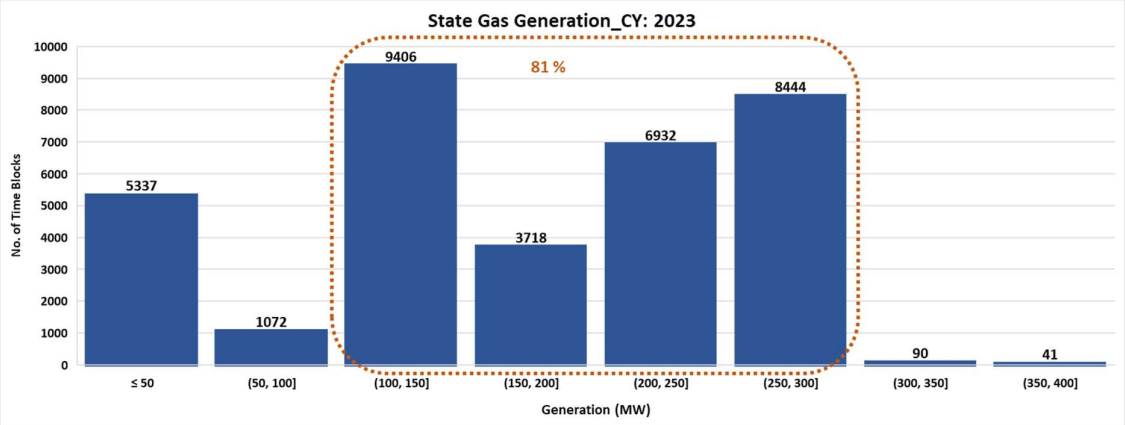
### 4.3.1. Injection Patterns:

Uran Gas based generating plant located in Raigad district is having total installed capacity of (672) MW. It has 4 x 108 MW & 2 x 120 MW units. Also, TPCL has gas-based plant at Trombay having total capacity of 180 MW.

The generation from gas-based plants depends up on availability of APM gas. Hence, based on the gas availability, these units are despatched. Some times TPCL Unit-7 is operated through RLNG gas to meet out contingencies under emergency situations.

The Daily Maximum & Minimum injection pattern of the Gas-based generation in the State is shown below.




From the above, it is observed that against the total installed capacity of 852 MW, the injection is only between 100 MW to 300 MW for 81 % of the period. For less than 1 % of the period i.e. for 131 No. of time blocks out of 35040-time blocks, generation is above 300 MW. This indicates that around 50 % of the capacity has become stranded due to non-availability of APM gas.

### 4.3.2. Non-availability of Gas Generating units in CY 2023:

| Owner | Station | Name of Unit | No. of Times under shut down | No. of Days not available | No. of Days under zero schedule |
|---|---|---|---|---|---|
| MSPGCL | Uran GTPS | Uran Unit 5 | - | - | - |
| | | Uran Unit 6 | 23 | 148 | 144 |
| | | Uran Unit 7 | 17 | 46 | 30 |
| | | Uran Unit 8 | 22 | 97 | 4 |
| | | Uran Unit A0 | - | - | - |
| | | Uran Unit B0 | 24 | 90 | 0 |

From the above, it can be seen that Unit-5 & Unit-A0 is completely not available during the complete year due to technical reasons. Also, Unit-6 is not available for 144 No. of days due to commercial reasons & for 148 days due to technical reasons. Uran, being strategically located near Navi Mumbai & Mumbai, it is beneficial to resolve the congestion in the MMR network. However, due to poor availability, it is not possible to utilize the capacity.

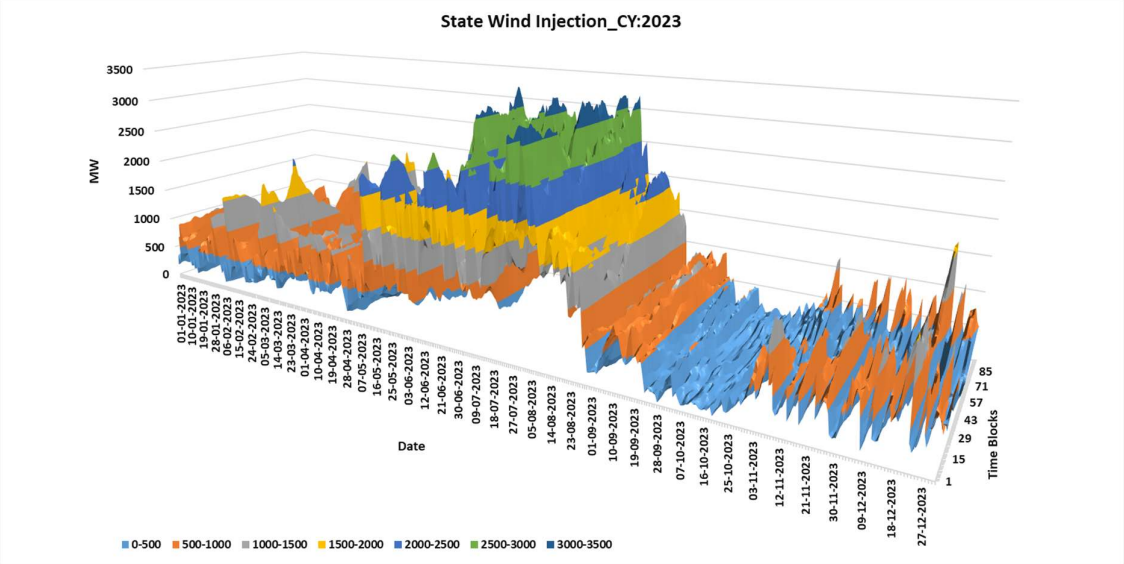
## 5.0. Generation Profile of RE Sources:

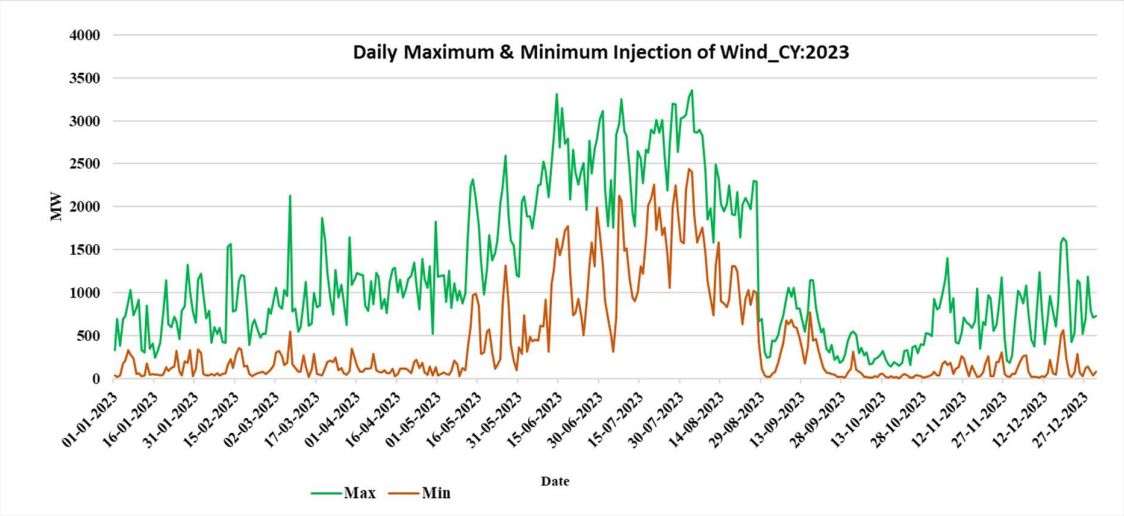
### 5.1. Wind & Solar Generation:

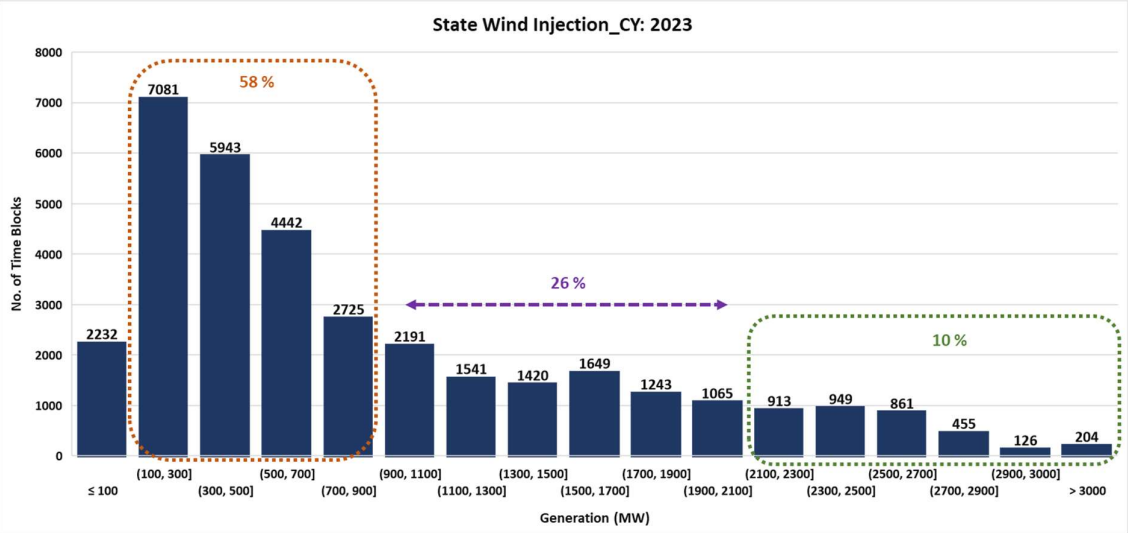
The details of month-wise Capacity addition in Wind & Solar Generation during CY: 2023 is tabulated below.

| Sr No. | Month | Capacity (MW) | | |
|---|---|---|---|---|
| | | Wind | Solar | Total |
| 1 | Jan-23 | 4992 | 2794 | 7786 |
| 2 | Feb-23 | 4992 | 2822 | 7814 |
| 3 | Mar-23 | 5005 | 2936 | 7941 |
| 4 | Apr-23 | 5005 | 2957 | 7962 |
| 5 | May-23 | 5073 | 3010 | 8082 |
| 6 | Jun-23 | 5100 | 3038 | 8138 |
| 7 | Jul-23 | 5100 | 3050 | 8150 |
| 8 | Aug-23 | 5129 | 3060 | 8189 |
| 9 | Sep-23 | 5129 | 3112 | 8241 |
| 10 | Oct-23 | 5131 | 3121 | 8252 |
| 11 | Nov-23 | 5145 | 3127 | 8272 |
| 12 | Dec-23 | 5145 | 3191 | 8336 |

### 5.1.1. Injection Pattern of Wind Generation:

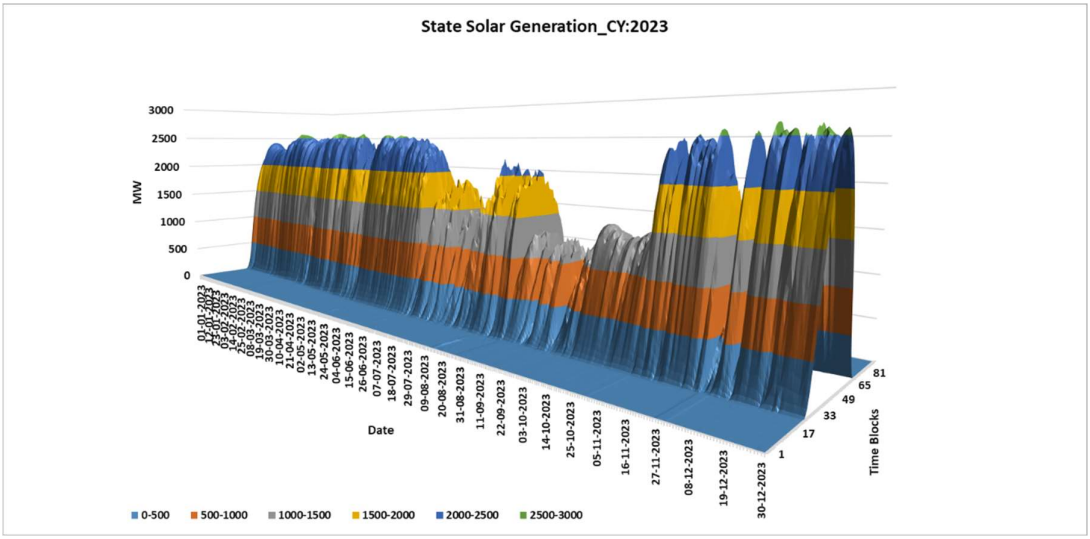


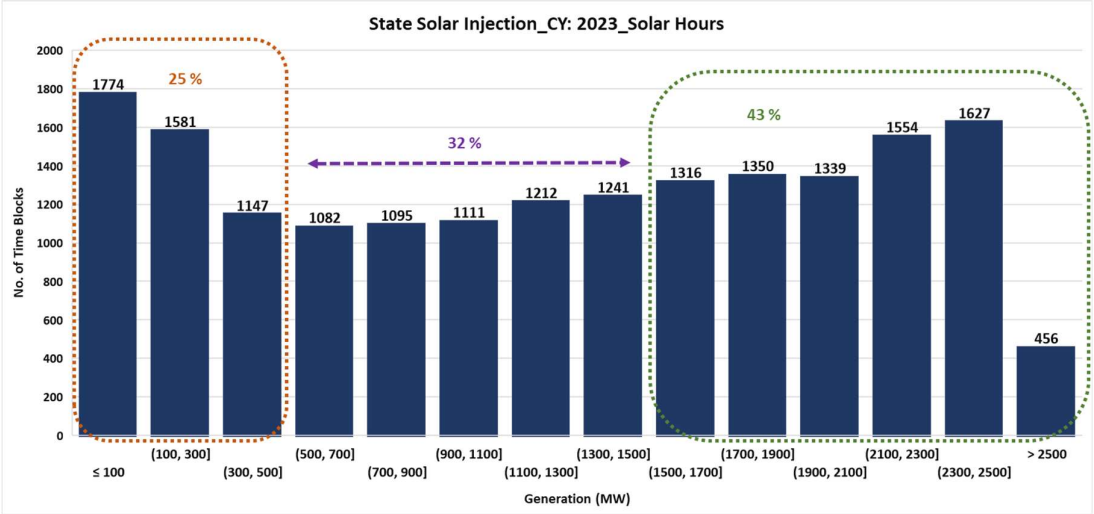


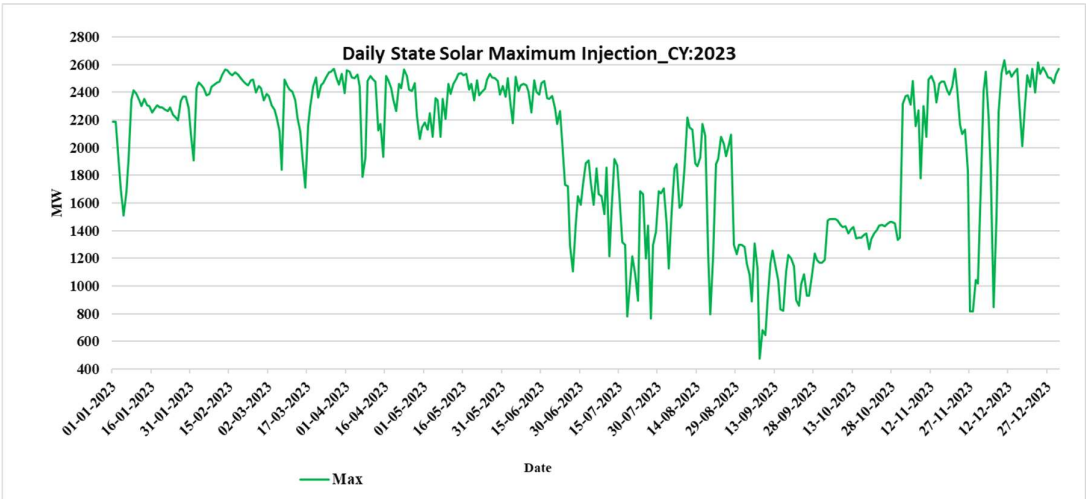




From the above, it is observed that for 58 % of the time Wind Generation is between 100 MW to 900 MW. Also, Wind injection is above 2100 MW only for 10 % of the period.

### 5.1.2. Injection Pattern of Solar Generation:

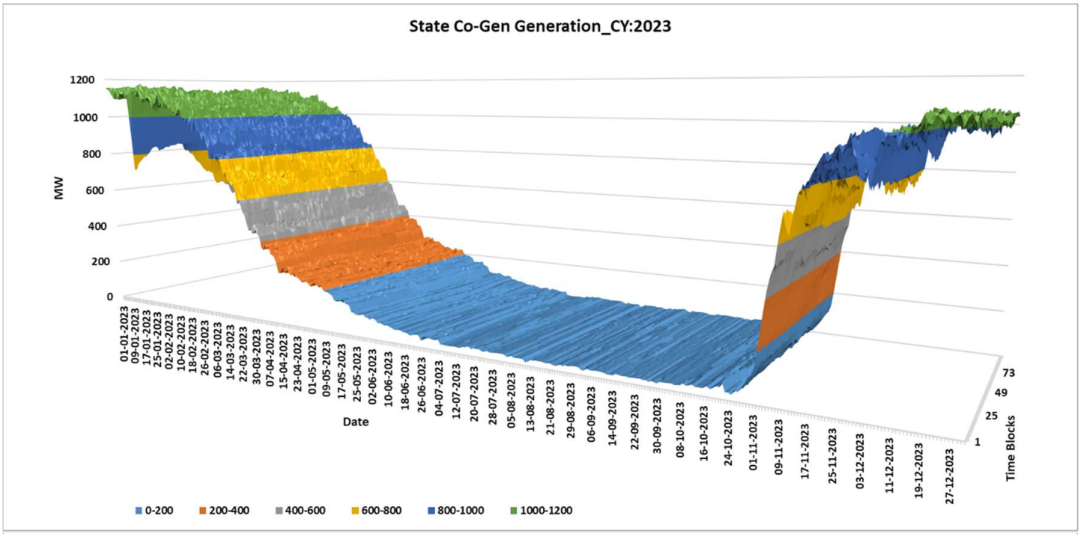


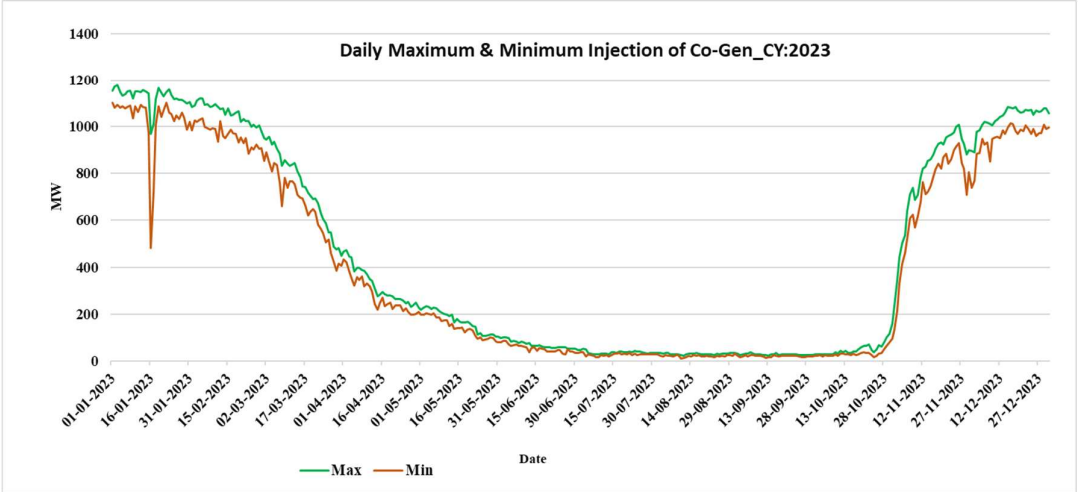



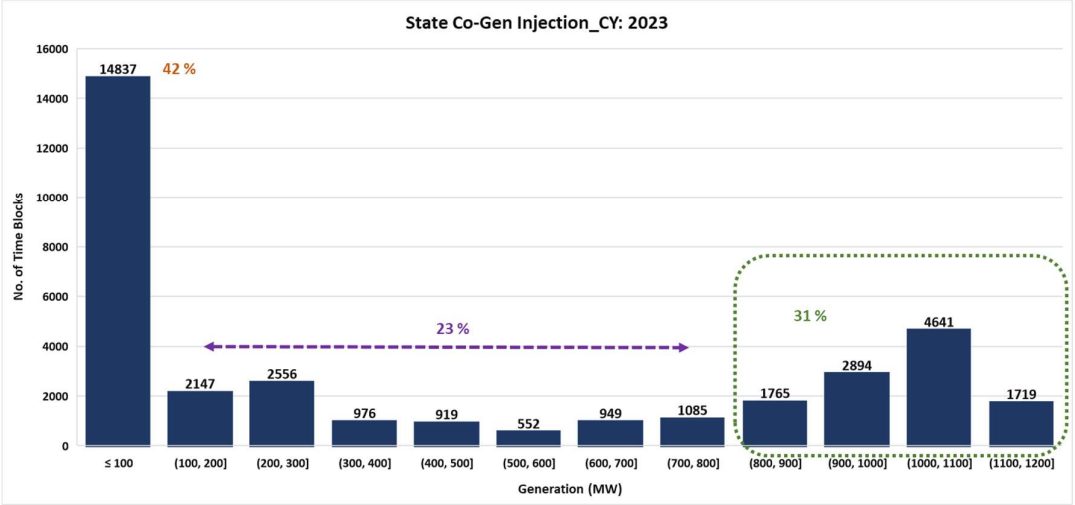




From the above, it is observed that during Solar hours i.e. between 06:00 to 18:30 hrs, for 32 % of the time Solar Generation is between 500 MW to 1500 MW. Also, Solar injection is above 1500 MW for 43 % of the period.

## 5.2. Bagasse/Biomass Generation:




Generation from Bagasse-based generation is seasonal & depends up on Sugarcane crushing which starts normally in September or October & is available till April/May. It is observed that against the total installed capacity of around 2700 MW, for 31 % of the period, injection is above 800 MW. Whereas for 42 % of the time, injection is below 100 MW.

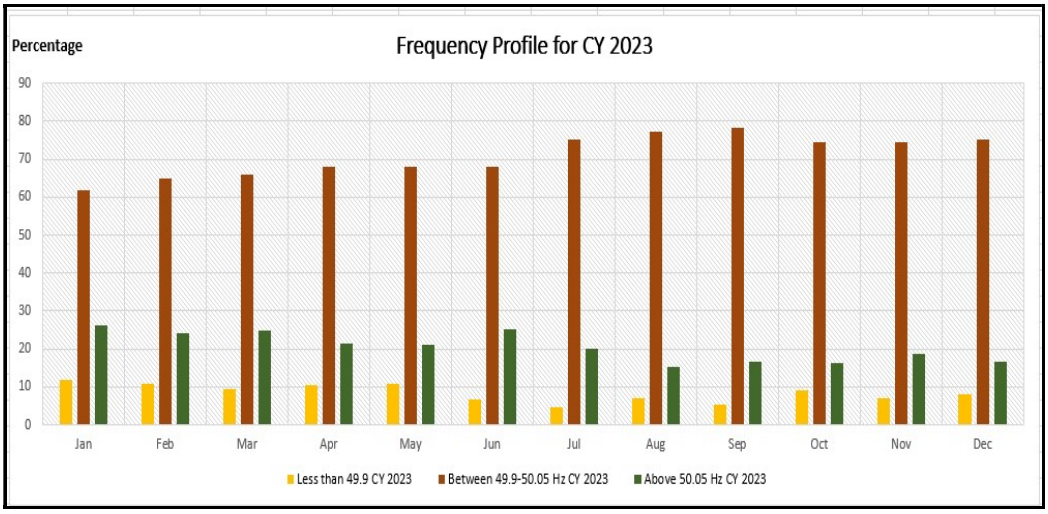
## 6.0. Grid Parameters of the State:

### 6.1. Frequency Profile:

In accordance with the IEGC' 2023, the permissible band of Frequency is 49.90 Hz to 50.05 Hz. Thus, for 70.93 % of the period, the System Frequency was within permissible band. The Maximum frequency of 50.47 Hz was recorded in January' 2023 whereas Minimum Frequency was recorded was 49.41 Hz in January' 2023.

The Month wise frequency profile for the CY: 2023 is mentioned as below:

| Month | Less than 49.9 Hz | Between 49.9 Hz to 50.05 Hz | Above 50.05 Hz |
|---|---|---|---|
| Jan | 11.929 | 61.687 | 26.384 |
| Feb | 10.952 | 64.742 | 24.306 |
| Mar | 9.36 | 65.885 | 24.756 |
| Apr | 10.621 | 67.866 | 21.514 |
| May | 10.883 | 68.071 | 21.046 |
| Jun | 6.653 | 67.998 | 25.35 |
| Jul | 4.718 | 75.332 | 19.951 |
| Aug | 7.191 | 77.379 | 15.43 |
| Sep | 5.38 | 78.127 | 16.493 |
| Oct | 9.037 | 74.509 | 16.454 |
| Nov | 6.986 | 74.417 | 18.597 |
| Dec | 8.017 | 75.204 | 16.779 |

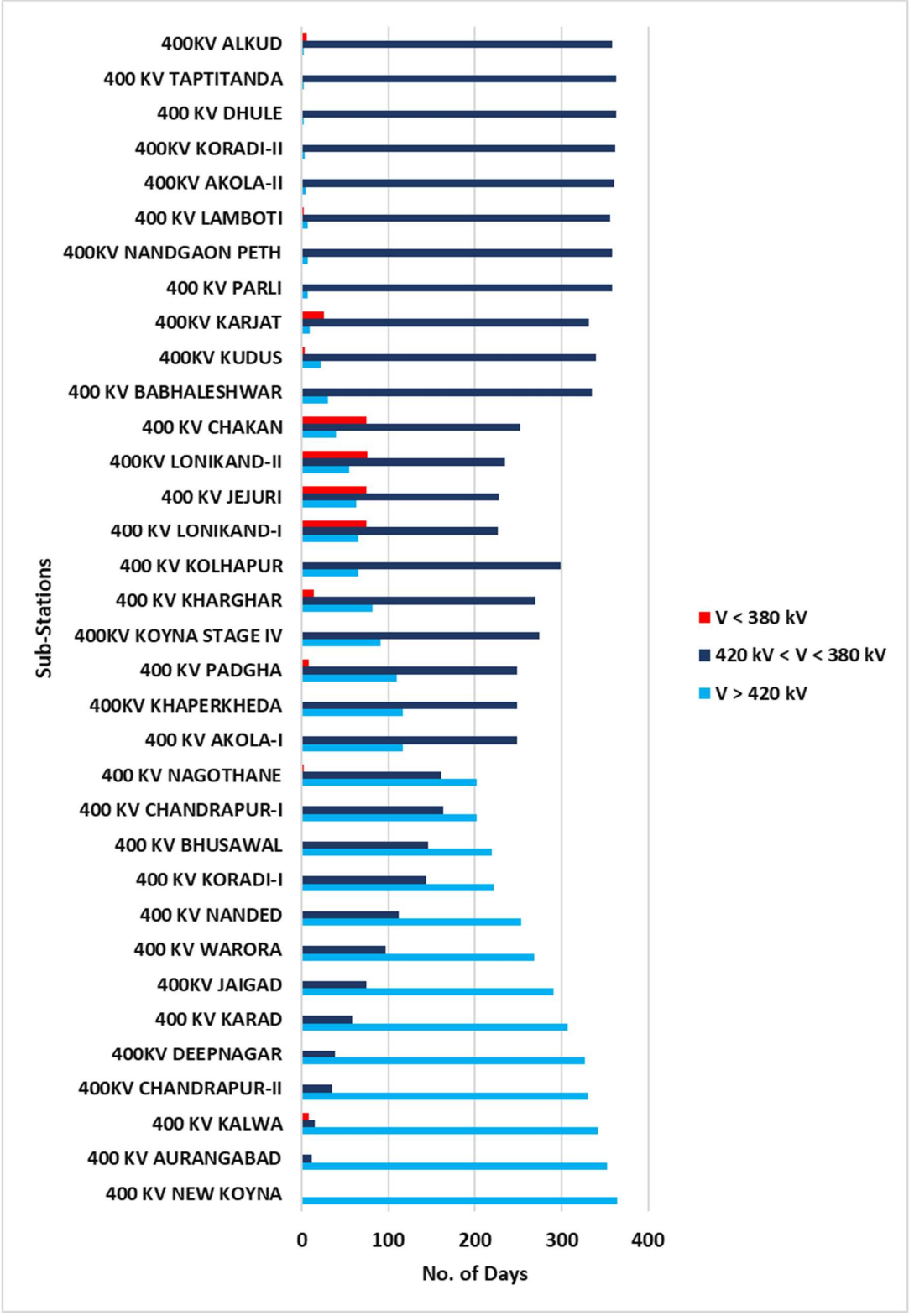



From the above, it is observed that the average frequency for the complete year was 49.99 Hz. Also, the frequency was above 50.05 Hz for average 50.59 % of times whereas frequency was below 49.90 Hz for 8.48 % of times.

## 6.2. Voltage Profile:

Day wise Maximum and Minimum voltages of 400kV substations are recorded at MSLDC. The voltage profile of 400kV Substations in CY 2023 is shown as below:

| Name of Substation | No. of Days in a year | | |
|---|---|---|---|
| | V > 420 kV | 420 kV <V < 380 kV | V < 380 kV |
| 400 KV AKOLA-I | 117 | 248 | 0 |
| 400 KV AURANGABAD | 353 | 12 | 0 |
| 400 KV BABHALESHWAR | 30 | 335 | 0 |
| 400 KV BHUSAWAL | 219 | 146 | 0 |
| 400 KV CHAKAN | 39 | 252 | 74 |
| 400 KV CHANDRAPUR-I | 202 | 163 | 0 |
| 400 KV DHULE | 2 | 363 | 0 |
| 400 KV JEJURI | 63 | 228 | 74 |
| 400 KV KALWA | 342 | 15 | 8 |
| 400 KV KARAD | 307 | 58 | 0 |
| 400 KV KHARGHAR | 82 | 269 | 14 |
| 400 KV KOLHAPUR | 65 | 299 | 1 |
| 400 KV KORADI-I | 222 | 143 | 0 |
| 400 KV LAMBOTI | 7 | 356 | 2 |
| 400 KV LONIKAND-I | 65 | 226 | 74 |
| 400 KV NAGOTHANE | 202 | 161 | 2 |
| 400 KV NANDED | 253 | 112 | 0 |
| 400 KV NEW KOYNA | 364 | 1 | 0 |
| 400 KV PADGHA | 109 | 248 | 8 |
| 400 KV PARLI | 7 | 358 | 0 |
| 400 KV TAPTITANDA | 2 | 363 | 0 |
| 400 KV WARORA | 268 | 97 | 0 |
| 400KV AKOLA-II | 4 | 361 | 0 |
| 400KV CHANDRAPUR-II | 330 | 35 | 0 |
| 400KV DEEPNAGAR | 327 | 38 | 0 |
| 400KV JAIGAD | 290 | 75 | 0 |
| 400KV KHAPERKHEDA | 117 | 248 | 0 |
| 400KV KORADI-II | 3 | 362 | 0 |
| 400KV LONIKAND-II | 55 | 234 | 76 |
| 400KV NANDGAON PETH | 7 | 358 | 0 |
| 400KV ALKUD | 2 | 358 | 5 |
| 400KV KARJAT | 9 | 331 | 25 |
| 400KV KOYNA STAGE IV | 91 | 274 | 0 |
| 400KV KUDUS | 22 | 340 | 3 |



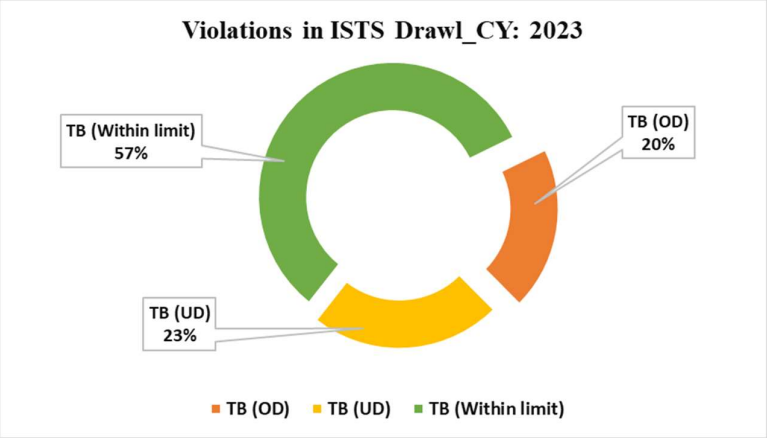

### 6.3. Violations in ISTS Drawl:

In accordance with the CERC (DSM) Regulations, 2022, the permissible deviations in drawl for RE rich States is 200 MW for each time block. Though it is the permissible limit, each State is mandated to maintain the drawl as per Schedule. Further, the violations are categorized in two parts viz. Category-1 (between 200 MW to 300 MW)

and Category-II (Above 300 MW). Hence, analysis is carried out for verification of violations in the drawl from ISTS.

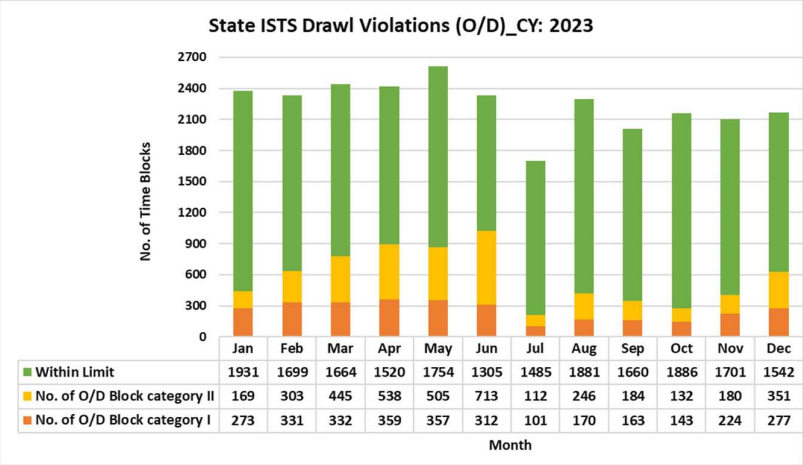
The detailed analysis is shown below:

| Deviation Violation Report of Maharashtra State for CY 2023 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Month | Total Time block | Over-drawl | | | Under-drawl | | |
| | | No. of O/D Block category I | No. of O/D Block category II | Max. O/D (MW) | No. of U/D Block category I | No. of U/D Block category II | Max. U/D (MW) |
| Jan | 2976 | 273 | 169 | 785 | 296 | 307 | -1164 |
| Feb | 2688 | 331 | 303 | 1570 | 195 | 160 | -1691 |
| Mar | 2976 | 332 | 445 | 1271 | 209 | 326 | -1494 |
| Apr | 2880 | 359 | 538 | 1130 | 216 | 247 | -1079 |
| May | 2976 | 357 | 505 | 1559 | 189 | 171 | -858 |
| Jun | 2880 | 312 | 713 | 1450 | 207 | 343 | -1619 |
| Jul | 2976 | 101 | 112 | 919 | 443 | 835 | -1090 |
| Aug | 2976 | 170 | 246 | 1129 | 311 | 368 | -992 |
| Sep | 2880 | 163 | 184 | 1365 | 323 | 550 | -1239 |
| Oct | 2976 | 143 | 132 | 706 | 352 | 463 | -1353 |
| Nov | 2880 | 224 | 180 | 742 | 299 | 476 | -1161 |
| Dec | 2976 | 277 | 351 | 871 | 324 | 482 | -965 |



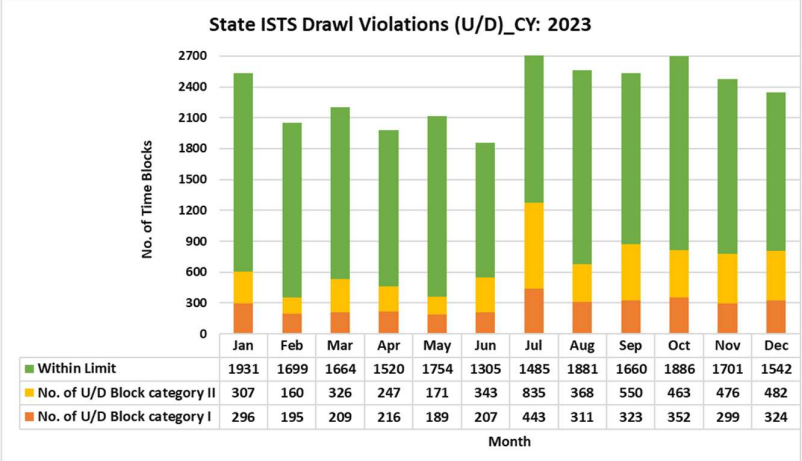

From the above, it is observed that for 57 % of the time blocks, State drawl was within permissible limit. Further, State was over-drawing beyond permissible limits for 20 % time and was under-drawing for 23 % of the time block.

The category-wise graphs are shown below:




| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Within Limit | 1931 | 1699 | 1664 | 1520 | 1754 | 1305 | 1485 | 1881 | 1660 | 1886 | 1701 | 1542 |
| No. of O/D Block category II | 169 | 303 | 445 | 538 | 505 | 713 | 112 | 246 | 184 | 132 | 180 | 351 |
| No. of O/D Block category I | 273 | 331 | 332 | 359 | 357 | 312 | 101 | 170 | 163 | 143 | 224 | 277 |

From the above, it is observed that out of total 20 % of the period of Over-drawl, the violations under Category-I & Category-II were for 9 % & 11 % respectively.

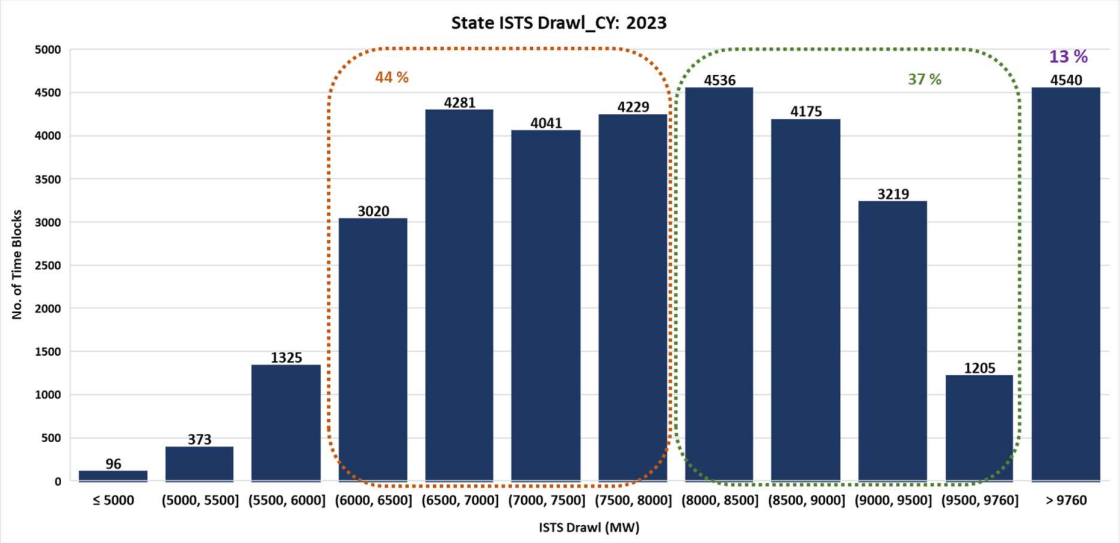



| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Within Limit | 1931 | 1699 | 1664 | 1520 | 1754 | 1305 | 1485 | 1881 | 1660 | 1886 | 1701 | 1542 |
| No. of U/D Block category II | 307 | 160 | 326 | 247 | 171 | 343 | 835 | 368 | 550 | 463 | 476 | 482 |
| No. of U/D Block category I | 296 | 195 | 209 | 216 | 189 | 207 | 443 | 311 | 323 | 352 | 299 | 324 |

From the above, it is observed that out of total 23 % of the period of Under-drawl, the violations under Category-I & Category-II were for 10 % & 13 % respectively.

The Available Transfer Capability (ATC) of the State is 9760 MW. Thus, the State is permitted to schedule & draw power from ISTS inter-connection points up to ATC limit.

Hence, analysis was carried out to identify the instances of violations of the ATC limit during CY: 2023. The details are as below:




It has been observed that for 4540 No. of time blocks, i.e. for 13% of the time, State has violated the ATC limit. Further, for 37 % of the period, ISTS Drawl is between 8000 MW to 9760 MW. Further, for 44 % of the period, ISTS drawl is between 6000 MW to 8000 MW.

## 7.0. System Constraints:

MSLDC is regularly submitting the operational feedback of State Transmission Utility (STU) on quarterly basis which includes Transmission Constraints, ICT, Low/High Voltage constraints, grid event details, Reactive compensation required to contain high voltage, Line loading, ICT loading and other important grid security related issues.

The System Constraints of Maharashtra State are classified in two major parts viz. Generation Constraints & Transmission Constraints. Each constraint is detailed below:

### 7.1. Generation Constraints:

#### 7.1.1. Low DC & Availability of Thermal Generators:

As per the analysis indicated in Point No. 4.1 above, the DC declared by the Thermal Generators is always on lower side. Also, the % Availability of the MSPGCL thermal units is not up to the target set in the MERC MYT Regulations, 2019. Hence, due to low DC & availability, even though the installed capacity of InSGS is high, it is becoming difficult for MSLDC to manage Load-Generation on day ahead as well as in real time. As complete InSGS is scheduled, no reserve capacity is available to mitigate any contingencies. Many times, Koyna Generation is required to be picked-up to meet demand which is resulting in to additional usage of water.

#### 7.1.2. Non-contracted Generation Capacity:

The details of non-contracted generating plants are shown below.

| Generating Company | Name of Generating Unit | Capacity (MW) | Tripped Date | Tripped Time | Sync. Date | Sync. Time | Reason of Outage |
|---|---|---|---|---|---|---|---|
| IPP | PIONEER GAS U1 | 262 | 07-02-2017 | 17.30 | | Continued. | No Schedule (NO PPA) |
| IPP | PIONEER GAS U2 | 126 | 07-02-2017 | 17.30 | | Continued. | No Schedule.(NO PPA) |
| IPP | VIPL U-1 | 300 | 29-12-2018 | 00.30 | | Continued. | Coal Shortage. (NO PPA From 20.05.2019) |
| IPP | VIPL U-2 | 300 | 17-01-2019 | 00.15 | | Continued. | Coal shortage.(NO PPA From 20.05.2019) |
| IPP | RPL SINNER U-1 | 270 | -- | -- | | -- | No Schedule (NO PPA) |
| IPP | RPL SINNER U-2 | 270 | -- | -- | | -- | No Schedule (NO PPA) |
| Total | | 1528 | | | | | |

It has been observed that 1528 MW capacity is not contracted. All these plants are presently out from the grid. The generation from this capacity will be beneficial for managing Grid.

#### 7.1.3. Low availability of APM Gas:

MSPGCL's Uran (672 MW) & TPCL's Trombay U-7 (180 MW) are gas-based generating plants. APM gas provided is on lower side compared to it sanctioned allocated quota. Due to low availability of APM gas, the generation is very low against the installed capacity. Considering location of these plants, any increase in the generation capacity of these plants will reduce the congestion in the 400 kV lines in MMR & Mumbai. Use of RLNG gas is very costly and hence, the power is to be

scheduled under 'VSE' which is additional burden on the State DSM Pool. Hence, efforts need to be made in increasing the supply of APM gas as per sanctioned allocations.

### 7.1.4. Generation capacity under long outage:

From the below mentioned table, it is observed that some of the units are under long outage. All these outages are either due to major overhaul or due to technical faults. The details are tabulated below:

| Name of Unit | Date Trip | Time Trip | Date Sync | Time Sync | Outage Type | Reason | Expected Date of revival |
|---|---|---|---|---|---|---|---|
| Tarapur 1 | 08-01-2020 | 10:37 | | Continued. | FORCED | Refueling. While refueling preparation, some repair works identified which are being executed before refueling. | 01-04-2024 |
| Uran Unit 7 | 25-05-2020 | 12.51 | 26-04-2023 | 08:44 | FORCED | Turbine Blade Failure | |
| Tarapur 2 | 13-07-2020 | 04:38 | | Continued. | FORCED | For cleaning of clogged basket strainer of cooling water system due to heavy ingress of debris from sea. The outage extended for repair and re-fueling. | 01-05-2024 |
| Ghatghar Unit-1 | 20-04-2022 | 00:35 | | Continued. | FORCED | Stator Earth Fault | 30-11-2023 |
| Uran Unit A0 | 07-09-2022 | 16:30 | | Continued. | FORCED | TURBINE TRIPPED ON HIGH VIBRATIONS | 31-03-2024 |
| Uran Unit 5 | 12-11-2022 | 13:23 | | Continued. | PLANNED | Major overhaul. | 15-02-2024 |
| Koyna Unit 11 | 10-07-2023 | 09:40 | | Continued. | PLANNED | COH | 07-12-2023 |

As these units are under long outage, the capacity is not being utilized for the System. Hence, the generating companies need to expedite the works to bring back these units on bar on priority.

### 7.1.5. Generator responsible for transmission constraints:

The installed capacity of Nashik Thermal units is 630 MW. However, these units are not operated to its Ex-Bus capacity being old units & coal issues. Due to low generation, the transmission network in Nashik Ring Main is severely stressed. The loading on 220 kV Babhaleshwar-Nashik D/C lines is always on higher side and in case of overload, LTS is operated resulting in to load shedding in Nashik Ring Main. Hence, it is necessary to operate Nashik units to its full capacity.

### 7.2. Transmission Constraints in Maharashtra Grid: -

#### 7.2.1. LTS Operation & ELR:

| Sr. No. | Name of Element | Congestion reason | Area | No. of Events | Remedial Measures to release congestion |
|---|---|---|---|---|---|
| 1. | 400 kV Chakan – Talegaon PG | 1) LR required to be carried out due to overloading of 400kV Chakan – Talegaon PG.<br>2) Due to injection of power from Solapur PG /ParliPG/Aurangabad PG at Talegaon PG the loading of this line increases | Pune | Frequent | 1) Explore the possibility to making LILO of Talegaon PG-Lonikand line LILO at Chakan<br>2) HTLS of Existing line i.e. 400KV Talegaon - Chakan, 220KV Talegaon PG-Talegaon Ambi D/C and 220KV urse-Chichwad S/C<br>3) Explore the installation of Phase shifting TF to divert the power flow on other ckts. |
| **2.** | 220kV Nashik GCR – Babhaleshwar DC | 1) These lines are source to Nashik city.<br>2) Both the line carries load of around 230 MW each with two MSPGCL units (2x210 MW) of Nashik on Bar. During tripping or non-availability of one unit causes operation of LTS or required emergency load shedding.<br>3) To manage the load on these lines, Ranwad load required to be shifted on Manmad s/s and 220kV Nashik – AKP and 220kV Padghe – Nashik required to Hand tripped.<br>4) Emergency Load shedding carried out to avoid overloading of both the lines. | Nashik | Frequent | 1) Commissioning of 400kV Pimpalgaon substation and Upgradation of line with HTLS conductor.<br>2) Explore the possibility of making RIPL Nashik unit power to Nashik GCR-OCR instead of Babhaleshwar.<br>3) Nashik unit generation (210 MW X 3) to be run at maximum capacity. |
| 3. | 220/33kV 50MVA TF 1 & 2 @ 220kV Kopargaon | ELR carried out to control the overloading of Transformers | Nashik | Frequent | Shifting of 33kV load from 220kV Kopargaon substation to 132kV Kopargaon substation is pending with MSEDCL. |
| 4. | 132kV Rahuri – | At 132kV Rahuri s/s, LTS operated & ELR | Nashik | | 132 kV Bhabhleshhwar-Rahuri- A'nagar (GEC) 39 |

| | | | | | |
|---|---|---|---|---|---|
| | Babhaleshwar ckt | required to be carried out due to overloading of 132kV Rahuri – Babhaleshwar ckt | | Frequent | ckm planned in five year plan. (132kV Rahuri – Ahmadnagar MIDC line charged from 132kV Rahuri s/s at loc. No. 147 on 05.11.2023@17:43 Hrs) – Length 15.85km |
| 5. | 132kV Sangamner – Babhaleshwar ckt | At 132kV Sangamner, 132kV Akole s/s & 132kV Rajur s/s, ELR required to be carried out due to overloading of 132kV Sangamner – Babhaleshwar ckt | Nashik | Frequent | Conversion of 132kV Sangamner – Babhaleshwar SCSC line into DCDC – 34Km planned in five year plan |

### 7.2.2. Line Hand tripped due to overloading:

Following lines are required to hand tripped to control the overloading:

| To control Overloading of | Name of Line required to hand tripped |
|---|---|
| 220kV Nashik – Babhaleshwar D/C | 220kV Eklahare (GCR) – Airoli Knowledge Park |
| | 220kV Eklahare (OCR) – Navsari ckt – 2 |
| | 220kV Eklahare (OCR) – Padghe |
| 400kV Jejuri ICTs | 220kV Lonand - Baramati |
| 400 kV Kalwa – Talegaon (PG) | Any one circuit of 400 kV Aurangabad (PG) – Talegaon (PG) D/C |
| 400 kV Chakan – Talegaon (PG) | |
| 400 kV Lonikand – Talegaon (PG) | |

### 7.2.3. 'N-1' Non-Compliant Elements:

The non 'N-1' compliant transmission elements are tabulated below:

| Sr.No | Name of Element | Congestion reason | Remedial Measures to release congestion |
|---|---|---|---|
| 1. | 765/400kV 1500 MVA Ektuni ICT | There are 2 numbers of 765/400kV 1500 MVA ICTs. The loading of these ICTs are 1800 – 2100 MW and hence not N-1 compliant.<br>During the outage of one of the ICT, generation of APML | Additional 1500 MVA ICT required |

| | | | |
|---|---|---|---|
| | | Tirora, RIPL Nandgaonpeth and Koradi 2 required to reduce or 400kV Ektuni – Taptitanda D/C and one ckt 400kV Ektuni – Babhaleshwar has to open to control the loading**.** | |
| **2.** | 400/220kV 600 MVA ICT @ Padghe | 600MVA ICT outage not feasible. 315 MVA ICT get overloaded first. Transferring of 500/600 MVA ICT to 220kV Transfer bus is not possible due to constraint of TBC. (Single conductor) | |
| 3. | 220kV Urse – Chinchwad ckt | 1) This Single circuit line is an important source for Pune Ring Main (PRM) and is carrying more than 200 MW.<br>2) PRM is at risk in the event of tripping of this line.<br>3) During normal operations, it is very difficult to approve planned as well as forced outages due to loading constraints.<br>4) To control the line loading, 220kV Hinjewadi – Infosys load required to shift on Kandalgaon and due to this these substations remain radial. | Upgradation of line with HTLS conductor.<br>Commissioning of proposed 220kV Talegaon – Chakan Ph II D/C |
| 4. | 400kV Lonikand 1 ICTs | 220KV Interconnector with Lonikand- 2 need to be made ON | This results into increase in loading of 220kV Urse-Chinchwad line hence strengthening is required |
| 5. | 400/220kV 500 MVA Alkud ICT | Only one ICT, so outage is not feasible | Explore the possibility of second ICT |
| 6. | 220kV Kalwa 2 – Colorchem & Colorchem - Temghar | Radial operation of Colorchem in case of tripping of 220kV Padghe – Temghar – Colorchem corridor | 1. Upgradation with HTLS conductor on 220kV Padghe – Temghar, Temghar – Colorchem – Kalwa corridor.<br>2. Additional |

| | | | |
|---|---|---|---|
| | | | source to Colourchem substation required. |
| 7. | 220kV Kalwa– Temghar ckt | High loaded line, requires switching ON 220kV interconnector at Kalwa | HTLS to be done on priority |
| 8. | 220kV Padghe – Wada | Radial operation of 3 substation in case of outage/Tripping | LTS to be provided to avoid overloading of 220kV Kolshet – Kamba line. |
| 9. | 220kV Padghe – Nalasopara (Tap to Vasai) | Overloading of line in case of tripping of 220kV Nalasopara – Boisar (PG) | Separate source at Vasai substation to be explored. |
| 10. | 220kV Padghe – Jambhul & 220kV Padghe - Pal | Radial operation of 4 substations in case of outage/Tripping | To avoid overloading of remaining lines, HTLS to be done & LTS to be provided. |
| 11. | 220kV Jejuri - Baramati | High loading due to agriculture load around 250MW. 220kV Baramati – Lonand to be kept open as per real time condition | Upgradation of line with HTLS conductor |
| 12. | 220kV Phursungi - Parvati | Radial operation of Jejuri-Kondhwa-Nanded City-Flagship | Upgradation of line with HTLS conductor. LTS to be provided on the Jejuri-Kondhwa line |
| 13. | 220kV Jejuri - Kondhwa | Radial operation of Kondwa-Nanded city-flagship - Parvati | Upgradation of line with HTLS conductor. LTS to be provided on the Phursungi - Parvati line. |
| 14. | 220kV Badnera-Wardha (PG) and 220kV Dhamangaon-Badnera | In case of tripping of either 220kV Badnera-Wardha (PG) or 220kV Dhamangaon-Badnera the other ckt gets overloaded (depending on Paras generation and Akola (Apatapa) ICT loading | To relieve the congestion exploring the possibilities of providing 500MVA ICT at 400kV Nandgaonpeth (Rattan India) with evacuation to Badnera. |

| | | | |
|---|---|---|---|
| 15. | 132kV Kanhan-Mansar | Radial feeder | Commissioning of By-pass isolator at 132kV Pench S/s so that second source could be made available at Mansar through 132kV Kanhan-Pench-Mansar. |
| 16. | 132kV Bhandara-Kardha D/c Line | In case of tripping of either ckt's the other ckt gets overloaded | Implementation of HTLS Scheme for Bhandara-Kardha D/c Line. Or Exploring possibilities of second source to either 132kV Kardha S/s or 132kV Sakoli S/s. |
| 17. | 132kV Chikhali-Dhad | Radial feeder | Expedite second source works from Bokardhan S/s. |
| 18. | 220KVKanhan s/s | 220kV Kanhan is sourced from 220kv Kanhan-Suryalakshmi – Khaperkheda and 400kv khaperkheda-kanhan ckt. Each ckt is loaded above 140 MW each. In case of tripping of any of the sources result in tripping of another source on overload. | Exploring the possibility of providing additional source on 220kv Kanhan bus |
| 19. | 220KV Kalmeshwar s/s | 220kV Kalmeshwar ss is sourced from 220kv Khaperkheda ss and 220kv Ambazari ss. In case of tripping of either ckt the other ckt tripped on overload | Exploring the possibility of providing additional source on 220kv Kalmeshwar bus |
| 20. | 132kV Nagpur Ring main Network | Steep rise in Nagpur urban demand is observed from 550 to 700 MW approx. causing overloading of 132kV ring main network. In case of tripping, of any one-line other line trips on overload. | Expedite the commissioning of 220kV Nagpur ring main network. |

### 7.2.4. Constraint in evacuation of Solar Generation:

A total 208 MW Solar Generation is connected to 132 kV Wagdari & Naldurg S/s, 149 MW & 59 MW Solar Generation respectively.

The said generation is evacuated through 132 kV Ujani-Naldurg S/C, 132 kV Bale –

Naldurg S/C & 132 kV Wagdari – Akkalkot S/C line. 132 kV Naldurg & 132 kV Wagdari S/s are interconnected through S/C line. Out of these three evacuating lines, 132 kV Ujani- Naldurg S/C & 132 kV Bale – Naldurg S/C lines are old more than 30 years.

In case of tripping of any line, the solar generation required to backed down so as to avoid tripping of remaining lines on overload.

### 7.2.5. Restoration of 400kV Karad – Solapur (PG):

For improving the voltages in 220 kV Jeur area, 400 kV Karad-Solapur (PG) S/C line has been temporarily converted to 220kV Solapur (PG) – Jeur line. This arrangement has been approved by CEA & WRPC purely on temporary basis. However, till date this arrangement is not restored as the planned works are not completed.

Being important 400 kV element in the transmission system, WRLDC & WRPC are continuously requesting MSLDC to take appropriate actions for restoration of the said line.

As informed by the STU, the work of 400/220 kV Karjat S/s, along with 220 kV Karjat – Jeur D/C line is in progress. Once the said Sub-station and line is commissioned, the low voltage issue shall be resolved and the 400 kV Karad-Solapur (PG) line can be restored & charged to 400 kV level.

For the system improvement, reconductoring of Moose conductor with HTLS conductor work carried out by Powergrid on 400kV Kolhapur (MS) – Kolhapur (PG) ckt – 1 & 2. Due to such conductor replacement work, loading of 400kV Karad – Kolhapur DC increased around 900MW. It causes the constraints while availing shut down on one of the ckt. This constraint can be resolve after the restoration of 400kV Karad – Solapur (PG).

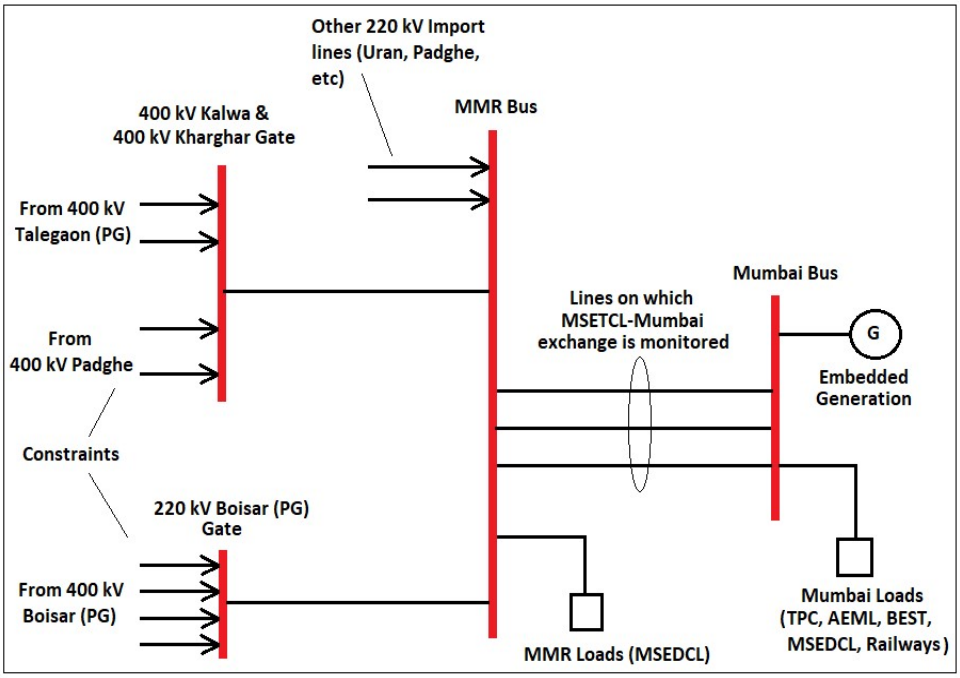
During the peak season, loading on 400kV Alkud – Solapur (PG) remains around 800 MW. This loading can be reduces after the restoration of 400kV Karad – Solapur (PG).

In view of above, to overcome the low voltage issue in Jeur area and for maintaining the 400 kV network availability by restoring the 400 kV Karad-Solapur (PG) S/C line to 400 kV level, the work of 400/220 kV Karjat S/s along with 220 kV Karjat – Jeur D/C line needs to be completed on priority.

### 7.2.6. MMR Transmission Constraints:

Constraint in loading of 400 kV MMR & Mumbai connected lines:

- Major power sources to MMR including Mumbai area at 400 kV level are 400 kV Talegaon (PG) and 400 kV Padghe.
- The main source for 400 kV Talegaon (PG) S/s is from 765/400 kV Pune GIS S/s through 400 kV four lines & 400 kV D/C lines from Aurangabad (PG) & Parli PG.
- In real time it is observed that power to the tune of around 2500-2800 MW is injected from 765/400 kV Pune GIS S/s. This high dumped power at Talegaon (PG) is evacuated through 400 kV Talegaon (PG) – Chakan S/C, 400 kV Talegaon (PG) – Kharghar S/C and 400 kV Talegaon (PG) – Kalwa S/C lines. Same power is evacuated through 400/220 kV ICTs at Talegaon (PG).




- Due to this high dumped power, all the 3 Nos. of 400 kV lines are always loaded above 500 MW. Depending upon MMR & Mumbai demand and Pune area demand, these lines are seen loaded beyond 650 MW. On the staggering day in Pune, the loading on 400 kV Talegaon (PG) – Chakan S/C line is reduced resulting into increased loading on the other 400 kV lines connecting to Kalwa & Kharghar S/s.
- It is observed that in-spite of HVDC loaded to 1300 MW, the contribution of 400 kV Padghe S/s on 400 kV Kalwa is less which is normally around 650 MW. Whereas the contribution from Talegaon (PG) is around 1000-1300 MW.
- To control the loading on these 400 kV lines, WRLDC is opening one circuit of 400 kV Aurangabad (PG) – Talegaon (PG) D/C. With opening of this line, the loading on these three 400 kV lines is reduced by around 20-30 MW each. However, opening of any grid line for load management is not desirable as such opening results into weakening of the network.
- In order to maintain the 400 kV transmission network connected to MMR area 'N-1' compliant, it is necessary to limit the line loadings up to 650 MW. Hence, to limit the loading up to 650 MW, internal Mumbai generation is picked up in real time, which is of high rate. As the internal generation is costly, the commercial impact is passed on to the consumers of its contracted Discoms.

### 7.2.7. Inter State ATC/TTC Constraint:

Presently, ATC / TTC for the Maharashtra State is as below:

Total Transfer Capability (TTC): - 10060 MW
Transmission reliability Margin (TRM): - 300 MW
Available Transfer Capability (ATC): - 9760 MW

During the violation of ATC, to control the Over drawl, Load shedding is required to carried out.

### 7.2.8. Line Hand tripped due to overvoltage:

Following lines are hand tripped to control the overvoltage in CY: 2023

| Name of Line | No. of Times Hand tripped |
|---|---|
| 400kV Jaigad – Karad ckt - 1 | 29 |
| 400kV Jaigad – Karad ckt - 2 | 25 |
| 400kV Khadka – Aurangabad (Waluj) | 45 |
| 400kV Lonikand – Koyna Stage IV | 16 |

## 7.3. Transmission constraints affecting Generation:

### 7.3.1. Nashik TPS Generation constraints:

It has been observed that the grid voltages in Nashik area drops below 205 KV as against 220KV. This reduction is mainly due to high reactive power requirement. To meet out the high MVAr requirement in Nashik area & maintain voltages within limits, Nashik Units are continuously sharing high MVAR. MSPGCL has informed that such high injection of reactive power is resulting in to increase of generator winding temperature. The rotor temperature increases up to $115^0$C. Also, an Excitation current has reached its maximum limit of 2600 Amperes resulting in huge stress on the insulation of Generator. To maintain the winding temperature at safe limits, generation is restricted which is causing loss in generation. Further, sudden drop in Grid Voltage results in generation reduction of around 40-50 MW for the running unit causing commercial loss MSPGCL. Further, reduction in generation (active power sacrificed due to MVAR requirement) results in reduction of availability of the units to be maintained as per Hon'ble MERC Regulations. Further, as per the present regulations, there is no provision of compensation for such reduction in availability due to MVAR requirements.

The issue was discussed in OCC & GCC meetings. STU, MSLDC & Nashik field office has carried out detailed studies for providing adequate reactive power compensation in Nashik area. Thus, reactive power compensation has been planned and the same is being implemented.

### 7.3.2. Backing Down of APML (Tiroda) & Koradi-II Generation:

The generation of APML (Tiroda) & MSPGCL's Koradi-II is evacuated through 765 kV network through 765/400 kV Ektoni S/s. The transformation capacity at 765/400 kV Ektoni S/s is 2 x 1500 MVA. Both the ICTs are loaded to more than 60 % of tis installed capacity. There is no redundancy available in the transformation capacity. In case of tripping or outage on any one ICT, the remaining ICT is either loaded to full rated capacity or above permissible capacity. Hence to maintain the loading within permissible limits, the generation at Tiroda & Koradi-II is required to be backed down. It is difficult for MSLDC to approve outage on these ICTs. To avoid tripping on overload due to tripping or outage on any ICT, SPS is installed which is providing alarm at both the generating stations & generation is backed down manually as per MSLDC's instructions. Hence, it is necessary to provide additional 1 x 1500 MVA 765/400 kV ICT at Ektoni S/s.

### 7.3.3. Koyna water utilization:

Koyna Generation is utilized by MSLDC as per the schedule issued by MSEDCL. Further, the dispatch is dependent up on the availability of other resources arranged by MSEDCL for meeting its demand. Hence, majority of water is utilized for meeting MSEDCL Demand.

However, Koyna generation is utilized by the MSLDC under some contingent conditions descried below:

- To control over-drawl by the State above 200 MW when all the State thermal generation is exhausted. This action is carried out to avoid hefty penalties at State Periphery.
- To support the Grid frequency when frequency-profile is at lower side, mainly below 49.85 Hz.
- To control overloading of 400 KV lines viz., Talegaon (PG) –Chakan ckt which normally loaded above 750 MW.
- To support the grid during system emergencies such as tripping of any generating unit and evacuating grid lines, HVDC pole, multiple tripping of important grid elements, to operate grid securely & reliably.
- During the power shortfall conditions, till actual effect of load shedding is visible.

As there are restrictions in water utilization, it is important to utilize Koyna Generation judiciously. Further, it has been observed that out of allocated annual quota of 67.5 TMC, around 5-6 TMC is used by MSLDC for mitigating Transmission Constraints.

### 7.3.4. MMR Constraints impacting Mumbai Generation:

Mumbai & partial area in MMR (Navi Mumbai, Thane, Mulund, Bhandup, etc) is mainly fed through 400 kV Kalwa, 400 kV Kharghar Sub-Stations through 400 kV Talegaon (PG) – Kalwa S/C, 400 kV Talegaon (PG) – Kharghar S/C & 400 kV Padghe – Kalwa D/C lines. The import through these lines is restricted to around 1900 MW. Further, Mumbai embedded generators, Trombay U-5, 7 & 8 and Dahanu U-1 & 2 have high sensitivity on these 400 kV lines feeding power to MMR including Mumbai. Hence, considering transmission constraints & 'N-1' contingencies over 400 kV network in MMR, MSLDC directs TPCL & AEML to keep these costly generators on bar.

Further, it is the responsibility of the Discom to optimize its power purchase cost by procuring low-cost power. Considering Load-Generation balance on Day ahead basis, Trombay Unit-5 & 8 get lower schedule. However, in real time due to transmission constraints, the Trombay generation is picked up. This additional generation pick-up is booked under 'VSE' which is compensated through State DSM Pool account.

Also, it is observed that during lean demand season, other State Thermal generators are withdrawn under Zero Schedule whereas these units are not permitted to withdraw under zero schedule considering transmission constraints. Under such conditions, cheaper State thermal generators are under zero schedule whereas costly Mumbai generation is kept on bar which has commercial impact on its contracted Discoms.

### 7.3.5. Reactive Power Requirement in Boisar area:

It has been informed by ADTPS in the OCC & GCC meeting that the reactive power sharing through the 220 kV Dahanu – Viraj line is on higher side. In peak hours the sharing of reactive power by Dahanu generators increases. Due to this high MVAr injection, the active power needs to be reduced. ADTPS units have been commissioned in 1995 and are old. Due to mechanical vibration issue in the Turbines, it is not possible to provide Reactive power support without reducing active power even within Capability curve.

Hence, adequate reactive power compensation needs to be planned & implemented in Boisar area.

## 8.0. Outage Planning

MSLDC is carrying out important function of managing outages of 220 kV level & above. All such outages are processed through web-based software. The details of outages processed by MSLDC during CY: 2023 is tabulated below:

| Outage Type | Total proposed Outages (Nos) | Total Deferred Outages | | | Total Approved Outages (Nos) | Total Availed Outages (Nos) | Total Not Availed Outages (Nos) | % | |
|---|---|---|---|---|---|---|---|---|---|
| | | Deferred from site (Nos) | Deferred by SLDC (Nos) | Deferred by WRLDC (Nos) | | | | Proposed / Availed | Approved / Availed |
| **OCCM** | 7009 | 3364 | 975 | 582 | 2088 | 1280 | 808 | 18.26 | 61.3 |
| **State Element** | 16094 | 3053 | 3338 | 0 | 9703 | 6403 | 3300 | 39.78 | 65.98 |
| **Emergency** | 2019 | 16 | 91 | 2 | 1910 | 1082 | 828 | 53.59 | 56.65 |
| **Total** | **25122** | **6433** | **4404** | **584** | **13701** | **8765** | **4936** | **34.88** | **63.97** |

*Note: Above outage figures are excluding 220kV & below VKM outages*

From the above, it is seen that total 25122 No. of outages were processed during CY: 2023 out of which around 26% of the outages were deferred by site itself. Further, around 18 % & 2 % outages were deferred by MSLDC & WRLDC respectively. Thus, 55 % outages i.e. 13701 No. of outages were approved by MSLDC. Out of approved outages, 63.97 % (8765 Nos) of the outages were availed by field whereas 36 % (4936 No) of outages were not availed in-spite of approval. Thus, the net percentage of proposed v/s availed outages is 34.88 % for CY: 2023.

The details of outages processed at ALDC, Ambazari are tabulated below:

| **Details of Outages processed at ALDC, Ambazari** | | | | | | |
|---|---|---|---|---|---|---|
| **Year** | **PLANNED** | | | **FORCED** | | |
| | 220 KV | 132 KV | **TOTAL** | 220 KV | 132 KV | **TOTAL** |
| **CY 2023** | 1178 | 1562 | **2740** | 212 | 246 | **458** |

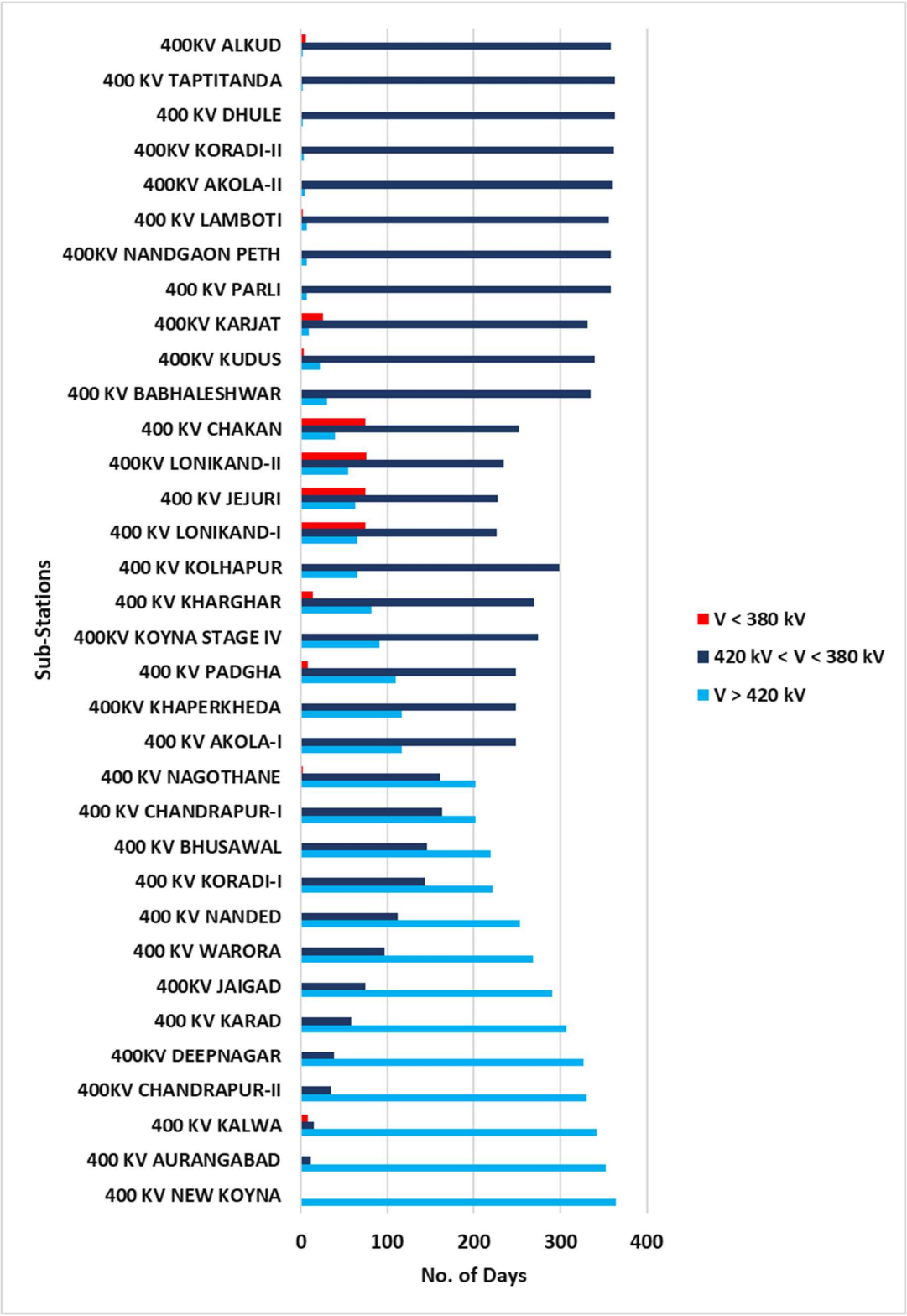
*Note: Outages of 220 kV & below network in VKM area are processed at ALDC, Ambazari.*

## 9.0. Reactive Power Compensation

Maharashtra Power System is witnessing voltage variations due to high load variations & clustered loads in specific areas viz. Mumbai & MMR, Pune, Nashik, Nagpur. Also, large AG demand is playing important role in system voltage fluctuations.

The voltage profile of 400kV Substations in CY 2023 is shown as below:

| Name of Substation | No. of Days in a year | | |
|---|---|---|---|
| | V > 420 kV | 420 kV <V < 380 kV | V < 380 kV |
| 400 KV AKOLA-I | 117 | 248 | 0 |
| 400 KV AURANGABAD | 353 | 12 | 0 |
| 400 KV BABHALESHWAR | 30 | 335 | 0 |
| 400 KV BHUSAWAL | 219 | 146 | 0 |
| 400 KV CHAKAN | 39 | 252 | 74 |
| 400 KV CHANDRAPUR-I | 202 | 163 | 0 |
| 400 KV DHULE | 2 | 363 | 0 |
| 400 KV JEJURI | 63 | 228 | 74 |
| 400 KV KALWA | 342 | 15 | 8 |
| 400 KV KARAD | 307 | 58 | 0 |
| 400 KV KHARGHAR | 82 | 269 | 14 |
| 400 KV KOLHAPUR | 65 | 299 | 1 |
| 400 KV KORADI-I | 222 | 143 | 0 |
| 400 KV LAMBOTI | 7 | 356 | 2 |
| 400 KV LONIKAND-I | 65 | 226 | 74 |
| 400 KV NAGOTHANE | 202 | 161 | 2 |
| 400 KV NANDED | 253 | 112 | 0 |
| 400 KV NEW KOYNA | 364 | 1 | 0 |
| 400 KV PADGHA | 109 | 248 | 8 |
| 400 KV PARLI | 7 | 358 | 0 |
| 400 KV TAPTITANDA | 2 | 363 | 0 |
| 400 KV WARORA | 268 | 97 | 0 |
| 400KV AKOLA-II | 4 | 361 | 0 |
| 400KV CHANDRAPUR-II | 330 | 35 | 0 |
| 400KV DEEPNAGAR | 327 | 38 | 0 |
| 400KV JAIGAD | 290 | 75 | 0 |
| 400KV KHAPERKHEDA | 117 | 248 | 0 |
| 400KV KORADI-II | 3 | 362 | 0 |
| 400KV LONIKAND-II | 55 | 234 | 76 |
| 400KV NANDGAON PETH | 7 | 358 | 0 |
| 400KV ALKUD | 2 | 358 | 5 |
| 400KV KARJAT | 9 | 331 | 25 |
| 400KV KOYNA STAGE IV | 91 | 274 | 0 |
| 400KV KUDUS | 22 | 340 | 3 |




Hence, to address high & low voltages in the system, reactive power compensation is required.

### 9.1. Inductive Compensation:

The list of existing Bus Reactors in the State is tabulated below:

| List of 765 kV Bus Reactors | | | | |
|---|---|---|---|---|
| **Sr. No.** | **Name of S/S** | **Owner** | **Nos of Reactor** | **Total MVAR** |
| 1 | Akola - II | MEGPTCL | 3X80 | 240 |
| 2 | Ektuni (Aurangabad - III) | MSETCL | 3X80 | 240 |
| 3 | Koradi - III | MEGPTCL | 3X80 | 240 |
| 4 | Tiroda | APML | 3X80 | 240 |

| List of 400 kV Bus Reactors | | | | |
|---|---|---|---|---|
| **Sr.No** | **Name of S/S** | **Owner** | **Nos of Reactor** | **Total MVAR** |
| 1 | Chandrapur | MSETCL | 1 x 125 | 125 |
| 2 | Deepnagar | MSETCL | 1 x 125 | 125 |
| 3 | Dhule | MSETCL | 1 x 125 | 125 |
| 4 | Jaigad | JPTL | 2 x 50 | 100 |
| 5 | Khaparkheda | MSETCL | 1 x 125 | 125 |
| 6 | Lonikand - 2 | MSETCL | 1 x 125 | 125 |
| 7 | Nandgaonpeth | Rattan India | 1 x 80 | 80 |
| 8 | Padghe | MSETCL | 1 x 80 | 80 |
| 9 | Parli-M | MSETCL | 1 x 50 | 50 |
| 10 | Tiroda | ATIL | 2 x 80 | 160 |
| 11 | Warora | MSETCL | 1 x 125 | 125 |
| 12 | Kolhapur | MSETCL | 1 x 125 | 125 |
| 13 | Lamboti | MSETCL | 1 x 125 | 125 |
| 14 | Dhule | Powergrid | 1 x 80 | 80 |
| 15 | Kolhapur | Powergrid | 1 x 80 | 80 |
| 16 | Vikhroli | KVTL | 1 x 125 | 125 |
| **List of 220 kV Bus Reactors** | | | | |
| 17 | Karanjade 220kV | TPCL | 2 x 40 | 80 |
| 18 | Karanjade 110kV | TPCL | 2 x 10 | 20 |
| 19 | Salsette 220kV | TPCL | 1 x 125 | 125 |
| 20 | Gorai 220 kV | AEML | 1 x 120 | 120 |

It has been observed that around Reactors to the tune of 470 MVAR are out of service since long period due to technical reasons. The details are tabulated below:

| STATUS OF FAULTY REACTORS | | | | |
|---|---|---|---|---|
| **Sr. No.** | **Name of the Line/ Reactors** | **MVAR** | **Date of failure** | **Present status** |
| 1 | 400kV Dhule S/S-SSP-1 (CSR) | 50 | 23.12.2016 | M/s BHEL reprentative visited site on 25.05.2023 for recommissioning of reactors. M/s BHEL informed that for at first stage -Reactor operation in fixed mode is being planned. The issue of tripping of CSR on differential protection will be addressed at later stage. Work is held up due to no response from M/s BHEL. |
| 2 | 400kV Dhule S/S-SSP-2 (CSR) | 50 | 27.05.2017 | |
| 3 | 400kV Karad – Lonikand (CSR) | 80 | 14.09.2017 | On 01.04.2020, CSR tripped due to Monkey fault resulting in some damages. Work is held up due to no response from M/s BHEL. |
| 4 | 400kV Babhleshwar Bus Reactor | 80 | 26.06.2019 | Reactor is being upgraded to 125 MVAr. 01 No of Reactor is supplied at site on16.10.2023 and second Reactor received at site on 13.12.2023. Accessories also received at site except cooling fans and pumps. 01 No of Reactor is placed on plinth, M/s. BHEL representative will reach at site tentatively in first week of Jan 2024 for further ETC work. 2nd Reactor also received at site.<br>M/s. BHEL representative visited at site and erection activity is started. Erection work of Ist Reactor is completed, testing & commissioning work is balance. |
| 5 | 400kV Khadka Bus Reactor | 50 | 10.11.2018 | Reactor is being upgraded to 125 MVAr. The scheme for Installation of new 125 MVAR Bus Reactor is approved vide BR No. 139/25 Dt. 12.12.2019. Tender floated but due to poor response, tender cancelled. Activity for re-floating of tender is in progress. |
| 6 | 400kV Kharghar Bus Reactor | 80 | 04.06.2020 | Scheme for procurement of new 80MVAR Reactor is approved and LOA for supply of Reactor has been issued on M/s BHEL on dtd 17.12.2021. Reactor is supplied at site on 22.09.2023. Reactor is placed on plinth. Erection of Reactor completed & testing work is in progress. Reactor will be ready for commissioning up to end of March - 24. |
| 7 | 400kV Nagothane Bus Reactor | 80 | 23.11.2021 | The proposal for repairs of the reactor is returned on 05.04.2023 by CO to field office for compliance. |

The list & Status of newly proposed Bus Reactors is tabulated below:

| Status of newly proposed Bus Reactors in the State | | | | |
|---|---|---|---|---|
| **Sr. No.** | **ame of Sub-Statio** | **MVAR** | **Target Date** | **Status** |
| 1 | Bus Reactor at 400KV Thapatitanda | 125 | Sep-24 | LOA for supply of Reactors is placed on M/s. CGL (Thaptitanda) & M/s BHEL (Girawali) on dtd 14.12.2022. Final inspection of Reactor is completed on 09.03.24 & inspection of oil is balance. LOI issued on 09.05.2023 to M/s. BNC Power Projects Ltd. for ETC work. Civil work is completed at Thaptitanda. Existing Reactor is dismantled in Dec 23 & Reactor plinth work is in progress at Girawali. Reactor (CGL make) received at 400kV Thaptitanda SS along with accessories & oil on 13.01.2024. 400kV Isolators received at site, CT, LA & Panels are balance for supply. |
| 2 | Bus Reactor at 400KV Girawali | 125 | Sep-24 | |
| 3 | Bus Reactor at 400KV Waluj | 125 | May-23 | 1)MERC Approval received vide L No. 118 on 28.03.2022. Technical bid open on 22.05.2023.Technical scrutiny under process. Under Tenderization at C.O. Projects |
| 4 | Bus Reactor at 400KV Chandrapur | 125 | Dec-24 | Turnkey tender for supply and ETC works of Reactor and other allied equipment is floated at zone level. The tender cancelled due to higher rates. Revised estimate preparation is under process at field office. Scheme revision in process at CO. LOA is to be issued after receipt of PSDF approval. Revised scheme is sanctioned excluding Jejuri Reactor vide BR No.167/46 dtd.04.03.2024. Indent submitted to CPA for procurement & scheme conveyed to field for ETC tender. |
| 5 | Bus Reactor at 400KV Babhaleshwar | 2 x 125 | Dec-23 | LOA for supply of Reactor is placed on M/s BHEL on dtd 17.12.2021. Final inspection completed during 07.09.23 to 19.09.23 of both units. LOA issued to M/s. R. K. Electricals for ETC work on 15.07.2022. 01 No of Reactor is supplied at site on16.10.2023 and second Reactor received at site on 13.12.2023. 01 No of Reactor is placed on plinth. M/s. BHEL representative visited at site and ETC work has been started. |
| 6 | Bus Reactor at Lonikand-I | 125 | Dec-24 | Turnkey tender for supply and ETC works of Reactor and other allied equipment is floated at zone level. The tender cancelled due to higher rates. Revised estimate preparation is under process at field office. Scheme revision in process at CO. LOA is to be issued after receipt of PSDF approval. Revised scheme is sanctioned excluding Jejuri Reactor vide BR No.167/46 dtd.04.03.2024. Indent submitted to CPA for procurement & scheme conveyed to field for ETC tender. |
| 7 | Bus Reactor at 400KV Jejuri | 125 | Dec-24 | |
| 8 | Bus Reactor at 400KV Chakan | 125 | Dec-24 | |
| 9 | Bus Reactor at 400KV Kalwa | 125 | Nov-23 | Commissioned in March-2024, however flaied. |
| 10 | Bus Reactor at 400KV Kudus | 125 | May-23 | MERC Approval received vide L No. 115 on 28.03.2022. Tender floated, but due to low response & higher rate tender cancellation note is put up by Project Dept. |

## 9.2. Capacitive Compensation:

Based on the report & suggestions from MSLDC regarding under-voltage scenarios in Pune, Nashik & Vashi area, the Chairman & Managing Director (MSETCL), constituted a Task Force vide Circular No. CMD/MSETCL/No./T-734 dated 16th June 2023. The Task Force has been mandated to study the requirement of Reactive Power Compensation in Pune, Nashik & Vashi Zone Transmission system and plan remedial measures for voltage improvements to avoid load shedding in MMR, Pune & Nashik area to address the under-voltage issues in transmission network observed in peak load season. The copy of report is attached herewith as ***ANNEXURE – 1***.

The details of existing & earlier proposed Capacitor banks in MSETCL area are tabulated below:

| Phase Capacitor | Amravati | A'bad | Karad | Nagpur | Nashik | Pune | Vashi | Grand Total |
|---|---|---|---|---|---|---|---|---|
| Pre-Phase Capacitor banks | 100 | 489 | - | - | 675 | 465 | - | **1729** |
| Phase-1 (Commissioned) | 200 | 340 | 5 | 25 | 130 | 150 | 20 | **870** |
| Phase-2 (Commissioned) | 175 | 190 | 80 | 65 | 360 | 50 | - | **920** |
| Phase-3 (Commissioned) | 130 | 70 | 125 | 40 | 320 | 30 | - | **715** |
| Phase-4 (Commissioned) | 270 | 315 | - | - | 360 | 120 | - | **1065** |
| **Existing Total Capacitor Banks (Pre-Phase + Phase-1 to 4)** | **875** | **1404** | **210** | **130** | **1845** | **815** | **20** | **5299** |
| Phase-5 (Proposed) | 95 | 175 | 170 | 140 | 255 | 120 | - | **955** |
| **Grand Total** | **970** | **1579** | **380** | **270** | **2100** | **935** | **20** | **6254** |

Based on the studies carried out by the Task Force, the additional requirement of Capacitor banks in Pune, Nashik & Vashi area is shown below:

| Sr. No. | Voltage Level (kV) | Pune Area | | |
|---|---|---|---|---|
| | | No. of S/s. with Voltage less than 0.9 (PU) | Compensation proposed at No. of S/s. | Proposed Compensation (MVAr) |
| 1 | 11 | 9 | 7 | 50 |
| 2 | 22 | 48 | 47 | 575 |
| 3 | 33 | 32 | 22 | 285 |
| 4 | 100 | - | - | - |
| 5 | 110 | 5 | 1 | 30 |
| 6 | 132 | 77 | 9 | 255 |
| 7 | 220 | 54 | 2 | 120 |
| | **Total** | **225** | **88** | **1315** |

| Sr. No. | Voltage Level (kV) | Nashik Area | | |
|---|---|---|---|---|
| | | No. of S/s. with Voltage less than 0.9 (PU) | Compensation proposed at No. of S/s. | Proposed Compensation (MVAr) |
| 1 | 11 | 3 | - | - |
| 2 | 22 | - | - | - |
| 3 | 33 | 9 | 3 | 70 |
| 4 | 100 | - | - | - |
| 5 | 110 | - | - | - |
| 6 | 132 | 6 | 2 | 90 |
| 7 | 220 | - | - | |
| | **Total** | **18** | **5** | **160** |

| Sr. No. | Voltage Level (kV) | Vashi Area | | |
|---|---|---|---|---|
| | | No. of S/s. with Voltage less than 0.9 (PU) | Compensation proposed at No. of S/s. | Proposed Compensation (MVAr) |
| 1 | 11 | 1 | - | - |
| 2 | 22 | 34 | 4 | 70 |
| 3 | 33 | 4 | 3 | 60 |
| 4 | 100 | 21 | 2 | 80 |
| 5 | 110 | - | - | - |
| 6 | 132 | 1 | 3 | - |
| 7 | 220 | 11 | 13 | 500 |
| | **Sub-Total** | **72** | **25** | **710** |

Thus, with the installation of above capacitor banks, the under-voltage issues in Pune, Nashik & Washi area will be eliminated.

## 10.0. Disaster Management

For smooth & reliable Grid Operations, it is necessary to maintain disaster management plan ready. Further, timely mock trials need to be carried out so as to enhance the skills of the personnel & to identify the lacunae in the processes & smoothen the entire process. Accordingly, under the Disaster Management Plan, SLDC is operating Area Load Despatch Centre (ALDC) located at Ambazari, Dist. Nagpur as Back-up control Centre. Also, Black-start mock drills of various gas-based & Hydel units is carried out.

The details of such activities carried out under Disaster Management are detailed below:

### 10.1. Black Start Mock Drills Coordination:

Black start resource is "a generating unit(s) and its associated set of equipment which has the ability to be started without support from the System or is designed to remain energized without connection to the remainder of the System, with the ability to energize a bus, meeting the Transmission Operator's restoration plan needs for Real and Reactive Power capability, frequency and voltage control, and that has been included in the Transmission Operator's restoration plan.

"Black Start Procedure" means the procedure necessary to recover from a partial or a total blackout in the State; [MEGC Regulations,2020 & IEGC]

The Black start mock drill is mandatory to enhance the system resilience. Coordinators were assigned for each black start stations in Maharashtra State. The coordinators had to update the details (contact number, DG capacity, Station capacity, SCADA display, report of the past drills etc.). Black-Start Mock Drill of 8 Nos. of stations were conducted in Maharashtra State during CY 2022. The details of the Black-Start Mock Drill are as below:

| SN | Power Station | Capacity (MW) | Type | DG Set Capacity | Sub-System | Connectivityat/Voltage level | Last Tested on |
|---|---|---|---|---|---|---|---|
| 1 | Bhivpuri HPS | 3 x 24 + 2 x 1.5 + 2 x 12 | Hydro | 250 kW | Mumbai island | 110 kV | 19.12.23 |
| 2 | Khopoli HPS | 3 x 24 + 2 x 12 | Hydro | 250 kVA | Mumbai-island | 110 kV | 19.12.23 |
| 3 | Bhira HPS | 6 x 25 | Hydro | 250 kVA | Mumbai-island | 110 kV | 19.12.23 |
| 4 | Uran (Gas) | 4 x 108 (GT) + 2 x 120 [Waste Heat Recovery (WHR) units] | Gas | 4 MW, PH1:412kVA PH2:450kVA, WH:520kVA | West | 220 kV | 12.12.23 |
| 5 | Koyna I & II(Pophali) HPS | 4 x 70 + 4 X 80 | Hydro | 2 MVA HG set | West | 220 kV | 20.11.23 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6 | Ghatghar HPS | 2 x 125 | Hydro | 2x1250 kVA | West | 220 kV | 22.12.23 |
| 7 | *Trombay-(7A&7B) | 1 x 120 + 1 x 60 | Gas | 2.5 MW | Mumbai island | 220 kV | 20.11.22<br><br>220 KV Trombay Dead Bus was charged from Unit-7 started in Blackstart mode. However, load was not taken on island due to difficulty in disconnecting city load for the drill |
| 8 | Pench | 2 x 80 | Hydro | 250 KVA | East | 132 kV | 12.09.23 |

As informed by Tata Power, Mumbai BSMD for Bhira, Khopoli and Bhivpuri were conducted with Davdi and MSETCL Neral load respectively during 2020. This activity was carried out for the first time by taking the load on the island and charging the line on no load. Also combined black start activity of Hydro Stations was carried out on 5th December 2021 on alternate path till Ambernath and carrying Load of Neral station was demonstrated. As far as Trombay Unit-7 blackstart is concerned, the activity of blackstart was demonstrated on 5th September 2021 wherein, Unit-7 was started in black start mode and 220 KV Trombay dead bus was charged successfully. However, activity of carrying any load on the island was not envisaged, as vacating any load in Mumbai area is difficult.

It may be seen from above that there are 3 tested black start sources in Western Maharashtra and 4 in Mumbai sub-system while there are no black start resources in Eastern Maharashtra subsystem. As informed by MSPGCL, the feasibility of blackstart capability at Koyna-III and Koyna-IV has to be studied. Although RGPPL is a gas power station it does not have a black start capability. So, the thermal generators located in Eastern Maharashtra subsystem viz. APML Tiroda, NTPC Mouda, Chandrapur, Koradi, Khaparkheda, Rattan India (Amrawati), Dhariwal, Parli, GMR Warora etc. would have to avail start-up power from neighbouring states (Madhya Pradesh, Chhattisgarh) or neighbouring Region (SR) if they survive/buildup their subsystem. Also considering the path lengths involved in reaching these power stations, it may take longer to feed start-up supply to these power stations post a black out in Maharashtra.

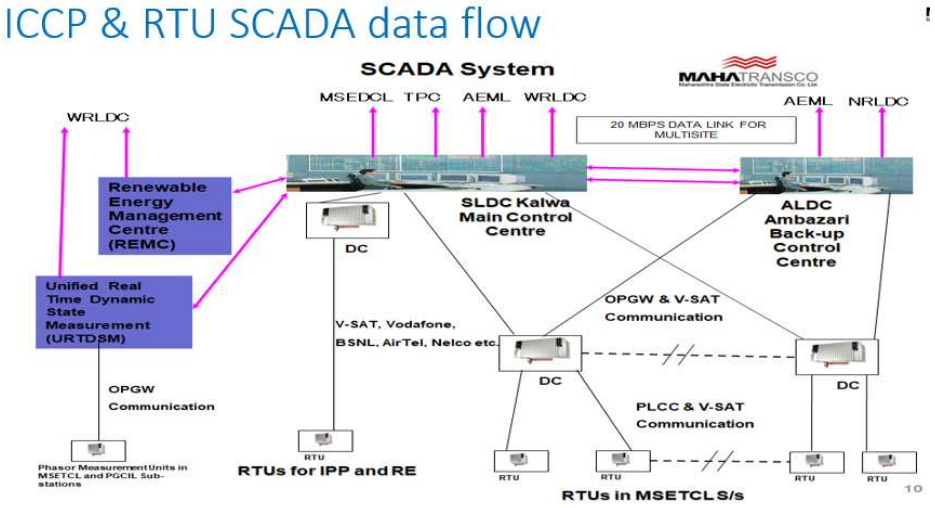
### 10.2. Back-up Control Operation through ALDC:

As per the directions of MOP & CABIL report under the category of Decision support systems, for fail-safe operation of LDCs even in case of a disaster, the back-up LDC should be planned and maintained as Main-I / Main-II rather than Main and Back-up.

The LDC functions shall be carried out from Main I and Main II at periodic intervals.

Also, as per CABIL Report under human resource adequacy, it is desirable that one of the sub-LDCs act as the Main-II (or back up) control center and be capable to taking up the functions of the Main-I control center in the event of a disaster.

- Mock operation from BCC is performed on 13-09-2023 (from 10:00Hrs to 17:00Hrs) to ensure smooth functionality of BCC during any contingency.
- Physical Shift operation, where all real time grid operations is done only from BCC during testing.
- Functionalities at BCC
  - SCADA Siemens Make Sinaut Spectrum 4.5.1 Available




**A) Pre-BCC Operation Modalities/preparation:**

**Preparedness of <u>SCADA Department</u> before start of BCC operation**

- A Pre-BCC meeting was arranged between SLDC Kalwa and ALDC Ambazari SCADA departments to discuss the action plan for smooth BCC operations. Joint testing and confirmation were carried out for the SCADA data at SLDC is completely available at ALDC with same accuracy.
- The intimation regarding the Backup Control Centre operation and the SOP was conveyed to all the OEMs of the respective systems i.e., SCADA, REMC and URTDSM. They were instructed to be available at both sites and be vigilant during the entire operations.
- All the stake holders including WRLDC, TATA, AEML, Discoms, Gencos etc. were informed about this operation and were requested to provide uninterrupted real time data and informed to be ready in order to meet any eventuality during the course of the operations.
- All the PAC Divisions/Circles of MSETCL were informed to maintain the healthiness of communication links/ Data Concentrators/ RTUs for real time SCADA data visibility at SLDC/ALDC Control Centers.
- Before Starting the operation, the healthiness of SCADA servers/ UIs/ VPS and DCs placed at control centers were assured.
- Healthiness of multisite/ICCP/BCC links were assured before starting and the

during operation of the BCC.

- Dedicated VoIP telephone channel was established between LM Cell of DISCOM and ALDC.

**Preparedness of Operations Dept Before Actual start of BCC operation (done before 12.09.2023):**

- Physically checked the availability of Separate Desk for Shift In charge, Outage Desk, REMC Desk and Scheduling Desk which was arranged from Backup Control Centre.
- Confirmed The Availability of SCADA System for Shift In charge and Outage Desk
- Confirmed The availability of PC for Shift In charge, Outage Desk and Scheduling Desk.
- The VPN/Remote access of one of the REMC(Op) PC in MSLDC, Airoli was provided by IT department for REMC Operation department. The same is tested before actual start of the BCC operation.
- Register For Shift In charge, Outage Engineer and Scheduling Engineer made available to note Real Time incidences.
- Confirmed Internet accessibility though Reliable LAN/Wi-Fi connection to all the PC's.
- Information given to all the QCAs & stakeholders through email and WhatsApp on 11-09-2023 about BCC operation date, time, and BCC contact numbers during the activity.
- Flash news displayed for BCC activity from Ambazari, Nagpur on the REMC scheduling portal front page from 11-09-2023 10:00Hrs.
- List of the all the QCAs with their control room contact numbers and email addresses kept available in soft as well as in hard copy.
- Tested the operation of Mobile phones, IP phones, Landline Phones checked by dialing the phone numbers of some stakeholders.
- Information given to all the stakeholders through email and WhatsApp on 11-09-2023 about BCC operation date, time, and BCC contact numbers during the activity.
- List of the all the major Discom and Generators with their control room contact numbers and email addresses kept available in soft as well as in hard copy.
- List of contact number & email addresses of all utilities/buyers kept available in soft as well as in hard copy.
- List of Nodal with their contact no's kept available in the soft as well hard form.
- Links regarding scheduling activities kept available with login credentials.
- Contact numbers of higher Authorities of WRLDC kept available in Hard as well as soft form.
- Contact numbers of field Higher Authorities, Mumbai utilities made available to tackle real time contingencies.

**B) Communication during BCC:**

- Following communication facilities are available at BCC:
- 5 number of hotline phones for VOIP and PLCC communication (WM + VKM area)
- 3 Nos. Landline (STD)
- 3 Nos. Mobile phones
- High speed Internet connection from two different ISPs.
- Voice Recording System

**C) Facilities at BCC for operation from BCC:**

- 4 number of SCADA workstations
- 1 No. of VPS display (4x2 configuration)
- 5 number of hotline phones and 3 Nos. Landline (STD)/ 3 Nos. Mobile phones
- 2 Nos. of Desktops/laptops for IT functionality (mail/scheduling/reporting)

**D) Operation:**

- Exchanging of code between CR and Logistics for shifting of SCADA functionalities from MCC to BCC
- Shifting of RTU polling functionality from MCC to BCC: RTUs are reporting to both the control centers simultaneously i.e. MCC and BCC. The polling priority can be changed from MCC to BCC from SCADA database editors.
- The ICCP links are directly connected from BCC of SLDCs to BCC of WRLDC. Hence, no shifting required.
- Standby team at MCC for any contingency: Regular Shift Engineers were present at MCC (Kalwa) as Standby Team, in case of any major contingency

**E) Observations and Key learnings after BCC Operation from Control Room Shift Desk:**

- Pre-Meeting required at ALDC with participating Engineers (CR) for orientation of Operations.
- Training and hands on experience is required to ALDC Engineers, to carry out hassle free and smooth BCC Operations by ALDC.
- Separate Screen should be available at ALDC for DSM schedule.
- Hot line communication with Tata Control Centre, AEML LD is required for speedy communication.
- Engineers at ALDC to be trained for SLDC Operations. (For which, partial works of SLDC to be allocated to ALDC on regular basis).
- For example:
    - Interaction with WRLDC for VKM related 765 & 400 kV network,
    - State System Reporting to Higher Management at ALDC in Morning,
    - DSM Scheduling in real time (say for 6 hours /week or so),
    - Evening Peak Load-Generation balance planning/ management (at least once in a Fortnight),
    - DSR preparation in Night hours (at least once in a Month), etc works.
- Systems at ALDC and SLDC to be same and should be always accessible / visible (For example, DSM software and its visibility, OMS/ E-logbook system, Express phones with all Major contacts, PMU systems, etc)
- ALDC Engineers to be trained for REMC Monitoring and actions to be taken.
- ALDC Engineers to be trained for Pune and Mumbai area network and its management

**F) Observations and Key learnings after BCC Operation from SCADA Desk:**

- No interruptions pertaining to SCADA/ICCP/BCC/Multisite data visibility were observed during BCC operation.
- At present the Data of IPPs/CPPs/RE generators is available at SLDC only. The same is shared to ALDC on multisite link. The failure of multisite link will result into the interruption of this data to ALDC. Hence a provision should be made for dual reporting of IPP/CPP/RE data to both the control centers simultaneously.
- ICCP data of TPCL Backup control center should be made available at ALDC Ambazari as this data is available only at SLDC Kalwa.
- REMC and URTDSM system is available only at SLDC Kalwa. The backup of these systems shall also be made available at ALDC.
- It was observed that there is only one physical path of optical fibre communication (OFC) to SLDC and ALDC. Redundant physical path must be established on top priority

**G) Observations and Key learnings after BCC Operation from Scheduling Desk:**

- One dedicated Scheduling PC with dual LAN need to be provided for REMC real time operation.
- Real time display for Wind & Solar Graphs for RE forecast, schedule and actual generation need to be provided in ALDC control room.
- At least two scheduling engineers from ALDC, Ambazari need to be deputed

to SLDC, Airoli for real time operation training before next BCC operation.

- One Dedicated Desktop SCADA system to be provided on Scheduling Desk.
- One Dedicated BARCO screen to view combined schedule (which, presently is available at SLDC) to be made available at Backup control center.

**H) Observations and Key learnings after BCC Operation from REMC Desk:**

- One dedicated REMC PC with dual LAN need to be provided for REMC real time operation. The REMC scheduling software & forecasting software need to be accessed directly from server.
- Real time display for Wind & Solar Graphs for RE forecast, schedule and actual generation need to be provided in ALDC control room.
- At least two engineers from ALDC, Ambazari need to be deputed to SLDC, Airoli for real time operation training before next BCC operation.

**I) Challenges faced during BCC operation and handling of challenge:**

- SLDC Code 648 received from SLDC Airoli for BCC Operation from Ambazari, Nagpur at 09:50 hrs.
- Padghe-Chandrapur HVDC Pole-2 base filter tripped at 09:50 hrs (due to Bird fault at Padgha) and Bipole load restricted to 850MW against 1500MW. Normalized at 10:34 hrs
- TPC Hydro Picked up vide SLDC Code & Thermal Unit 5 and 8 full generation scheduled to safe guard Important Grid Lines during the above period.
- At 13:17 Hrs LBB operated at 400kV Akola s/s resulting in tripping of ICT I & II, Wardha PG Ckt- I & II, and Aurangabad Ckt I & II.
- Necessary operation and control actions for normalcy at 400kV Akola s/s after the disturbance is taken by BCC team and normalcy restored at 16:04 Hrs.

## 11.0. Achievements

### 11.1. Special Studies carried out at MSLDC:

**a) Simulation Studies:**

To ensure smooth & reliable operation of the Grid & for proper outage planning, simulation studies are carried out at MSLDC on regular basis. All the major & long duration outages are sanctioned only after conducting simulations at different network & demand scenarios. However, following special studies were carried out by MSLDC.

- Validation of various relay settings under Mumbai islanding scheme through Dynamic Simulation Studies jointly with VJTI.
- Simulation studies for Nagpur Islanding scheme.

**b) Analytical studies:**

- Analysis of RE forecasting & accuracy evaluation studies and submission of report with recommendations of error band tightening to Hon'ble MERC.
- Inter-connection & Impact assessment studies for large scale Solar Capacity of around 7000 MW proposed to be connected to Distribution network under MSKVY 2.0 scheme.
- Reactive Power compensation requirements in Pune, Nashik & Vashi area jointly with STU.
- Various studies for smooth implementation of the MERC(DSM) Regulations through DSM working group & Sub-Group.
- Under voltage studies in Pune & Nashik area.
- Comparative analysis of the MEGC' 2020 & IEGC' 2023.

### 11.2. Award:

The "LDC Excellence Award" is instituted to recognize the exceptional work done by the Load Despatch Centers (LDCs) in the Indian power sector. The secretariat of Forum of Load Despatchers (FOLD).

The nominations along with predefined data was sought from all the SLDCs & RLDCs in the Country. These nominations are categorized among various SLDCs based on the Installed Capacity & Power System sizing. Accordingly, SLDCs are categorized as Large SLDC, Medium SLDC & Emerging SLDC. Maharashtra is covered under Large SLDC wherein there are total 13 Nos. of SLDCs. For the year 2023, Maharashtra has received 3rd LDC excellence award.