सत्यमेव जयते

महाराष्ट्र विद्युत नियामक आयोग
Maharashtra Electricity Regulatory Commission

MERC/ Tariff/ ToD/22-23/ 0504 **Date :- 1 November, 2022**

Sub:- Study report on time of day tariff structure in electricity tariff in Maharashtra

Sir/Madam,

With objective to study changes in consumption pattern and load curve of Distribution Licensees in Maharashtra and design the TOD Tariff structure which helps in optimizing power procurement expenses and also encourage demand response schemes, the Commission has initiated a Study on ToD tariff structure through M/s ABPS Infrastructure Advisory Ltd.

Said Study has been completed and Report has been submitted to the Commission. Copy of the said Report is attached herewith for ready reference. Said Report has also been uploaded on MERC Website.

Study Report recommends change in current ToD tariff structure and also recommended seasonal ToD Tariff structure. You are requested to go through attached Report and after analysing its own requirement, Distribution Licensees, if they think fit, may propose changes in ToD tariff structure in upcoming MTR Petition with supporting justifications. After considering all suggestion and objections during public consultation process, the Commission will finally decide on changing ToD Tariff structure or otherwise, in MTR Orders.

(Abhijit Deshpande)
Secretary, MERC

Encl. Study Report on ToD tariff structure

To,
All Distribution Licensees in Maharashtra

१३वा मजला, केंद्र क्र. १, जागतिक व्यापार केंद्र, कफ परेड, कुलाबा, मुंबई - ४०० ००५.
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E-mail : mercindia@merc.gov.in / mercindia@mercindia.org.in **Website :** www.merc.gov.in / www.mercindia.org.in

REPORT ON STUDY OF TIME OF DAY (TOD) TARIFF STRUCTURE IN ELECTRICITY TARIFF IN MAHARASHTRA

September 2022

Prepared by:
ABPS Infrastructure Advisory Pvt. Ltd.

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1 Background

1.1 Context

The Maharashtra Electricity Regulatory Commission (MERC or Commission) had introduced the concept of Time of Day (TOD) tariff for HT Industrial (HTP - I and HTP - II) in its Tariff Order dated 5 May 2000 in Case No. 1 of 1999 consumers, as a critical tool for Demand Side Management with an intention to flatten the load curve after observing a wide gap between maximum demand and minimum demand.

Over the years, the Commission has made TOD tariff structure mandatory for all HT consumers and LT consumers having load above 20 kW. Further, the additional charges for peak hours and rebate in tariff for off-peak hours have also been modified over the years. However, the ToD timeslots slots have remained unchanged since May 2000. The same ToD timeslots are applicable for all Distribution Licensees in the State of Maharashtra.

The Commission received request from different Distribution Licensees for change in ToD tariff structure during the latest Multi-Year Tariff (MYT) proceedings. The Commission has made the following observations on such request for revision in ToD tariff structure in the MYT Orders:

> *"8.25.7 In the past the Commission has followed centralized MoD approach and standardized ToD timeslots and rates. The Commission upon analysing the same observed that, the existing ToD structure matches with the rates prevalent in the Power Exchange, i.e., ToD rate is high when Power Exchange power is costly and ToD rate is low when Power Exchange power is cheaper. From 1 April 2020, the State is shifting to decentralized MoD under the DSM framework, and each DISCOM must plan its power procurement as per its load curve. Hence, the ToD structure can be different for each DISCOM. If proposed changes in ToD rates are accepted, it will result into consumer shift from DISCOM to RE plants. Penalising consumers in such a manner will result into loss of consumers for DISCOMs.*
>
> *8.25.8 In addition, RPO Regulations for the next Control Period envisages substantial increase in Solar power, which will be helping the load curve as it shall be contributing to meet the daytime peak load requirement. Such RE projects would be commissioned in the next couple of years. Hence, at the time of MTR, it would be appropriate to revisit and revise, if necessary, the ToD timeslots and rates as per DISCOM's power*

procurement planning. The Commission may also consider having seasonal ToD rate in order to assist the DISCOMs to absorb seasonal variation in RE generation which as per RPO Regulations, 2019 would be 25% in FY 2024-25.

8.25.9 Thus, in view of above, the Commission has decided to continue with the existing structure of ToD slots and applicable charges and directs MSEDCL to submit a detailed proposal at the time of MTR."

The Commission has appointed ABPS Infrastructure Advisory Private Limited (ABPS Infra) for undertaking this study for identifying various options for redesigning the ToD tariff structure in the State of Maharashtra.

1.2 Scope of Work

The Commission has identified the Objective for the assignment as under:

"To study changes in consumption pattern and load curve of Distribution Licensees in Maharashtra and design the TOD Tariff structure which helps in optimizing power procurement expenses and also encourage demand response schemes."

The Commission has identified the Overall Scope of Work for the assignment as under:

"…to submit a Report covering detailed analysis as listed below and recommending Time of Day tariff structure which helps in optimizing power procurement expenses and also encourage demand response schemes."

The detailed Scope of work for the assignment are as under:

1. *"Study of Load Curve of Distribution Licensees (time block sensitive) in the State and its impact of State Load Curve.*
2. *Contribution of each consumer category in Load Curve of their respective Distribution Licensee and State Load Curve.*
3. *Existing & future power purchase mix of Distribution Licensees and mapping the same with their load curves.*
4. *Study of ToD tariff structure in other States in India and also international best practices for ToD tariff structure.*
5. *Possibility of different ToD time slots and / or rate for each consumer category and or Distribution Licensee (comparison of the present structure vs the best fit structure). Explore the possibility of Seasonal variation in time slots/ or rate.*

6. *Roadmap for mandating ToD tariff structure for load below 20 kW. (Acceleration due to the proposed installations of Smart Meters).*
7. *Possibility of providing flexibility in ToD tariff which can be used to make electricity tariff dynamic (tariff which can be change based on power purchase rate in market), for incentivizing demand response schemes.*
8. *Based on above, proposed ToD tariff structure which will incentivize / dis-incentivize the consumer for shifting their load in such a manner that Distribution Licensee optimize its power procurement expenses.*
9. *Design of a mechanism / formats to capture impact of changes made in ToD tariff structure on Discom's Load Curve."*

1.3 Structure of Report

The Report is structured in the following Chapters:

Chapter 1: Background
Chapter 2: Objective of this study
Chapter 3: Methodology
Chapter 4: Hour-wise Analysis of Licensee Load Curve in last 4 Years
Chapter 5: Category-wise Load curve comparison with Supply curve
Chapter 6: Comparison between Seasonal Load Curve and Yearly Load Curve
Chapter 7: Price of Electricity in Power Exchanges
Chapter 8: Comparison of ToD tariff in different States of India
Chapter 9: ToD tariff in other countries
Chapter 10: Different Options for ToD Tariff
Chapter 11: Recommendations for ToD Tariff
Chapter 12: Roadmap for implementation of revised ToD tariff

2 Objective of this Study

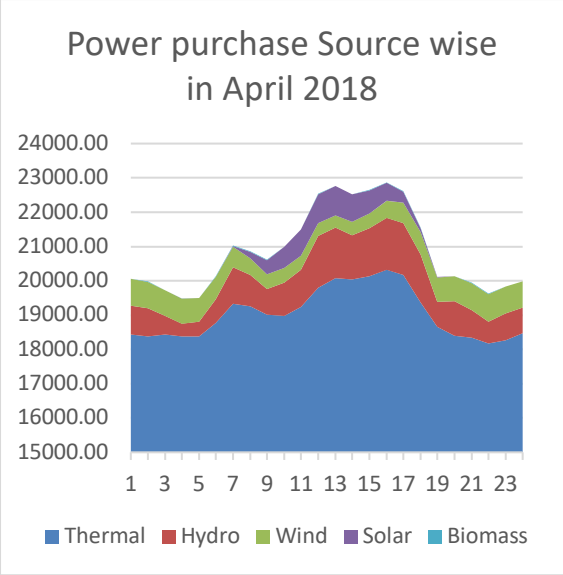
The objective of this assignment is to study the consumption pattern and Load curve of different Distribution Licensees in Maharashtra and re-design the ToD Tariff Structure, in order to optimize the power procurement expenses and also encourage demand response schemes.

The earlier objective of ToD tariff was to flatten the load curve, so that the generation capacity to be tied-up could be optimised and the power purchase during peak hours could be minimised, to optimise the power purchase cost. However, due to increasing contribution of power purchase from Solar and Wind Sources, the objective of ToD tariff is no longer flattening of the load curve but to fit the load curve to the available supply mix, in order to optimise the power purchase cost.

The time slot for which incentive has to be provided and extent of incentive to be provided would depend on the reduction in power purchase expenses due to shift in the load curve to match the supply curve to the extent possible.

To optimize the power purchase cost of Distribution Licensees, the source-wise quantum of power purchase by Distribution Licensee has been analysed with respect to the projected optimised power purchase mix of each Distribution Licensee and combined power purchase mix of Major Distribution Licensees, viz., MSEDCL, AEML-D, TPC-D, and BEST.

The year-wise source-wise hourly power purchase mix has been analysed based on the Load Generation Balance Report (LGBR) of the major DISCOMs for the last 4 years, as shown in the monthly Graphs below: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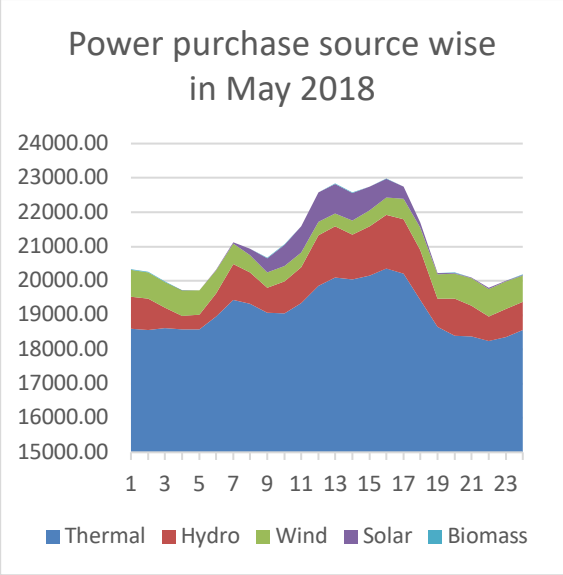
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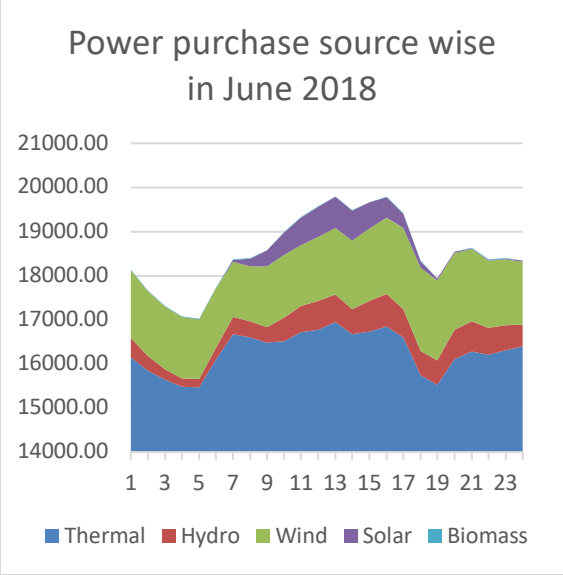
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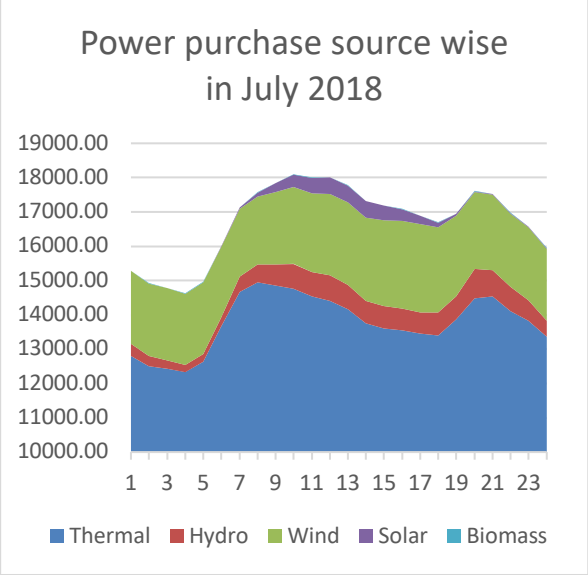
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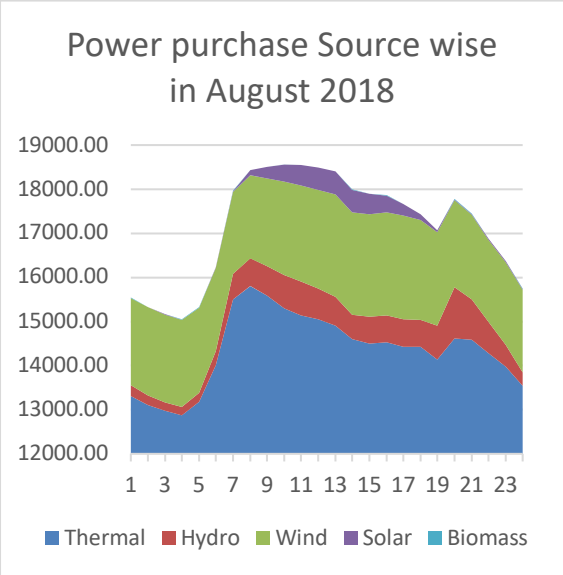
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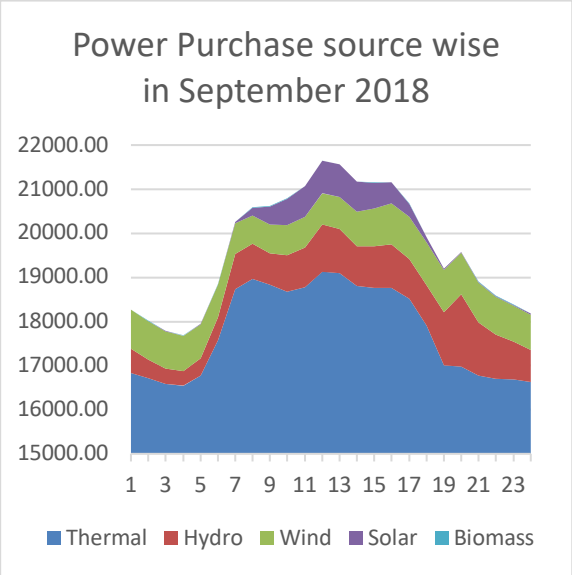
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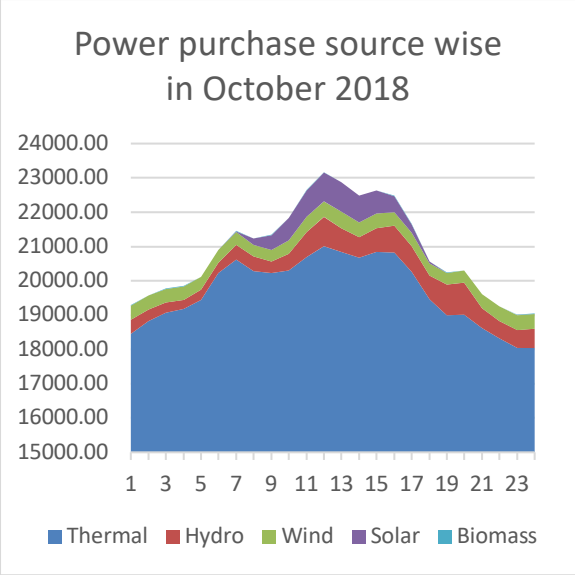
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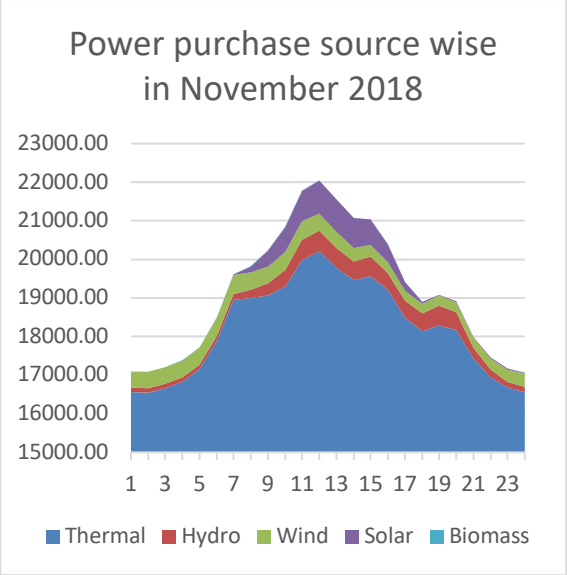
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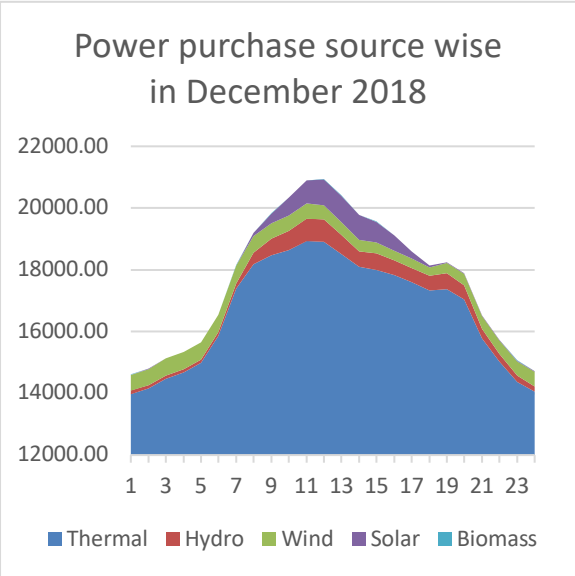
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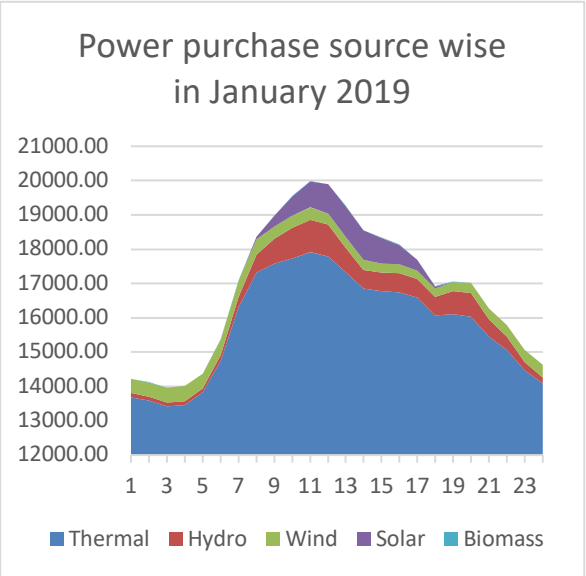
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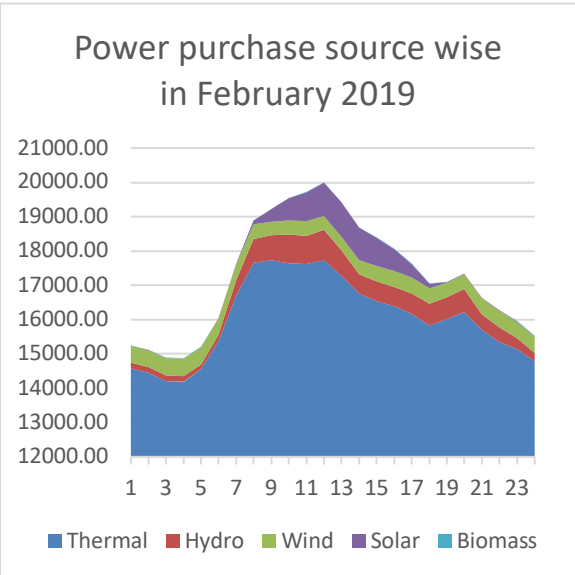
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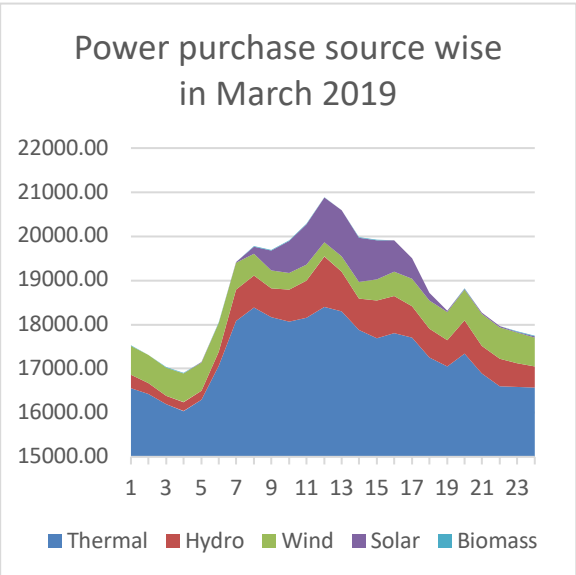
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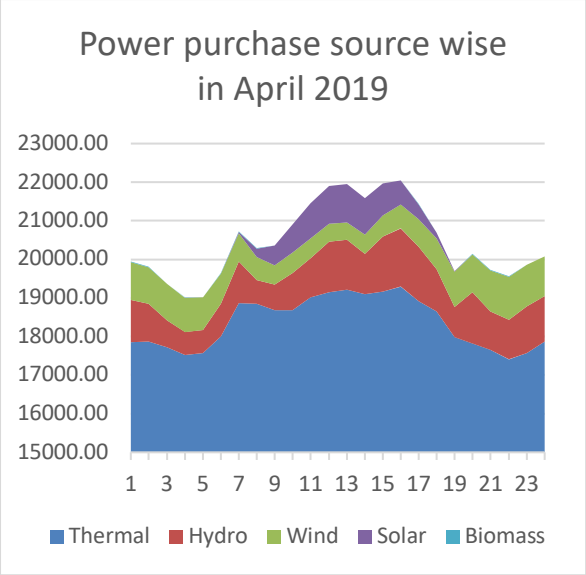
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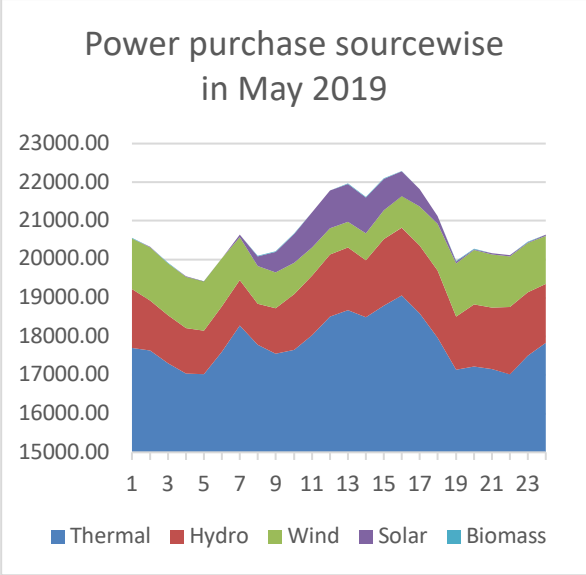
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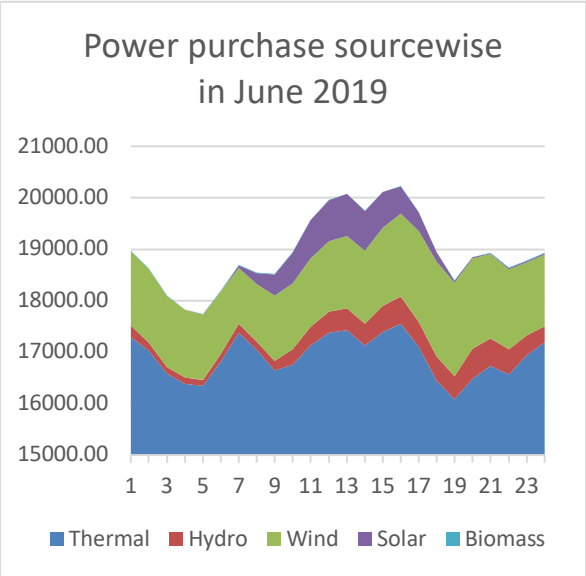
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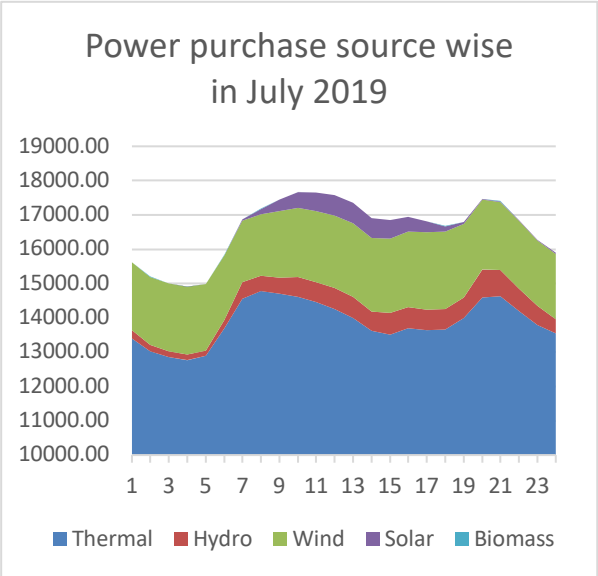
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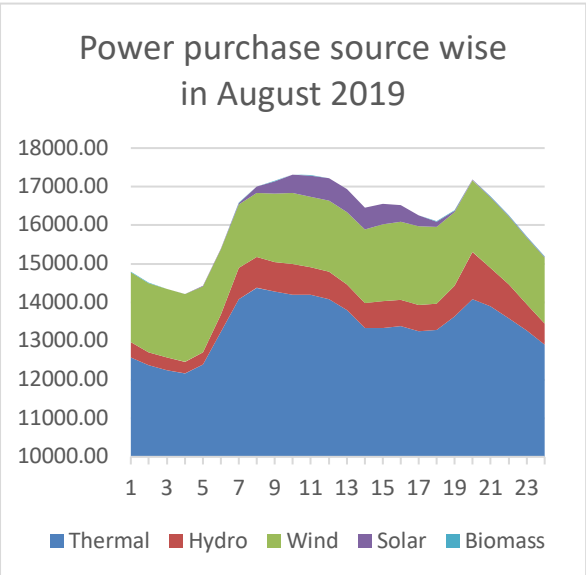
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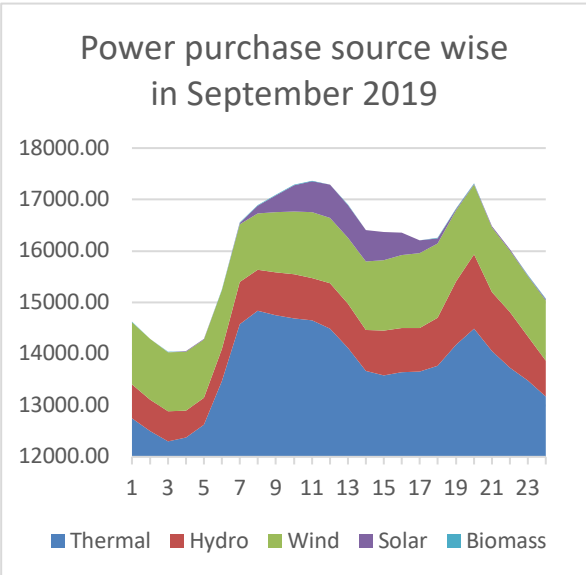
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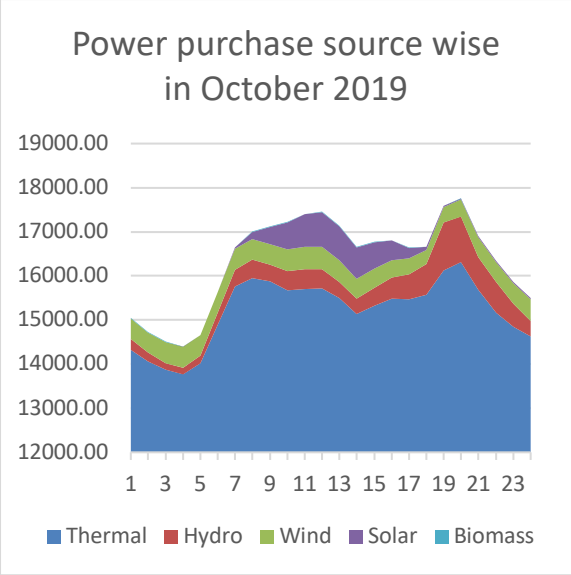
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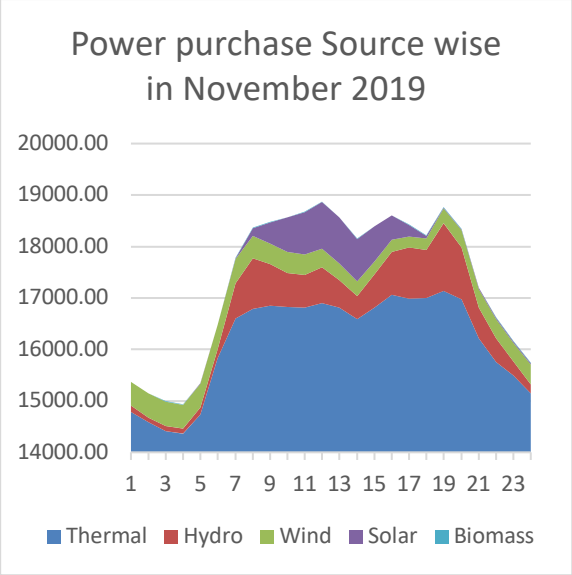
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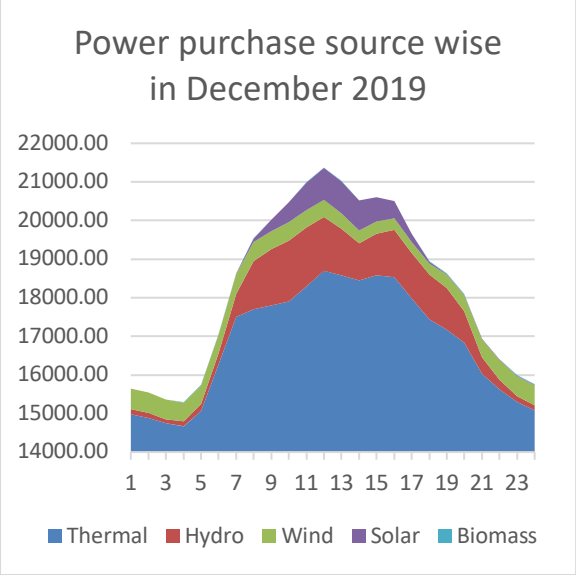
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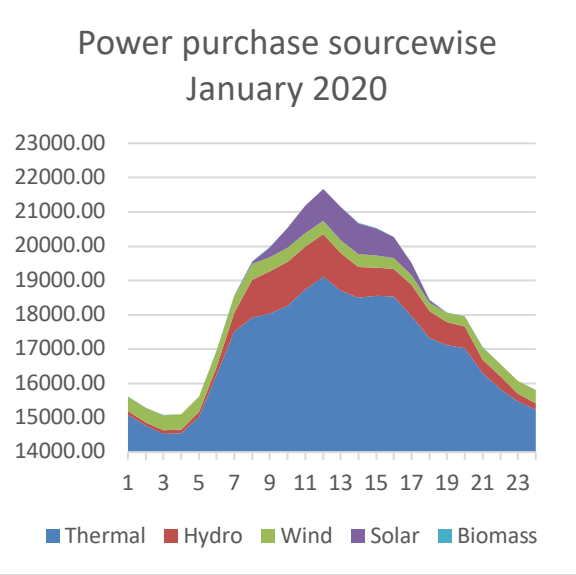
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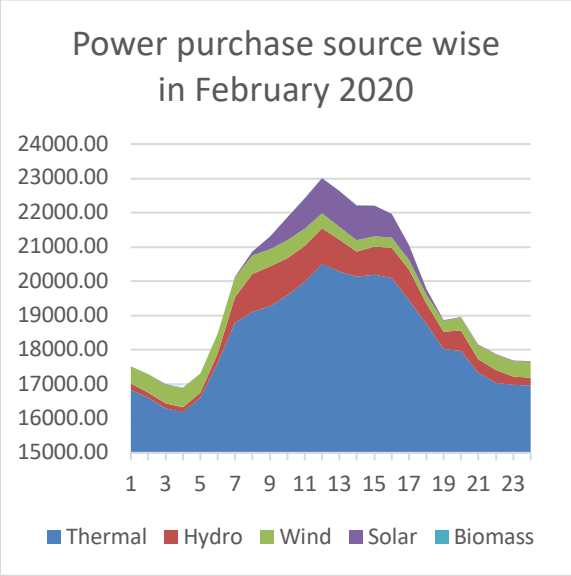
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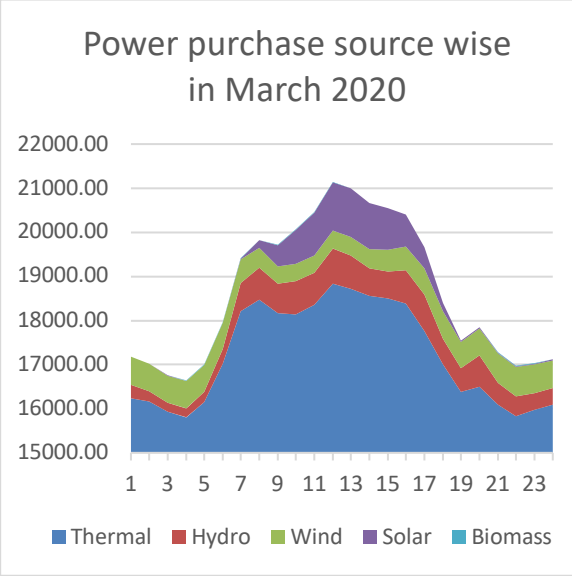
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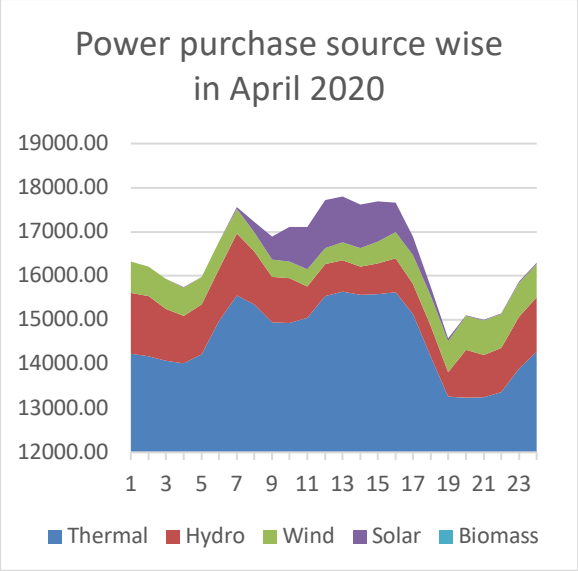
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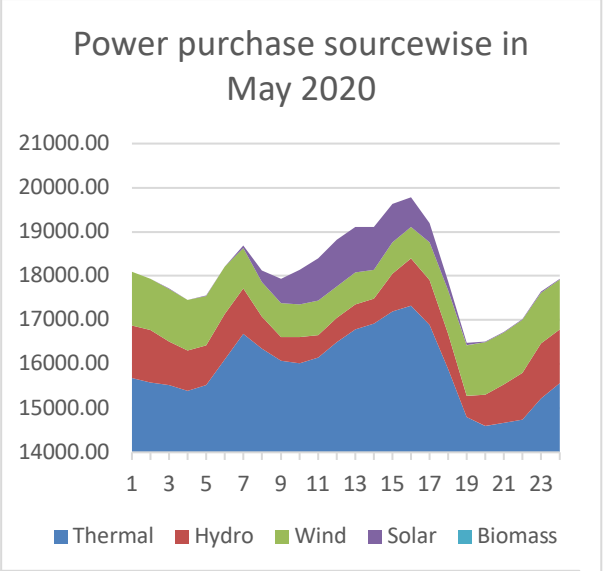
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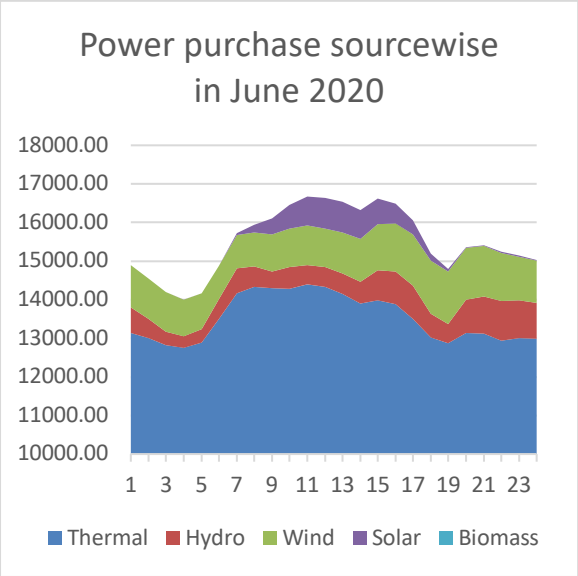
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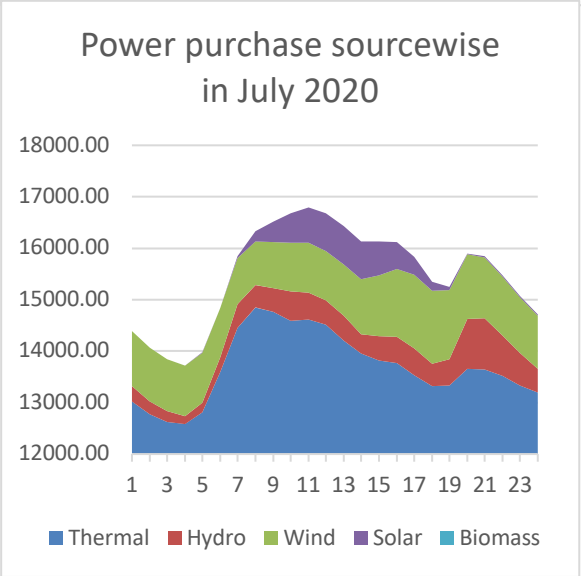
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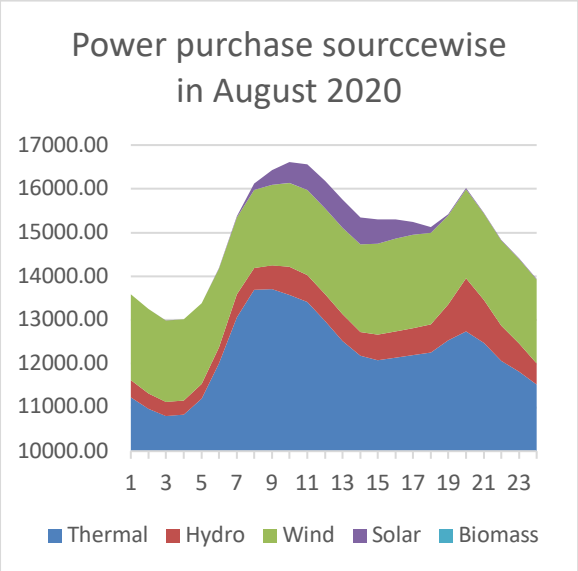
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase sourccewise in August 2020
17000.00
16000.00
15000.00
14000.00
13000.00
12000.00
11000.00
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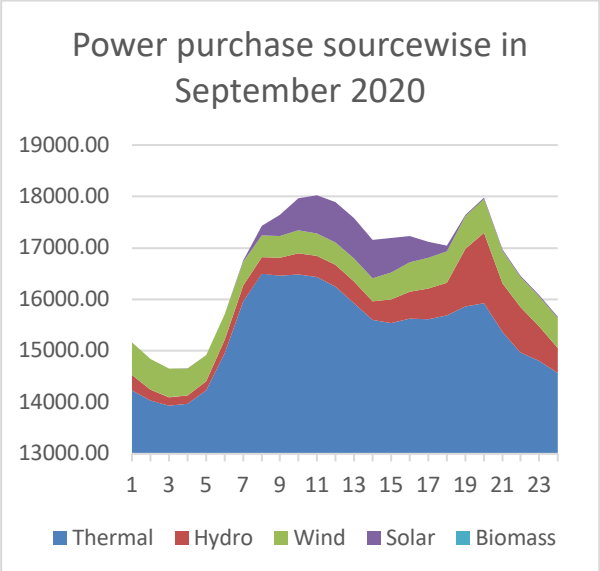
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase sourcewise in September 2020
19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
13000.00
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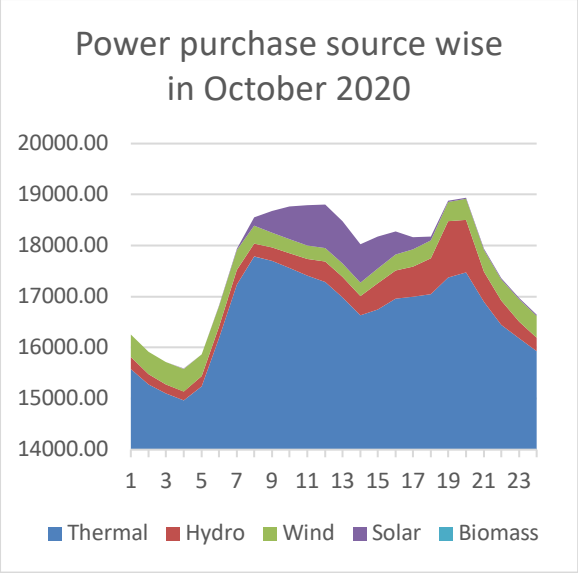
Thermal Hydro Wind Solar Biomass


Power purchase source wise in October 2020
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19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
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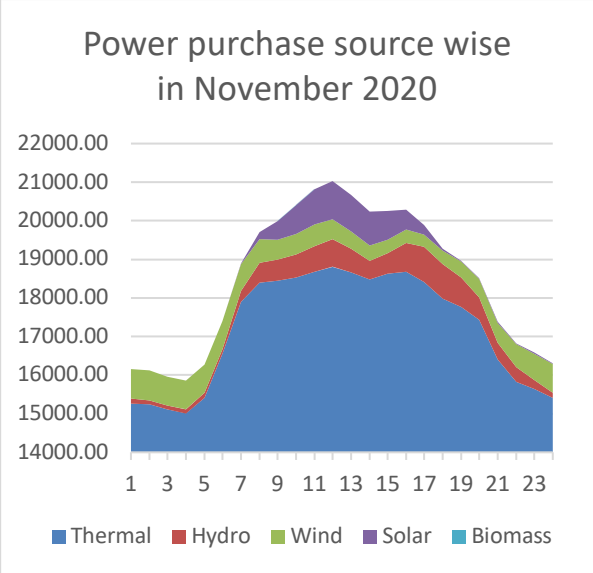
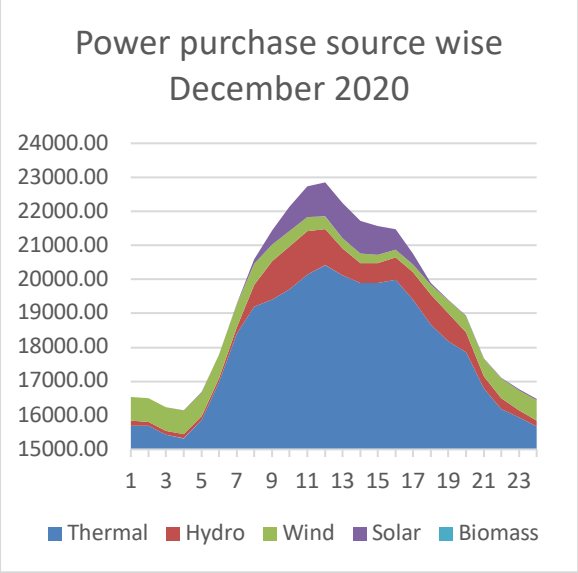
Thermal Hydro Wind Solar Biomass


Power purchase source wise in November 2020
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase source wise December 2020
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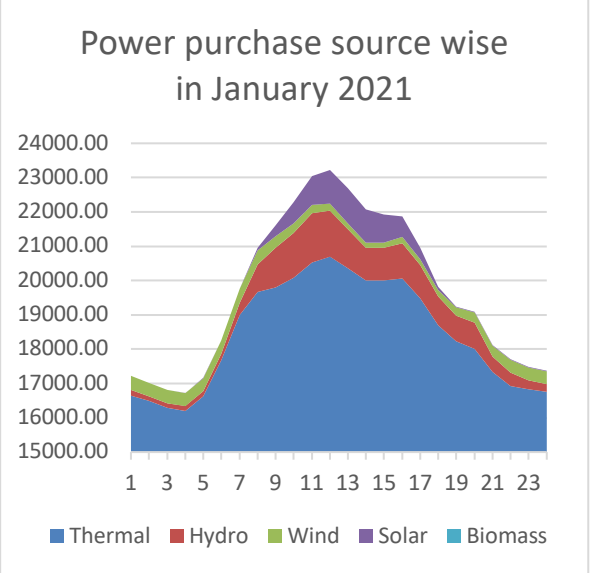
23000.00
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass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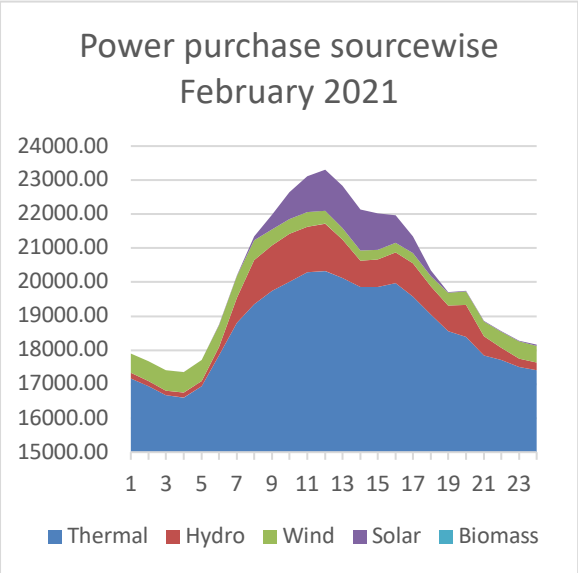
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase sourcewise February 2021
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23000.00
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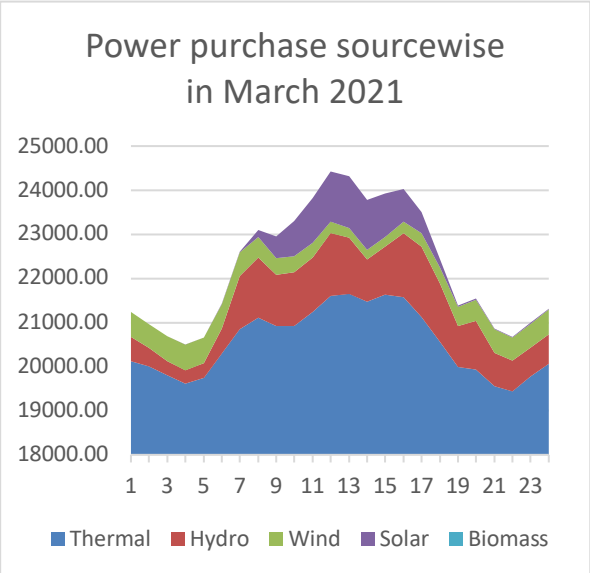
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase sourcewise in March 2021
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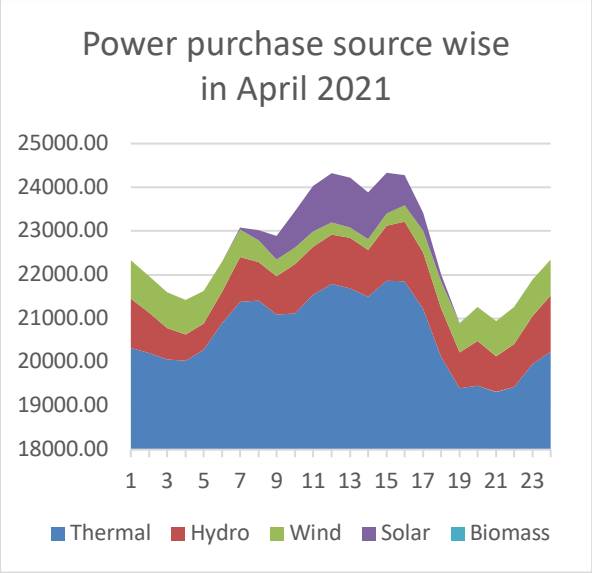
24000.00
23000.00
22000.00
21000.00
20000.00
19000.00
18000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase source wise in April 2021
25000.00
24000.00
23000.00
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21000.00
20000.00
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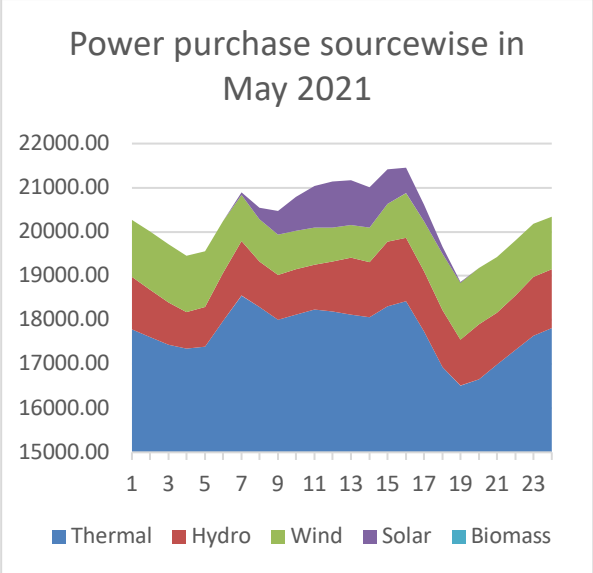
18000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase sourcewise in May 2021
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18000.00
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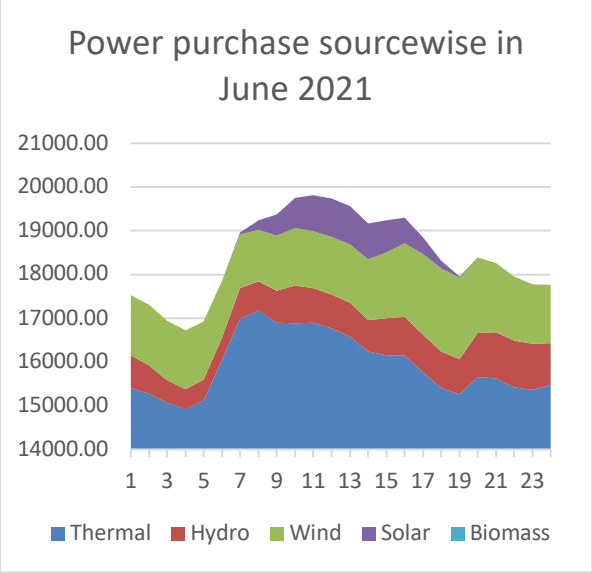
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase sourcewise in June 2021
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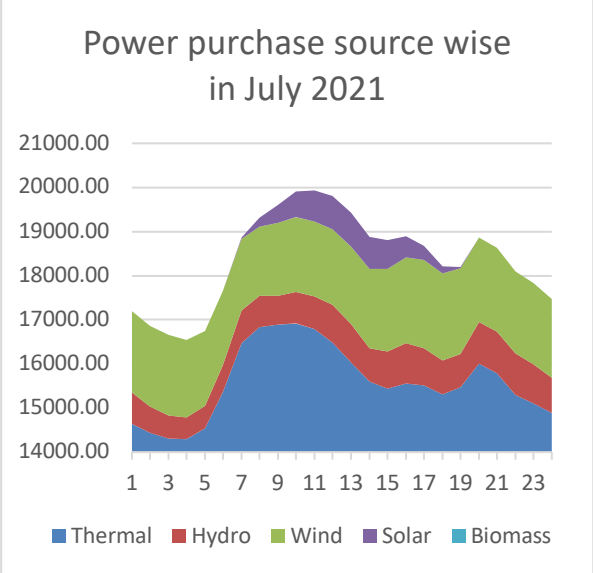
18000.00
17000.00
16000.00
15000.00
14000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase source wise in July 2021
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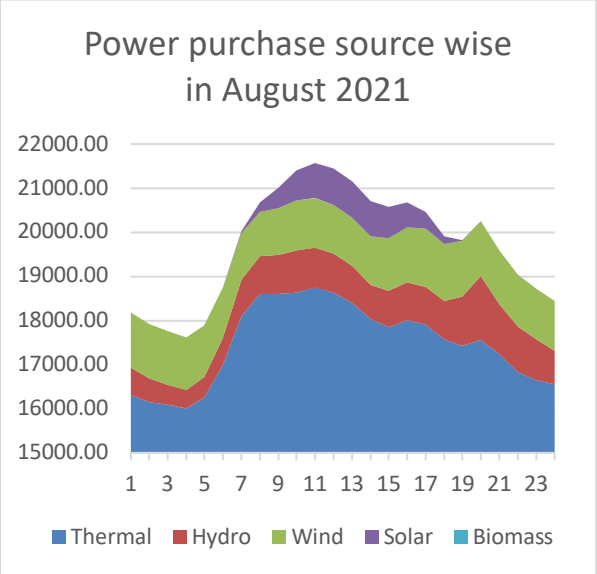
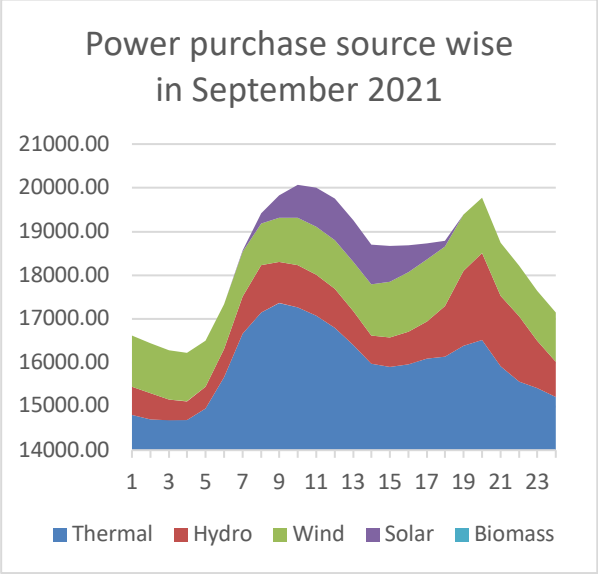
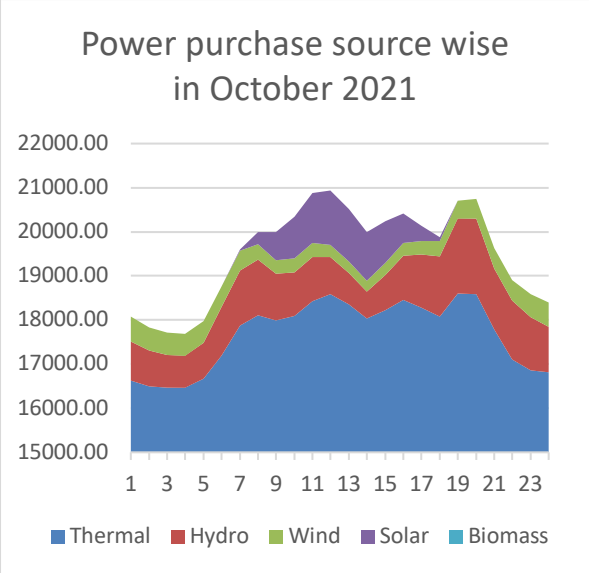
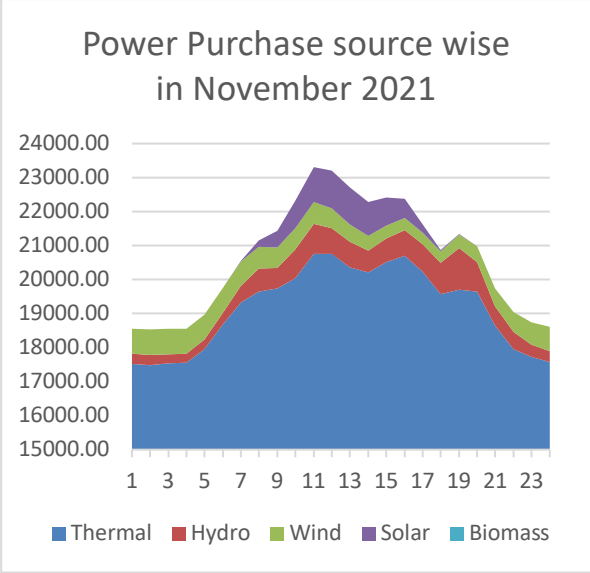
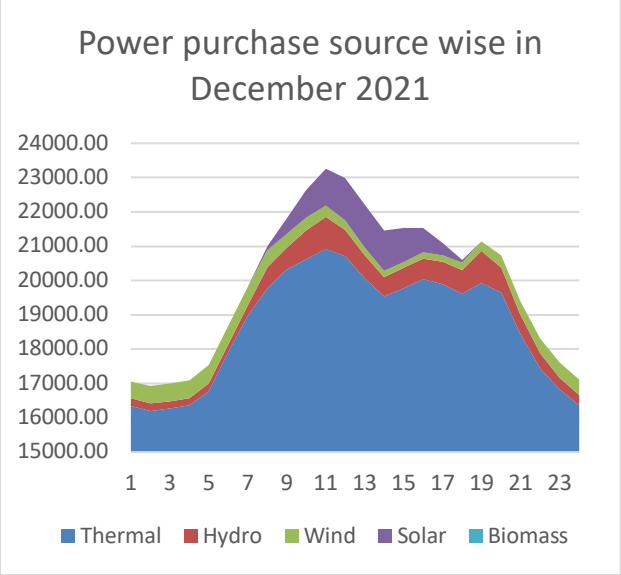
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Power purchase source wise in August 2021
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass

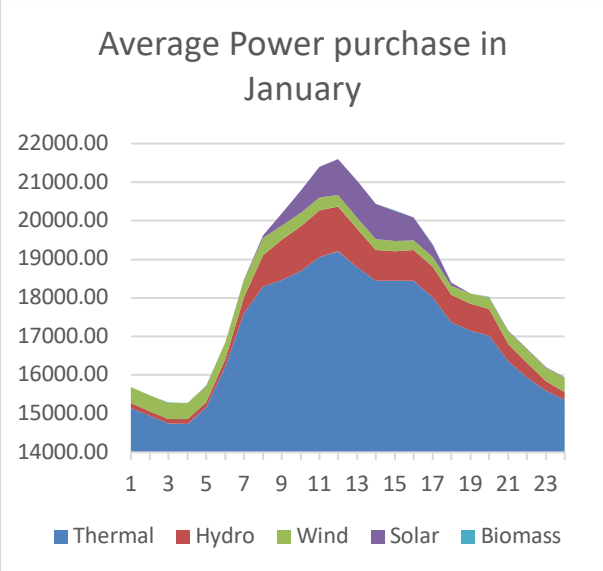

Power purchase source wise in September 2021
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass

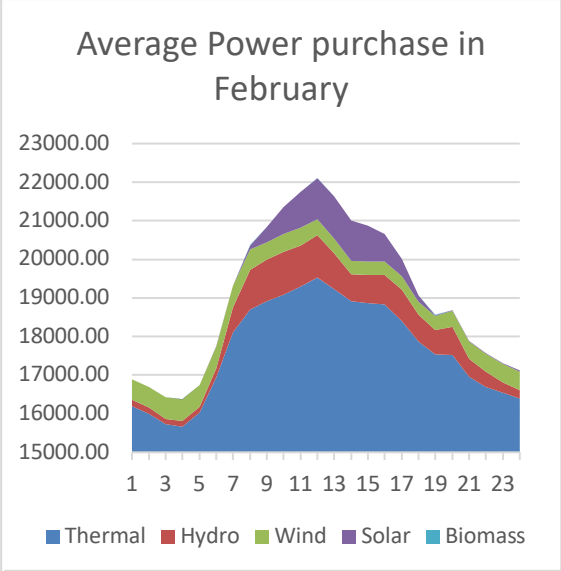


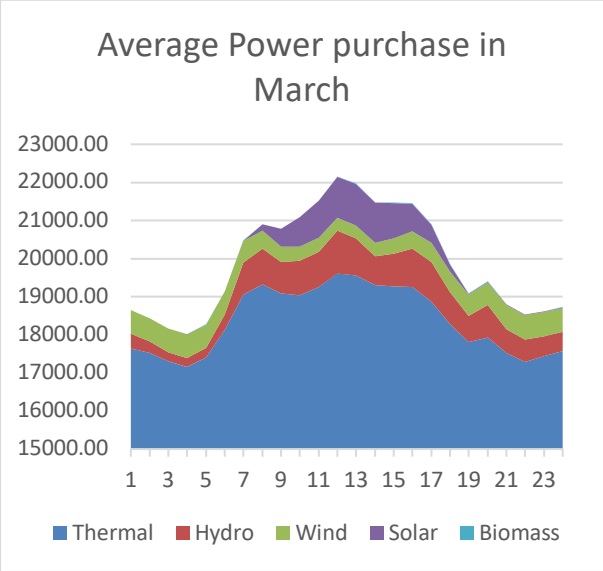




The average month-wise Power purchase mix is shown in the monthly Graphs below:


Average Power purchase in January
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in February
23000.00
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in March
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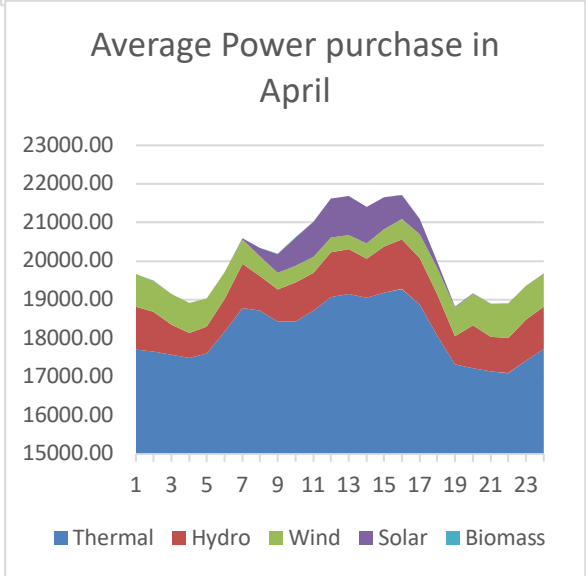
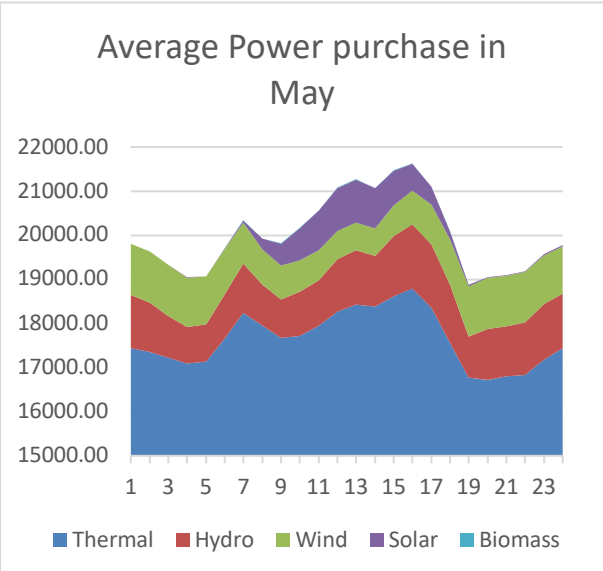
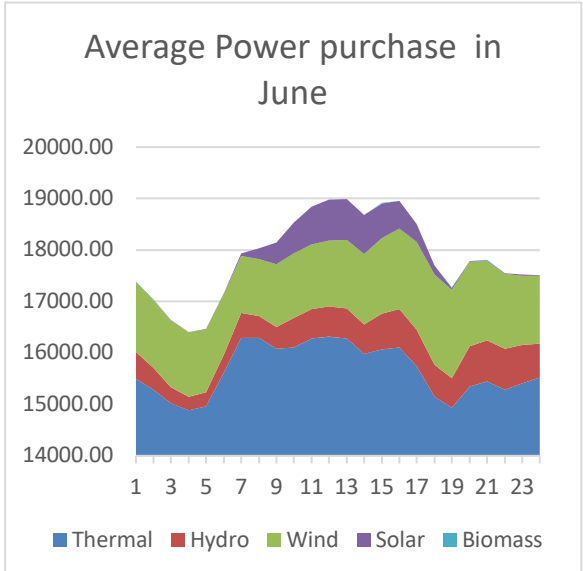
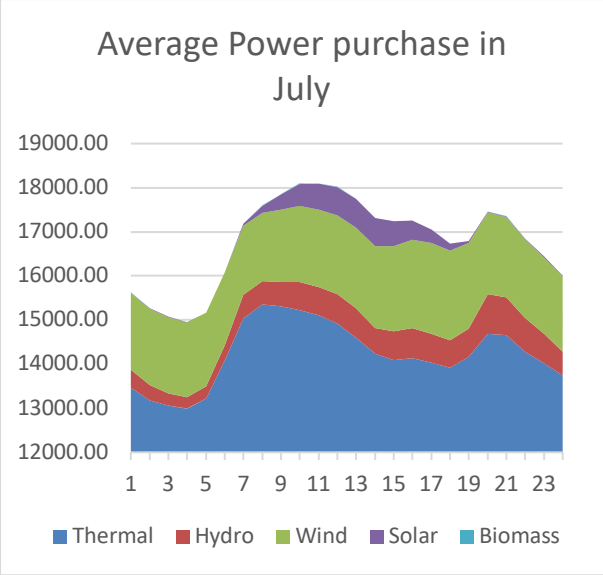
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in April
23000.00
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in May
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in June
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in July
19000.00
18000.00
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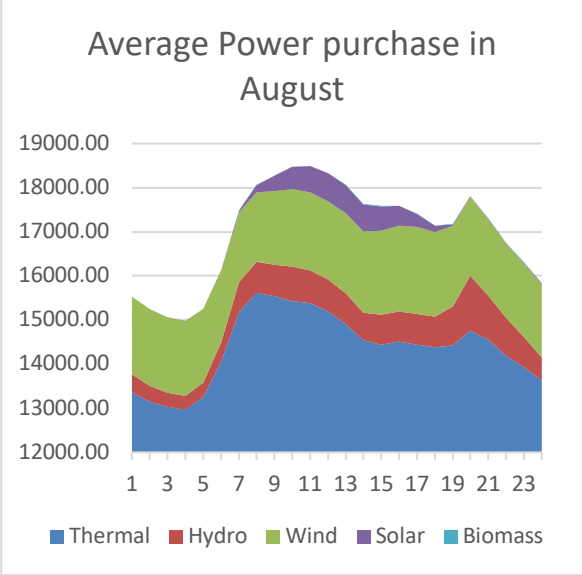
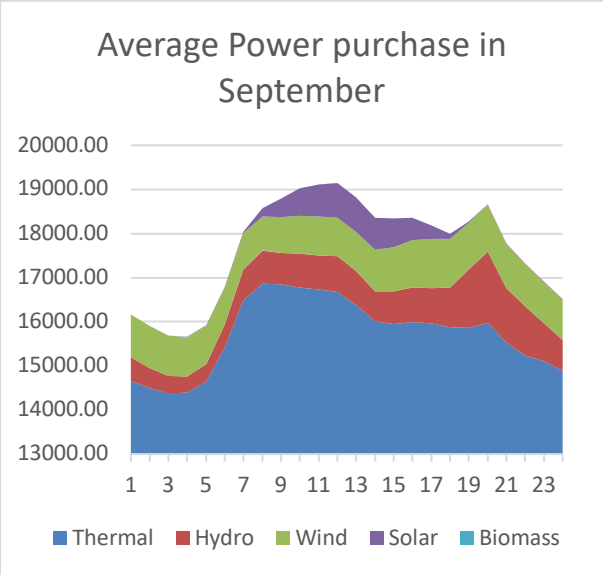
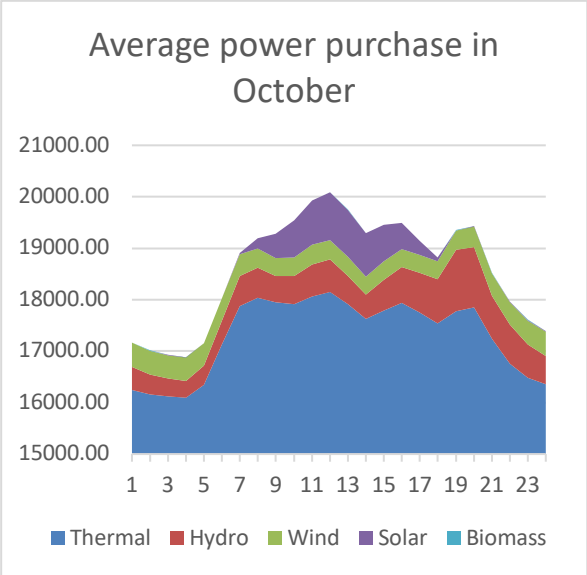
16000.00
15000.00
14000.00
13000.00
12000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in August
19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
13000.00
12000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in September
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
13000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average power purchase in October
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18000.00
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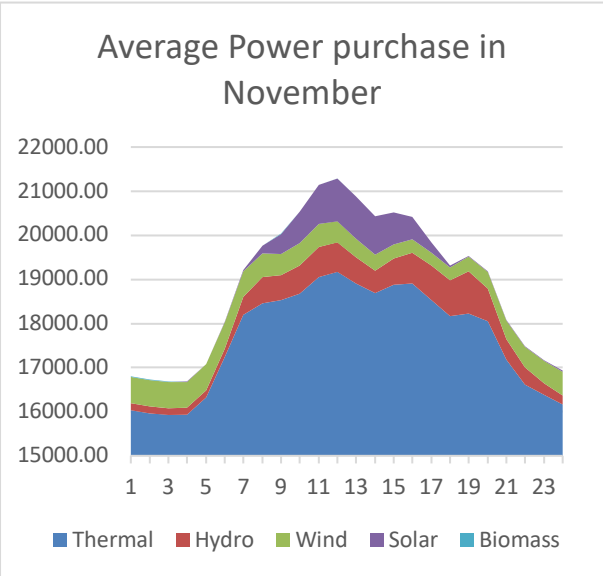
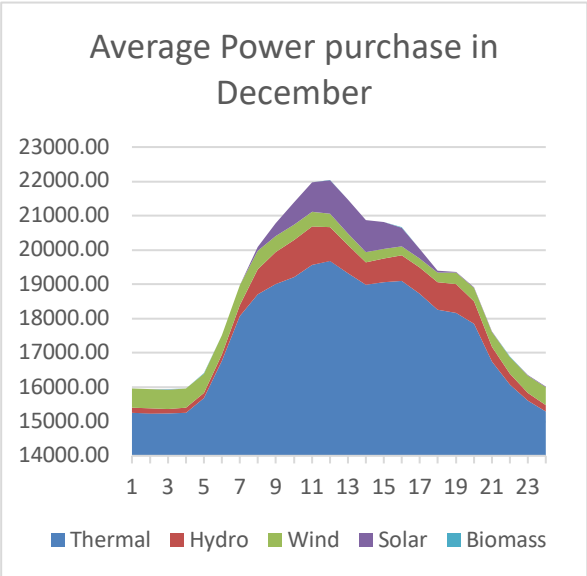
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in November
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass


Average Power purchase in December
23000.00
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
14000.00
1 3 5 7 9 11 13 15 17 19 21 23
Thermal Hydro Wind Solar Biomass

Note: The Average of January to March months have been taken for FY 2018-19 to FY 2020-21.

The above Graphs show that

1. Contribution of Wind power is highest during the period from June to September
2. Solar power is contributing daily from around 08:00 hrs to 16:00 hrs
3. Hydro power is mainly used in the months of March to May and October to December
4. Renewable Energy (RE) Sources have been projected to be approximately 15-20% of total power purchase quantum of the State.
5. Significant increase in RE absorption between 8 am to 5 pm due to solar power generation.
6. MERC RPO Regulations, 2019, has mandated at least 25% RE procurement by Distribution Licensees by FY 2024-25.

The average Power Purchase Mix of MSEDCL is given below:

Maharashtra State Electricity Distribution Company Limited (MSEDCL)						
Hour	**Thermal**	**Hydro**	**Wind**	**Solar**	**Short-term/ Bilateral Power purchase**	**Total**
1	13716.57	368.73	866.26	0.01	224.48	15176.05
2	13643.47	335.72	856.92	0.01	250.55	15086.68
3	13544.33	289.99	850.13	0.01	294.24	14978.71
4	13516.66	267.95	834.38	0.01	323.71	14942.71
5	13739.48	288.61	818.39	0.01	386.07	15232.55
6	14293.74	379.99	802.30	0.10	614.32	16090.45
7	14885.88	579.54	763.89	22.50	943.63	17195.44
8	15080.69	635.90	716.14	154.95	958.25	17545.93
9	15090.89	602.22	702.90	391.73	774.90	17562.63
10	15109.96	628.00	719.79	611.24	663.17	17732.15
11	15154.40	602.69	719.94	762.05	686.76	17925.84
12	15139.87	625.71	700.03	840.86	771.27	18077.74
13	14982.40	562.80	696.28	844.31	746.36	17832.15
14	14817.22	464.72	698.64	795.53	699.82	17475.93

Maharashtra State Electricity Distribution Company Limited (MSEDCL)						
Hour	**Thermal**	**Hydro**	**Wind**	**Solar**	**Short-term/ Bilateral Power purchase**	**Total**
15	14800.47	527.31	732.66	691.42	751.77	17503.63
16	14823.23	569.93	768.01	517.52	786.27	17464.97
17	14689.22	568.86	809.70	307.13	650.36	17025.27
18	14510.62	530.48	826.14	106.82	425.06	16399.12
19	14447.03	536.82	837.95	11.65	309.65	16143.10
20	14560.64	638.62	847.97	0.07	260.51	16307.81
21	14309.62	459.76	850.31	0.00	140.88	15760.57
22	14067.28	447.05	842.70	0.00	97.63	15454.67
23	13961.70	431.28	832.46	0.00	97.97	15323.41
24	13852.54	405.41	826.99	0.00	130.92	15215.85

From this, we can conclude that for MSEDCL:

1. Long Term Power from Thermal power plants constitutes the majority of MSEDCL's power mix. It provides the base power and also the peak power in day time.
2. Additional peak power is provided by Hydro Power and power from Power Exchanges/Short Term power sources.

For FY 2022-23 and subsequent years, MSEDCL has stated that the projection according to MYT Order for FY 2020-21 to FY 2024-25 may be considered. The data from the Order is insufficient for this analysis, so we have considered the source-wise generation curve for FY 2022-23 same as that in FY 2021-22, as a clear increasing trend in power purchase is observed. The power Purchase mix of MSEDCL for FY 2021-22 is given below:

Maharashtra State Electricity Distribution Company Limited (MSEDCL)							
Hour	**Thermal**	**Hydro**	**Wind**	**Solar**	**PX**	**STPP**	**Total**
1	14515.05	568.96	996.95	0.00	-16.40	291.95	16356.50
2	14438.68	522.92	992.87	0.00	20.30	288.88	16263.64
3	14406.20	468.14	983.18	0.00	59.87	289.01	16206.39
4	14410.22	436.47	957.64	0.00	92.52	289.42	16186.26
5	14626.77	477.35	934.03	0.00	152.35	293.61	16484.12
6	15082.00	587.91	908.28	0.02	428.28	311.74	17318.22

Maharashtra State Electricity Distribution Company Limited (MSEDCL)							
Hour	**Thermal**	**Hydro**	**Wind**	**Solar**	**PX**	**STPP**	**Total**
7	15536.55	747.96	854.91	34.08	789.57	330.69	18293.76
8	15774.71	763.51	785.51	198.97	780.32	335.50	18638.53
9	15852.69	678.51	777.11	454.27	580.67	332.42	18675.66
10	15976.05	712.39	801.32	681.12	422.96	325.21	18919.05
11	16063.49	665.93	792.67	831.63	423.67	319.01	19096.40
12	15961.51	614.62	759.23	906.63	437.06	306.60	18985.66
13	15721.10	600.78	743.00	894.66	390.09	295.86	18645.48
14	15520.25	540.32	755.46	834.80	336.15	289.38	18276.37
15	15514.39	623.45	806.30	722.00	424.50	297.47	18388.12
16	15560.56	663.31	874.81	527.79	491.35	309.29	18427.11
17	15442.88	661.91	938.31	306.53	365.44	316.28	18031.35
18	15266.12	669.78	967.83	112.29	162.20	322.94	17501.16
19	15311.22	785.65	970.57	13.17	112.82	330.76	17524.19
20	15446.42	874.72	979.64	0.06	74.15	341.15	17716.15
21	15186.91	705.76	968.58	0.00	-76.56	329.62	17114.31
22	14869.66	723.87	957.86	0.00	-111.87	314.95	16754.47
23	14762.85	690.77	947.01	0.00	-107.95	305.09	16597.76
24	14653.87	645.24	942.75	0.00	-86.70	298.72	16453.88

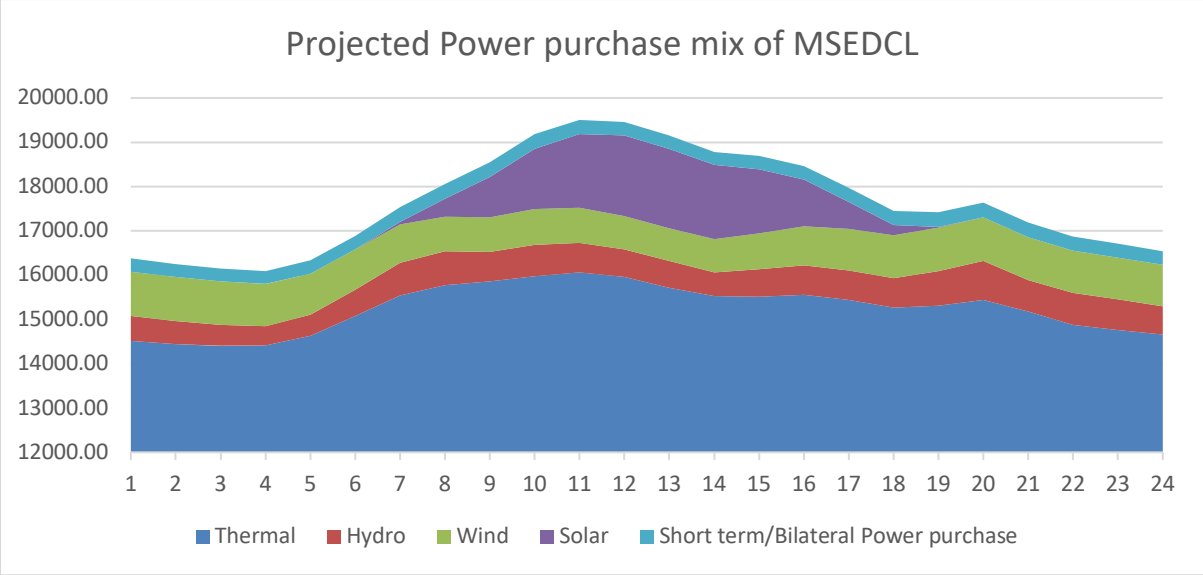
However, it huge Solar power capacity addition is expected after FY 2021-22. At the end of March 2022, Solar Power Capacity was 2803 MW. In coming years, more than 2500 MW of Solar power is expected to be commissioned based on already executed PPAs. So, for projection purposes, Solar power generation in FY 2022-23 is considered double of what it is observed in FY 2021-22.

Also, presently purchase from Power Exchange is being used to bridge the gap between supply and demand. To optimise the power purchase cost of MSEDCL, it needs to minimise its power purchase from Power Exchanges, which cater to meet the peak demand of MSEDCL.

The average projected year-wise source-wise hourly power purchase mix for MSEDCL for FY 2022-23, considering the purchase from Power Exchange as Nil, is shown in the Table below:

Maharashtra State Electricity Distribution Company Limited (MSEDCL)						
Hour	**Thermal**	**Hydro**	**Wind**	**Solar**	**STPP**	**Total**
1	14515.05	568.96	996.95	0.00	291.95	16372.90
2	14438.68	522.92	992.87	0.00	288.88	16243.34
3	14406.20	468.14	983.18	0.00	289.01	16146.52
4	14410.22	436.47	957.64	0.00	289.42	16093.74
5	14626.77	477.35	934.03	0.00	293.61	16331.76
6	15082.00	587.91	908.28	0.03	311.74	16889.94
7	15536.55	747.96	854.91	68.17	330.69	17504.19
8	15774.71	763.51	785.51	397.95	335.50	17858.20
9	15852.69	678.51	777.11	908.54	332.42	18094.99
10	15976.05	712.39	801.32	1362.23	325.21	18496.09
11	16063.49	665.93	792.67	1663.26	319.01	18672.73
12	15961.51	614.62	759.23	1813.26	306.60	18548.60
13	15721.10	600.78	743.00	1789.31	295.86	18255.39
14	15520.25	540.32	755.46	1669.61	289.38	17940.22
15	15514.39	623.45	806.30	1443.99	297.47	17963.61
16	15560.56	663.31	874.81	1055.58	309.29	17935.76
17	15442.88	661.91	938.31	613.05	316.28	17665.91
18	15266.12	669.78	967.83	224.59	322.94	17338.97
19	15311.22	785.65	970.57	26.34	330.76	17411.37
20	15446.42	874.72	979.64	0.13	341.15	17642.00
21	15186.91	705.76	968.58	0.00	329.62	17190.87
22	14869.66	723.87	957.86	0.00	314.95	16866.34
23	14762.85	690.77	947.01	0.00	305.09	16705.72
24	14653.87	645.24	942.75	0.00	298.72	16540.58

For better understanding, the graph of projected power purchase mix of MSEDCL is given below:



The average Power Purchase Mix of AEML-D is given below:

Adani Electricity Mumbai Limited - Distribution							
Hour	**Long term Thermal**	**Short term Thermal**	**Solar**	**Wind and Hydro**	**Hybrid**	**Others**	**Total**
1	393.80	500.69	7.11	24.07	0.34	87.22	1011.33
2	388.76	426.60	4.95	24.07	1.03	87.65	931.57
3	383.87	372.78	3.54	24.05	1.71	85.86	870.51
4	379.66	338.56	2.67	23.98	2.39	84.67	830.72
5	379.40	319.77	2.10	23.92	3.07	81.24	808.30
6	392.13	320.99	1.86	23.88	3.75	70.58	811.94
7	421.63	338.03	1.58	23.35	4.68	38.03	825.94
8	434.07	370.23	4.49	23.37	6.92	30.79	868.31
9	428.31	445.38	10.48	23.47	10.93	47.45	964.13
10	426.05	530.60	17.95	23.57	14.69	54.94	1065.52
11	427.41	594.79	22.49	23.66	17.41	60.12	1143.05
12	426.66	618.22	25.55	23.65	18.91	65.45	1175.36
13	422.94	604.44	26.80	23.79	19.76	71.59	1166.23
14	416.38	561.98	25.92	23.86	19.99	72.59	1117.79
15	415.84	575.52	24.02	23.83	19.75	74.51	1130.53
16	420.09	585.02	20.15	23.81	18.58	69.11	1133.83
17	420.72	572.80	13.97	23.74	16.60	67.67	1112.61
18	418.96	556.72	8.14	23.69	13.99	73.14	1091.82
19	416.45	570.18	5.70	23.40	12.84	82.40	1107.14

Adani Electricity Mumbai Limited - Distribution							
Hour	**Long term Thermal**	**Short term Thermal**	**Solar**	**Wind and Hydro**	**Hybrid**	**Others**	**Total**
20	418.80	591.05	5.28	23.38	13.32	80.13	1128.60
21	408.32	565.34	4.56	23.39	14.04	96.04	1108.84
22	400.64	541.86	4.32	23.39	14.75	99.17	1081.61
23	397.98	548.72	4.97	23.39	15.47	100.43	1088.68
24	396.91	553.73	5.55	23.40	16.16	98.17	1091.73

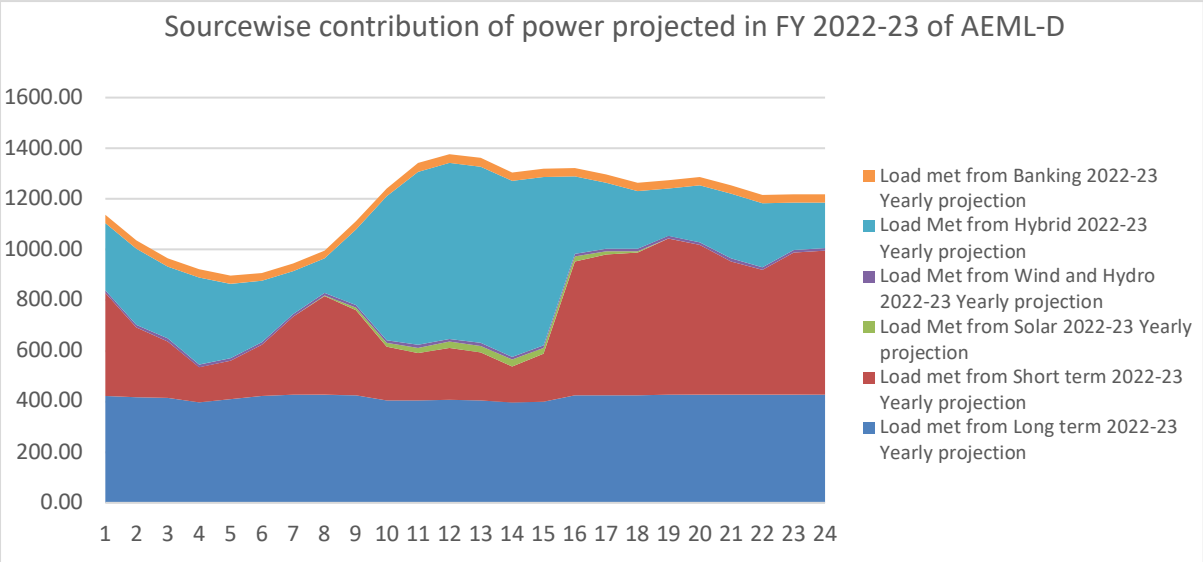
From this, we can conclude that for AEML-D, long-term power from thermal power plant and short-term power procurement from conventional sources constitutes the majority of AEML-D's Power purchase mix. It provides the base power and also the peak power in day time.

For FY 2022-23, AEML-D has provided hour/time-block wise Generation Load curve according to its existing and planned tied up sources. Thus, the average projected year-wise source-wise hourly power purchase mix for AEML-D for FY 2022-23 is shown in the Table below:

Adani Electricity Mumbai Limited - Distribution							
Hour	**Long term Thermal**	**Short term Thermal**	**Solar**	**Wind and Hydro**	**Hybrid**	**Banking**	**Total**
1	422.91	406.05	0.00	11.13	264.79	32.25	1137.13
2	416.49	275.48	0.00	11.13	299.58	32.25	1034.93
3	415.17	222.16	0.00	11.13	283.66	32.25	964.37
4	397.62	137.28	0.00	11.13	342.91	32.25	921.20
5	409.29	150.95	0.00	11.13	293.43	32.25	897.06
6	421.84	202.57	0.00	11.13	240.70	32.25	908.50
7	426.10	308.63	0.03	11.13	168.23	32.25	946.38
8	426.21	389.34	2.18	11.13	135.68	32.25	996.79
9	425.04	336.81	8.55	11.13	298.15	32.25	1111.94
10	403.15	212.50	15.35	11.13	567.25	32.25	1241.62
11	403.23	188.35	21.17	11.13	683.30	33.84	1341.00
12	406.13	205.86	24.66	11.13	694.57	34.10	1376.45
13	404.44	188.54	26.71	11.13	696.40	34.36	1361.58
14	395.92	143.46	26.43	11.13	693.54	34.76	1305.24

Adani Electricity Mumbai Limited - Distribution							
Hour	**Long term Thermal**	**Short term Thermal**	**Solar**	**Wind and Hydro**	**Hybrid**	**Banking**	**Total**
15	400.07	188.57	23.10	11.13	662.99	33.84	1319.70
16	425.02	528.67	18.17	11.13	306.52	32.78	1322.29
17	424.94	556.59	11.15	11.13	259.79	32.25	1295.85
18	425.45	562.96	3.66	11.13	227.84	32.25	1263.29
19	426.15	617.24	0.20	11.13	186.85	32.25	1273.82
20	426.21	591.29	0.00	11.13	224.80	32.25	1285.69
21	426.21	527.03	0.00	11.13	257.42	32.25	1254.05
22	426.21	493.45	0.00	11.13	252.42	32.25	1215.46
23	426.21	561.98	0.00	11.13	187.05	32.25	1218.62
24	426.17	569.42	0.00	11.13	179.71	32.25	1218.68

For better understanding, the graph of projected power purchase mix of AEML-D is given below:



Similarly, the average Power Purchase mix of TPC-D is given below:

The Tata Power Company Limited (TPC-D)						
Hour	**Thermal**	**Hydro**	**Solar**	**Wind**	**Short term power purchase (both PX and Bilateral)**	**Total**
1	304.50	41.51	0.00	54.93	127.22	528.16
2	300.39	28.40	-0.01	55.10	127.62	511.50
3	294.70	17.80	-0.01	54.90	125.62	493.01
4	290.08	12.97	-0.01	55.07	119.25	477.37
5	289.59	12.20	-0.01	54.83	114.34	470.94
6	297.26	15.39	-0.01	54.50	111.27	478.42
7	316.14	27.45	0.60	54.15	96.43	494.77
8	329.78	41.11	4.26	53.81	99.19	528.16
9	329.70	62.30	10.72	53.63	128.74	585.08
10	329.20	96.39	16.81	53.80	154.98	651.17
11	331.15	113.85	20.78	54.56	168.73	689.08
12	331.20	122.67	22.79	54.95	169.64	701.25
13	329.32	118.86	23.18	55.41	170.67	697.44
14	324.27	106.97	21.94	55.52	176.27	684.97
15	321.26	119.76	19.25	55.17	174.72	690.16
16	324.45	132.10	14.59	55.45	160.34	686.92
17	325.80	139.63	8.85	55.77	148.49	678.53
18	325.18	135.52	3.23	55.57	142.61	662.10
19	323.88	136.85	0.44	55.97	130.90	648.04
20	325.33	153.23	0.00	55.62	113.72	647.89
21	319.62	140.51	-0.01	55.42	118.48	634.02
22	312.52	116.78	-0.01	55.17	127.02	611.47
23	309.90	84.23	-0.01	54.96	126.56	575.65
24	308.34	61.45	-0.01	54.92	124.35	549.05

From this, we can conclude that for TPC-D:

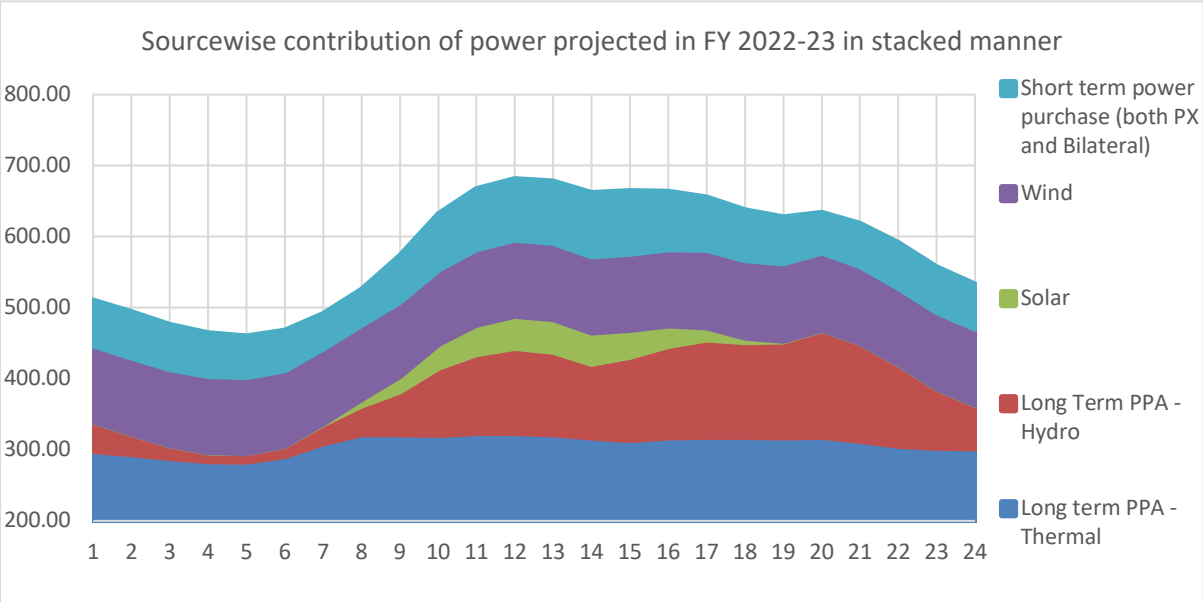
1. Long Term Power from Thermal power plant, Hydro power plant and short-term Power procurement from conventional sources constitutes the majority of TPC-D's Power mix. It provides the base power and also the peak power in day time.

2. Additional Peak power is provided by the Hydro power.

For FY 2022-23, TPC-D has provided month wise Generation Load curve according to its existing and planned tied up sources. In FY 2022-23, TPC-D is going to increase its procurement of Power from its Solar and Wind sources due to introduction of Hybrid power in its energy mix. The average projected year-wise source-wise hourly power purchase mix for TPC-D for FY 2022-23 is shown in the Table below:

The Tata Power Company Limited (TPC-D)						
Hour	**Thermal**	**Hydro**	**Solar**	**Wind**	**Short term power purchase (both PX and Bilateral)**	**Total**
1	298.17	41.66	-0.01	107.24	63.42	510.48
2	294.17	28.52	-0.01	107.66	63.65	494.00
3	288.50	17.70	-0.01	107.26	62.87	476.32
4	283.79	12.70	-0.01	107.57	59.93	463.97
5	283.35	11.96	-0.01	107.02	57.50	459.82
6	290.81	15.11	-0.01	106.26	55.87	468.05
7	308.74	27.06	1.23	105.49	48.53	491.05
8	321.89	40.42	8.64	104.76	50.01	525.71
9	321.46	60.97	21.43	104.31	64.91	573.08
10	321.27	94.01	33.53	104.50	78.18	631.49
11	323.69	111.10	41.37	105.93	85.00	667.09
12	323.82	119.73	45.25	106.69	85.52	681.01
13	321.92	116.00	45.98	107.63	86.09	677.62
14	316.99	104.15	43.55	107.80	88.91	661.40
15	314.00	116.47	38.18	107.17	88.04	663.85
16	317.11	128.77	28.88	107.77	80.61	663.15
17	318.58	136.45	17.45	108.55	74.29	655.32
18	318.36	133.34	6.41	108.42	70.51	637.05
19	317.27	134.80	0.87	109.48	64.40	626.82
20	318.44	150.23	0.00	108.85	56.33	633.86
21	312.82	137.89	-0.01	108.40	58.80	617.90
22	305.83	114.66	-0.01	107.84	63.31	591.62
23	303.28	83.31	-0.01	107.35	63.16	557.09
24	301.87	61.39	-0.01	107.19	62.00	532.45

For better understanding, the graph of projected power purchase mix of TPC-D is given below:



The average power purchase mix of BEST is provided in the Table below:

BEST						
Hour	**Long term PPA - Thermal**	**Long Term PPA - Hydro**	**Solar**	**Biomass**	**Short term power purchase**	**Total**
1	335.93	43.76	0.00	3.87	33.99	417.54
2	331.83	29.78	0.00	3.87	28.48	393.96
3	326.31	18.66	0.00	3.87	23.49	372.32
4	321.64	13.68	0.00	3.87	20.56	359.75
5	321.38	12.85	0.00	3.87	19.76	357.85
6	329.41	16.18	0.00	3.87	23.65	373.11
7	347.40	26.91	0.27	3.87	21.89	400.20
8	361.27	39.87	1.31	3.87	27.08	433.24
9	361.44	63.03	5.71	3.87	43.58	476.96
10	360.44	100.11	13.12	3.87	58.01	532.61
11	361.37	119.49	18.26	3.87	83.75	582.30
12	360.60	129.28	21.38	3.86	93.70	603.45
13	358.22	125.67	22.81	3.86	98.61	603.30
14	353.08	113.37	21.44	3.86	90.26	576.64
15	350.92	126.83	19.64	3.86	88.31	584.61
16	354.15	138.74	14.57	3.86	83.29	591.54

BEST						
Hour	**Long term PPA - Thermal**	**Long Term PPA - Hydro**	**Solar**	**Biomass**	**Short term power purchase**	**Total**
17	355.11	145.47	7.60	3.86	74.26	585.35
18	355.77	141.34	2.44	3.86	62.02	565.44
19	355.94	142.31	0.14	3.86	41.11	543.36
20	357.38	159.03	0.00	3.86	34.52	554.80
21	352.03	146.09	0.00	3.87	32.77	534.75
22	345.36	122.45	0.00	3.87	35.44	507.12
23	342.86	88.76	0.00	3.87	41.28	476.76
24	340.95	64.85	0.00	3.87	40.41	450.08

From this, we can conclude that for BEST:

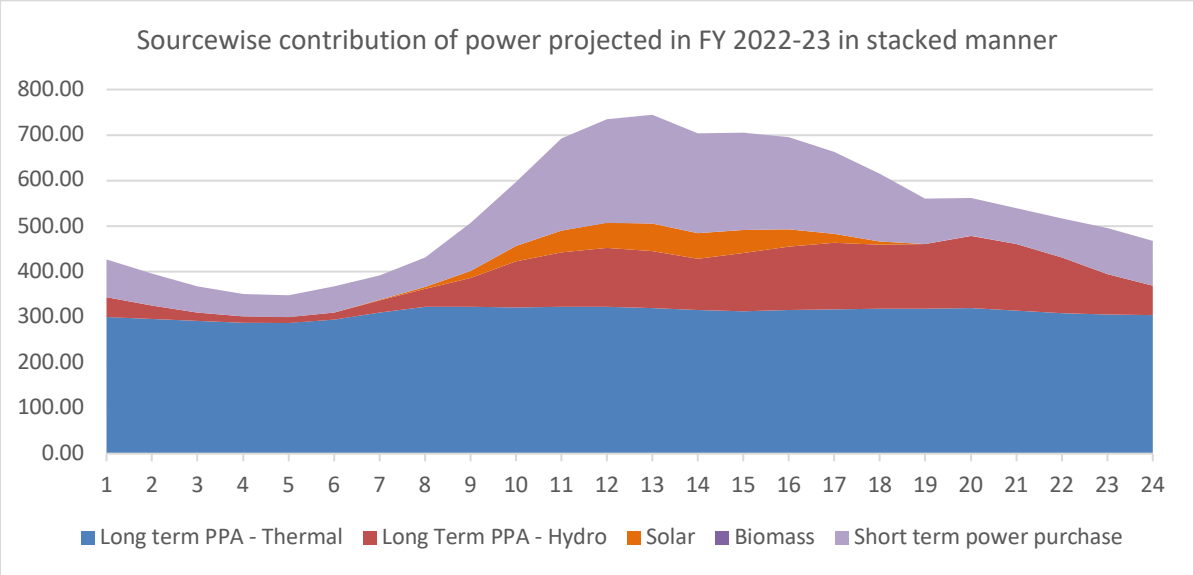
1. Long-term power from thermal power plant, Hydro power plant and short-term power procurement from conventional sources constitutes the majority of BEST's power mix. It provides the base power and also the peak power in day time.
2. Additional peak power is provided by the Hydro power.

For FY 2022-23, BEST has provided month-wise Generation Load curve according to its existing and planned tied up sources. BEST is tying up with Hybrid and Solar power plants in future. However, these plants will come online after FY 2023-24. BEST has provided projection of its available tied up sources. The average projected year-wise source-wise hourly power purchase mix for BEST for FY 2022-23 is shown in the Table below:

BEST						
Hour	**Long term PPA - Thermal**	**Long Term PPA - Hydro**	**Solar**	**Biomass**	**Short term power purchase**	**Total**
1	299.99	43.77	0.00	0.00	82.36	426.12
2	296.33	29.79	0.00	0.00	69.01	395.12
3	291.40	18.67	0.00	0.00	56.92	366.98
4	287.23	13.68	0.00	0.00	49.82	350.73
5	286.99	12.85	0.00	0.00	47.88	347.73
6	294.16	16.18	0.00	0.00	57.31	367.66

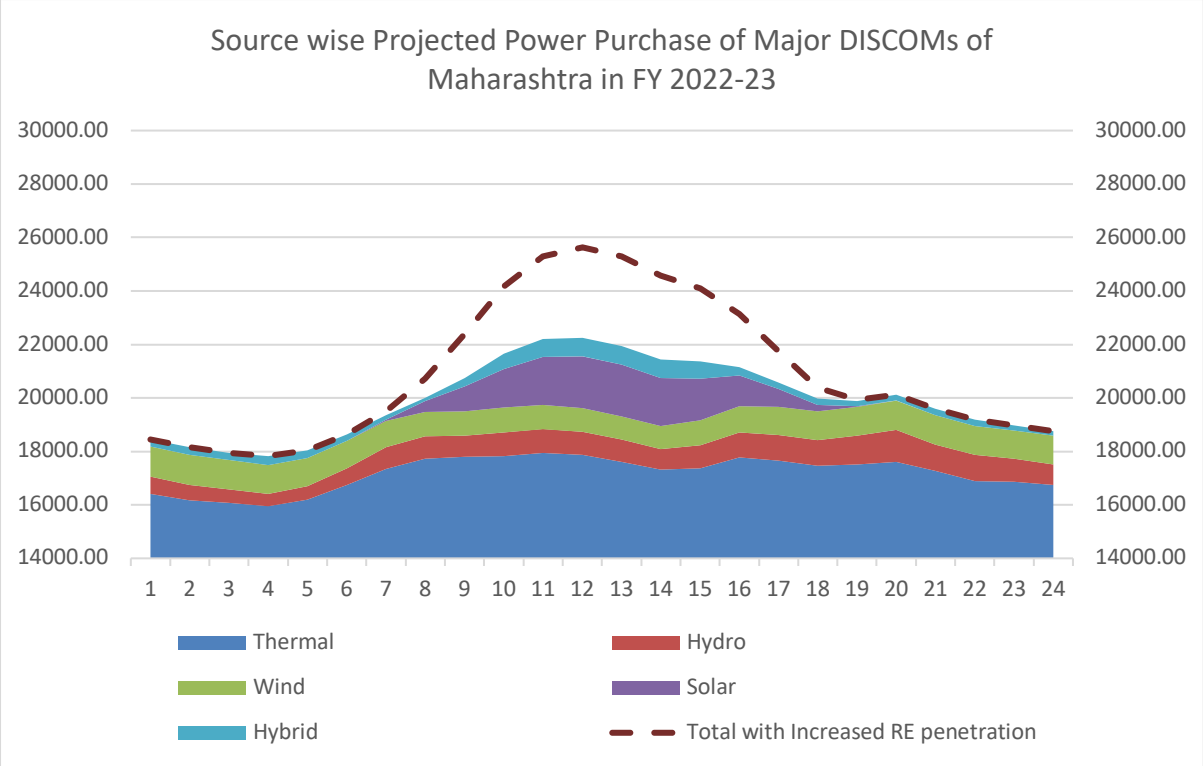
BEST						
Hour	**Long term PPA - Thermal**	**Long Term PPA - Hydro**	**Solar**	**Biomass**	**Short term power purchase**	**Total**
7	310.23	26.92	0.71	0.00	53.04	390.90
8	322.62	39.88	3.44	0.00	65.62	431.56
9	322.77	63.05	15.01	0.00	105.60	506.43
10	321.87	100.14	34.49	0.00	140.56	597.07
11	322.70	119.53	48.00	0.00	202.94	693.17
12	322.02	129.32	56.20	0.00	227.05	734.58
13	319.89	125.71	59.96	0.00	238.94	744.50
14	315.30	113.40	56.36	0.00	218.71	703.78
15	313.37	126.87	51.63	0.00	213.99	705.85
16	316.26	138.78	38.30	0.00	201.82	695.16
17	317.11	145.51	19.98	0.00	179.94	662.55
18	317.70	141.38	6.41	0.00	150.28	615.78
19	317.86	142.35	0.37	0.00	99.61	560.19
20	319.14	159.08	0.00	0.00	83.65	561.87
21	314.36	146.13	0.00	0.00	79.41	539.90
22	308.41	122.49	0.00	0.00	85.88	516.77
23	306.18	88.79	0.00	0.00	100.03	494.99
24	304.47	64.87	0.00	0.00	97.92	467.26

For better understanding, the graph of projected power purchase mix of BEST is given below:



The combined power purchase mix of Maharashtra's Major Distribution Licensees is as under:

Hour	Thermal	Hydro	Wind	Solar	Hydro	Total	Total with Increased RE Generation
1	16412.15	654.39	1115.32	-0.01	264.79	18446.65	18446.65
2	16174.93	581.23	1111.66	-0.01	299.58	18167.39	18167.39
3	16064.48	504.51	1101.57	-0.01	283.66	17954.21	17954.21
4	15947.56	462.85	1076.34	-0.01	342.91	17829.65	17829.65
5	16188.60	502.16	1052.18	-0.01	293.43	18036.36	18036.36
6	16748.56	619.20	1025.67	0.02	240.70	18634.16	18634.18
7	17354.77	801.94	971.53	70.14	168.23	19366.61	19446.67
8	17718.15	843.81	901.40	412.21	135.68	20011.25	20481.78
9	17793.95	802.53	892.55	953.54	298.15	20740.71	21829.18
10	17811.05	906.54	916.95	1445.59	567.25	21647.38	23297.53
11	17942.24	896.56	909.73	1773.80	683.30	22205.62	24230.41
12	17872.60	863.67	877.05	1939.37	694.57	22247.26	24461.06
13	17611.15	842.49	861.76	1921.96	696.40	21933.75	24127.67
14	17323.68	757.87	874.39	1795.95	693.54	21445.44	23495.52
15	17363.74	866.79	924.60	1556.89	662.99	21375.01	23152.21
16	17772.13	930.86	993.71	1140.93	306.52	21144.14	22446.52
17	17662.87	943.87	1057.99	661.63	259.79	20586.15	21341.40
18	17466.58	944.50	1087.38	241.07	227.84	19967.37	20242.55
19	17516.76	1062.80	1091.18	27.77	186.85	19885.37	19917.07
20	17614.88	1184.03	1099.62	0.13	224.80	20123.46	20123.46
21	17267.41	989.78	1088.11	-0.01	257.42	19602.72	19602.72
22	16899.95	961.02	1076.83	-0.01	252.42	19190.20	19190.20
23	16861.03	862.87	1065.49	-0.01	187.05	18976.42	18976.42
24	16746.69	771.50	1061.07	-0.01	179.71	18758.95	18758.95



From this, it is observed that Renewable Energy (RE) Sources have been projected to be approximately 15-20% of total power purchase quantum of the State. Also, the data shows significant increase in RE absorption between 8 am to 5 pm due to solar power generation. The Commission, in its MERC RPO Regulations, 2019, has mandated at least 25% RE Energy adoption by Distribution Licensees by FY 2024-25. Keeping this in mind, as more RE sources are made operational, the energy mix of Maharashtra would have to accommodate more RE power. In other word, Maharashtra's Load curve would have to match the Generation Curve to accommodate maximum RE (Solar and Wind) Power in the Energy Mix.

Hence, the objective of the present study is to find ways to modify the load curve to match above generation curve, so that maximum solar generation can be absorbed and RPO targets also can be fulfilled by each Licensee, and to optimise the power purchase costs of the Distribution Licensees.

3 Methodology

The category-wise consumption pattern has been studied to identify different time slots where incentive/ disincentives are required to be introduced Licensee-wise/State-wise.

As a part of this analysis, we have analysed the data submitted by each DISCOM on their actual load curve, Load Generation Balance Report (LGBR) from FY 2018-19 to FY 2021-22, category-wise consumption based on slot-wise monthly consumption data, and source-wise power purchase cost for the same.

1. **Hour-wise analysis of Load curve and comparison of average Load curve of All Licensees as well as the State as a whole in last 4 years**

The hourly Load Curve of each Distribution Licensee – annual and seasonal (quarterly) for last 4 years have been analysed for finding out how the consumption pattern of the Licensee has changed over the years and whether the peak hours and off-peak hours correspond to the ToD time-slots stipulated by MERC. The State Load Curve – annual and seasonal (quarterly) for last 4 years has also been analysed on the same lines. The hourly average consumption for each day of the year has been considered.

2. **Category-wise Load curve vs. Overall Load curve of Distribution Licensee in Last 4 Years**

Category-wise (for categories where ToD meters are installed) hourly Load curve for each year has been compared with Overall Load Curve of respective Licensee, to analyse how each category has contributed to overall load curve.

3. **Comparison between Seasonal Load Curve and Full year average Load Curve for 4 Years**

Comparison of seasonal Load curve with Full Year Average Load curve has been done to find out if seasonal peak is different from the Yearly peak and if different time slots according to the Season is justified for the Licensee.

4. **Study of the Power Purchase mix of the Distribution Licensees**

The existing and future power purchase mix of each Distribution Licensee has been analysed and mapped with their respective load curves.

5. Comparison of category-wise Load curve with projected Load curve, to identify ToD tariff Structure in different options

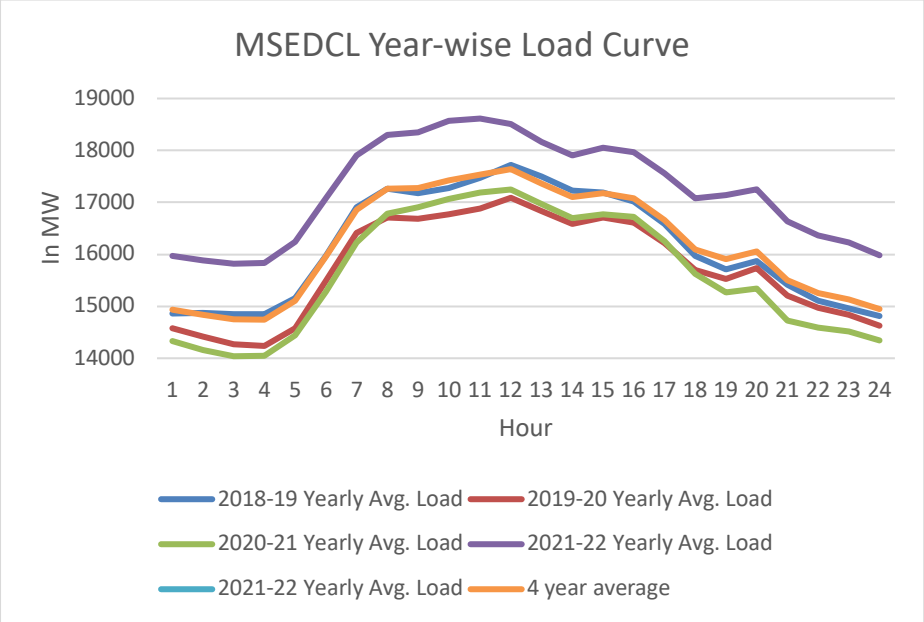
The individual category-wise average Load curve has been compared with projected Load curve of FY 2022-23 to show the difference between projected supply position with actual consumption characteristic of the individual category and degree of demand response needed to align Load with supply position. Wherever applicable, peak power purchase has been reduced from projected load curve so that optimised load curve of the Licensee can be identified.

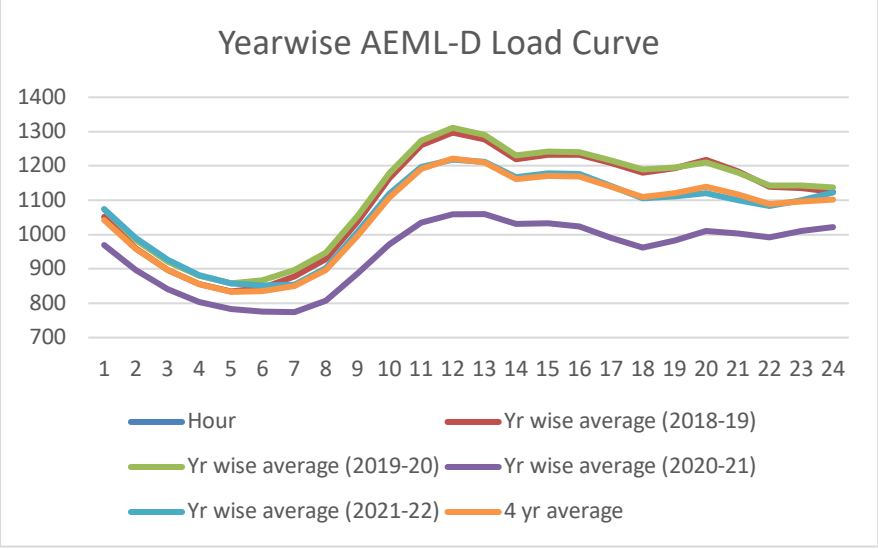
6. Study of the short-term Power Purchase rates in the Power Exchange

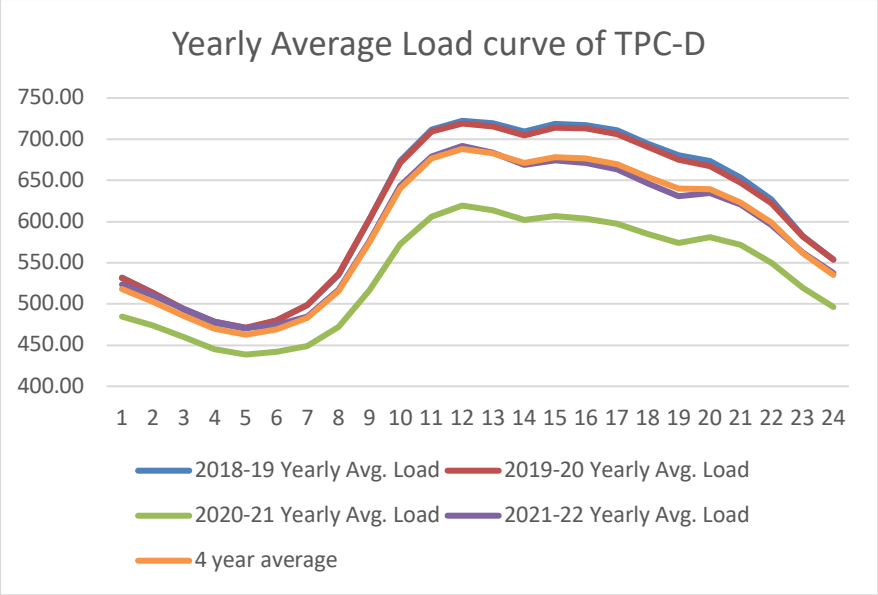
The short-term Power Purchase rates in the Power Exchange including hourly and seasonal variation have been studied, in order to provide an insight into the ToD time slots and the ToD rates that would be appropriate.

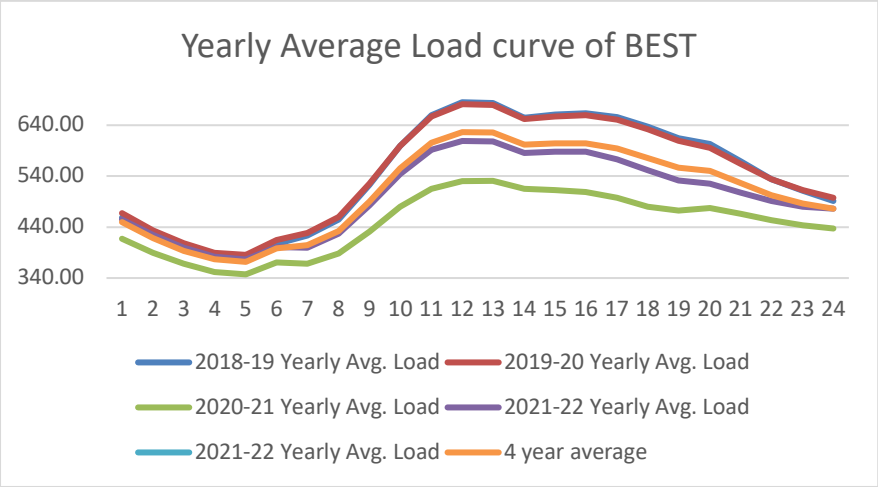
4 Hour-wise Analysis of Licensee Load Curve in last 4 Years

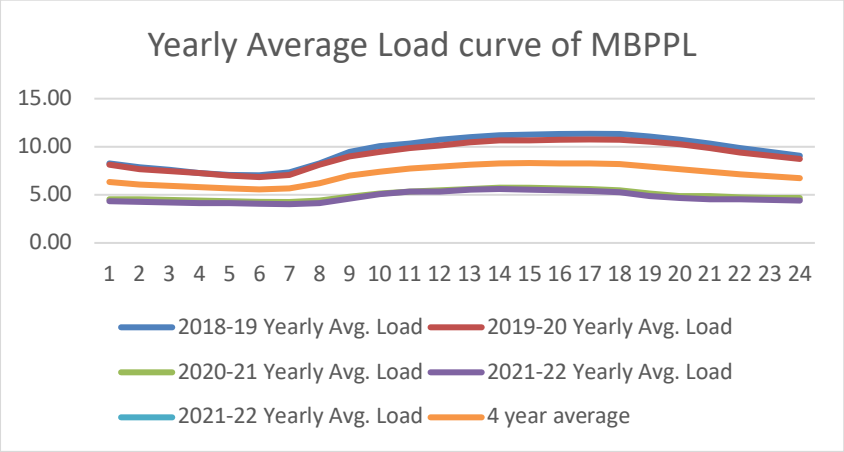
In this Chapter, the hour-wise load of each Distribution Licensee has been analysed for the last 4 years, viz., FY 2018-19, FY 2019-20, FY 2020-21, and FY 2021-22, as shown in the Graphs below:

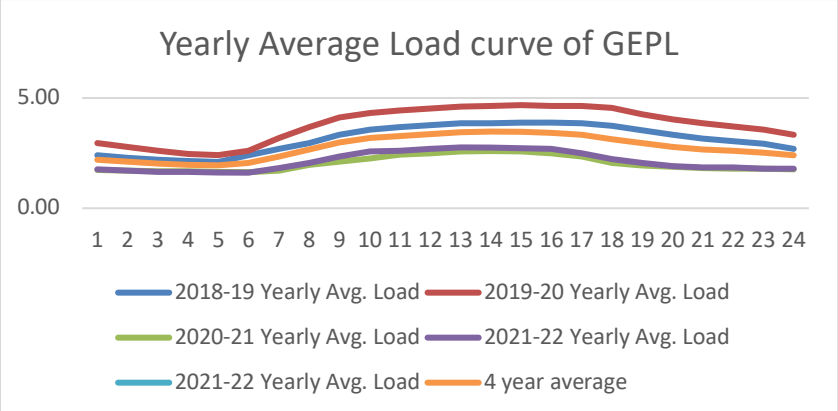


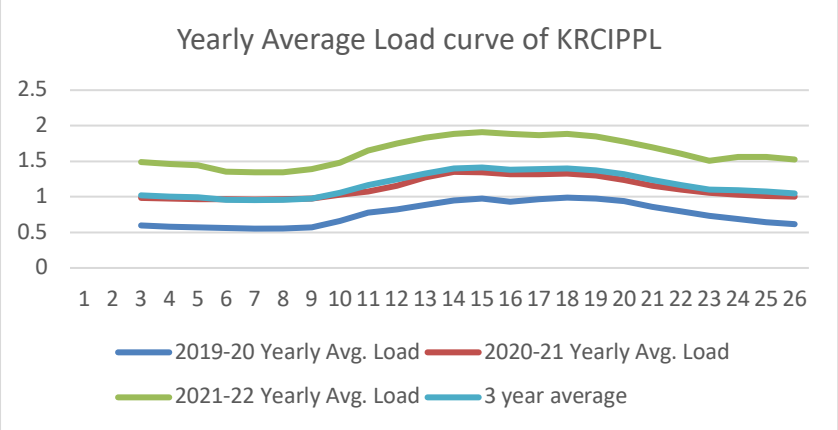


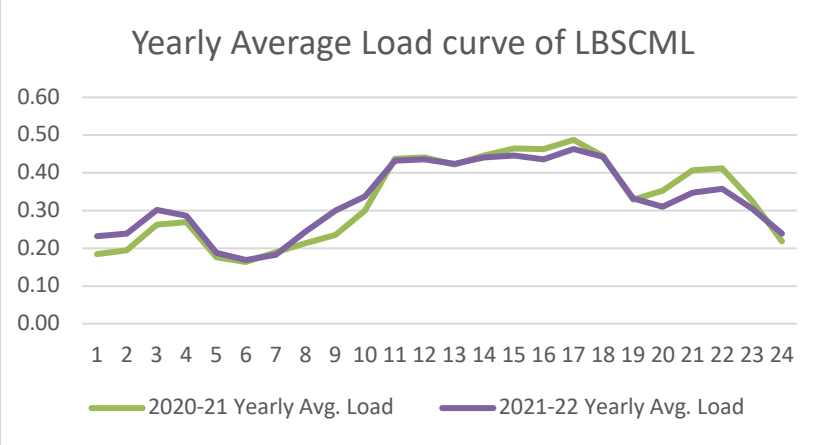

Yearly Average Load curve of TPC-D
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
2018-19 Yearly Avg. Load
2019-20 Yearly Avg. Load
2020-21 Yearly Avg. Load
2021-22 Yearly Avg. Load
4 year average

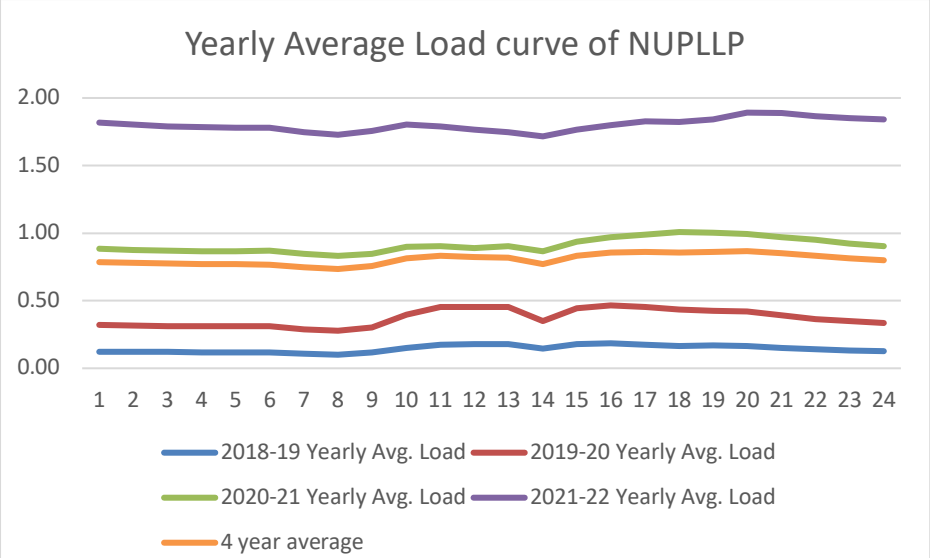

Yearly Average Load curve of BEST
640.00
540.00
440.00
340.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
2018-19 Yearly Avg. Load
2019-20 Yearly Avg. Load
2020-21 Yearly Avg. Load
2021-22 Yearly Avg. Load
2021-22 Yearly Avg. Load
4 year average

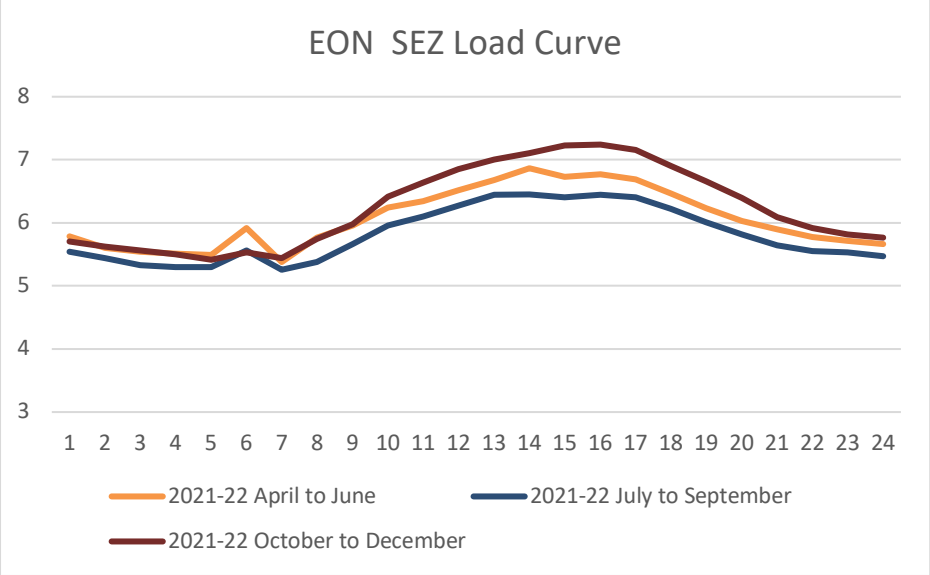

Yearly Average Load curve of MBPPL
15.00
10.00
5.00
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
2018-19 Yearly Avg. Load
2019-20 Yearly Avg. Load
2020-21 Yearly Avg. Load
2021-22 Yearly Avg. Load
2021-22 Yearly Avg. Load
4 year average

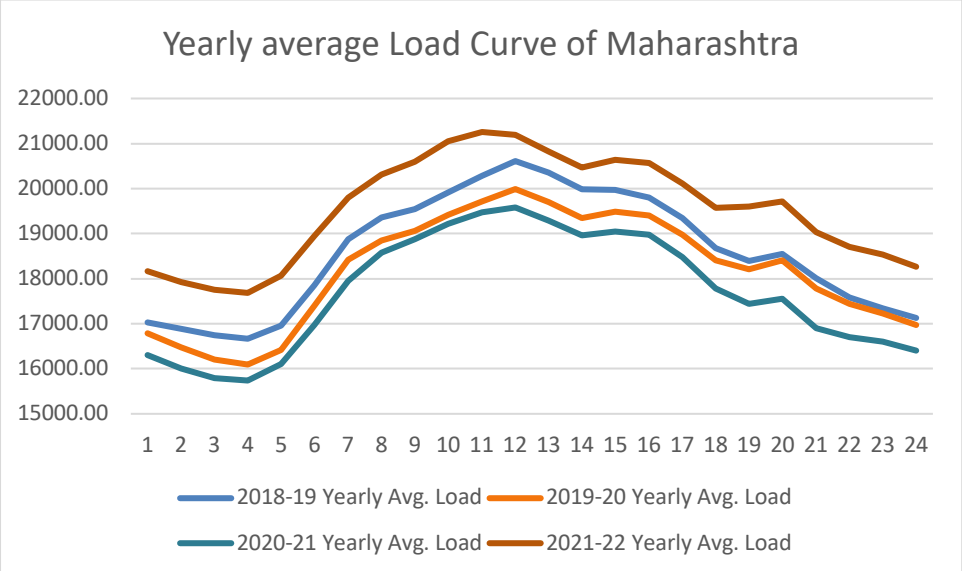

Yearly Average Load curve of GEPL
5.00
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
2018-19 Yearly Avg. Load
2019-20 Yearly Avg. Load
2020-21 Yearly Avg. Load
2021-22 Yearly Avg. Load
2021-22 Yearly Avg. Load
4 year average


Yearly Average Load curve of KRCIPPL
2.5
2
1.5
1
0.5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
2019-20 Yearly Avg. Load
2020-21 Yearly Avg. Load
2021-22 Yearly Avg. Load
3 year average


Yearly Average Load curve of LBSCML
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
2020-21 Yearly Avg. Load
2021-22 Yearly Avg. Load


Yearly Average Load curve of NUPLLP
2.00
1.50
1.00
0.50
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
2018-19 Yearly Avg. Load
2019-20 Yearly Avg. Load
2020-21 Yearly Avg. Load
2021-22 Yearly Avg. Load
4 year average


EON SEZ Load Curve
8
7
6
5
4
3
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
2021-22 April to June
2021-22 July to September
2021-22 October to December


Yearly average Load Curve of Maharashtra
22000.00
21000.00
20000.00
19000.00
18000.00
17000.00
16000.00
15000.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
2018-19 Yearly Avg. Load
2019-20 Yearly Avg. Load
2020-21 Yearly Avg. Load
2021-22 Yearly Avg. Load

Licensee	Peak Time Slot	Analysis
MSEDCL	7 am to 4 pm	The peak hours do not correspond to the peak ToD time slot. This is due to the impact of the time period during which agricultural supply is provided. There is justification for modification of the ToD timeslots and rates for MSEDCL, on a stand-alone basis.
AEML-D	10 am to 2 am	The peak hours and night off-peak hours do not correspond to the peak ToD and night off-peak time slots stipulated by MERC. There is justification for modification of the ToD timeslots and rates for AEML-D, on a stand-alone basis.
TPC-D	10 am to 5 pm	The peak hours do not correspond to the peak ToD time slots stipulated by MERC. There is justification for modification of the ToD timeslots and rates for TPC-D, on a stand-alone basis.
BEST	11 am to 1 pm	The peak hours do not correspond to the peak ToD time slots stipulated by MERC. There is justification for modification of the ToD timeslots and rates for BEST, on a stand-alone basis.
MBPPL	2 pm to 7 pm	Load curve is almost flat. ToD Tariff has been discontinued w.e.f. April 2020. No justification for re-introduction of ToD tariff on account of load curve
GEPL	10 am to 5 pm	Load curve is almost flat. ToD Tariff has been discontinued w.e.f. April 2020. No justification for re-introduction of ToD tariff on account of load curve
KRCIPPL	2 pm to 7 pm	Load curve is almost flat. ToD Tariff has been discontinued w.e.f. April 2020. No justification for re-introduction of ToD tariff on account of load curve
LBSCML	11 am to 18 pm	Licensee is new and MERC is yet to determine tariff for LBSCML. Load is less than 0.5 MW. No justification for introduction of ToD tariff on account of load curve
NUPLLP	No Peak Load	Load curve is almost flat. MERC is yet to determine tariff for NUPLLP. No justification for introduction of ToD tariff on account of load curve

Licensee	Peak Time Slot	Analysis
EON SEZ	2 pm to 5 pm	Licensee is new and MERC is yet to determine tariff for EON SEZ. The load curve is not flat, and peak hours are visible. There is justification for stipulation of ToD timeslots and rates for EON, on a stand-alone basis.
Combined whole Maharashtra	9 am to 2 pm	The peak hours do not correspond to the peak ToD time slots stipulated by MERC. There is justification for modification of the ToD timeslots and rates for the State as a whole.

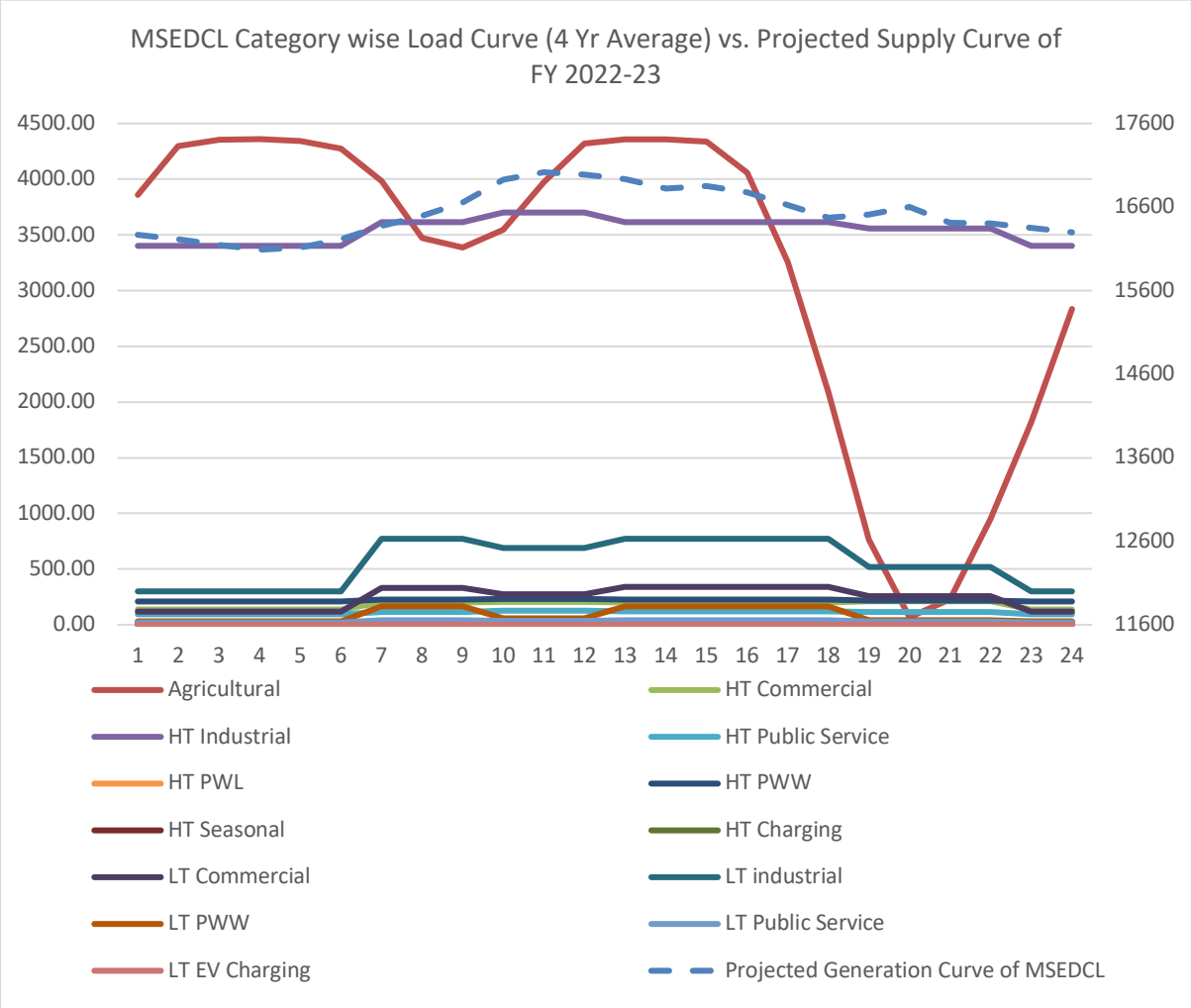
Depending on the strategy adopted, viz., State-wise ToD timeslots and ToD rates as at present, or Distribution Licensee-wise ToD timeslots and ToD rates, there is justification for modification of the ToD timeslots as well as ToD rates.

5 Category-wise load curve comparison with Supply curve

The Distribution Licensees have submitted category-wise load curves based on the existing ToD meters installed for identified categories. The categories like residential and agricultural category, though contributing significantly to the load curve, are not subjected to ToD tariff and do not have ToD meters installed, hence, their ToD consumption pattern has not been provided by the Distribution Licensees.

In this Section, we have compared the available category-wise load curves with the projected supply curve in FY 2022-23.

MSEDCL



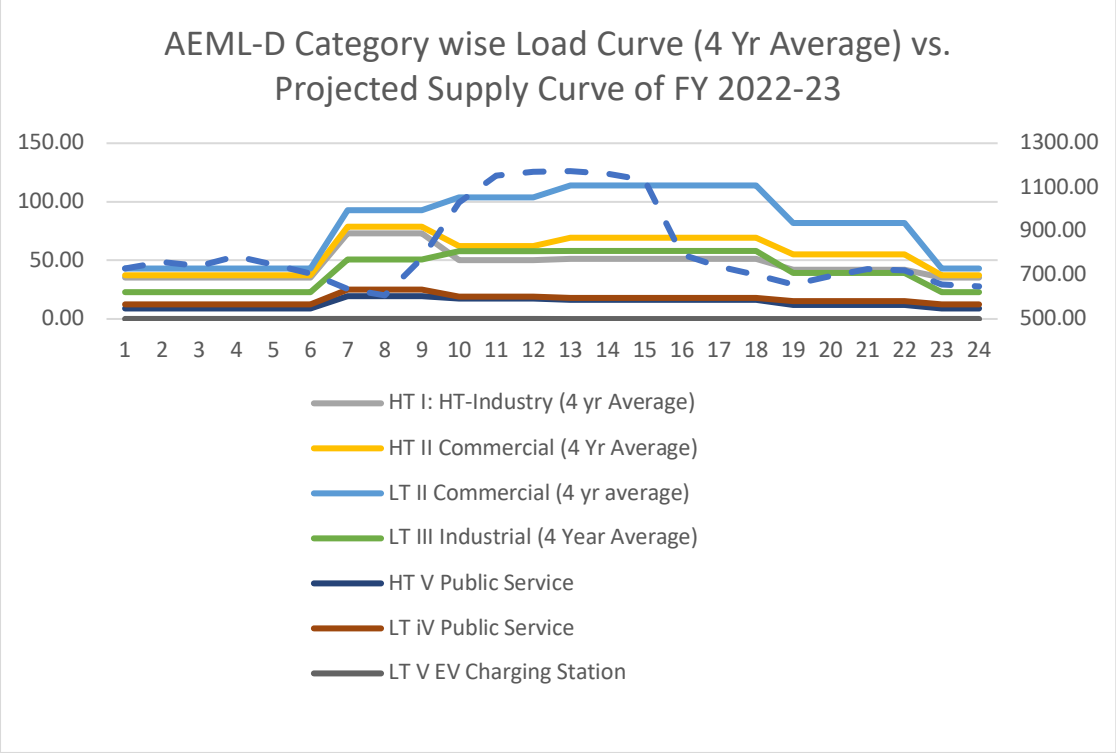
Observations (MSEDCL):

1. The percentage of residential consumption is 20%, for which ToD data is not available, though the same is reflected in the Licensee-wise load curve.
2. The load of all categories is lowest in the night off-peak hours from 23:00 hours to 06:00 hours;
3. Agricultural feeders are provided electricity primarily in 2 time slots of 8 or 10 hours, which translates to 16 to 18 hours daily to agricultural feeders.
4. Agricultural electricity consumption is highest in the early morning hours from 01:00 hours to 06:00 hours, after which there is a slight dip, and load reaches the peak levels between 12:00 to 15:00 hours. The agricultural load varies based on the supply to agricultural feeders based on applicable Circulars published by MSEDCL for particular time periods.
5. The HT Industrial load is the highest, followed by LT Industrial and LT Commercial category;
6. The HT Industrial load is almost flat throughout the day;
7. The LT Industrial load, LT Commercial load, and LT PWW load show a distinct pattern, reaching peak levels by 07:00 hours which remain steady till 18:00 hours, except for a dip between 10:00 to 12:00 hours;
8. The LT Industrial load, LT Commercial load, and LT PWW load reduce from 19:00 hours to 22:00 hours, before reaching base levels in the night off-peak hours;
9. The HT Commercial load reaches peak by 07:00 hours and remains steady till 22:00 hours;
10. MSEDCL has been largely able to utilise the surplus available during off-peak hours by supplying to agricultural feeders during these hours.
11. MSEDCL's projected supply curve in FY 2022-23 ranges between 16,000 to 17,000 MW;
12. The supply curve is increasing from 05:00 hours and is peaking at 11:00 hours, due to the contribution of solar power;
13. The supply is at the highest levels of 16,750 MW between 09:00 hours to 16:00 hours;
14. Considering the RPO targets specified by MERC, MSEDCL will have to procure higher quantum of power from Solar RE generating stations, which will increase the availability of power during the period from 09:00 hours to 16:00 hours, which will have to be absorbed by ensuring load shift to these hours;
15. At the same time, MSEDCL's supply curve starts reducing after 16:00 hours, which is also the time at which the market rates of power are the highest (as discussed in subsequent Chapter);

16. Also, as explained in subsequent Chapter, the market rates for power peak during the morning hours from 06:00 to 09:00;
17. In view of the above, the proposed ToD time slots for MSEDCL with proposal for incentive or disincentive are as under:

Sl.	Time-slot	Incentive/Disincentive
1	09:00 to 16:00 hours	Rebate
2	16:00 to 20:00 hours	Additional Charge
3	20:00 to 00:00 hours	Additional Charge
4	00:00 to 06:00 hours	Normal
5	06:00 to 09:00 hours	Additional Charge

AEML-D



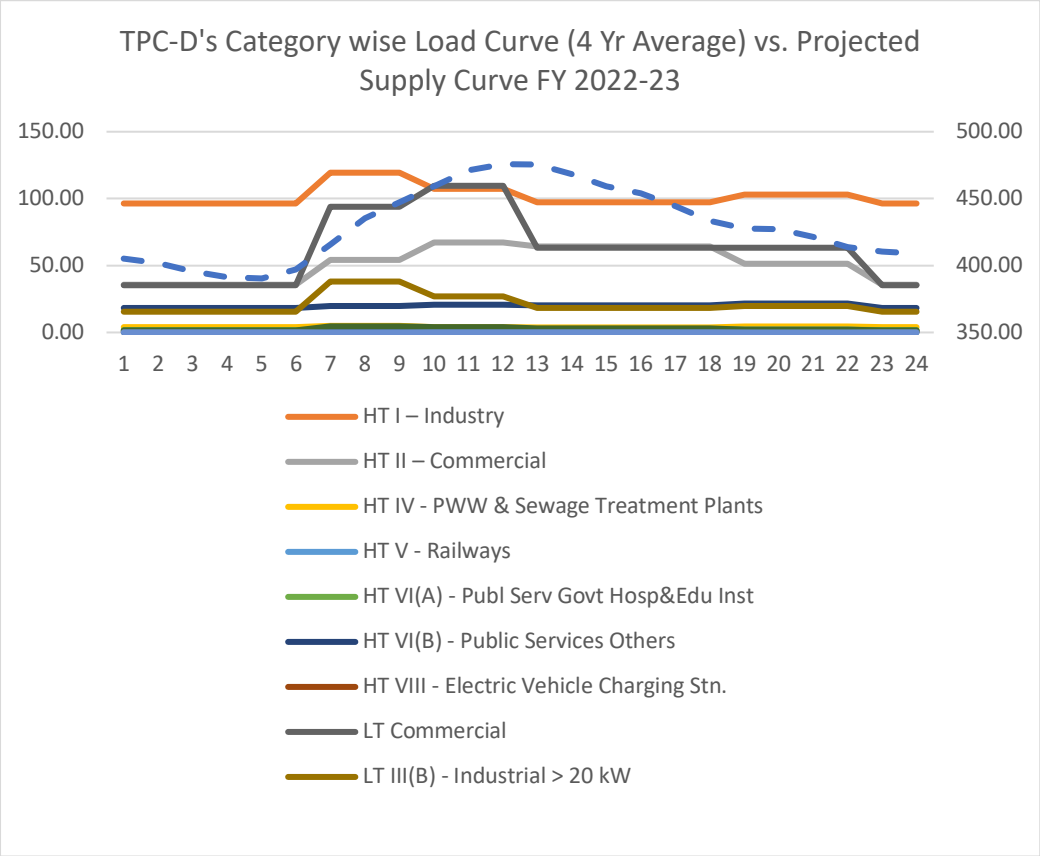
Observations (AEML-D):

1. The percentage of residential consumption is 52%, for which ToD data is not available, though the same is reflected in the Licensee-wise load curve.
2. The load of all categories is lowest in the night off-peak hours from 23:00 hours to 06:00 hours;

3. The LT-II Commercial load is the highest, followed by HT-II Commercial, LT-III Industrial and HT-I Industrial category;
4. The LT-II Commercial load and LT-III Industrial show a distinct pattern, reaching peak levels from 10:00 hours to 18:00 hours, reducing somewhat till 22:00 hours;
5. The HT-II Commercial and HT-I Industrial category show a different pattern, reaching peak levels from 07:00 hours to 09:00 hours, and reducing somewhat till 18:00 hours;
6. AEML-D's projected supply curve in FY 2022-23 has been considered after excluding short-term power from Power Exchanges, for appropriate analysis;
7. AEML-D's projected supply curve in FY 2022-23 is rising from 08:00 hours and peaking to 1175 MW between 11:00 hours to 15:00 hours, which coincides with the solar power generation tied-up by AEML-D;
8. During the remaining hours of the day, AEML-D's supply curve is range-bound between 600 MW to 800 MW;
9. The supply is at the highest levels in excess of 1000 MW between 10:00 hours to 15:00 hours;
10. Considering the RPO targets specified by MERC, AEML-D has tied up with Solar-Wind Hybrid power, which will increase the availability of power during the period from 09:00 hours to 16:00 hours, which will have to be absorbed by ensuring load shift to these hours;
11. At the same time, AEML-D's supply curve starts reducing after 15:00 hours, which is also the time at which the market rates of power are the highest (as discussed in subsequent Chapter);
12. Also, as explained in subsequent Chapter, the market rates for power peak during the morning hours from 06:00 to 09:00;
13. In view of the above, the proposed ToD time slots for AEML-D with proposal for incentive or disincentive are as under:

Sl.	**Time-slot**	**Incentive/Disincentive**
1	09:00 to 16:00 hours	Rebate
2	16:00 to 20:00 hours	Additional Charge
3	20:00 to 00:00 hours	Additional Charge
4	00:00 to 06:00 hours	Normal
5	06:00 to 09:00 hours	Additional Charge

TPC-D



Observations (TPC-D):

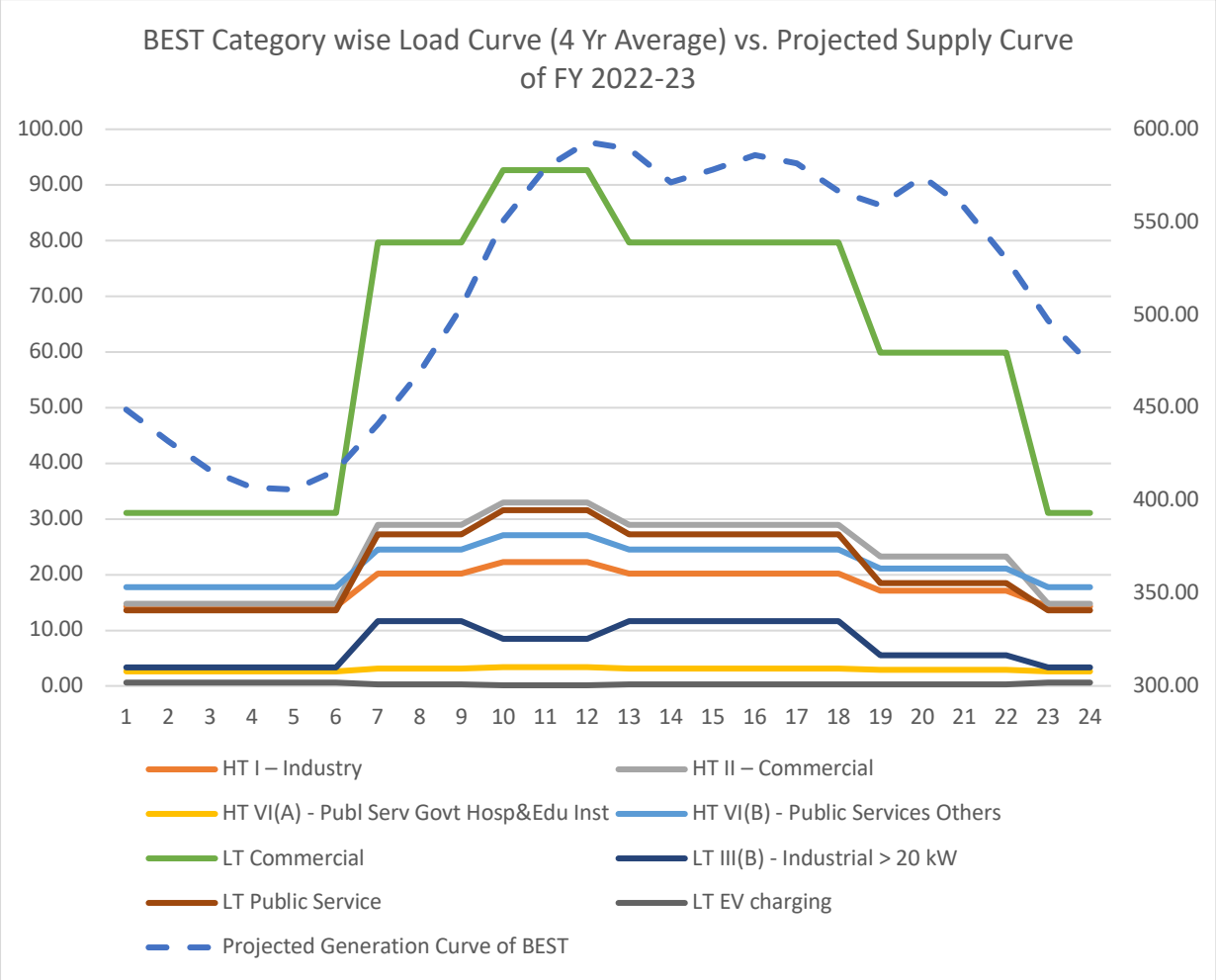
1. The percentage of residential consumption is 45%, for which ToD data is not available, though the same is reflected in the Licensee-wise load curve.
2. The load of all categories is lowest in the night off-peak hours from 23:00 hours to 06:00 hours;
3. The HT-I Industry load is the highest, followed by LT Commercial, HT-II Commercial, and LT-III (B) Industrial category;
4. The HT-I Industry category and HT LT III (B) Industrial categories are peaking from 07:00 to 09:00 hours, while LT Commercial and HT-II Commercial categories are peaking from 10:00 to 12:00 hours;
5. TPC-D's projected supply curve in FY 2022-23 is ranging between 400 MW to 475 MW, and rising from 05:00 hours and peaking to 475 MW at 12:00 hours, which is linked to the solar power generation tied-up by TPC-D;
6. During the remaining hours of the day, TPC-D's supply curve is falling steadily to reach levels of ~400 MW at 05:00 hours;
7. Considering the RPO targets specified by MERC, TPC-D has tied up with Solar power, which will increase the availability of power during the period from 09:00

hours to 16:00 hours, which will have to be absorbed by ensuring load shift to these hours;

8. The market rates of power are the highest during the period from 14:00 hours to 20:00 hours (as discussed in subsequent Chapter);
9. Also, as explained in subsequent Chapter, the market rates for power peak during the morning hours from 06:00 to 09:00;
10. In view of the above, the proposed ToD time slots for TPC-D with proposal for incentive or disincentive are as under:

Sl.	Time-slot	Incentive/Disincentive
1	09:00 to 16:00 hours	Rebate
2	16:00 to 20:00 hours	Additional Charge
3	20:00 to 00:00 hours	Additional Charge
4	00:00 to 06:00 hours	Normal
5	06:00 to 09:00 hours	Additional Charge

BEST

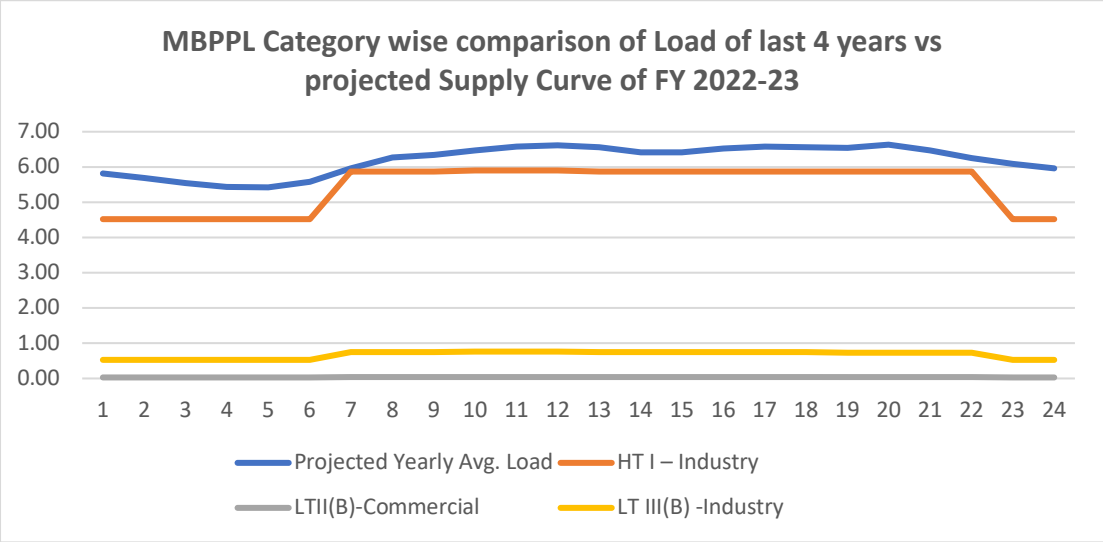


Observations (BEST):

1. The percentage of residential consumption is 45%, for which ToD data is not available, though the same is reflected in the Licensee-wise load curve.
2. The load of all categories is lowest in the night off-peak hours from 23:00 hours to 06:00 hours;
3. The LT Commercial load is the highest, followed by HT Commercial, LT Public Service, HT Public Service, HT Industry and LT Industry categories;
4. The load pattern of all categories is quite similar, with load increasing at 07:00 hours, peaking between 10:00 to 12:00 hours, with 50% load between 19:00 to 22:00 hours;
5. BEST's projected supply curve in FY 2022-23 is peaking at close to 600 MW between 11:00 hours to 21:00 hours;
6. During the remaining hours of the day, BEST's supply curve is falling steadily to reach levels of ~400 MW at 05:00 hours;
7. Considering the RPO targets specified by MERC, BEST has tied up with Solar power, which will increase the availability of power during the period from 09:00 hours to 16:00 hours, which will have to be absorbed by ensuring load shift to these hours;
8. The market rates of power are the highest during the period from 14:00 hours to 20:00 hours (as discussed in subsequent Chapter);
9. Also, as explained in subsequent Chapter, the market rates for power peak during the morning hours from 06:00 to 09:00;
10. In view of the above, the proposed ToD time slots for BEST with proposal for incentive or disincentive are as under:

Sl.	Time-slot	Incentive/Disincentive
1	09:00 to 16:00 hours	Rebate
2	16:00 to 20:00 hours	Additional Charge
3	20:00 to 00:00 hours	Additional Charge
4	00:00 to 06:00 hours	Normal
5	06:00 to 09:00 hours	Additional Charge

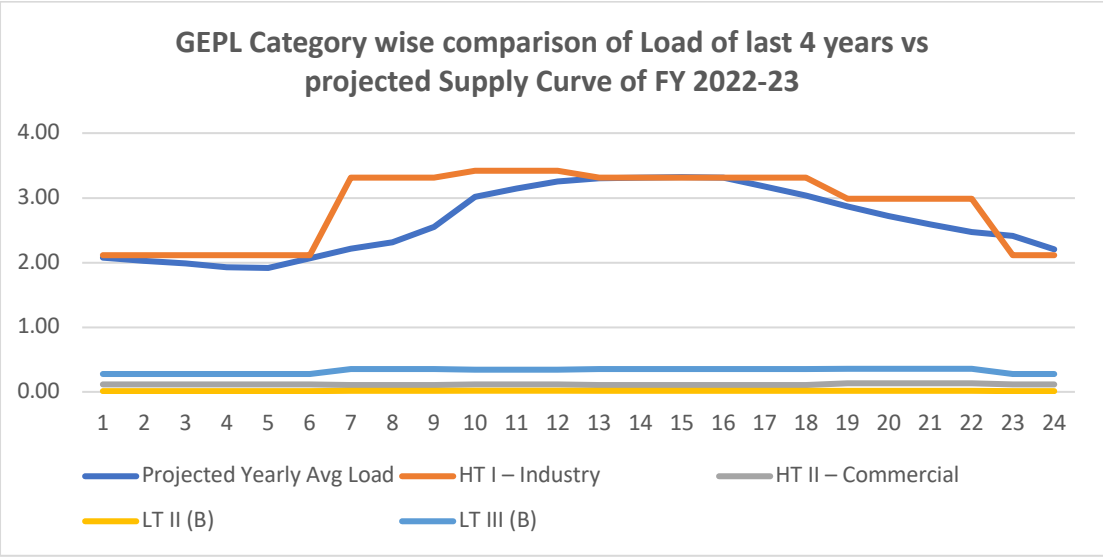
MBPPL



Observations (MBPPL):

1. MBPPL's projected supply curve in FY 2022-23 is similar to the projected load curve, which shows a clear increase from 07:00 hours to 22:00 hours;
2. The load curve of MBPPL is almost flat;
3. ToD Tariff has been discontinued w.e.f. April 2020;
4. There is no justification for re-introduction of ToD tariff on account of load curve.

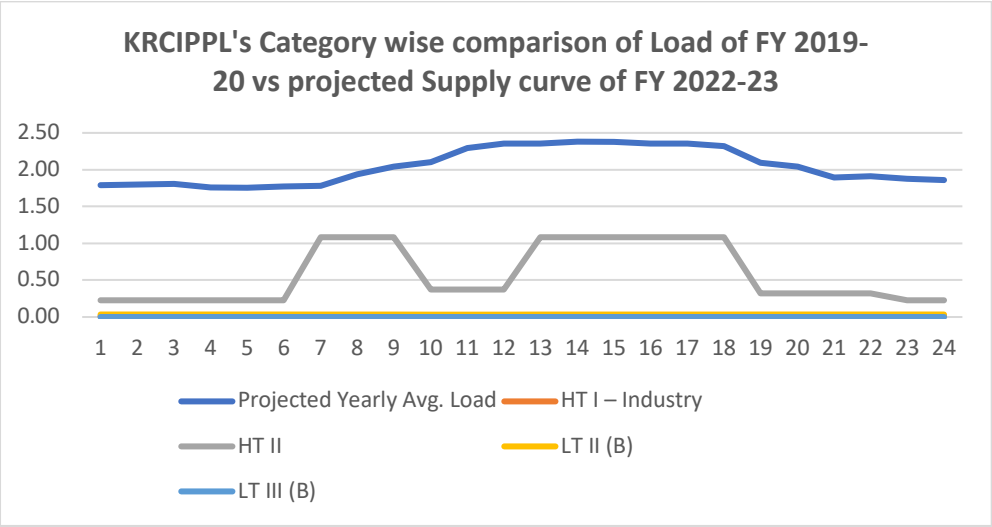
GEPL



Observations (GEPL):

1. GEPL's projected supply curve in FY 2022-23 is similar to the projected load curve, which shows a clear increase from 07:00 hours to 22:00 hours;
2. The load curve of GEPL is almost flat;
3. ToD Tariff has been discontinued w.e.f. April 2020;
4. There is no justification for re-introduction of ToD tariff on account of load curve.

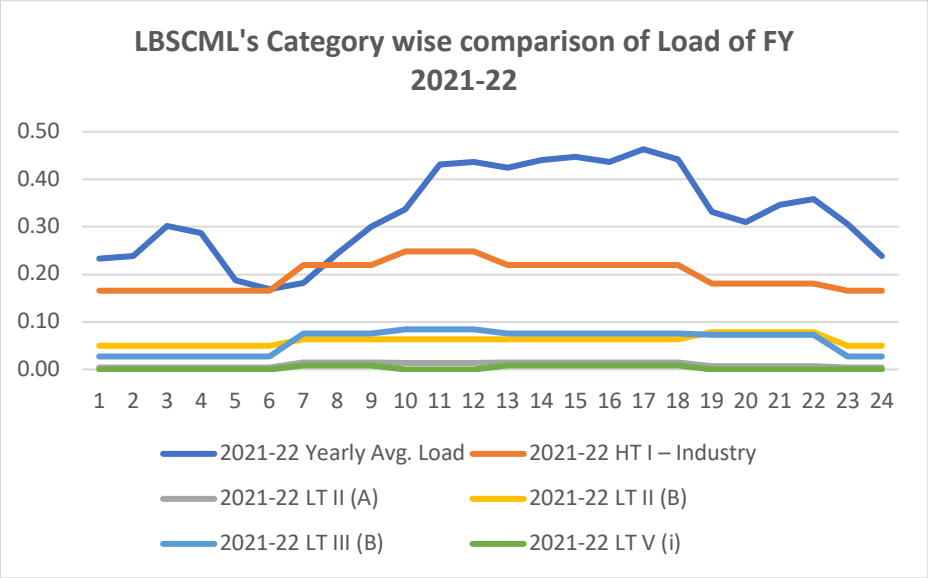
KRCIPPL



Observations (KRCIPPL):

1. KRCIPPL's projected supply curve in FY 2022-23 is similar to the projected load curve, which shows an increase from 07:00 hours to 09:00 hours, followed by a dip from 10:00 to 12:00 hours, and again increasing to same peak levels from 13:00 to 18:00 hours.
2. The load is minimal in the remaining hours;
3. ToD Tariff has been discontinued w.e.f. April 2020;
4. There is no justification for re-introduction of ToD tariff on account of load curve.

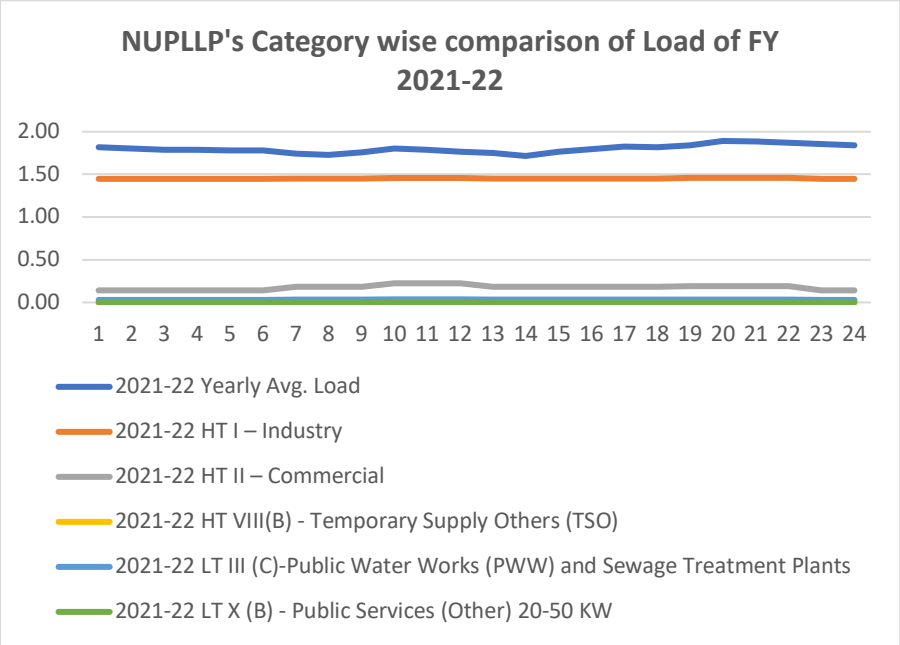
LBSCML



Observations (LBSCML):

1. LBSCML's projected supply curve in FY 2022-23 is peaking between 11:00 hours to 18:00 hours;
2. The load of all categories is lowest in the night off-peak hours from 23:00 hours to 06:00 hours;
3. The HT-I Industry load is the highest, followed by LT Industry and LT Commercial categories;
4. The load pattern of all categories is quite similar, with load increasing at 07:00 hours, peaking between 10:00 to 12:00 hours, and remaining at higher levels between 13:00 to 18:00 hours;
5. The Distribution Licensee is new, and MERC is yet to determine retail tariff for LBSCML.
6. The present load is less than 0.5 MW.
7. There is no justification for introduction of ToD tariff on account of load curve.

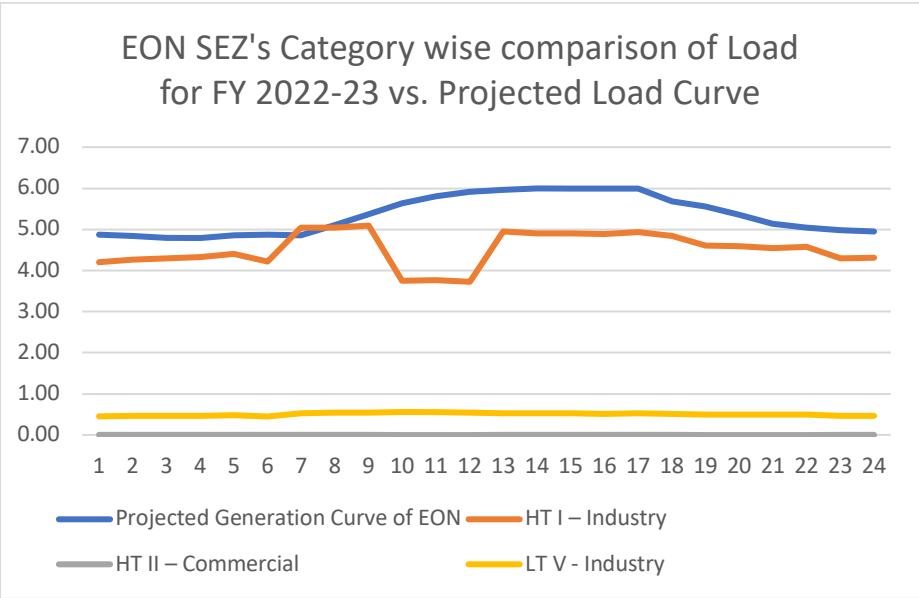
NUPLLP



Observations (NUPLLP):

1. NUPLLP's projected supply curve in FY 2022-23 is almost flat and matches the load curve of all the categories;
2. The HT-I Industry load is the highest, followed by HT-II Commercial category;
3. The load curve of NUPLLP is almost flat.
4. MERC is yet to determine retail tariff for NUPLLP.
5. There is no justification for introduction of ToD tariff on account of load curve.

EON



Observations (EON):

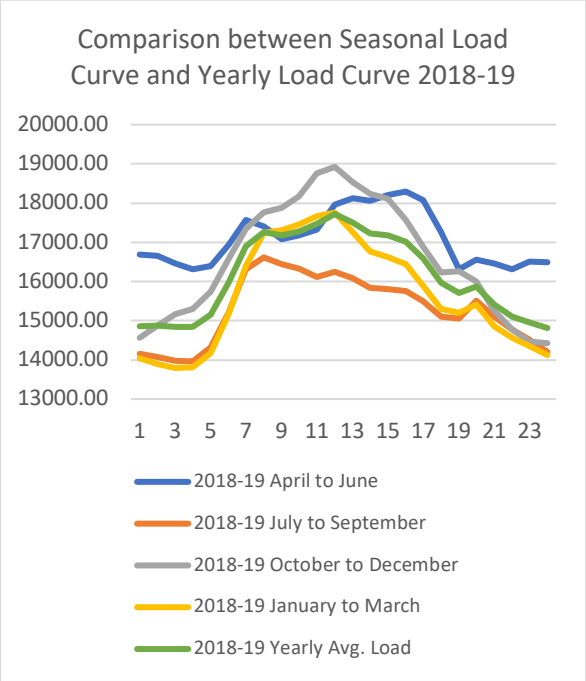
1. EON's projected supply curve in FY 2022-23 is peaking from 11:00 to 16:00 hours;
2. The HT-I Industry load is the highest, followed by LT-V Industry category;
3. HT-I Industry load curve is peaking from 07:00 hours to 09:00 hours and again from 13:00 hours to 17:00 hours;
4. HT-I Industry load curve is lowest from 10:00 to 12:00 hours;
5. The LT-V Industry load is a flat load curve;
6. In case ToD tariff is considered for EON, then the ToD time slots with proposal for incentive or disincentive are proposed same as for other Licensees, as under:

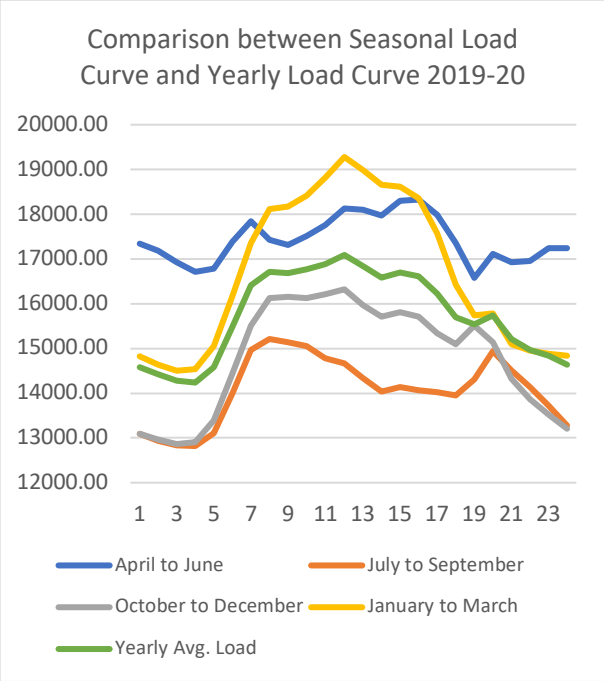
Sl.	**Time-slot**	**Incentive/Disincentive**
1	09:00 to 16:00 hours	Rebate
2	16:00 to 20:00 hours	Additional Charge
3	20:00 to 00:00 hours	Additional Charge
4	00:00 to 06:00 hours	Normal
5	06:00 to 09:00 hours	Additional Charge

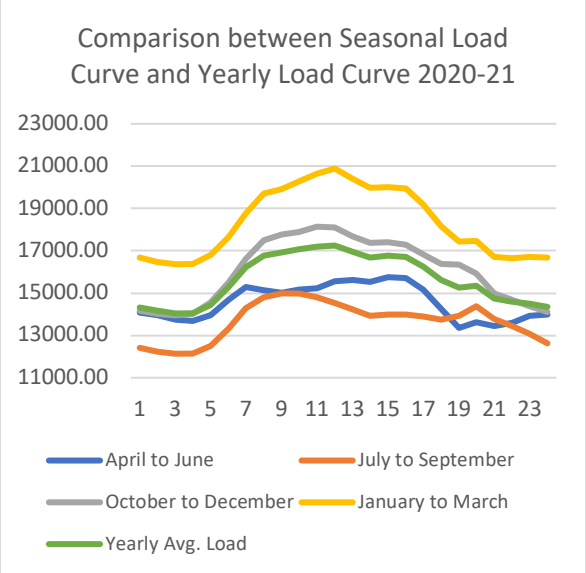
6 Comparison between Seasonal Load Curve and Yearly Load Curve

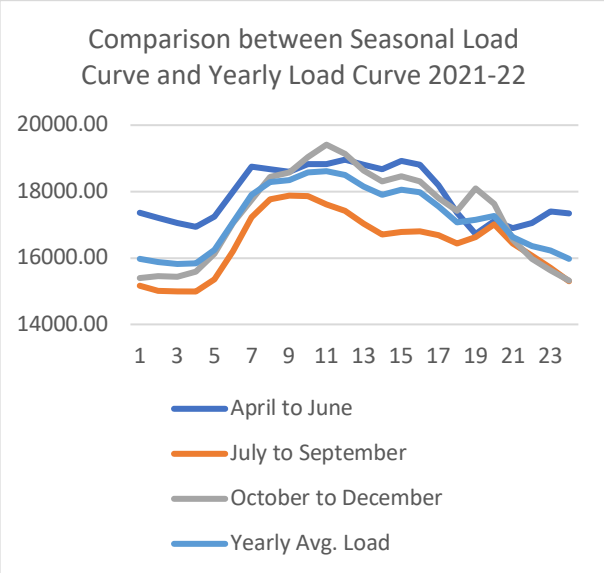
Seasonal Load Curves of each Distribution Licensee have been compared for the last 4 years to identify if Seasonal ToD tariff is required to be implemented.

MSEDCL







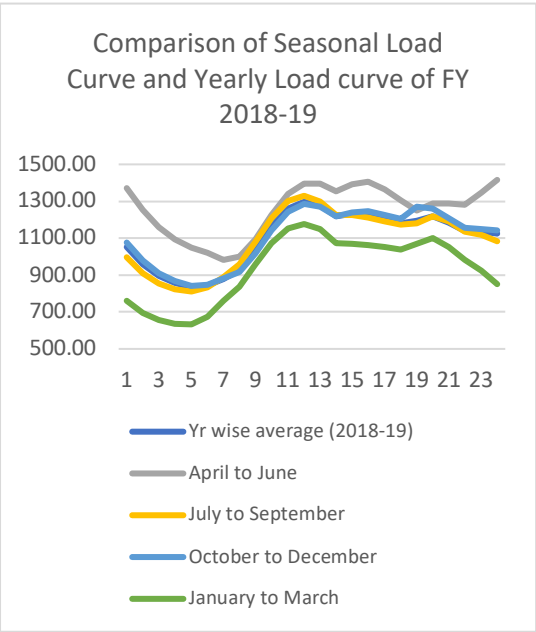


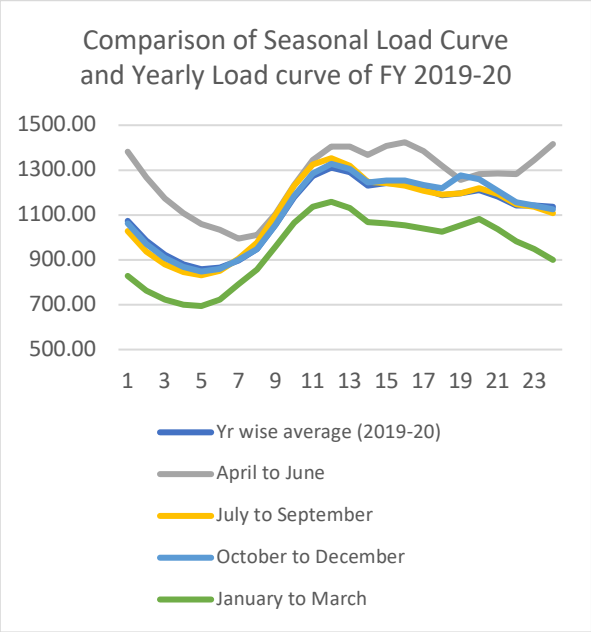
Observations (MSEDCL):

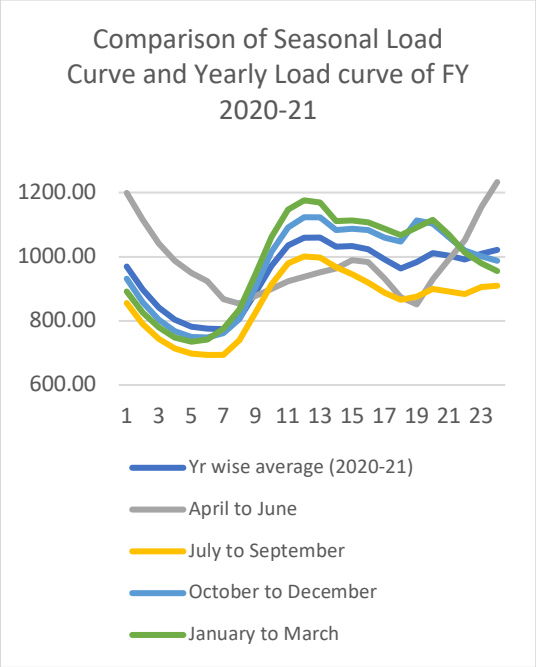
1. In FY 2018-19, the April to June curve shows different characteristics, as compared to the load curves of other 3 periods and the annual load curve;
2. In FY 2019-20, the January to March curve and July to September curve show slightly different characteristics, as compared to the load curves of other 3 periods and the annual load curve;
3. In the latest 2 years, viz., FY 2020-21 and FY 2021-22, the load curves for all 4 periods are quite similar, though the demand in January to March period is significantly higher than that in other periods; this could be on account of COVID-19 impact;
4. MSEDCL is supplying to Agricultural category based on its supply constraints. In all years, MSEDCL is supplying peak agricultural electricity between 00:00 to 06:00 hours and 11:00 to 15:00 hours. This differs upto 2 hours on month-on-month basis according to the Circulars issued by MSEDCL based on its power procurement planning and management of demand and supply;
5. The consumption during the night hours is not reducing significantly on account of supply to agricultural category during this period;
6. The night consumption is particularly high during the April to June period, which will also increase the power purchase cost due to the higher rate of power during this period;
7. MSEDCL is already accounting for night surplus due to peak wind power generation and day surplus due to peak solar power generation;

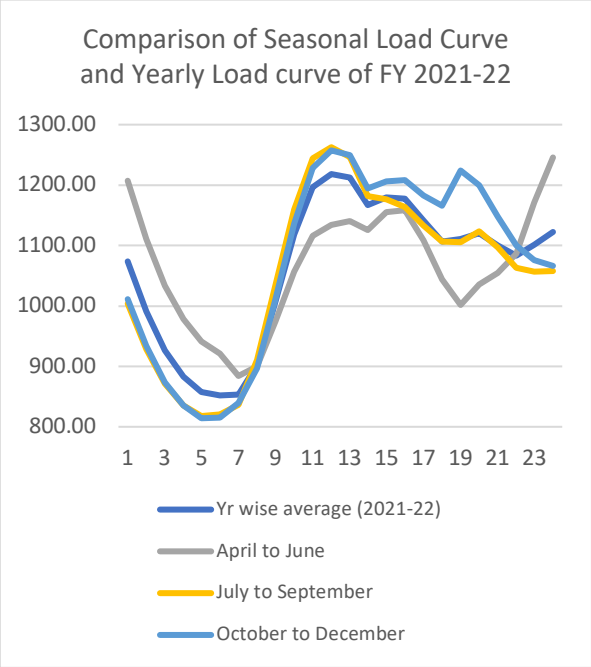
Based on the above demand-side analysis, seasonal ToD is recommended for MSEDCL as a whole for the April to June period.

AEML-D









Observations (AEML-D):

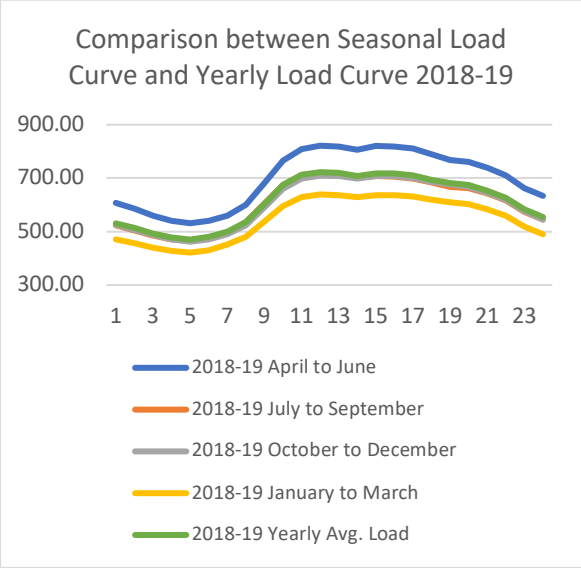
1. In all the 4 years, the April to June load curve is slightly different as compared to the other load curves and annual load curve;
2. In April to June, there is significantly more consumption in night hours (2100 to 0300), which is due to increased cooling load of LT Residential category consumers;
3. In FY 2018-19 and FY 2019-20, the April to June load curve is the highest;
4. In FY 2020-21 and FY 2021-22, all the load curves have shifted downwards and are

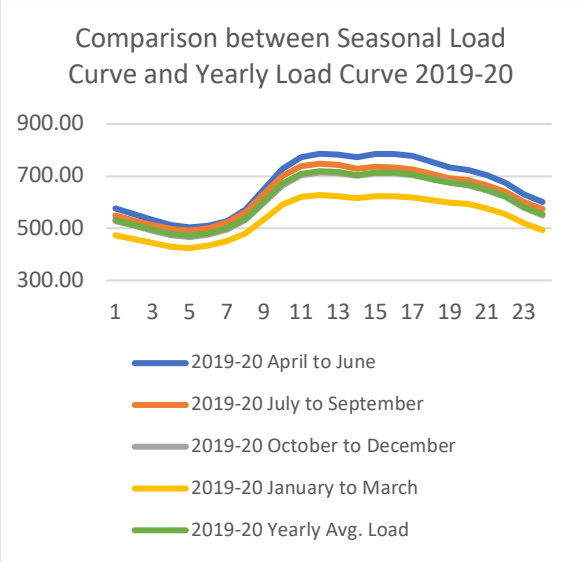
ranging around 1100 to 1200 MW, while they were in the 1200 to 1400 MW range in the previous years;

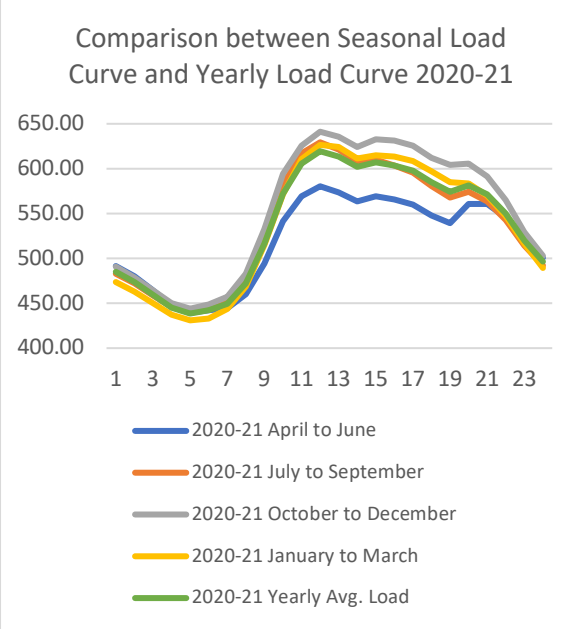
5. In FY 2020-21, the demand from January to March is higher than that in other periods; whereas, in FY 2021-22, the October to December load is the highest (Jan to March data was not submitted).

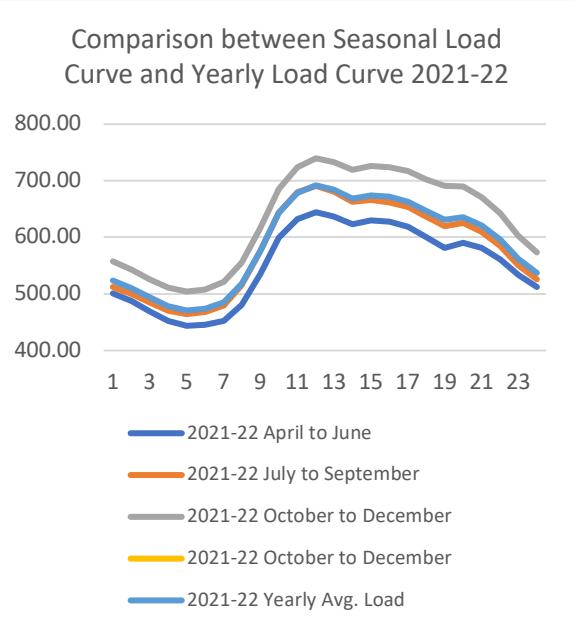
Based on the above demand-side analysis, seasonal ToD is recommended for AEML-D as a whole for the April to June period.

TPC-D







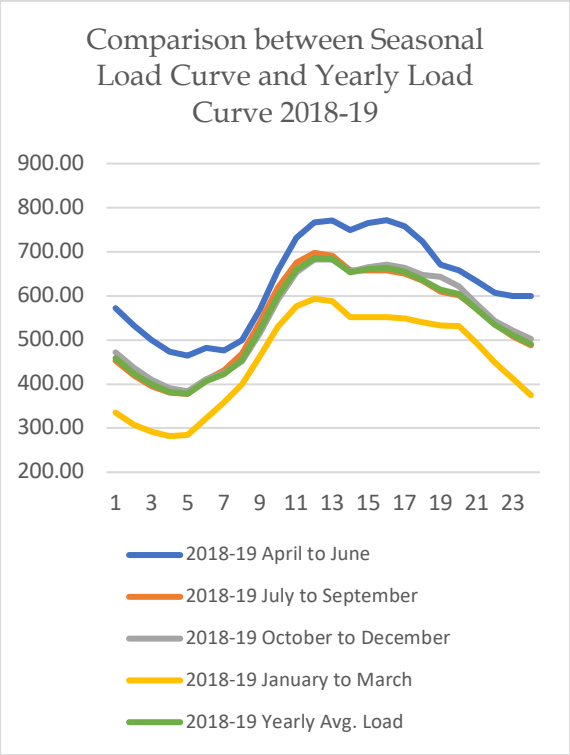


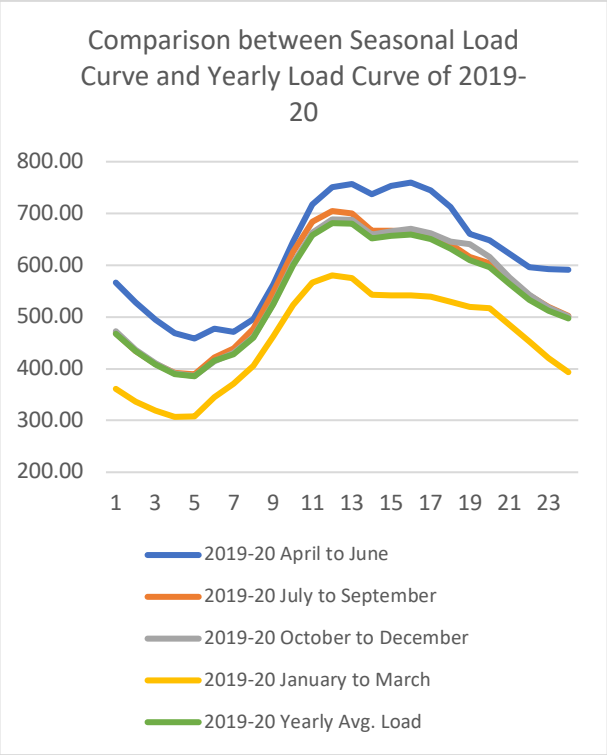
Observations (TPC-D):

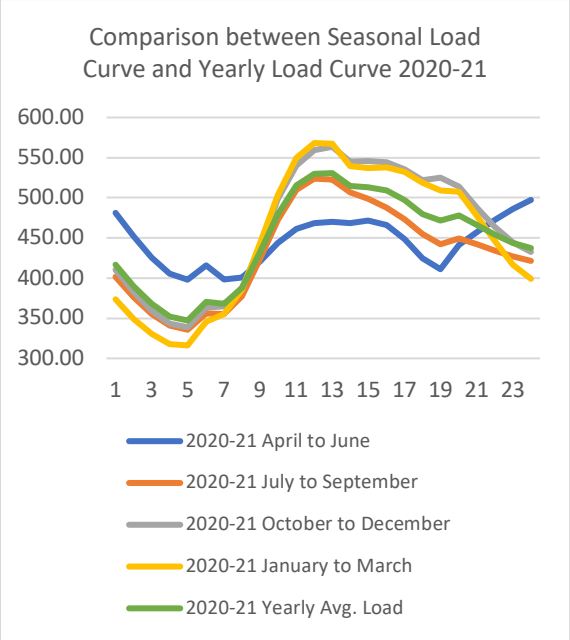
1. In all the 4 years, the load curve for all 4 periods is very similar;
2. In FY 2018-19 and FY 2019-20, the April to June load curve is the highest;
3. In FY 2020-21 and FY 2021-22, the October to December load curve is the highest;
4. In FY 2020-21 and FY 2021-22, all the load curves have shifted downwards and are ranging around 600 to 650 MW, while they were in the 700 to 800 MW range in the previous years;

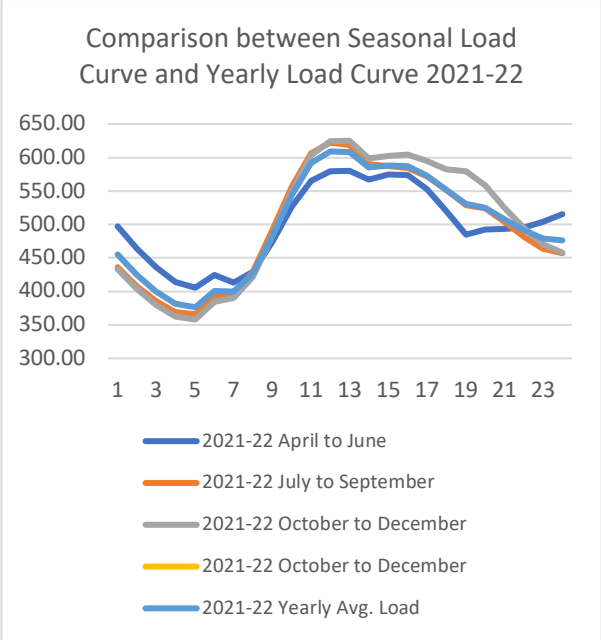
Based on the above demand-side analysis, no seasonal ToD is recommended for TPC-D for any category.

BEST









Observations (BEST):

1. In FY 2018-19, FY 2019-20, and FY 2021-22, the load curve for all 4 periods is very similar;
2. In FY 2020-21 and FY 2021-22, the April to June load curve shows a slightly different pattern and load has also reduced significantly, which can be attributed to COVID-19 impact;
3. In FY 2018-19 and FY 2019-20, the April to June load curve is the highest;
4. In FY 2020-21 and FY 2021-22, the October to December load curve is the highest;
5. In FY 2020-21 and FY 2021-22, all the load curves have shifted downwards and are ranging around 500 to 600 MW, while they were in the 600 to 750 MW range in the previous years;
6. In FY 2020-21 and FY 2021-22, there is significantly more consumption in night hours (2100 to 0300) in the April to June period, which is due to increased cooling load of LT Residential category consumers.

Based on the above demand-side analysis, seasonal ToD is recommended for BEST as a whole for the April to June period.

Other Small Licensees

All other Distribution Licensees in Maharashtra are small SEZ based Deemed Distribution Licensees. They have fixed consumer base and most have little if any variation in demand seasonally. So, there is no requirement of seasonal Tariff for Small Distribution Licensees in Maharashtra.

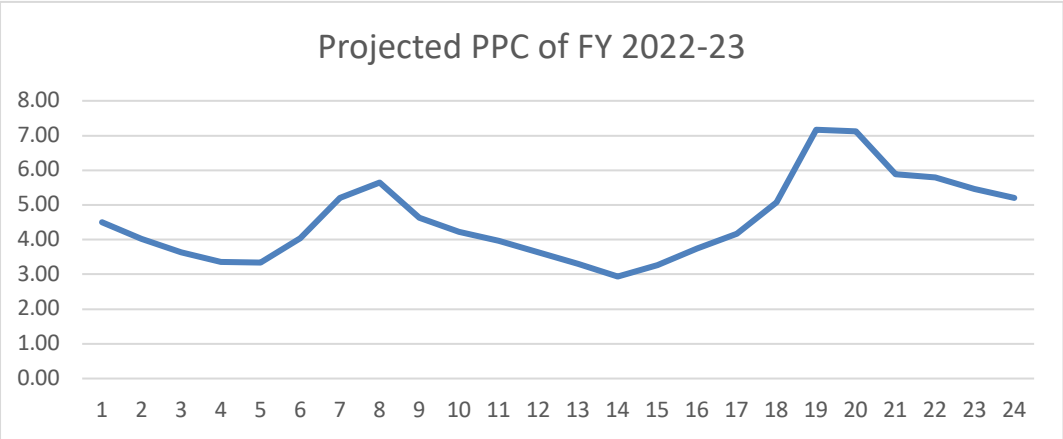
7 Price of Electricity in Power Exchanges

The average electricity price for the previous 4 years for every hour in the Day Ahead Market (DAM) of the Indian Energy Exchange (IEX), which is the most predominant Power Exchange from where Distribution Licensees procure their short-term power requirement, is analysed below:

(In Rs./kWh)

Hour	2018-19	2019-20	2020-21	2021-22	CAGR	Projected Rate for FY 2022-23
00:00 – 01:00	3.76	3.07	2.58	4.34	4.87%	4.55
01:00 – 02:00	3.32	2.78	2.44	3.87	5.18%	4.07
02:00 – 03:00	3.09	2.60	2.33	3.53	4.45%	3.68
03:00 – 04:00	2.88	2.47	2.24	3.25	4.10%	3.39
04:00 – 05:00	2.92	2.46	2.27	3.26	3.69%	3.38
05:00 – 06:00	3.17	2.63	2.44	3.85	6.73%	4.11
06:00 – 07:00	3.69	2.87	2.75	4.85	9.54%	5.32
07:00 – 08:00	3.99	2.95	3.00	5.27	9.71%	5.79
08:00 – 09:00	3.78	2.90	3.17	4.45	5.57%	4.70
09:00 – 10:00	3.83	2.96	3.30	4.14	2.63%	4.25
10:00 – 11:00	3.78	2.87	3.05	3.93	1.34%	3.98
11:00 – 12:00	3.69	2.83	2.87	3.65	-0.37%	3.65
12:00 – 13:00	3.52	2.75	2.75	3.35	-1.67%	3.35
13:00 – 14:00	3.30	2.63	2.52	3.01	-3.05%	3.01
14:00 – 15:00	3.57	2.77	2.58	3.32	-2.41%	3.32
15:00 – 16:00	3.95	2.94	2.73	3.79	-1.39%	3.79
16:00 – 17:00	4.08	3.00	2.95	4.15	0.57%	4.17
17:00 – 18:00	4.07	2.94	2.92	4.86	6.05%	5.15
18:00 – 19:00	4.71	3.27	3.23	6.59	11.84%	7.37
19:00 – 20:00	5.40	3.84	3.52	6.74	7.63%	7.25
20:00 – 21:00	5.11	3.89	3.19	5.72	3.81%	5.94
21:00 – 22:00	4.56	3.78	3.14	5.52	6.57%	5.88
22:00 – 23:00	4.44	3.61	2.92	5.24	5.70%	5.54
23:00 – 24:00	3.97	3.31	2.73	4.92	7.48%	5.29

There is no clear trend in the rates prevalent in the IEX over the past 4 years. However, due to various reasons, the rates have been higher in FY 2021-22 and FY 2022-23 as well, hence, rather than taking the average rate of last 4 years, the growth in rates have been considered, for projecting the power purchase rate for FY 2022-23, as shown in the Table above.

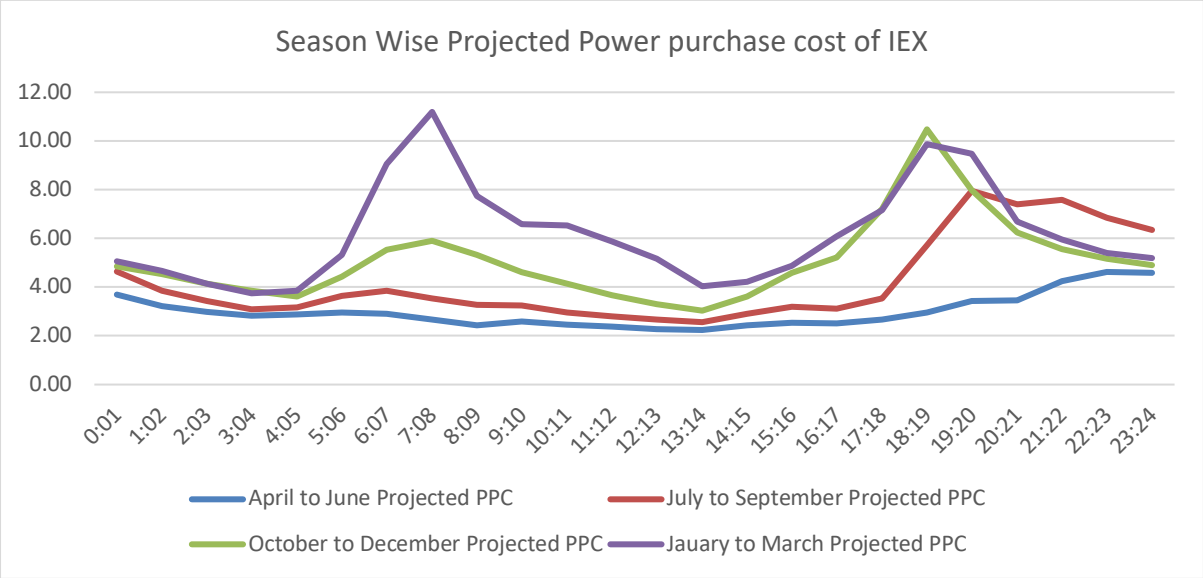


Similarly, the season-wise power purchase rate has been projected for FY 2022-23, as shown in the Table below, based on last 4-years power purchase rate in DAM of IEX.

(In Rs./kWh)

Hour	April to June Projected Rate	July to September Projected Rate	October to December Projected Rate	January to March Projected Rate
00:00 – 01:00	3.70	4.63	4.85	5.05
01:00 – 02:00	3.22	3.85	4.53	4.68
02:00 – 03:00	3.00	3.44	4.14	4.15
03:00 – 04:00	2.84	3.10	3.85	3.75
04:00 – 05:00	2.87	3.17	3.60	3.85
05:00 – 06:00	2.96	3.64	4.43	5.32
06:00 – 07:00	2.90	3.86	5.53	9.05
07:00 – 08:00	2.67	3.55	5.89	11.20
08:00 – 09:00	2.43	3.29	5.32	7.75
09:00 – 10:00	2.58	3.26	4.61	6.59
10:00 – 11:00	2.45	2.96	4.15	6.53
11:00 – 12:00	2.38	2.80	3.68	5.88
12:00 – 13:00	2.28	2.68	3.31	5.15
13:00 – 14:00	2.24	2.56	3.03	4.02

Hour	April to June Projected Rate	July to September Projected Rate	October to December Projected Rate	January to March Projected Rate
14:00 – 15:00	2.43	2.91	3.61	4.22
15:00 – 16:00	2.54	3.20	4.59	4.88
16:00 – 17:00	2.52	3.12	5.23	6.09
17:00 – 18:00	2.66	3.54	7.23	7.17
18:00 – 19:00	2.95	5.73	10.48	9.86
19:00 – 20:00	3.44	7.95	7.97	9.48
20:00 – 21:00	3.45	7.40	6.25	6.69
21:00 – 22:00	4.24	7.59	5.55	5.96
22:00 – 23:00	4.62	6.86	5.17	5.40
23:00 – 24:00	4.58	6.35	4.89	5.19



From the above, it is observed that the power purchase rate is peaking between 07:00 to 09:00 hours in the morning and 17:00 to 20:00 hours in the evening. Also, morning peak in rates is more significant in January to March period and to a lesser extent in October to December period. In the evening peak, the rates are high for all periods, except the April to June period. Thus, **there is a need to disincentivise consumption during morning peak and evening peak in these two seasons, viz., January to March and October to December.**

In the April to June period, the rates are higher during night hours as compared to the day hours, however, the overall rates during the April to June period are lower than

that in other periods, hence, it is not proposed to have any seasonal ToD tariff for the April to June period.

Hence, seasonal ToD tariff may be considered as an option, wherein, the ToD rates could be higher for the morning peak and evening peak for the January to March period and October to December period. For the April to June period, depending on the market rates and each Distribution Licensee's power purchase agreements/arrangements, each Distribution Licensee may propose seasonal ToD tariff along with its Mid-term Review/Multi-Year Tariff Petition, along with necessary data and justification.

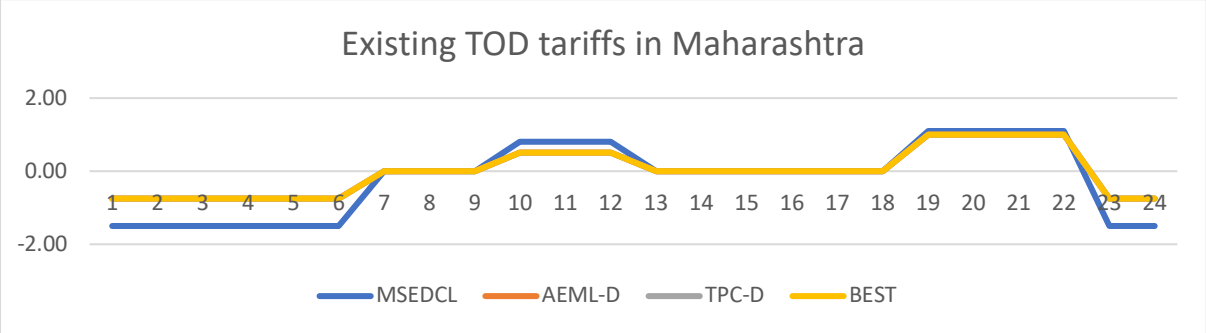
8 Comparison of ToD tariff in different States of India

Maharashtra:

ToD Tariff is applicable to HT and LT Industrial, HT and LT commercial, HT and LT Public Water works and Sewage Treatment Plants, HT and Public Services (Both Govt and Others), HT and LT Electric Vehicle charging station consumers. Till now, LT Domestic, HT Group housing, HT and LT Agricultural are still not under the ToD Tariff regime. The ToD Tariff Structure is as follows:

Time Slot	06:00 to 09:00 Hrs	09:00 to 12:00 Hrs	12:00 to 18:00 Hrs	18:00 to 22:00 Hrs	22:00 to 06:00 Hrs
MSEDCL	0.00	0.80	0.00	1.10	-1.50
AEML-D	0.00	0.50	0.00	1.00	-0.75
TPC-D	0.00	0.50	0.00	1.00	-0.75
BEST	0.00	0.50	0.00	1.00	-0.75
Small SEZs	N/A*				

* Small SEZ's have been exempted from ToD Tariff structure by the Commission through their respective Tariff Orders in 2020 as their Load curve would remain static despite implementation of ToD, and most SEZs have contracted power as per their load curve.



Chhattisgarh: ToD Tariff is applicable to Mines, Industrial including steel industries and Commercial HT consumers in Chhattisgarh, as shown below:

Period of Use	Normal rate of Demand Charge Plus
Normal period (5:00 a.m. to 6:00 p.m.)	Normal rate of Energy Charges
Evening peak load period (6:00 p.m. to 11:00 p.m.)	120% of normal rate of Energy Charge

Period of Use	Normal rate of Demand Charge Plus
Off-peak load period (11:00 p.m. to 5:00 am of next day)	65% of normal rate of Energy Charge

Madhya Pradesh:

In MP, Seasonal ToD tariff is applicable to HT consumers of Industry, Commercial, Mines, etc., as shown below:

Peak / Off-peak Period	Surcharge / Rebate on energy charges on energy consumed during the corresponding period
Months: April to October	
Normal hours (Hours excluding off peak hours)	Normal rate of Energy Charge
Off peak load period (10 p.m. to 6 a.m. next day)	10% of Normal rate of Energy Charge as Rebate
Months: November to March	
Normal hours (i.e., Hours excluding off peak hours)	Normal rate of Energy Charge
Off peak load period (10 p.m. to 6 a.m. next day)	20% of Normal rate of Energy Charge as Rebate

Goa:

In Goa, all HT/EHT Consumers as well as LT Industry consumers are subject to ToD Tariff, as shown below:

Time of use	Energy Charges
Normal period (7:00 a.m. to 6:00 p.m.)	Normal rate of energy charges
Evening peak load period (6:00 p.m. to 11.00 p.m.)	120% of normal rate of energy charges
Off-peak load period (11:00 p.m. to 7:00 a.m.)	90% of normal rate of energy charges

West Bengal:

In West Bengal, Commercial Rural and Commercial Urban, Irrigation Pumping, Public utility, Bulk supply and Industry are under the purview of Time of Day tariff

as well as seasonal Tariff. The applicable ToD tariff for some categories is presented below, for illustration:

LT Consumer categories

1. **LT Commercial:**
   a. **Optional Tariff 1 (Normal ToD)–** No Telescopic Tariff; 3 ToD tariff slots applicable as below for energy charge.

Time Slot	Energy charge (Paise/kWh)
06.00 hrs to 17.00 hrs	453
17.00 hrs to 23.00 hrs.	498
23.00 hrs to 06.00 hrs.	421

   b. **Optional Tariff 2 (Prepaid ToD)** – No Telescopic Tariff. Would have to opt for Prepaid Meter. Energy charge are marginally less than Normal ToD.

Time Slot	Energy charge (Paise/kWh)
06.00 hrs to 17.00 hrs	448
17.00 hrs to 23.00 hrs.	493
23.00 hrs to 06.00 hrs.	417

2. **LT Industry**
   a. **Default scheme -** Energy charge of all Units below 500 units 476 paise/kWh, above 500 Units 487 Paise/kWh
   b. **Optional Tariff 1 (Prepaid ToD) –**

Time Slot	Energy charge (Paise/kWh)
06.00 hrs to 17.00 hrs	480
17.00 hrs to 23.00 hrs.	634
23.00 hrs to 06.00 hrs.	360

HT Consumer categories

All HT consumers are charged Seasonal Tariff

1. **HT public Utility:**
   a. **Default Scheme**

Season	Energy charge (Paise/kWh)
Summer	405
Monsoon	403
Winter	401

   b. **Optional Tariff (Normal ToD) –**

Time Slot	Season	Summer	Monsoon	Winter
06.00 hrs17.00 hrs & 20.00 hrs23.00 hrs	ALL Units	403	401	399
17.00 hrs20.00 hrs	ALL Units	443	441	439
23.00 hrs06.00 hrs	ALL Units	375	373	371

2. **HT Industries- For 11 kV Consumer only**
   a. **Non-ToD Scheme –**

Season	Energy charge (Paise/kWh)
Summer	437
Monsoon	435
Winter	433

   b. **Normal ToD for all other consumer:**

Time Slot	Season	Summer	Monsoon	Winter
06.00 hrs17.00 hrs & 20.00 hrs23.00 hrs	ALL Units	428	426	424
17.00 hrs20.00 hrs	ALL Units	503	501	498
23.00 hrs06.00 hrs	ALL Units	364	362	360

3. **EHT Industries (33 KV and 132 KV consumers**
   a. **Normal ToD for all other consumer:**

Time Slot	Season	Summer	Monsoon	Winter
06.00 hrs17.00 hrs	ALL Units	422	420	418
17.00 hrs23.00 hrs	ALL Units	496	494	491
23.00 hrs06.00 hrs	ALL Units	359	357	355

4. **HT Commercial**
   a. **Non- ToD scheme –**

Season	Energy charge (Paise/kWh)
Summer	442
Monsoon	437
Winter	432

   b. **Normal – ToD –**

Time Slot	Season	Summer	Monsoon	Winter
06.00 hrs17.00 hrs	ALL Units	437	432	427
17.00 hrs23.00 hrs	ALL Units	577	570	564
23.00 hrs06.00 hrs	ALL Units	315	311	307

Gujarat:

In Gujarat, ToD Tariff is applicable to HTP 1 and 2 Categories, which are consumers having Contract Demand of more than 100 kVA, water works, and HTP-III category, as shown below:

Consumer Category		Time Interval	Rs./kWh
HT (HTP-I & HTP-II)	Demand <= 500 kVA	0700 -1100 hrs and 1800 to 2200 hrs	(+0.45)
	Demand > 500 kVA		(+0.85)
All Water Works	Connected load >=50 HP	1100 Hrs to 1800 Hrs	(+0.4)
		2200 Hrs to 0600 Hrs next day	(+0.85)
HTP-III		0700 -1100 hrs and 1800 to 2200 hrs	(+0.85)

Andhra Pradesh:

Consumer Category		Time Interval	Rs./kVAh
HT III(A)	Industry (General)	Peak (6 AM to 10 AM & 6 PM to 10 PM).	+1.00
		TOD- Off Peak (10 PM to 6 AM)	-1.00
HT II (A) (ii)	HT Commercial	6 P.M. - 10 P.M.	+1.00

Odisha:

Consumer Category	Time Interval	Rs./kWh
Three phase consumers with static meters excluding Public Lighting, emergency supply to CGP, LT Domestic and LT General Purpose categories	10 PM in the evening to 6 AM of the next day.	20 paise/unit for energy consumed during off peak hours

Karnataka:

Consumer Category	Time Interval	Rs./unit
LT (5) (a)(b), LT 6 (c), HT 1, HT 2(a) {except railway traction installation}, HT 2(b), HT 2(c)	6 A.M to 10 A.M	0.00
	10 A.M to 6 P.M	0.00
	6. P.M to 10 P.M	From July to Nov. (monsoon period)-0.00 From Dec. to Jun. +1.00
	10 P.M to 6 A.M	From July to Nov. (monsoon period)-0.00 From Dec. to Jun.(-1.00)

Uttarakhand:

Consumer Category	Time Interval	Rs./kVAh
LT Industry	Normal Hours (0900-1800 Hrs in Summer) (0700-1800 Hrs in Winter)	Rs. 4.25/kVAh
	Peak Hours (0600-0900 Hrs and 1800-2200 in Summer) (1800-2300 in Winter)	Rs. 6.38/kVAh

Consumer Category	Time Interval	Rs./kVAh	
	Off Peak Hours (2200-0600 Hrs in summer) (2300-0700 Hrs in Winter)	Rs. 3.61/kVAh	
HT Industry	Normal Hours (0900-1800 Hrs in Summer) (0700-1800 Hrs in Winter)	Upto 40% LF	Over 40% LF
		Rs. 4.20/kVAh	Rs. 4.60/kVAh
	Peak Hours (0600-0900 Hrs and 1800-2200 in Summer) (1800-2300 in Winter)	Rs. 6.90/kVAh	Rs. 6.90/kVAh
	Off Peak Hours (2200-0600 Hrs in summer) (2300-0700 Hrs in Winter)	Rs. 3.57/kVAh	Rs. 3.91/kVAh

Comparison of ToD Tariff in different States

State	ToD Tariff method adopted	Seasonal Pricing	Applicable to
Maharashtra	Static ToD tariff according to Time Slot	No	HT and LT Industrial, HT and LT commercial, HT and LT Public Water works and Sewage Treatment Plants, HT and Public Services (Both Govt and Others), HT and LT Electric Vehicle charging stations
Chhattisgarh	Static ToD tariff according to Time Slot	No	HT/EHT Industrial and Commercial Consumers, Mines, etc. No LT Consumer under ToD
Madhya Pradesh	Static ToD tariff according to Time Slot	No	HT/EHT Industrial and Commercial Consumers, Mines etc. No LT Consumer under ToD
Goa	Static ToD tariff according to Time Slot	Yes	HT/EHT Industrial and Commercial Consumers, Mines, etc. as well as LT

State	ToD Tariff method adopted	Seasonal Pricing	Applicable to
			industrial Consumers under ToD
West Bengal	Static ToD tariff according to Time Slot	Yes	HT/EHT Consumers and LT Consumers under ToD. Consumer can opt for ToD tariff as well as prepaid tariff
Gujarat	Static ToD tariff according to Time Slot	No	HT/EHT Industry and Commercial Consumers and LT Water works
Andhra	Static ToD tariff according to Time Slot	No	HT Industry and Commercial Consumers
Odisha	Static ToD tariff according to Time Slot	No	All HT and LT Consumers having 3 Phase Connection except LT Domestic, General purpose and Public Lighting
Karnataka	Static ToD tariff according to Time Slot	Yes	HT and LT Industry and Commercial Consumers
Uttarakhand	Static ToD tariff according to Time Slot	Yes	HT and LT Industry Consumers

Very few States are having seasonal ToD tariff. Also, ToD tariff has been extended to LT categories in few States only. In Maharashtra, ToD tariff has been applicable for most HT categories and LT industrial and commercial categories for several years now.

9 ToD tariff in other countries

There are mainly 4 types of ToD tariff structure prevalent internationally, as under:

1. **Static ToD Tariff:** Time-zone wise ToD Tariff (This type of ToD Tariff is implemented in Maharashtra as well as rest of India). this is very common in Europe; e.g., in Italy, all low-voltage consumers are mandatorily exposed to ToD pricing if they do not choose a supplier in the liberalised market.
2. **Dynamic Real time Pricing:** Hourly pricing based on spot prices discovered on Power Exchanges. Estonia, Romania, Spain, Sweden and the UK applied such tariffs (e.g., between 25 % and 50 % of all households in Estonia and Spain incur their supply charges based on hourly pricing).
3. **Dynamic Monthly Pricing:** These are applicable in Denmark, Norway and Sweden, where electricity consumers incur spot-market-based pricing through the monthly average wholesale price.
4. **Critical Peak Pricing:** A rate in which electricity prices increase substantially for a few days in a year, typically during times the wholesale prices are the highest. E.g., French Tempo tariff is a contract with a fixed price all year except for a maximum of 22 days with very high prices.

Finland:

In Finland, consumers have the option of choosing a dynamic pricing tariff structure for electricity. Retail suppliers offer dynamic pricing to consumers who chose to do so in the liberalised market. The price is determined based on the Nordpool spot price for the price area of Finland. The customer, who chooses a dynamic price tariff structure, pays the hourly price, retailer's premium and a monthly fixed fee to the retailer with which they opted to enter into a contract.

The customer can check electricity prices for each hour of the succeeding day from the chosen retailer's website. The published prices are based on the spot market timetable. Therefore, the prices for the next day (24 hours), starting from midnight, are finalised at around 2 p.m. of D-1 (day ahead). The price that the customer pays for a particular time slot depends on the time of consumption. This customer requires hourly metering, which is the case for all consumers in Finland. Customers can see their hourly consumption one day after delivery on their local distribution system operator's (DSO's) web portal or application.

Observations:

This type of dynamic pricing can be implemented only after installation of Smart Meters for all consumers. Billing would become quite complex and there could be increase in consumer grievances.

United States:

Con ED, a utility operating in the US, has implemented a demand response programme in Illinois. Consumers are billed according to an hourly pricing programme in which electricity prices are reflective of the electricity load (i.e., prices were low during the low demand period and prices were high during the high demand hours).

Observations:

This type of Dynamic pricing would use fixed tariff increment for different demand supply situation. Demand supply position can be defined in different blocks (Like when IEX Price >Rs.10/kWh etc.) This model too would also be complex and may give rise to more consumer grievances.

10 Different Options for ToD Tariff

The ToD tariff structure can be modified in a certain manner to achieve the desired objective. As discussed, different ToD tariff structures have been implemented by various electricity suppliers. The applicability and adaptability of these models for implementation in Maharashtra are as under:

1. **Static ToD Tariff:**

This is the ToD Tariff, which is most prevalent throughout India and in most other countries. In this approach, differential tariff is pre-determined for different time blocks. There is no linkage to real-time market prices of electricity.

This option is the existing ToD tariff prevalent in Maharashtra. All Distribution Licensees in Maharashtra have implemented ToD Tariff for specific consumer categories, as discussed in previous sections.

There would be no further cost involved for implementing this Tariff in Maharashtra aside from procurement and operationalisation of smart meters for LT Residential consumers. Present ToD meters with modification can be used for any alteration in Static ToD Tariff structure.

2. **Dynamic Real Time Pricing:**

This Dynamic ToD Tariff model is operational in Finland, Estonia, Romania, Spain, Sweden and UK, where the consumers of liberalised market can opt for this ToD Tariff. In this model, the consumer pays the hourly price, Licensee's Wire and Transmission and associated cost (clubbed as a premium in line with Cross subsidy charges) and a monthly fixed fee to the Licensee with whom they opted to enter into a contract.

This model may be the ideal Dynamic Pricing Method as it is based on actual rates discovered. However, the environment in which it is operationalised is totally different than the situation prevalent in Maharashtra. In Finland, those consumers who have opted for liberalised tariff can only use this Scheme, as regulatory oversight on such dynamic pricing is very difficult. As our Distribution Licensees operate under regulated regime, it is difficult to adopt this type of Scheme as regulatory oversight is required (visibility of data and daily analysis) which would

be a huge regulatory exercise. Such a cumbersome model is very difficult to implement currently in the country.

3. Variable Monthly TOD Tariff

This type of ToD Tariff is implemented in Norway, Sweden and Denmark where consumers' time blocks are fixed beforehand and price of each block is determined monthly based on monthly average power purchase cost.

This approach is similar to the seasonal ToD tariffs implemented in some States. As discussed in the next Chapter, ABPS Infra has discussed options for seasonal tariff in Maharashtra.

4. Critical Peak ToD Tariff

In this ToD Tariff, Licensees fix a rate in which electricity prices increase substantially for a few days in a year, typically during times the wholesale prices are the highest. Customers are notified of days when such critical prices would be implemented well in advance. This is applied to a smaller extent in the UK, Lithuania, Portugal, Romania and France.

At the moment, dynamic ToD Tariff has not been implemented in any State in the country. The objective of dynamic pricing in ToD Tariff is to reduce the risk of DISCOMs for power purchase cost recovery, and to send across the correct pricing signals to the consumers on real-time basis. However, **considering the need for regulatory oversight, and the increased scope for consumer grievances, at present, such dynamic ToD tariff mechanism is not recommended.**

11 Recommendations for ToD Tariff

In this Chapter, Distribution Licensee-wise ToD tariff structure has been proposed based on all the analysis as discussed in earlier Chapters.
ABPS has proposed the ToD Tariff under the following 2 Options, viz.,

- **Option 1**: consider the existing licensee-wise Merit Order Despatch (MOD) principles to be continued;
- **Option 2**: consider that the earlier approach of State-wise MOD principles shall be re-introduced, in view of the nation-wise MoD principles being implemented in a phased manner.

Option 1: Licensee-wise MoD approach

As discussed in Chapter 5, the proposed ToD timeslots are same for all Distribution Licensees, as they are linked to the movement of the supply curve, need to absorb increasing injection of solar power, and need to disincentivise consumption during the time periods when the market rates are high. Further, no ToD tariffs are proposed for most of the small SEZ Deemed Distribution Licensees.

However, though the ToD time slots are proposed to be same for all Distribution Licensees, the ToD rates for different time slots are not proposed to be at the same level. In order to rationally compute the ToD rate, we have adopted the approach of computing the difference between the average market rate for short-term power prevalent during that time slot and the Average Power Purchase Cost (APPC) of the respective Distribution Licensee, suitably rounded off.
The proposed licensee-wise ToD tariffs are discussed below:

MSEDCL

ABPS proposes 2 options, viz., Static ToD tariff for whole year, and Seasonal ToD Tariff wherein differential ToD rates are proposed for morning peak and evening peak in the October to December period and January to March period, as discussed below:

(a) Static TOD Tariff for MSEDCL for whole year (without seasonal ToD tariff):

The APPC of MSEDCL is considered as Rs. 4.64/kWh based on MSEDCL data. The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot and the APPC of MSEDCL, suitably rounded off, as shown in the Table below:

Proposed ToD Tariff for MSEDCL (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.00	1.25	0.90	-0.80	0.50

(b) **Seasonal Static ToD Tariff of MSEDCL (differential ToD tariff for October to December period and January to March period):**

In this Option, differential ToD tariff is proposed only for the October to December period and January to March period, while for the remaining two periods, the ToD tariff proposed above for whole year shall be applicable.

The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot for the respective periods, viz., October to December and January to March and the APPC of MSEDCL, suitably rounded off.

The difference in market rates of power for the evening peak period for the October to December period and the APPC is working out very high, in excess of Rs. 3.00/kWh, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the October to December period is shown in the Table below:

Proposed ToD Tariff for MSEDCL for October to December period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.00	1.50	0.90	-0.80	0.90

the difference in market rates of power for the morning peak period and evening peak period for the January to March period and the APPC is working out very high, in excess of Rs. 4.50/kWh and Rs. 3.50/kWh, respectively, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the January to March period is shown in the Table below:

Proposed ToD Tariff for MSEDCL for January to March period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.00	1.75	0.90	-0.80	2.25

AEML-D

ABPS proposes 2 options, viz., Static ToD tariff for whole year, and Seasonal ToD Tariff wherein differential ToD rates are proposed for morning peak and evening peak in the October to December period and January to March period, as discussed below:

(a) Static TOD Tariff for AEMl-D for whole year (without seasonal ToD tariff):

The APPC of AEML-D is considered as Rs. 4.00/kWh based on AEML-D data. The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot and the APPC of AEML-D, suitably rounded off, as shown in the Table below:

Proposed ToD Tariff for AEML-D (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-0.40	1.90	1.60	-0.20	1.20

(b) **Seasonal Static ToD Tariff of AEML-D (differential ToD tariff for October to December period and January to March period):**

In this Option, differential ToD tariff is proposed only for the October to December period and January to March period, while for the remaining two periods, the ToD tariff proposed above for whole year shall be applicable.

The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot for the respective periods and the APPC of AEML-D, suitably rounded off.

The difference in market rates of power for the evening peak period for the October to December period and the APPC is working out very high, in excess of Rs. 3.70/kWh, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the October to December period is shown in the Table below:

Proposed ToD Tariff for AEML-D for October to December period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-0.40	1.85	1.60	-0.20	1.60

The difference in market rates of power for the morning peak period and evening peak period for the January to March period and the APPC is working out very high, in excess of Rs. 5.00/kWh and Rs. 4.00/kWh, respectively, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the January to March period is shown in the Table below:

Proposed ToD Tariff for AEML-D for January to March period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-0.40	2.00	1.60	-0.20	2.50

TPC-D

ABPS proposes 2 options, viz., Static ToD tariff for whole year, and Seasonal ToD Tariff wherein differential ToD rates are proposed for morning peak and evening peak in the October to December period and January to March period, as discussed below:

(a) Static TOD Tariff for TPC-D for whole year (without seasonal ToD tariff):

The APPC of TPC-D is considered as Rs. 4.99/kWh based on TPC-D data. The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot and the APPC of TPC-D, suitably rounded off, as shown in the Table below:

Proposed ToD Tariff for TPC-D (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.40	0.90	0.60	-1.15	0.20

(b) **Seasonal Static ToD Tariff of TPC-D (differential ToD tariff for October to December period and January to March period):**

In this Option, differential ToD tariff is proposed only for the October to December period and January to March period, while for the remaining two periods, the ToD tariff proposed above for whole year shall be applicable.

The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot for the respective periods and the APPC of TPC-D, suitably rounded off.

The difference in market rates of power for the evening peak period for the October to December period and the APPC is working out very high, in excess of Rs. 2.70/kWh, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the October to December period is shown in the Table below:

Proposed ToD Tariff for TPC-D for October to December period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.40	1.35	0.60	-1.15	0.60

The difference in market rates of power for the morning peak period and evening peak period for the January to March period and the APPC is working out very high, in excess of Rs. 4.30/kWh and Rs. 3.20/kWh, respectively, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the January to March period is shown in the Table below:

Proposed ToD Tariff for TPC-D for January to March period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.40	1.60	0.60	-1.15	2.15

BEST

ABPS proposes 2 options, viz., Static ToD tariff for whole year, and Seasonal ToD Tariff wherein differential ToD rates are proposed for morning peak and evening peak in the October to December period and January to March period, as discussed below:

(a) Static TOD Tariff for BEST for whole year (without seasonal ToD tariff):

The APPC of BEST is considered as Rs. 4.93/kWh based on BEST data. The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot and the APPC of BEST, suitably rounded off, as shown in the Table below:

Proposed ToD Tariff for BEST (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.35	0.95	0.65	-1.10	0.20

(b) **Seasonal Static ToD Tariff of BEST (differential ToD tariff for October to December period and January to March period):**

In this Option, differential ToD tariff is proposed only for the October to December period and January to March period, while for the remaining two periods, the ToD tariff proposed above for whole year shall be applicable.

The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot for the respective periods and the APPC of BEST, suitably rounded off.

The difference in market rates of power for the evening peak period for the October to December period and the APPC is working out very high, in excess of Rs. 2.80/kWh, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the October to December period is shown in the Table below:

Proposed ToD Tariff for BEST for October to December period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.35	1.40	0.650	-1.10	0.65

The difference in market rates of power for the morning peak period and evening peak period for the January to March period and the APPC is working out very high, in excess of Rs. 4.40/kWh and Rs. 3.20/kWh, respectively, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the January to March period is shown in the Table below:

Proposed ToD Tariff for BEST for January to March period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.35	1.60	0.650	-1.10	2.20

MBPPL

The load curve of MBPPL is almost flat. ToD Tariff has been discontinued w.e.f. April 2020. There is no justification for re-introduction of ToD tariff on account of load curve.

GEPL

The load curve of GEPL is almost flat. ToD Tariff has been discontinued w.e.f. April 2020. There is no justification for re-introduction of ToD tariff on account of load curve.

KRCIPPL

The load curve of KRCIPPL is almost flat. ToD Tariff has been discontinued w.e.f. April 2020. There is no justification for re-introduction of ToD tariff on account of load curve.

LBSCML

Licensee is new, and MERC is yet to determine retail tariff for LBSCML. The present load is less than 0.5 MW. There is no justification for introduction of ToD tariff on account of load curve.

NUPLLP

The load curve of NUPLLP is almost flat. MERC is yet to determine retail tariff for NUPLLP. There is no justification for introduction of ToD tariff on account of load curve.

EON SEZ

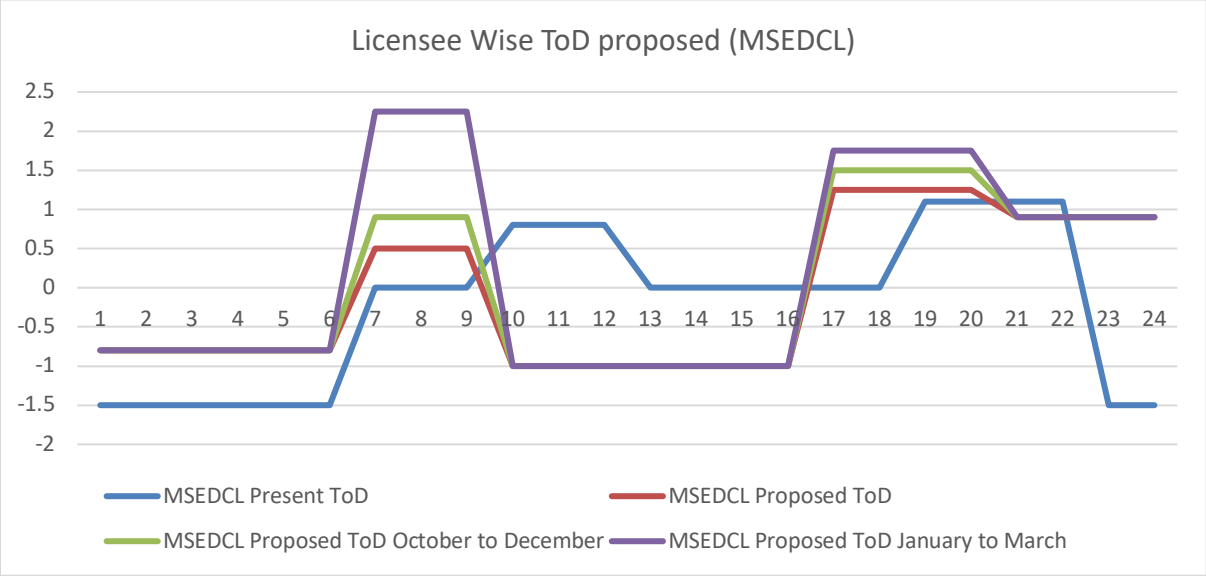
ABPS has proposed only Static ToD tariff for whole year for EON SEZ, as discussed below:

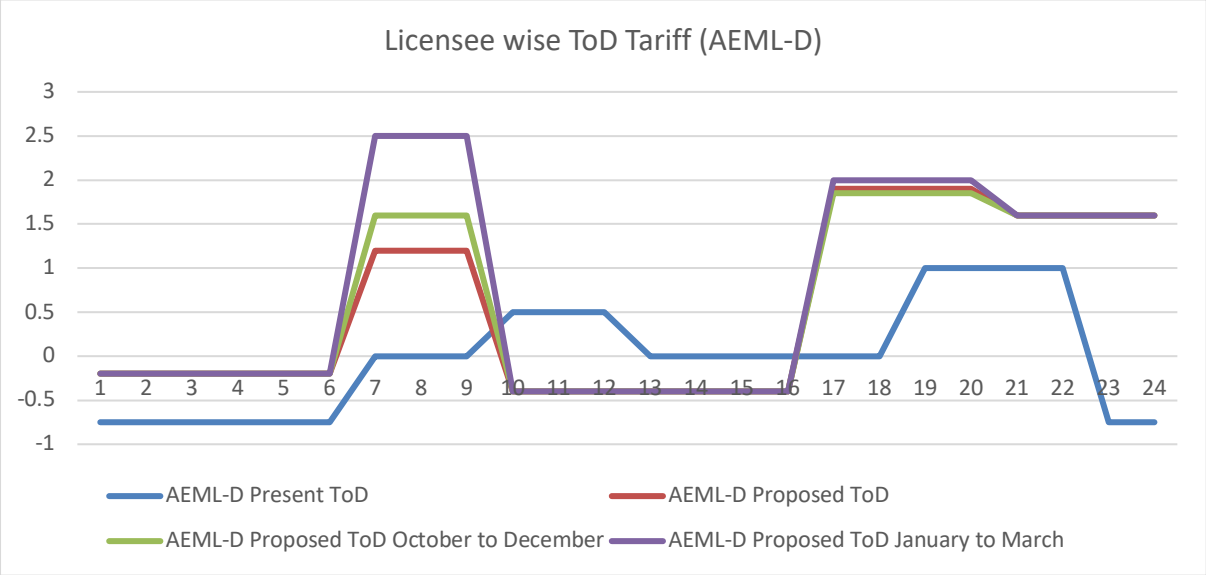
(a) Static TOD Tariff for EON for whole year (without seasonal ToD tariff):

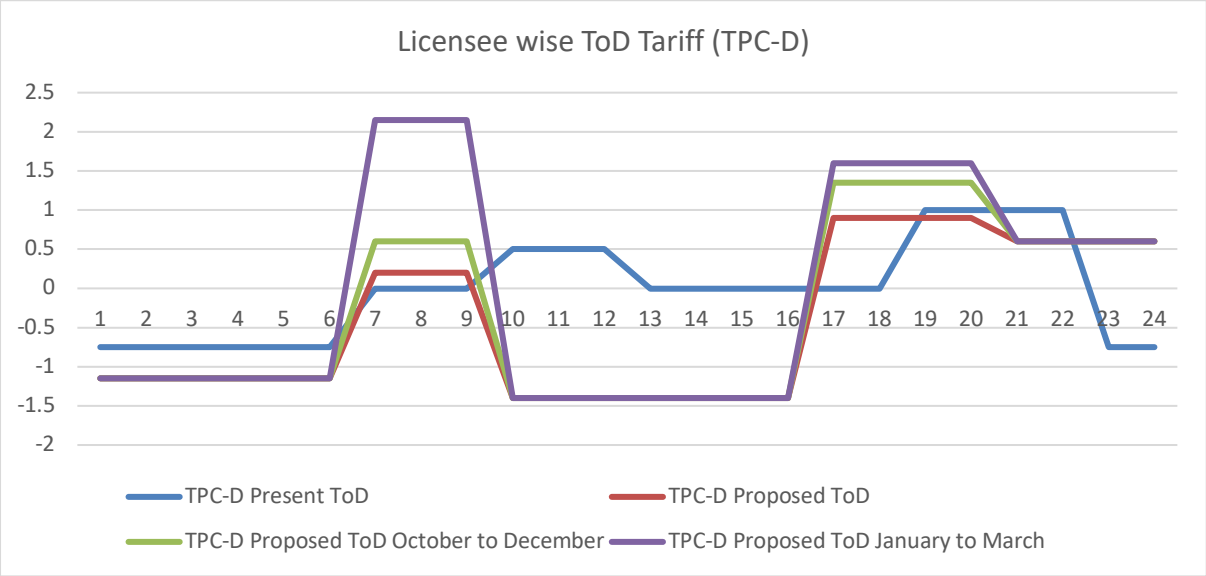
The APPC of EON is considered as Rs. 4.37/kWh based on EON data. The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot and the APPC of EON, suitably rounded off, as shown in the Table below:

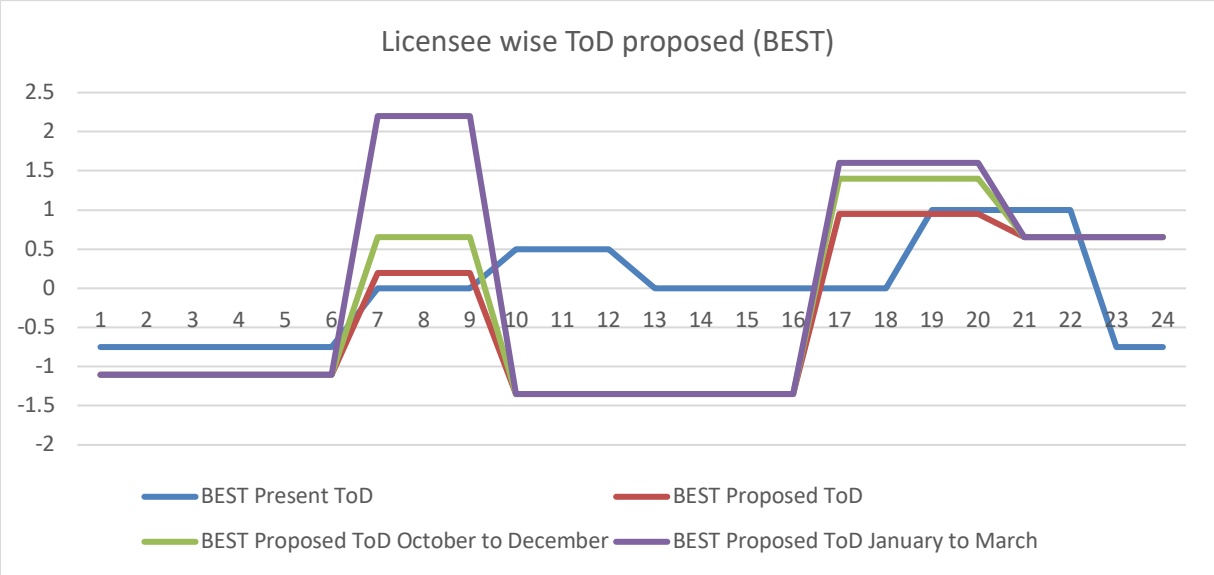
Proposed ToD Tariff for EON (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-0.80	1.50	1.20	-0.55	0.80

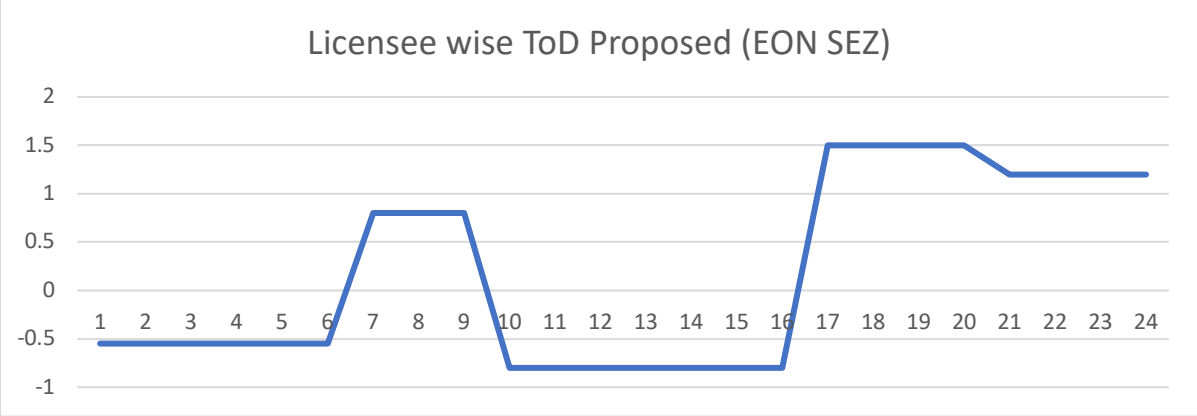
Licensee Wise ToD Proposed:






Licensee wise ToD Tariff (TPC-D)
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
TPC-D Present ToD
TPC-D Proposed ToD
TPC-D Proposed ToD October to December
TPC-D Proposed ToD January to March


Licensee wise ToD proposed (BEST)
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
BEST Present ToD
BEST Proposed ToD
BEST Proposed ToD October to December
BEST Proposed ToD January to March


Licensee wise ToD Proposed (EON SEZ)
2
1.5
1
0.5
0
-0.5
-1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Option 2: State-wise MoD approach

The ToD time slots have been proposed same for all Distribution Licensees, hence, the same ToD time slots shall be applicable for the Option of State-wise uniform ToD tariff also.

Similar to the approach adopted for Licensee-wise ToD tariff rates, the ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot and the APPC of the State as a whole, suitably rounded off.

Proposed ToD Tariff for State (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.00	1.25	1.00	-0.80	0.55

(a) **Seasonal Static ToD Tariff of the State (differential ToD tariff for October to December period and January to March period):**

In this Option, differential ToD tariff is proposed only for the October to December period and January to March period, while for the remaining two periods, the ToD tariff proposed above for whole year shall be applicable.

The ToD tariff for different time-slots have been proposed as the difference between the average market rate for short-term power prevalent during that time slot for the respective periods and the APPC of the State as a whole, suitably rounded off.

The difference in market rates of power for the evening peak period for the October to December period and the APPC is working out very high, in excess of Rs. 3.10/kWh, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the October to December period is shown in the Table below:

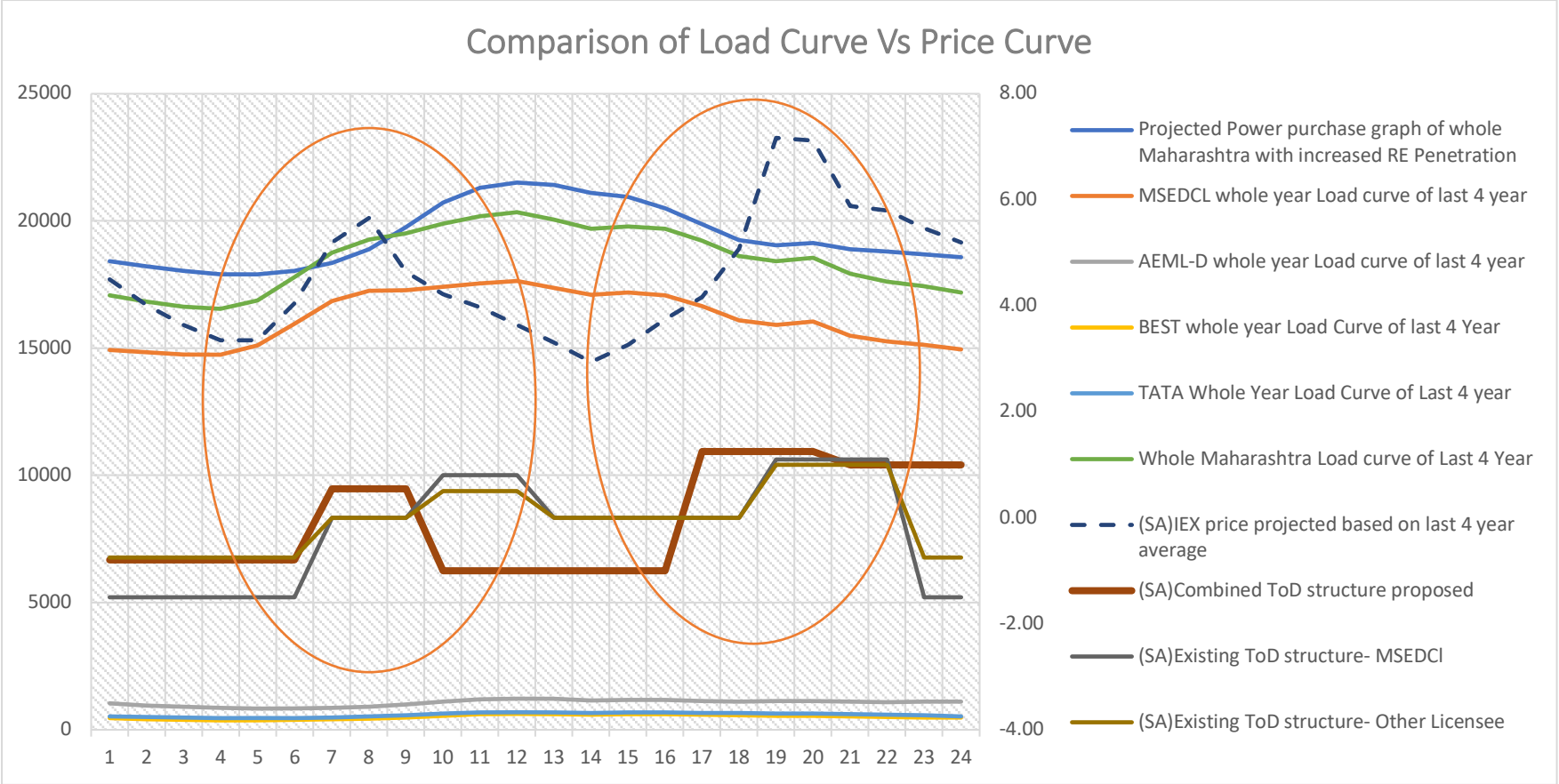
Proposed ToD Tariff for the State for October to December period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.00	1.55	1.00	-0.80	1.00

The difference in market rates of power for the morning peak period and evening peak period for the January to March period and the APPC is working out very high, in excess of Rs. 4.70/kWh and Rs. 3.50/kWh, respectively, which cannot be charged as ToD tariff. Hence, it is proposed to recover 50% of the incremental cost through the Additional ToD charges.

The proposed ToD tariff for the January to March period is shown in the Table below:

Proposed ToD Tariff for the State for January to March period (Additional Charges/(Rebate) in Rs./kWh)				
09:00 to 16:00 hours	**16:00 to 20:00 hours**	**20:00 to 00:00 hours**	**00:00 to 06:00 hours**	**06:00 to 09:00 hours**
-1.00	1.75	1.00	-0.80	2.35

Comparison of Licensee-wise Load curve of Major Licensees and whole Maharashtra Load curve vs. IEX price Curve, Existing and Proposed ToD Tariff for whole year and as well as seasonally is given below to show the overall improvement the proposed ToD Tariff would usher in:


Comparison of Load Curve Vs Price Curve
25000
20000
15000
10000
5000
0
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Projected Power purchase graph of whole Maharashtra with increased RE Penetration
MSEDCL whole year Load curve of last 4 year
AEML-D whole year Load curve of last 4 year
BEST whole year Load Curve of last 4 Year
TATA Whole Year Load Curve of Last 4 year
Whole Maharashtra Load curve of Last 4 Year
(SA)IEX price projected based on last 4 year average
(SA)Combined ToD structure proposed
(SA)Existing ToD structure- MSEDCl
(SA)Existing ToD structure- Other Licensee

Forward Path for Distribution Licensees in Maharashtra

The various options for licensee-wise ToD tariff including scope for seasonal ToD tariff with their implications have been discussed in earlier parts of this Report. **Based on these findings, in the subsequent Tariff process, each Distribution Licensee may propose the appropriate ToD tariff for its licence area, based on the desired objectives, its cost structure, its sales mix, etc., with due justification backed up by proper data.**

Option for Dynamic ToD Tariff in Maharashtra

The monthly dynamic ToD tariff has been implemented in Nordic countries like Norway, Denmark and Sweden. However, these markets are competitive markets, and the Regulator is not required to ensure that the correct tariff is charged.

For implementation of such system in Maharashtra, MERC would have to play an important role. The power purchase cost would have to be allocated to categories subjected to ToD tariff and categories not subjected to ToD Tariff. At the end of the month, the Commission will have to review hour-wise/Time-zone wise power purchase cost of Licensees w.r.t to the Revenue from consumers with ToD tariff to the Licensee and adjust the shortfall/surplus according to the average price of electricity in the market. In this manner, the ToD tariff can be adjusted on a monthly basis, in a partial dynamic manner. The merits and de-merits of this Option are:

Merits:

1. This exercise is similar to the monthly vetting of FCA done by the Commission.
2. Time zone-wise recovery of power purchase cost would happen in a more dynamic manner.

De-merits:

1. Power purchase of ToD consumers and Non-ToD consumers would have to be segregated based on some assumptions.
2. Source of power for ToD tariff must be declared and approved by the Commission beforehand so that Licensee cannot show higher cost source of power for ToD consumers.

3. This model is implemented in Nordic pool countries with consumers who have opted for liberalised Tariff.
4. MERC would have additional responsibility of vetting the power purchase costs w.r.t. the revenue earned on a monthly basis.

Load Management solution for absorbing higher solar injection during day-time

Another solution for absorbing the higher expected solar power injection during day hours may be to shift part of agricultural category supply to these hours:

- Will help to absorb the higher injection of solar power
- Agricultural supply hours would be partly during day-time unlike presently primarily during night hours
- Cheaper solar power would be used to meet load of subsidised agricultural category

Though the above solution is not a ToD tariff solution, the same may be considered as appropriate, by MSEDCL while preparing its strategy for ToD tariffs.

12 Roadmap for implementation of revised ToD tariff

The Distribution Licensee-wise population of ToD Meters, and ability of re-programming the ToD meters physically/remotely is summarised below:

MSEDCL

1. The existing TOD meters cannot be reprogrammed remotely for change in time-slots;
2. Smart Meters yet to be installed;
3. Existing category-wise population of ToD meters:

Sl.	LT Category	Number of ToD Meters
1	LT Residential	526
2	LT Commercial	32565
3	LT Industrial	87907
4	LT Agriculture	47
5	LT Street Light	309
6	LT Agriculture Others	470
7	LT Public Services	6732
8	LT Public Water Works	55913
9	LT Powerloom	7003
10	LT WG/NCE	2
11	LT EV Charge Station	3
	TOTAL	**191477**

Note: Up to January 2022

Sl.	HT Category	Number of ToD Meters
1	HT Industries	14086
2	HT Seasonal Industries	541
3	HT Commercial	2915
4	HT Public Water Work	1019
5	HT Public Service	1516

Sl.	HT Category	Number of ToD Meters
6	HT Railway/Metro/Mono	98
7	HT Temporary	50
8	HT Agriculture/Poultry	1430
9	HT Residential	375
10	HT MSPGCL Auxiliary	27
11	HT EV Charging Station	4
	TOTAL	**22061**

Note: Up to December 2021

AEML-D

1. Registers are fixed (6 or 8 Nos.) but in case of any change of TOD timing in future, same can be incorporated for some of the make of meters, but not all.
2. The TOD timings are programmable onsite.
3. Substantial changes will be required for change in ToD configuration.
4. Existing category-wise population of ToD meters:

Category	1 ph	3 ph	Factory ToD Configured	ToD Reprogrammable
BPL	154	0	93	0
HT - Public Services (A)	0	11	11	11
HT - Public Services (B)	0	140	140	133
HT - Railways	0	16	16	16
HT 1 (Industrial)	0	205	205	199
HT 1 Industrial OA	0	59	59	0
HT 2 (Commercial.)	0	452	452	439
HT 2 Commercial OA	0	97	97	0
HT 3 (Group Housing Soc.)	0	24	24	22
LT -I Residential	1754510	182	1176268	8486
LT -I Residential (3 Ph)	6298	285469	288799	534
LT II Commercial	316924	113747	334384	2386
LT III(A) - LT Industrial upto 20 kW TOD Option	2924	16378	18144	13427
LT III(B) - LT Industrial above 20 kW	0	3087	3087	2182
LT IX : LT - EVCS	7	19	26	8
LT VI: LT -Street Lights	0	3625	3625	0
LT X (A) : LT - Agriculture Pumpsets	2	21	23	1
LT X (B) : LT - Agriculture Others	0	8	8	0
LT X: LT -Public Service (A)	409	695	1060	659
HT - Public Services (A) OA	0	20	20	0
LT X: LT -Public Service (B)	1464	3275	4479	29
Total	**2082692**	**427530**	**1831020**	**28532**

5. Category-wise number of Smart Meters are as under:

Category	1 ph	3 ph
LT -I Residential	7957	15
LT -I Residential (3 Ph)	11	507
LT II Commercial	1777	417
LT III(A) - LT Industrial upto 20 kW TOD Option	26	31
LT IX : LT - EVCS	1	0
LT X (A) : LT - Agriculture Pumpsets	0	1
LT X: LT -Public Service (A)	6	0
LT X: LT -Public Service (B)	19	7
Grand Total	**9797**	**978**

TPC-D

1. Out of existing ToD meters, only smart meters can be reprogramed remotely.
2. The category-wise and type-wise number of ToD meters are as shown in the Table below:

Meter Type / Consumer Category	1 Phase	1 Phase Smart	3 Phase LTCT Smart	3 Phase WC Smart	3 Phase HTCT	3 Phase LTCT	3 Phase WC	ABT	Grand Total
HT I – Industry			1		112	3		14	130
HT II – Commercial					168	3	1		172
HTIII - Group Housing					15	30			45
HT V(B) - Railways Metro & Monorail					21				21
HT VI(A) - Publ Serv Govt Hosp&Edu Inst					19				19
HT VI(B) - Public Services Others					50	2	2	6	60
HT VIII - Electric Vehicle Charging Stn.					2				2
LT II(B) - Commercial 20 to 50 kW			73	168		1103	1273		2617
LT II(C) - Commercial > 50 kW			260			2142	55		2457
LT III(B) - Industrial > 20 kW			22	2		864	170		1058
LT IX(A) - Publ Serv Govt Hosp&Edu Inst	6		8			58	37		109
LT IX(B) - Public Services Others	77		13	13		204	123		430
LT XI - Electric Vehicle Charging Stn.	29	25	4	4		7	14		83
Total	**112**	**25**	**381**	**187**	**387**	**4416**	**1675**	**20**	**7203**

3. The category-wise breakup of Smart Meters is as shown in the Table below:

Meter Type / Consumer Category	1 Phase Smart	3 Phase LTCT Smart	3 Phase WC Smart	Grand Total
HT I – Industry		1		1
LT II(B) - Commercial 20 to 50 kW		73	168	241
LT II(C) - Commercial > 50 kW		260		260
LT III(B) - Industrial > 20 kW		22	2	24
LT IX(A) - Publ Serv Govt Hosp&Edu Inst		8		8
LT IX(B) - Public Services Others		13	13	26
LT XI - Electric Vehicle Charging Stn.	25	4	4	33
Total	**25**	**381**	**187**	**593**

BEST

1. The existing ToD meters cannot be reprogrammed remotely for change in Time slots
2. Since no modification/ reprogramming is possible for time slots of existing TOD meters remotely, it is suggested not to change existing time slots till the existing meters are replaced by Smart Meters under AMI Project.

As can be seen from the above, all the Distribution Licensees have programmable ToD meters with offline modification capability with 5 to 8 tariff registers. So, implementation of change in ToD tariff structure with old ToD meters is possible with modification taking place in offline mode. This will take time of around 3-6 months, depending on the population of ToD meters, and will require involvement of the meter manufacturer. The ToD tariffs to be charged during the period when the ToD meters are being re-programmed will need to be decided, as at any point of time, there will be some consumers with present ToD time slots programmed, and other consumers with revised ToD time slots programmed.

In order to resolve this issue, the Distribution Licensees may consider:

- retaining the existing time-slots and proposing revised ToD tariffs, till such time as smart meters are installed; or
- proposing Tariff Schedule with ToD tariffs for existing as well as proposed time-slots with the applicability depending on the status of the ToD meter reprogramming. However, the Licensees would have to ensure that all the earlier ToD meters are reprogrammed within a specific time period of say, 3 months to 6 months with the schedule of reprogramming clearly published.

The change in the ToD time slots will have to be implemented, after due consideration of these practical aspects.

Roadmap for mandating ToD tariff structure for load below 20 kW including for Residential category

Most of the Distribution Licensees have already completed or are in the process of installing ToD metering for consumers having load more than 20 kW including Domestic Category.

BEST has communicated that it is in the process of framing RFP for procurement of Smart Meters. The status of roll-out of smart meters by TPC-D and AEML-D has been detailed above.

The Revamped Distribution Sector Scheme (RDSS) has proposed that all consumers across all categories should have smart meters, and all Distribution Licensees are likely to propose Capex Schemes for the same. Implementation of ToD tariff for these categories with load below 20 kW including Residential category, would depend on the progress of installation of Smart Meters. Once such Capex Schemes and Smart Meters are installed, much more consumption pattern data would be available for the big Residential category, about which concrete data is not available at present.

The ToD tariff would have to be extended to these categories based on study of the consumption pattern and ability to shift consumption of these categories, which can be considered once the Smart Metering data is available.

However, **to start with, even before installation of smart meters, optional ToD tariff may be proposed by the Distribution Licensees for the residential category, with appropriate ToD tariff, to encourage Electric Vehicle (EV) charging stations.**

Based on these findings, in the subsequent Tariff process, each Distribution Licensee may propose the appropriate ToD tariff for its licence area, based on the desired objectives, its cost structure, its sales mix, etc., with due justification backed up by proper data.