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Ministry of Power
केंद्रीय विद्युत प्राधिकरण
Central Electricity Authority
Distribution Planning & Technology Division
वितरण योजना एवं प्रौद्योगिकी प्रभाग

No CEA-DPT-Dist Plan2030/2024

Dated: 2.02.2024

Subject: Draft Distribution Perspective Plan 2030 –Request for Stakeholder Comments

As per the Electricity Act, 2003, CEA is to prepare the National Electricity Plan once in five years. Further, Section 73 (a) of the Act also provides the formulation of short-term and perspective plans for development of the electricity system as one of the functions of the CEA.

Accordingly, a Draft Distribution Perspective Plan 2030 (DPP-2030) has been prepared by CEA in order to fulfill its obligation of the Act. The Draft Distribution Perspective Plan has been prepared based on the data received from distribution utilities. The Draft Distribution Perspective Plan is attached herewith.

The inputs/comments/suggestions on the Draft Distribution Perspective Plan are requested from Stake Holders. The inputs/comments/suggestions on the same may be furnished to Chief Engineer (DP&T), 6th Floor, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066 Tel.No.011-26732662 Email: cedpt-cea@gov.in latest by 1st April 2024.

New Delhi

2nd Feb 2024



Distribution Perspective Plan 2030



Ministry of Power
Central Electricity Authority
November 2023

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EXECUTIVE SUMMARY

India is presently one of the fastest growing economy in the World and currently, it is the fifth largest economy in the World; and it is poised to become the third largest economy by 2030. This will only be possible if there is sufficient electricity to power this growth. It is essential that generation capacity, transmission capacity and distribution capacity are added at a pace matching the growth in demand- and in fact slightly ahead of the demand; so that the shortage of electricity does not slow down growth. Resource Adequacy Planning Guidelines have already been issued by Ministry of Power for distribution companies. Compliance to the Resource Adequacy Norms and Guidelines shall ensure that DISCOMs tie up sufficient capacity to meet the demand of the area they are licensed to serve. Further, Rights of Electricity Consumers Rules, 2020 also prescribe payment of compensation to consumers for avoidable load shedding.

Government of India has historically played a leading role in providing for energy needs of the nation. To liberalize the development of power sector, the Government brought the Electricity Act into force in June, 2003. It replaces the three existing legislations namely, Indian Electricity Act, 1910, the Electricity (Supply) Act 1948 and Electricity Regulatory Commission Act, 1998. The Electricity Act 2003 consolidates laws relating to generation, transmission, distribution, trading and use of electricity to ensure development of electricity industry, promoting competition therein, protecting interest of consumers, supply of electricity to all areas, rationalization of electricity tariff, ensuring transparent policies regarding subsidies etc.

Under the Indian Constitution, power is a concurrent subject and as per IE Act 2003, the distribution of electricity is a licensed activity. Hence, the responsibility for distribution and supply of 24x7 reliable & quality power to all consumers within the licensed area rests with the respective distribution utility. However, Government of India provides assistance to States by allocation of power from Central Generating Stations, establishment of Inter States Transmission system and providing funding for distribution infrastructure under various Central Sector / centrally sponsored schemes (like IPDS, DDUGJY, PSDF, Saubhagya, RDSS, etc.) for improving the distribution sector.

Power distribution is the final and most crucial link in the electricity supply value chain which is directly connected to the consumers. However, distribution sector is facing various challenges like unreliable power supply, high AT&C losses, old and overloaded network, low

cost recovery, low consumer satisfaction, etc. resulting poor financial health of Discoms and distribution companies are not able to undertake corresponding investments in infrastructure augmentation. Recently in last few year, the distribution sector has received greater attention and various reforms measures/ Rules have been notified by Ministry of Power for improving financial viability of distribution utilities and equipping them to provide 24x7 reliable & quality power to consumer. Several initiatives have also been introduced to bring down the Aggregate Technical and Commercial (AT&C) losses along within the definitive regulatory framework. Recently, Govt. has launched RDSS scheme with the aim to improve the quality and reliability of power supply to consumers through a financially sustainable and operationally efficient distribution Sector. The Scheme aims to reduce the AT&C losses to Pan-India levels of 12-15% and reduction of ACS - ARR gap to zero by 2024-25. The Scheme has an outlay of Rs.3,03,758 crores for over 5 years i.e FY 2021-22 to FY 2025-26, with an estimated GBS from Central Government of Rs. 97,631.

Realizing the importance of the requirement of Distribution infrastructure for meeting the load up to 2030, CEA in consultation with distribution utilities prepared the Distribution Perspective Plan upto 2029-30 based on the information received from the Discoms. This Plan has included the Discom wise and All India level Distribution infrastructure planned by discoms to meet the projected demand by 2029-30. The best practices being followed by the Discoms for management of distribution system to provide reliable and quality power to consumer along with more consumer satisfaction have also been included in the respective chapters. The details of the new technologies available for introduction of Smart Distribution and a chapter on Capacity Building for distribution utilities have also been included for guidance of the distribution utilities.

Although, the development of distribution infrastructure is an evolving process and the actual requirement generally depend on the field conditions, however, the present distribution perspective plan would provide a broad picture of the distribution infrastructure plans of discoms up to 2030.

The DPP 2030 has included the utility wise & All India projected plans for:

1. Distribution Infrastructure

- Sub Stations (66/33/22 kV)- Nos, MVA
- Feeders(66/33/22 kV) - Nos, Ckm
- 11 KV Feeders – Nos , Ckm
- Capacitor banks- Nos, MVAr
- Distribution Transformers- Nos, MVA
- LT Feeders (415V, 240V)- Nos., CKm

- 2. AT&C loss Reduction trajectory till 2030**
- 3. Consumer Metering status and Consumer Growth**
- 4. Estimated Fund Requirement (Requirement, availability)**

DPP 2030 has also included the following Chapters :

1. Best Practices adopted by Discoms

- Operation & Maintenance
- System Capacity enhancement & Resilience
- Demand side Management
- Improving Tariff Structure
- Improving Human Resource
- Customer Services
- Improving Metering
- Loss reduction and Theft control
- Improving Safety
- Adoption of New Technology
- Cyber Security

2. Smart Distribution system

- Advanced Metering Infrastructure (AMI)
- Supervisory Control and Data Acquisition (SCADA) – Existing & Planned
- Mini SCADA - Real Time Data Acquisition System (RTDAS)- existing & Planned
- Distribution Management System(DMS)
- Advanced Distribution Management System (ADMS)
- Geographical Information System (GIS)
- Customer Relationship Management(CRM)
- Outage Management System (OMS)
- Demand Response(DR)
- Enterprise Resource Planning (ERP)
- Distribution Transformer Monitoring System (DTMS)
- Smart Street Lights (with noise and pollution sensors)
- Smart Battery Storage system
- Smart Micro Grid

- Home Automation System / Smart Homes
- Smart EV Charging Stations

3. Capacity Building for Distribution Utilities

- Capacity Building Approach
- Various Stages in Capacity Building
- Organization Structure of a Discom
- Various Programs for Training of Discom Personnel
- Recognition of Training Institute by CEA
- Basic Structure of Curriculum for O&M of Distribution system
- Distribution Sector Capacity Building program

SUMMARY OF DISTRIBUTION INFRASTRUCTURE PLANNED (AS ON MARCH 2022 AND MARCH 2030)

Sr	Description	Unit	March-22	March-30	%age Increase
1	Substation Count (66/33/22 kV)	Nos	39,965	52,157	31%
2	Substation Capacity (66/33/22 kV)	MVA	48,2810	62,4332	29%
3	Feeders (66/33/22kV) Count	No	36,804	54,639	48%
4	Feeders (66/33/22kV) Length	CKM	58,9304	77,7994	32%
5	Feeders (11kV) Nos	Nos	230979	323899	40%
6	Feeders (11kV) Length	CKM	49,35,279	59,03,782	20%
7	Distribution Transformer(DT) count	Nos	1,46,74,261	1,93,32,115	32%
8	Distribution Transformer(DT)	MVA	6,89,192	9,27,656	35%
9	LT Feeders (1-Ph & 3 Ph)	CKM	79,45,758	9774634	23%
10	Capacitor Bank	MVAR	59,255	1,05,209	78%
11	Consumers (in Crores)	Nos	33	52	58%

For converting these plans/ projections into ground reality, a coordinated effort is required from all stakeholders especially the policy makers i.e. Discoms, State Govt., Central Govt, State Regulators, Industry etc. The electrical manufacturing sector is set to come forward to supply the requisite material & equipment under the aegis of “Make In India” as per requirement.

Estimated Funds requirement for Distribution Infrastructure upgradation

Investment Required from 2022-27 in Rs lakh Crore	Total Investment available with the Discom from various sources for period 2022-27 (Rs lakh Cr.) including RDSS	Investment Required from 2027-30 in Rs lakh Crore	Total Investment Required from 2022-30 in Rs lakh Crore	% of required investment already sanctioned upto 2027 under RDSS and other schemes
Rs 4.28	Rs 1.89	Rs 2.86	Rs 7.42	44.11 %

Projected AT&C loss Trajectory

Range	As on 31.03.2022 (PFC-2021-22 data)	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Loss>25	23	15	8	4	3	1	0	0	0
25<=Loss<20	3	10	11	4	2	4	3	1	1
20<=Loss<15	7	13	15	15	18	11	11	11	7
Loss<=15	38	33	37	48	48	55	57	59	63
Total	71	71	71	71	71	71	71	71	71

AT&C loss is an apt indicator of the utility’s Operational performance. With more utilities aggressively driving towards sub 10%, the distribution sector is set to move to the higher orbits of performance growth & sustainability by 2030. The introduction of ICT including Smart Metering and other new technologies along with network addition / optimization would also help Discoms to further curtail the losses.

1.1 DEVELOPMENT OF POWER SECTOR IN THE COUNTRY

The growing power demand is a reflection of the economic growth in the country. The Indian power sector has undergone a significant transformation in the past few years. A significant amount of generation capacity including RE capacity has been added in the country transforming the country to power surplus. Regional grids have also been integrated into a single national synchronous grid facilitating flow of power from one corner of the country to another through strong inter regional AC and HVDC links resulting in “One Nation – One Grid – One Frequency”. The Indian grid has now emerged as the largest integrated grid in the world. Over the years, the installed capacity of the country has increased to 416 GW as on 31.3.2023 from a meager 1713 MW in 1950. Similarly, the electricity generation has increased to 1,421 BU (including imports from Bhutan and from renewable sources) in the year 2022-23 from 5.1 Billion units in 1950. The per capita consumption of electricity in the country has also increased to 1,255 kWh in the year 2021-22 from 18 kWh in 1950. The country has also met peak demand of 240 GW during 2023-24 on 1st September 2023.

The country has achieved universal electrification as every village, every hamlet and every willing home has been connected to electricity thereby ensuring universal access. This transformation from an acutely power deficit country, to a situation where we can export electricity to our neighboring countries, has been made possible by the relentless efforts of the Government and all the stakeholders. In the recent past, various schemes like Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Integrated Power Development Scheme (IPDS) and Pradhan Mantri Sahaj Bijli Har Ghar Yojana –SAUBHAGYA were implemented for strengthening the distribution system and providing access to electricity to All. With the results of these steps, the average availability of power in urban areas is around 23.8 hours while the average availability of power in rural areas is around 20.6 hours presently. The Government and other stakeholders are working together to ensure unhindered power supply and efforts at all fronts are being made and measures are being taken for better utilisation of various resources.

Under DUUGJY and thereafter SAUBHAGYA, the electrification of all villages and all willing households were completed by 31st March, 2022. A total of 18,374 villages were electrified under DDUGJY scheme and a total of 2.86 crore households were electrified under the aegis of SAUBHAGYA, upto 31-03-2022. However, a lot has still to be done in the Distribution sector to supply reliable, affordable & quality 24x7 power supply to all the consumers.

There is concern around the world regarding the deteriorating environment on account of greenhouse gas emissions. Transition to non-fossil fuel sources of energy is essential to reduce emissions and most countries in the world have pledged to carry out this transition according to trajectories announced by them. India has emerged as a leader in energy transition in spite of the fact that its per capita emissions are the lowest in the world. The country had pledged that by 2030, more than 40% of the installed electricity generation capacity will be from non-fossil fuel sources. This target was achieved 9 years ahead of schedule– in November, 2021. India’s non-fossil fuel capacity is already 42 percent. The country is currently on the path to honour the pledge in COP26 at Glasgow that 50% of the electricity generation installed capacity will be met from non-fossil fuel sources by 2030.

With the objective of beginning an era of empowering Consumers, laying down rights of the consumers and a system of enforcement of these rights, while facilitating ease of doing business in power sector, Ministry of Power promulgated the Electricity (Right of Consumers) Rules 2020 with the conviction that the power systems exist to serve the consumers and the consumers have rights to get reliable services and quality electricity.

Typically, the flow of electricity is from generating stations to the end-consumers through Transmission, sub-transmission and Distribution networks. The electricity is generated mostly at voltages between 11 KV to 33 KV which is stepped up to 132KV, 220 KV or 400KV or 765KV for transmitting to various parts of the country through inter-state transmission network and within State through intra-state transmission network. For distribution purposes, the electricity is suitably stepped down to 66KV, 33 KV, 22KV, 11KV and 0.4 KV for supplying to the consumers. In some states/UTs, some additional voltages like 6.6 KV or 3.3 KV are also in practice.

Distribution network is an integral part of the Electricity supply value chain, which connects consumers with generation. Operation and maintenance of distribution network is the responsibility of DISCOM. A typical DISCOM is structured into various Zones, Circles, Divisions and Sub-divisions to oversee not only O&M functions but also to carry out the commercial operation like consumer billing, collection and recovery of dues etc.

In most of the states, the jurisdiction of distribution utility’s network starts from the Voltage level of 66KV or 33KV & below, which is emanating from the secondary bus of the Transmission Substation of CTU or STU. In some States, the jurisdiction of distribution companies starts from 11 KV & below like Gujarat & Karnataka. The 66 KV or 33 KV is stepped down to 11 KV or 22 KV at Primary Sub-station (PSS) and then from 11KV or 22KV to 0.4 KV at the Distribution Transformer level (DSS) to supply power to the consumers. Most of the customers of Domestic category, industrial category, commercial category, agriculture category, street lighting etc. are generally fed at 230Volts (1-phase) /400Volts (3-phase) supply, whereas large customers are fed at higher Voltages such as 33 KV, 11 KV or 6.6KV etc. depending on SERC Regulations, load requirement and availability of the network etc.

Generally, any fault on 11 kV outgoing feeder from 33/11 KV or 66/11 KV S/S trips the complete 11 kV feeder from grid S/S resulting in power outage for a number of consumers. Many of the tripping may be on account of fault or overloading of network. Many times, the distribution equipment or network is not timely upgraded and new loads are released without evaluating the loading conditions of line and transformers in the network resulting in overloading of the system. Further, in absence of redundancy in network, the reliability of supply to consumers is adversely affected.

Every DISCOM has to take necessary action to achieve 24x7 Power supply to all consumers (except Agriculture consumers) and adequate supply to Agriculture consumers as per State Policy with minimized power supply interruptions as per the Standards of Performance (SOP) notified by respective SERC. DISCOMs have to take necessary action to augment the distribution system to perform as per the Rules and regulations notified by SERCs. DISCOMs should also adopt the smart distribution technologies like SCADA/DMS/OMS, Smart metering, scientific study of the network, Ring Main Units (RMUs), HVDS etc. for monitoring & controlling the system to provide reliable supply to the consumers.

1.2 CENTRAL SCHEMES FOR DEVELOPMENT OF DISTRIBUTION INFRASTRUCTURE IN THE COUNTRY – REVAMPED DISTRIBUTION SECTOR SCHEME (RDSS)

Government of India launched the Revamped Distribution Sector Scheme (RDSS) to help DISCOMs improve their operational efficiency and financial sustainability by providing result-linked financial assistance to DISCOMs to strengthen supply infrastructure based on meeting prequalifying criteria and achieving basic minimum operational efficiency benchmarks. RDSS has an outlay of ~INR 3.04 lakh Cr. over 5 years i.e., FY 2021-22 to FY 2025-26. The outlay includes an estimated Government Budgetary Support (GBS) of ~INR 0.98 lakh Cr.

The main objectives of RDSS are:

- Reduction of AT&C losses to pan-India levels of 12-15% by FY 2024-25.
- Reduction of ACS-ARR gap to zero by FY 2024-25.
- Improvement in the quality, reliability, and affordability of power supply to consumers through a financially sustainable and operationally efficient distribution sector.

The Scheme has two parts: Part 'A' - Financial support for upgradation of the Distribution Infrastructure and Prepaid Smart Metering & System Metering and Part 'B' - Training & Capacity Building and other Enabling & Supporting Activities. Under the scheme, eligible DISCOMs (all State-owned Distribution companies and State /UT Power Departments excluding private Sector power companies) are being provided financial support for upgradation of the Distribution Infrastructure, Distribution Automation, IT intervention and implementation of SCADA/DMS & Smart Metering system for the Network as well as prepaid smart metering systems for consumers.

Prepaid Smart metering is one of the critical interventions envisaged under RDSS. This provides for prepaid Smart metering for consumers, system metering at feeder and DT level with communicating feature along with associated Advanced Metering Infrastructure (AMI) would be implemented under TOTEX mode (Total expenditure includes both capital and operational expenditure) thereby allowing the Discoms for measurement of energy flows at all level as well as energy accounting without any human interference. Proper and accurate energy accounting is the key to identification of high loss areas and theft prone areas, whereby, utilities billing and collection efficiencies will improve significantly, thereby reducing the AT&C losses of Discoms.

Advanced ICT like Artificial Intelligence, Machine Learning and Blockchain Technology would be leveraged to analyse data generated through IT/OT devices including System Meters, prepaid Smart meters to prepare actionable MIS from system generated energy accounting reports every month so as to enable the DISCOMs to take informed decisions on loss reduction, demand forecasting, asset management, Time of Day (ToD) tariff, Renewable Energy (RE) Integration and for other predictive analysis. This would contribute a great deal towards enhancing operational efficiency and financial sustainability of the DISCOMs. Gross Budgetary Support (GBS) under the Scheme would be used for development of applications related to the use of advanced ICT like Artificial Intelligence, Machine Learning and Blockchain Technology in the Distribution Sector and also for promoting development of Start-Ups in the Electricity Distribution Sector across the country.

Funding Pattern:

For rolling out prepaid Smart metering in a mission mode under Part A – in "Other than Special Category States", a fixed amount of 15% (22.5% in case of Special Category States) of the cost per meter worked out over the whole project period, subject to a maximum of Rs. 900/- (Rs. 1350/- in case of special category States) per meter in case of consumer meters, will be funded.

States/UTs would be incentivised for deployment of prepaid Smart meters by December, 2023. An incentive @ 7.5% of the cost per consumer meter worked out for the whole project or Rs. 450 per consumer meter, whichever is lower, would be provided for "Other than Special Category States" for prepaid Smart meters installed within the targeted timeline of first phase mission i.e. by December, 2023. The incentive for Special Category States would be @ 11.25% of the cost per consumer meter worked out for the whole project or Rs. 675 per consumer meter, whichever is lower. The funds for prepaid Smart Metering will be made available to the DISCOMs only after installation, commissioning and demonstration of at least one prepaid billing period in the area specified by the DISCOM in the DPR approved by the Monitoring Committee.

Development of applications related to the use of advanced ICT like Artificial Intelligence, machine Learning and Blockchain Technology in the Distribution Sector and the unified billing and collection system will be funded 100% through the GBS.

For Distribution System upgradation works, maximum financial assistance given to DISCOMs of "Other than Special Category States" will be 60% of the approved cost, while for the DISCOMs in "Special Category States", the maximum financial assistance will be 90% of the approved cost.

Part B of the Scheme will be fully funded by grant through Central/State Governments.

Monitoring Committee:

An inter-ministerial Monitoring Committee for the Scheme has been constituted under the chairmanship of Secretary, Ministry of Power. The Monitoring Committee frames and approves all operational guidelines, sanction all Action Plans & DPRs of DISCOMs / States and proposals/DPRs under Part B, and review and monitor implementation of Scheme including review of Third-Party Mid-Term Evaluation of the Scheme carried out by the Nodal Agency.

The funds for a particular year in respect of Infrastructure Works would be released in respect of a DISCOM for a particular year only after it has been found to have fulfilled the pre-qualifying criteria and its total weighted score is at least 60 marks on the result evaluation matrix after having been evaluated by the Nodal Agency and approved as such by the Monitoring Committee. Evaluation of parameters relating to financial accounts shall be based on audited quarterly/ annual accounts.

Nodal Agency:

REC Limited and Power Finance Corporation Limited (PFC) has been designated the Nodal Agencies for the Scheme and are responsible for operationalization of Scheme in the entire country.

Status of RDSS

At present, under RDSS, ~20 crore prepaid Smart meters, ~54 lakh DT meters and ~1.98 lakh Feeder meter have been sanctioned with a total sanctioned cost of Rs 1.3 Lakh Cr with GBS of over Rs. INR 24,000 Cr.

Under the scheme, Capital investment is budgeted for loss reduction works, system strengthening to cater load growth and modernization to make smart distribution system. Loss Reduction works include replacement of bare conductor with AB cable, HVDS systems, feeder bifurcation etc. Similarly, system strengthening includes creation of new substations, feeders, upgradation of transformation capacity, cables etc. Modernization includes SCADA, DMS, IT/OT, ERP, GIS enabled applications, ADMS etc. to make to make distributions systems smarter.

So far, Loss Reduction works of ~INR 1.2 lakh Cr. have also been sanctioned with GBS of about Rs 76000 Cr. The funds are being released based on progress of works post tendering by utilities and subject to meeting pre- qualification criteria.

1.3 LEGAL PROVISIONS

As per Section 3(4) of the Electricity Act 2003, Central Electricity Authority (CEA) has been entrusted with the responsibility of preparing the National Electricity Plan in accordance with the National Electricity Policy and notifies such plan once in five years. Also, section 73 (a) of the Act provides that formulation of short-term and perspective plans for development of the electricity system and coordinating the activities of various planning agencies for the optimal utilization of resources to sub serve the interests of the national economy, which is one of the functions of the CEA. The Distribution Perspective Plan 2030 (DPP-2030) is being taken up by CEA in order to fulfill its obligation in this regard.

As per the Electricity Act, 2003, distribution of electricity is a licensed activity and it is the responsibility of respective distribution licensees to provide reliable & quality power supply to all consumers in their area of operation. State Electricity Regulatory Commission monitors the performance of the DISCOMs and also notifies the Performance Standards (SoP) to be met by DISCOMs.

An attempt has been made in the present Distribution Perspective Plan (DPP-2030) to provide a national level scenario of existing and planned distribution infrastructure based on the DISCOM wise details upto 2030. The Distribution Perspective Plan consists various chapter on expected demand of the DISCOMs & State as per 20th EPS, including infrastructure plan of the DISCOMs to meet the projected demand by 2029-30. It also consists of chapter on best practices adopted by utilities in management of distribution system, reforms undertaken in distribution sector, capacity building and details of automation & new technologies available in distribution sector etc.

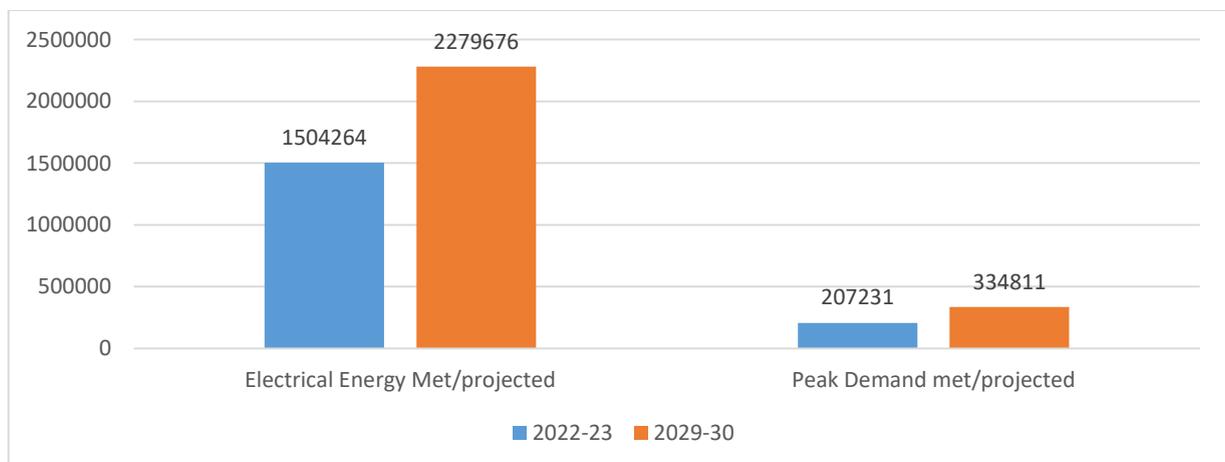
2.1 PEAK ELECTRICITY DEMAND AND ELECTRICAL ENERGY REQUIREMENT AS PER 20TH EPS

In the 20th Electric Power Survey (EPS) of CEA, the Peak Electricity Demand and Electrical Energy Requirement of each DISCOMs has been worked out in consultation with all the stakeholders including the DISCOMs. The Peak Electricity demand of the country is expected to increase from 2,07,231 MW in 2022-23 to 3,34,811 MW in 2029-30 and the Electrical Energy Requirement is expected to increase from 15,04,264 Million Units (MU) in 2022-23 to 22,79,676 Million Units in 2029-30.

During 2022-23 to 2029-30, the CAGR of the Peak Electricity Demand is expected to be 7.09% and the CAGR of the Electrical Energy Requirement is expected to be 6.12%. The Electrical Energy Requirement and Peak Electricity Demand on all-India basis upto 2029-30 is as under:

Table 2.1: Growth of Electricity Consumption in the country

Description	2022-23	2029-30	2022-23 to 2029-30 CAGR (%)
Electrical Energy Met/ projected	15,04,264 MU (Actual Met))	22,79,676 MU	6.12
Peak demand Met/projected	2,07,231 MW (Actual Met)	3,34,811 MW	7.09



The DISCOM wise Peak Electricity Demand and Electrical Energy Requirement for nine years i.e. up to 2029-30 is shown in Table -2.2 and Table- 2.3 respectively.

Table -2.2: DISCOM-wise Peak Electricity Demand (Utilities) (MW)

State/ Discom	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Chandigarh	428	435	449	464	478	492	505	519	533
Delhi - BRPL	3196	3500	3702	3921	4158	4416	4697	5005	5344
Delhi - BYPL	1673	1772	1851	1931	2012	2096	2181	2267	2355
Delhi - MES	48	50	52	54	56	58	60	62	64
Delhi - NDMC	307	348	376	390	403	416	430	443	457
Delhi - TPDDL	2251	2254	2346	2448	2554	2663	2779	2901	3047
Delhi	7329	7770	8164	8571	9003	9460	9948	10469	11046
Haryana - DHBVN	6250	6673	7121	7638	8193	8782	9407	10065	10823
Haryana - UHBVN	6069	6307	6628	6990	7372	7800	8234	8689	9217
Haryana	12137	12788	13546	14411	15335	16337	17380	18478	19744
Himachal Pradesh	2033	2119	2215	2328	2448	2571	2699	2829	2983
J&K - JPDCL	1403	1404	1451	1503	1559	1620	1685	1755	1830
J&K - KPDCCL	1696	1772	1930	1977	1997	2064	2211	2370	2520
J&K	3000	3075	3273	3369	3443	3566	3772	3993	4211
Ladakh	61	65	70	74	79	85	91	97	104
Punjab	13558	14327	14859	15502	16189	16925	17684	18478	19466
Rajasthan - AVVNL	4576	4516	4801	5130	5426	5735	6052	6375	6755
Rajasthan - JVVNL	5961	6485	7598	8078	8597	9156	9746	10368	11127
Rajasthan - JdVVNL	5424	5453	5686	5941	6207	6495	6784	7083	7417
Rajasthan	15803	16291	17906	18959	20030	21175	22358	23590	25048
UP - DVVNL	7070	7226	7613	8062	8542	9058	9600	10171	10831
UP - KESCO	741	799	825	852	881	911	943	976	1011
UP - MVVNL	6556	6893	7352	7856	8394	8971	9581	10231	10956
UP - NPCL	509	579	646	732	831	942	1067	1205	1380
UP - PuVVNL	6588	6868	7250	7664	8100	8563	9048	9561	10133
UP - PVVNL	9349	9728	10260	10882	11550	12265	13016	13808	14739
Uttar Pradesh	24991	26028	27531	29235	31061	33017	35082	37270	39781
Uttarakhand	2474	2603	2742	2905	3072	3249	3433	3623	3847
Northern Region	73367	77767	82688	87457	92476	97898	103650	109714	116745
Chhattisgarh	5029	5358	5708	6132	6592	7081	7602	8152	8805
Dadar Nagar Haveli	892	1021	1074	1138	1204	1273	1346	1421	1512
Daman & Diu	373	405	424	447	470	493	521	549	583
Goa	703	740	778	818	859	901	945	989	1043
Gujarat - DGVCL	4239	4695	4979	5334	5716	6115	6533	6963	7490
Gujarat - MGVCL	2305	2510	2631	2786	2953	3126	3305	3488	3719
Gujarat -	6587	7119	7532	8081	8685	9327	10008	10717	11642

State/ Discom	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
PGVCL									
Gujarat - Torrent	2605	2826	2936	3055	3180	3310	3449	3599	3776
Gujarat - UGVCL	5056	5878	6246	6700	7198	7732	8305	8910	9666
Gujarat	19457	21550	22762	24291	25953	27710	29573	31515	33964
MP - Central Zone	5692	6096	6365	6689	7034	7569	7947	8331	8794
MP - Eastern Zone	4448	4795	5047	5347	5669	6039	6399	6770	7204
MP - Western Zone	6407	6765	7142	7596	8082	8805	9348	9905	10571
Madhya Pradesh	15941	17009	17874	18914	20024	21592	22826	24091	25596
Maharashtra - Adani	2132	2254	2360	2472	2566	2682	2779	2882	2998
Maharashtra - BEST	937	953	967	982	996	1011	1026	1042	1061
Maharashtra - MSEDCL	24566	26558	27732	29115	30582	32271	33897	35573	37601
Maharashtra - Tata Power	897	923	939	958	976	994	1013	1032	1054
Maharashtra	28083	30203	31495	32999	34567	36376	38105	39891	42042
Western Region	65437	70963	74704	79137	83986	89457	94748	100246	107050
AP - APCPDCL	2958	3141	3335	3553	3784	4033	4286	4548	4841
AP - APEPDCL	3994	4279	4620	5028	5476	5963	6481	7031	7689
AP - APSPDCL	5258	5570	5915	6326	6773	7265	7774	8310	8942
Andhra Pradesh	12563	13363	14269	15337	16495	17758	19076	20461	22091
Karnataka - BESCOM	6570	6508	6717	6961	7217	7542	7824	8108	8443
Karnataka - CESC	1809	1888	1982	2086	2193	2336	2461	2591	2736
Karnataka - GESCOM	1896	1934	1996	2069	2145	2234	2333	2418	2522
Karnataka - HESCOM	3082	3198	3320	3457	3602	3799	3964	4135	4333
Karnataka - MESCOM	1366	1426	1495	1573	1655	1756	1848	1945	2058
Karnataka	14841	15075	15636	16277	16947	17810	18578	19352	20254
Kerala	4390	4592	4808	5044	5291	5549	5818	6101	6431
Lakshadweep	11	12	12	12	13	13	13	14	14
Puducherry	473	502	517	533	549	567	584	602	624
Tamil Nadu	16899	17361	18336	19413	20545	21736	22976	24276	25764
Telangana - TSNPDCL	6269	6576	7005	7477	7980	8540	9111	9713	10384
Telangana - TSSPDCL	8360	8556	9201	9940	10738	11614	12528	13495	14606
Telangana	14176	14663	15704	16877	18138	19529	20968	22488	24215

State/ Discom	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Southern Region	61165	63424	67143	71362	75861	80864	85953	91285	97440
A&N	60	61	63	64	66	67	69	70	72
Bihar - NBPDCCL	3302	3556	3836	4141	4468	4817	5189	5583	6009
Bihar - SBPDCL	3656	3977	4339	4742	5179	5649	6154	6694	7288
Bihar	6923	7495	8184	8908	9743	10553	11416	12326	13360
DVC	3081	3248	3450	3689	3947	4220	4510	4814	5176
Jharkhand - JBVNL	2322	2464	2614	2784	2967	3165	3369	3582	3827
Jharkhand - TSL	422	432	446	469	495	522	552	582	628
Jharkhand - TSUSIL	148	157	167	176	186	197	208	219	235
Jharkhand	2835	2994	3163	3362	3576	3808	4048	4297	4597
Odisha - TPCODL	1664	1789	1887	2005	2131	2263	2403	2547	2715
Odisha - TPNODL	1082	1157	1219	1298	1384	1475	1571	1670	1794
Odisha - TPSODL	698	725	754	789	828	868	910	952	1005
Odisha - TPWODL	1806	1999	2110	2260	2429	2613	2813	3027	3304
Odisha	5645	6490	6635	6918	7252	7630	8053	8514	9107
Sikkim	134	141	150	159	169	179	190	201	214
West Bengal - CESC	2226	2349	2427	2515	2606	2699	2794	2890	3002
West Bengal - IPCL	205	260	304	348	404	463	530	561	595
West Bengal - WBSEDCL	7322	8281	8777	9364	9998	10670	11386	12140	13042
West Bengal	9090	10150	10726	11395	12123	12891	13708	14530	15507
Eastern Region	26043	28737	30479	32544	34857	37265	39847	42546	45752
AP	170	180	190	201	211	223	234	246	259
Assam	2138	2376	2526	2689	2861	3045	3240	3449	3683
Manipur	260	276	291	308	325	344	363	383	404
Meghalaya	408	424	441	457	474	492	510	528	546
Mizoram	157	170	184	199	215	231	249	268	289
Nagaland	155	163	171	179	187	195	204	213	221
Tripura	329	356	421	452	484	531	567	605	645
North Eastern Region	3437	3755	4029	4284	4556	4855	5159	5481	5835
All India	203115	216966	230144	244565	260118	277201	294716	313098	334811

Table -2.3:DISCOM - wise Electrical Energy Requirement (Utilities) (MU)

State/ Discom	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Chandigarh	1550	1676	1720	1763	1803	1844	1885	1927	1975
Delhi - BRPL	12673	15062	15863	16710	17606	18554	19562	20637	21795
Delhi - BYPL	6506	7428	7661	7893	8123	8351	8575	8795	9015
Delhi - MES	236	241	246	250	255	260	265	270	277
Delhi - NDMC	1096	1286	1368	1395	1421	1447	1474	1503	1534
Delhi - TPDDL	9937	10486	10882	11333	11808	12304	12825	13375	14037
Delhi	31527	35715	37346	39000	40771	42566	44448	46425	48641
Haryana - DHBVN	30899	34919	37431	40328	43455	46791	50344	54107	58438
Haryana - UHBVN	22986	25925	27385	29166	31116	33319	35596	38025	41036
Haryana	55535	62706	66926	71821	77217	82981	89050	95486	103176
Himachal Pradesh	12115	12614	13172	13829	14522	15238	15979	16730	17628
J&K - JPDCL	7958	8202	8476	8780	9106	9445	9793	10135	10469
J&K - KPDCCL	10913	10906	11848	12101	12183	12534	13352	14194	15051
J&K	19324	19568	20811	21382	21800	22507	23700	24912	26132
Ladakh	190	210	233	259	288	321	357	398	443
Punjab	62851	66464	69686	73493	77571	81959	86536	91359	97237
Rajasthan - AVVNL	24377	26749	28483	30485	32297	34194	36138	38133	40469
Rajasthan - JVVNL	34648	42702	50087	53305	56793	60549	64520	68710	73820
Rajasthan - JdVVNL	29822	31096	32461	33959	35527	37218	38921	40684	42657
Rajasthan	89918	101757	112368	119167	126118	133550	141260	149303	158836
UP - DVVNL	28154	31196	32788	34609	36554	38638	40816	43109	45759
UP - KESCO	3728	4376	4526	4679	4833	4990	5149	5311	5474
UP - MVVNL	26018	30288	32213	34327	36578	38986	41527	44225	47229
UP - NPCL	2630	3165	3522	3981	4511	5104	5773	6507	7438
UP - PuVVNL	29997	35377	37281	39346	41522	43827	46237	48781	51616
UP - PVVNL	36787	44104	46650	49621	52820	56249	59867	63690	68176
Uttar Pradesh	129580	151152	159775	169529	179967	191138	202920	215392	229712
Uttarakhand	15541	16301	17138	18087	19093	20142	21238	22374	23702
Northern Region	418188	468224	499239	528394	559218	592312	627443	664377	707554
Chhattisgarh	31948	36260	38528	41223	44130	47208	50475	53900	57983
Dadar Nagar Haveli	6848	7794	8165	8605	9072	9559	10070	10594	11225
Daman & Diu	2615	2840	2970	3121	3277	3437	3622	3815	4042
Goa	4456	4630	4820	5038	5270	5512	5765	6032	6350
Gujarat - DGVCL	26889	30498	32427	34834	37431	40151	43009	45957	49572
Gujarat - MGVCL	12763	14073	14822	15771	16793	17857	18969	20107	21536
Gujarat - PGVCL	39404	43008	45589	49009	52771	56773	61036	65478	71263
Gujarat - Torrent	11880	12992	13415	13876	14354	14848	15375	15941	16622
Gujarat - UGVCL	30408	36328	38821	41877	45241	48873	52784	56943	62111
Gujarat	123788	139566	148082	158654	170323	182507	195467	209008	226141
MP - Central Zone	30133	34527	36341	38498	40801	44253	46826	49468	52618

State/ Discom	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
MP - Eastern Zone	25340	28988	30608	32534	34601	36976	39302	41715	44525
MP - Western Zone	29525	33608	35809	38430	41258	45347	48570	51915	55886
Madhya Pradesh	86521	98863	104600	111424	118751	128844	137111	145662	155770
Maharashtra - Adani	12128	12696	13172	13683	14098	14647	15116	15632	16225
Maharashtra - BEST	4950	5024	5095	5165	5233	5301	5370	5444	5532
Maharashtra - MSEDCL	144907	154639	160629	167746	175261	183949	192180	200590	210874
Maharashtra - Tata Power	5503	5654	5747	5850	5952	6053	6153	6253	6376
Maharashtra	172818	183777	191499	200087	209593	219726	229362	239207	251578
Western Region	428994	473729	498665	528152	560416	596793	631873	668218	713089
AP - APCPDCL	16748	17711	18770	19962	21219	22572	23944	25358	26944
AP - APEPDCL	24849	26952	29384	32292	35502	39024	42814	46878	51734
AP - APSPDCL	26327	27750	29394	31360	33487	35830	38242	40769	43758
Andhra Pradesh	68438	72961	78134	84245	90889	98162	105792	113859	123361
Karnataka - BESCO	34996	35980	37071	38352	39688	41407	42877	44356	46108
Karnataka - CESC	8210	8599	9016	9472	9945	10577	11125	11694	12330
Karnataka - GESCOM	8398	8625	8880	9183	9498	9869	10279	10630	11062
Karnataka - HESCO	14021	14501	15026	15621	16245	17103	17816	18552	19405
Karnataka - MESCOM	6384	6671	6983	7333	7702	8157	8573	9008	9513
Karnataka	72799	75202	77876	80922	84132	88232	91852	95486	99758
Kerala	26626	27892	29244	30729	32281	33903	35597	37384	39464
Lakshadweep	56	58	60	62	64	66	68	71	73
Puducherry	2907	3048	3136	3234	3332	3436	3539	3647	3776
Tamil Nadu	109914	115788	122102	129079	136399	144086	152074	160430	170006
Telangana - TSNPDCL	22117	22963	24208	25566	26996	28581	30160	31799	33618
Telangana - TSSPDCL	47903	49388	52365	55762	59369	63271	67235	71331	76021
Telangana	70871	73229	77503	82316	87414	92967	98578	104383	110971
Southern Region	351611	368179	388055	410587	434511	460853	487501	515259	547409
A&N	338	345	350	357	363	368	373	378	383
Bihar - NBPDCCL	15196	17538	18823	20216	21701	23276	24944	26702	28589
Bihar - SBPDCL	18325	21267	23084	25099	27271	29593	32072	34702	37580
Bihar	36239	41814	45560	49438	53920	58256	62871	67715	73241
DVC	16630	17624	18757	20100	21550	23087	24721	26437	28482
Jharkhand - JBVNL	14016	14804	15678	16675	17737	18895	20079	21314	22730

State/ Discom	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Jharkhand - TSL	2390	2432	2506	2633	2776	2928	3090	3256	3510
Jharkhand - TSUSIL	667	703	752	823	904	993	1093	1200	1355
Jharkhand	18355	19334	20677	22112	23846	25463	27140	28873	31096
Odisha - TPCODL	9126	9788	10320	10955	11637	12354	13107	13886	14795
Odisha - TPNODL	7470	7996	8418	8959	9550	10172	10830	11510	12360
Odisha - TPSODL	4052	4191	4354	4555	4773	4999	5236	5480	5778
Odisha - TPWODL	10274	11331	11949	12788	13734	14761	15881	17075	18617
Odisha	38344	43060	43582	44985	46689	48627	50810	53180	56316
Sikkim	616	651	689	730	773	819	867	919	974
West Bengal - CESC	10925	11489	11860	12278	12710	13148	13597	14051	14580
West Bengal - IPCL	1211	1522	1777	2028	2356	2694	3082	3259	3458
West Bengal - WBSEDCL	41614	46851	49609	52874	56395	60127	64097	68278	73274
West Bengal	54020	60163	63564	67518	71820	76352	81182	86018	91771
Eastern Region	164542	182992	193179	205240	218961	232971	247963	263519	282264
AP	875	916	964	1012	1064	1117	1170	1227	1289
Assam	10869	11972	12679	13454	14279	15151	16079	17069	18183
Manipur	1029	1089	1152	1218	1289	1363	1441	1522	1610
Meghalaya	2264	2350	2437	2527	2618	2711	2805	2898	2993
Mizoram	823	897	978	1063	1156	1252	1357	1464	1577
Nagaland	867	909	953	997	1041	1088	1134	1182	1228
Tripura	1585	1663	1913	1991	2073	2222	2306	2391	2481
North Eastern Region	18312	19796	21076	22261	23521	24904	26292	27752	29359
All India	1381646	1512918	1600214	1694634	1796627	1907835	2021072	2139125	2279676

3.1 INTRODUCTION

For any power distribution utility, planning of adequate distribution system to cater existing as well as future load growth requirement is of utmost importance. The driving factors for DISCOMs generally are Consumer growth, consumption growth, availability & price of Electricity, Energy Efficient Measures, availability of local generation through solar/wind, roof top solar system & Risk of Migration of consumers to open access etc. To meet the expected load in their area of operation and to provide the reliable power supply to the consumers, DISCOMs need to work out Electrical Energy(MUs) Requirement, Peak Demand Projections, Trajectory of AT&C losses, Selection of Load Factor, Impact of DSM measures etc. to finalize its plan document.

The use of automation and smart metering can play a pivotal role in bringing the positive transformation in the distribution sector. 24x7 reliable power can be supplied to the consumer by providing alternate route (e.g. formation of Ring Main feeders), in case of any interruption in the supply from one feeder. To achieve this objective, distribution system should have automation not only at network level but customer related services should also be fully integrated and automated with SCADA/DMS and GIS mapping. Additionally, AMI/smart metering would facilitate the smooth integration of renewable energy, especially roof top solar, with the grid. It would enable bi-directional energy flows reducing the demand projections of the DISCOMs.

3.2 PLANNING FOR EFFICIENT DISTRIBUTION SYSTEM

The plan for distribution system should, inter-alia, include the following elements:

- i) Resource Adequacy Plan - availability of adequate power supply
- ii) Requirement of adequate Sub-Transmission & Distribution lines (66/33/22/11 kV) and cables to feed the 66/33/22 /11 KV Sub-stations
- iii) Requirement of adequate capacity of Sub-Transmission & Distribution Substations (Power Sub-station 66/11 or 33/11 kV and Distribution Sub-station 11/0.4 kV or 22 kV/0.4 kV or 33/0.4 kV)
- iv) Requirement of adequate IT infrastructure like SCADA, DMS, GIS, OMS, AMR, AMI etc along with appropriate communication system
- v) Metering of Consumers, feeders & distribution Transformers as per CEA regulations
- vi) Adoption of Reform processes and capacity building, etc

3.3 IMPORTANT FACTOR TO BE CONSIDERED FOR PLANNING OF DISTRIBUTION SYSTEM

While preparing any Distribution Plan, the planner needs to consider the following factors:

- a. **Load Growth:** Distribution Plans need to consider the load growth of a defined period (say 5 years /10 Years etc). Commensurate electrical network augmentation and strengthening against load/consumer growth in existing area /additional consumers in new arrears area etc. has to be proposed including replacement of the overloaded network element based on the degree of overloading (Transformers/Feeders/grid stations/Substations). The DISCOM's Load growth at Sub-Transmission level (66/33KV) should be synchronised with the state transmission's expansion plan.
- b. **System Reliability Improvement:** The Plans need to consider replacement of old/obsolete and fault prone equipment in the system to maintain high network reliability through replacement of outlived equipment for reliable power supply, replacement of HT Switchgear Scheme, feeder Augmentation Schemes and Replacement of Old and Outlived LT ACBs and LT Panels etc.
- c. **Loss Reduction:** addressing reduction of technical & commercial losses through data analysis of smart meters, elimination of electricity theft through LT Aerial Bunched cable (ABC) / UG cables. Adopting HVDS in theft prone areas, augmentation of overloaded system etc, Area wise loss level is assessed along with the actual field conditions for defining the trajectory of future AT&C loss reduction .
- d. **Improve Customer Satisfaction:** To identify various works to upgrade IT tools/software to meet various business requirements, install compatible hardware and provide better connectivity between various offices, Grid Substations etc, adopting new technologies like GIS mapping, Outage Management system, Consumer friendly centers etc for improving consumer satisfaction.
- e. **Safety and Security:** Implement CEA safety regulations, Cyber Security Guidelines, advisories, Disaster Management Plan, safety protocols and other security measures to protect distribution infrastructure from physical threats, cyber attacks, and natural disasters.
- f. **Environmental Considerations:** Promote environmentally friendly practices by minimizing emissions, reducing energy losses, and integrating renewable energy sources into the distribution network.

- g. **Technological Advancements with Data Analytices:** Embrace emerging technologies such as advanced metering infrastructure (AMI), grid automation, SCADA, DMS, OMS, predictive maintenance to enhance the efficiency and reliability of the distribution system etc. Also leverage data analytics to gain insights into grid performance, customer behavior, and maintenance needs. Data-driven decisions can optimize operations and planning.
- h. **Training and Workforce Development:** To prepare a program for workforce training and development to ensure that employees are skilled in operating and maintaining, consumer complain handling & modern distribution systems etc.

3.4 SCIENTIFIC DISTRIBUTION SYSTEM PLANNING USING PLANNING SOFTWARE TOOLS

For any power distribution utility, planning of adequate distribution system to cater existing as well as future load growth requirement is of utmost importance. The driving factors for planning of the system generally are consumer growth, consumption growth, change in consumption pattern of the consumers, dynamic price of electricity, energy efficient measures, etc. The Discoms need to work out Electrical Energy Requirement Projections, Electrical Demand Projections, Trajectory of T&D losses, Selection of Load Factor, optimal design of the distribution system, Impact of DSM measures etc through use of software tools available for distribution planning.

The planning for distribution system includes the analysis of existing system and planning of optimal future requirement of sub transmission and Distribution lines & Distribution Substations keeping in view the futuristic approach . This would also include the requirement of adequate Communication system and IT infrastructure like SCADA, DMS, OMS, AMI etc

Through this approach, a distribution company should be able to analyze the distribution network for following:

- Optimization of loading of Transformers (power transformers and distribution transformers) and Feeders.
- Ensuring an adequate network for existing as well future need with N-1 redundancy in the network i.e. at Medium Voltage (MV) (11 KV) and High voltage (HV) (66 and 33 KV).
- Reduction of technical Losses by optimizing the Network configuration and by comparing the various optimized scenarios
- Ensure voltage regulation in line with the Regulations.

The system is planned with the primary objective of meeting load growth and maintaining the desired redundancy level in the system to meet current supply requirements. System is to be analyzed during contingency condition and loading of various network elements to be reviewed, cases where space and transmission up-stream network availability is there have to be considered in the plan. Area wise loss level is also assessed along with the ground reality for future T&D loss reduction trajectory.

Through the use of system software , the new development/addition/augmentation can be studied against the overloaded network element based on the degree of overloading (Transformers/ Feeders/ grid stations/ Substations). The works required to upgrade IT tools/software to meet various business requirements, install compatible hardware and provide better connectivity between various offices, Grid Substations etc are also to be planned for introducing transparency in the system.

3.5 DISTRIBUTION PLAN -2030 STRATEGY

The primary responsibility for distribution and supply of power to all consumers rests with the DISCOMs /Power Departments of States and UTs and they are required to plan their system and procure adequate power to supply their consumers as per the Standard of Performance (SOP) notified by the respective SERCs. However, in order to provide a uniform framework and guidelines to utilities/DISCOMs and to evolve an integrated approach for strengthening of Distribution sector in the country, National Electricity Distribution Plan upto 2029-30, has been prepared.

This present Distribution Perspective Plan 2030 is based on the data/ inputs provided by the Distribution Companies and State Power Departments considering the projected electricity requirement in 20th EPS and other related factors. This DPP 2030 captures plan data of major 70 DISCOMs and the data of vary small discoms like various SEZs, Port Trusts, Steel Plants, Tea States, MES etc. Various small/minor discoms are located in Kerala (08 Nos), Maharashtra (05 Nos), Gujarat (05 Nos), Chhattisgarh (02 Nos), Jharkhand (02 Nos) and West Bengal (02 Nos), which have very small distribution infrastructure, limited consumers and may not have much impact on the overall projections included in the plan. The data for DISCOM's which have not furnished the data for the plan has been updated from their ARR /details submitted for RDSS etc.

This Plan has been prepared for assessment of requirement for development of the distribution sector provide 24x7 quality & reliable supply to the consumers and coordinating the activities of various planning agencies for the optimal utilization of resources to serve the interests of the consumers. Also, the Distribution Perspective Plan would also help the Industry to enhance their manufacturing capacity as per the projected requirement of various equipment and material .

This Distribution Perspective Plan captures requirement of Electrical Infrastructure :

- To meet the discom wise Peak Load as projected in 20th Electric Power Survey (EPS).
- To ensure distribution network reliability for 24x7 power supply to end consumers
- To reduce the AT&C losses to the range of below 10%
- To adopt the best practices in distribution sector for enhancing the efficiency of the system and enhancing the consumer satisfaction
- To benefit the end consumer by introduction of automation and smart metering
- To explore other measures like capacity building & various reforms in distribution sector.
- An overview of estimated Fund requirement, availability & Gaps

The best practices being followed by various DISCOMs for management of Distribution system, reduction of AT&C losses, and to provide reliable and quality power to its consumers have also been included in the Plan. The details of automation & smart technologies available in distribution sector along with need for capacity building, etc. have also been included.

Although, the development of distribution infrastructure is an evolving process and generally depend on the actual requirement in the field, but the present distribution perspective plan (DPP) would provide a broad picture of the requirement of distribution companies in the country upto 2029-30.

4 Distribution Plan 2030 –All India Summary

4.1 INTRODUCTION

In order to assess the distribution system requirement in the country upto 2029-30, it is essential to have corresponding load demand forecast, generation capacity availability and transmission capacity availability. Accordingly, load demand forecast as projected in 20th Electric Power Survey (EPS) report of CEA and generation and transmission system as forecasted in the Resource Adequacy Plan, National Electricity Plan for generation and transmission have been considered to assess the adequacy of distribution system requirement in the country.

4.2 DEMAND SCENARIO

Electricity Demand of the country as forecasted in 20th EPS are as under:

Table 4.1: Demand Projection as per 20th EPS

	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Peak Demand (MW)	203115	216966	230144	244565	260118	277201	294716	313098	334811
Energy Requirement (MU)	1381646	1512918	1600214	1694634	1796627	1907835	2021072	2139125	2279676

From the table, it can be seen that as per 20th EPS of CEA, the peak electricity demand of the country is going to increase by CAGR of 6.45% during 2021-22 to 2029-30, while the energy requirement is going to increase by CAGR of 6.46 % during the same period.

4.3 GENERATION SCENARIO

As per National Electricity Plan (Generation) prepared by CEA, it is expected that the total generation installed capacity of the country would be around 786 GW by March 2030 as against the installed capacity of around 400 GW by March 2022. It is also envisaged that the %age of renewable capacity would be around 62.6% of total installed capacity by March 2030.

The following scenario for installed capacity of the country at the end of 2029-30 has been envisaged:-

Table 4.2: Projected Installed Capacity of India by end of 2029-30

Fuel Type	Installed Capacity (MW) as on 31.03.2022	Projected Installed Capacity (MW) as on 31.03.2030
Conventional		
Coal + Lignite	210700	251568
Gas	24900	24900
Nuclear	6780	6780
Diesel	509	509
Sub-Total (Convention)	242889	294017
Renewable		
Hydro	41977	58278
PSP	4746	18990
Solar	53996	292966
Wind	40358	102296
Bio Mass	10683	14500
Small Hydro (less than 25 MW)	4848	5350
Sub-Total Renewable	156608	492380
Total Installed Capacity	399497	786397

It may be noted that total conventional installed capacity in the country will increase by only 21% during 2021-22 to 2029-30 while the renewable capacity would increase by 214% with total installed capacity increase by 97% during 2021-22 to 2029-30. Keeping in view the expected peak demand at the end of 2029-30, the expected generation capacity will be adequate for meeting the peak demand requirement at the end of 2029-30

4.4 DISTRIBUTION SYSTEM PLANNED BY 2030

4.4.1 66 KV/33 KV/22 KV Substations

Based on the data provided by the utilities, as on 31.03.2022, the total number of Power Sub-stations (66/11 kV, 33/11 kV and 22/11 kV) in the country was 39965 with a total installed capacity of 4,82,810 MVA. During 2022-23 to 2029-30, it is envisaged to add another 12,192 substations in the country with total power substation capacity addition of about 1,41,522 MVA. As a result, cumulative power sub-station (S/s) capacity in the country at the end of 2029-30 would be around 6,24,332 MVA with an increase of 29.31% compared to the substation capacity as on 31.03.2022

The year wise details are as tabled under:

Table 4.3: Planned sub-station (66/33/22kV) Capacity of India by end of 2029-30

	Status as on 31.03.2022	Yearly addition								Total Addition during 2022-30	Expected capacity by 2029-30
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
Number of S/s	39965	1173	2003	2286	1870	1230	1218	1155	1257	12192	52157
Capacity of S/s (MVA) (New+Aug.)	482810	14523	21878	24628	21889	14909	14442	13232	16020	141522	624332

State wise and Utility wise break-up of planned sub-station capacity addition by end of 2029-30 in terms of number and capacity are given at **Annexure -I & Annexure-II** respectively. It may be observed that the projected sub-transmission power substation capacity at the end of 2029-30 (i.e.624332 MVA) will be adequate to meet the peak demand of the country projected for 2029-30 (i.e 334811 MW /372012 MVA at 0.9 pf) resulting in about 60% aggregate loading of power sub-stations. However, some of the Sub-stations may be overloaded for some time based on the local load conditions.

On analysis of the substation capacity addition program of various State/UTs, following salient points are observed:

- Maximum capacity addition in terms of MVA during 2022-30 is planned in Gujarat (27,342 MVA)
- Maximum addition in terms of number of S/s during 2022-30 is planned in Uttar Pradesh (1804 nos.)

4.4.2 66 KV/33 KV/22 KV Feeders

The projected increase in the Power Sub-stations (SS) capacity would require commensurate 66 KV/33 KV feeding network expansion for efficient & effective power evacuation down the line. As on 31.03.2022, total number of 66/33/22 kV feeders in the country were around 36,804 with total length of 5,89,304 ckm. During 2022-23 to 2029-30, it is planned to add another 17,835 no of 66/33/22 kV feeders in the country with total addition in feeder length of 1,88,690 ckm. As a result, total 66/33/22 kV feeder would be around 54,639 with a total length of about 7,77,994 ckm by 2030 with an increase of 32.02% with reference to the 66/33/22 kV feeder length as on 31.03.2022.

The year wise details are as tabled under:

Table 4.4: Planned 66/33/22kV Feeder capacity of India by end of 2029-30

	Capacity as on 31.03.2022	Yearly addition								Total Addition during 2022-30	Expected capacity by 2029-30
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
Number of Feeder	36804	1680	3307	3790	2892	2047	1408	1311	1400	17835	54639
Length of Feeders (ckm)	589304	17674	34945	40754	33188	18580	15446	13905	14197	188690	777994

The state wise and utility wise break-up of planned 66/33/22 kV feeder addition in terms of number and length of 66/33/22 kV feeder by end of 2029-30 are given at **Annexure -III & Annexure-IV** respectively.

On analysis of the 66/33/22 kV feeder addition program of various State/UTs, it has been observed that

- i. Maximum number of feeder addition is planned in Karnataka (3,102 Nos)
- ii. Maximum feeder length addition during 2022-30 is planned in Uttar Pradesh (34,674 ckm).
- iii. Around 98% existing feeders at 66/33/22kV level are metered in the country.

4.4.3 11 KV Feeders

As on 31.03.2022, total number of 11 kV feeders in the country were 2,30,979 with total length of 49,35,279 ckm. During 2022-23 to 2029-30, it is planned to add another 92,920 no of 11 kV feeders in the country with total addition of feeder length of about 9,68,503 ckm. As a result, total 11 kV feeder would be around 3,23,899 Nos with length of about 59,03,782 ckm by 2029-30 with an increase of 19.62% compared to the 11 kV feeder length as on 31.03.2022. The year wise details are as tabled under:

Table 4.5: Planned 11kV Feeder capacity of India by end of 2029-30

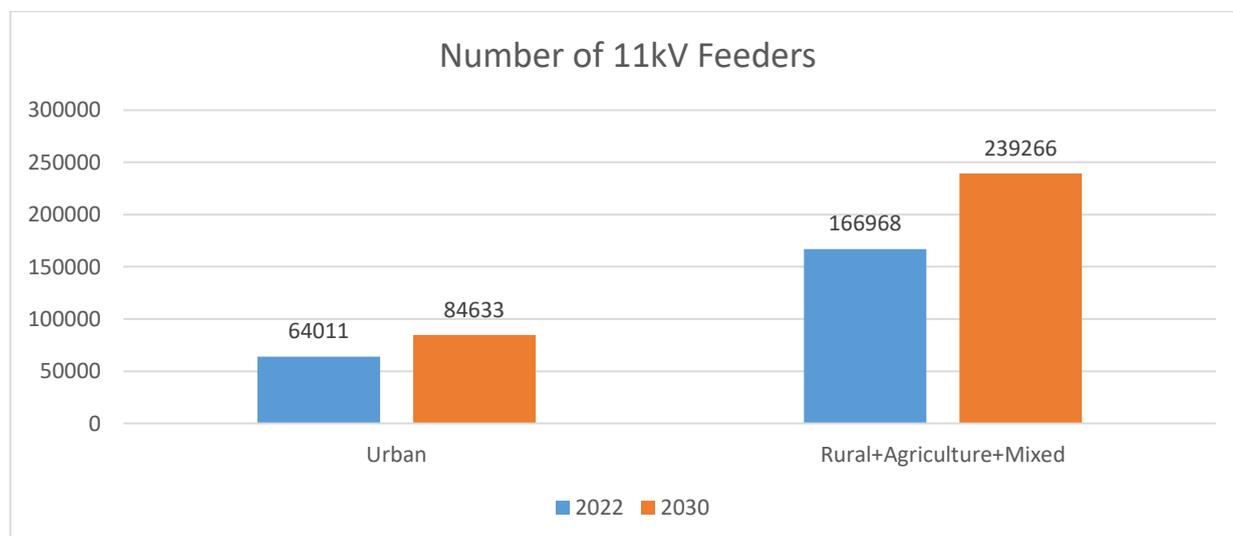
	Status as on 31.03.2022	Yearly addition								Total Addition during 2023-30	Expected Nos/Length by 2029-30
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
Number of Feeders	230979	10408	19527	18142	12484	8567	7553	7947	8292	92920	323899
Length of Feeders (ckm)	4935279	111823	200772	193086	130282	86527	79774	81988	84252	968503	5903782

State wise and Utility wise break-up of planned feeder capacity addition in terms of number and feeder length by end of 2029-30 are given at **Annexure -V & Annexure-VI** respectively.

On analysis of the 11 kV feeder addition program of various State/UTs, following salient points are observed:

- Maximum 11 kV feeders and feeder length addition during 2022-30 are planned in Rajasthan (12048 nos /165838 ckm)
- Average length of 11 kV feeder in the country would reduce from around 21 km in 2022 to around 18 km in 2030.
- Around 97% existing 11 KV Feeders are metered in the country.
- There is 40% increase in total No of 11 kV Feeder in the country.

The graphical representation of the different categories of 11kV feeders in the year 2022 and 2030 is shown in the charts.



4.4.4 Feeder Metering – National Feeder Monitoring System

The metering percentage of 66 kV/33 kV/22 kV and 11kV Feeders is given below:

Table 4.6: Feeder Metering

	Number	Metered	Metering % as on 31st March 2022	100% Metering targeted by
66kV/33kV/22kV Feeders	36804	36024	98 %	2023-24
11 kV Feeders	230979	224590	97 %	2023-24

Under RDSS, a National Feeder Monitoring System(NFMS) is being developed with the aim to set up a Centralized Unified Feeder Monitoring System for the country which will be further linked into NPP. It is envisaged that all the feeder data would be fed through online mechanism (M2M) instead of manual intervention in NFMS.

NFMS is envisaged with the following key objectives:

- a) Automatic monitoring for Reliability of Power parameter such as SAIFI, SAIDI and Hours of Supply etc.
- b) Automatic monitoring for Quality of Power such as Voltage level, Frequency, Power factor etc.
- c) Enabling Inputs for DISCOM Consumer Service Rating, Demand forecasting, Network Planning, Load Management & Energy Accounting and other operational & strategic initiatives
- d) Advanced reporting and generation of multi layered MIS for all stakeholders along with enablement for Advanced Data based Analytics (AI/ML based)
- e) Enabling seamless Machine to Machine data transfer from field equipment to the servers and data processing Unit without any manual interventions

Additionally, the broad objective of NFMS are as follows:

- NFMS would facilitate to monitor the accurate & effective online recording of the energy exchanges in distribution system to reduce operational errors viz. bias error, typographical errors etc. caused by involvement of human element
- Demand forecasting and load planning.
- Provide a web based analytical platform to generate & view the analytical reports and derive valuable insights from the feeder data of various DISCOMS and there shall be no restrictions on the no of users using the analytics Platform
- Provide an android & iOS-based application for the field officers and Senior management to view the reports, analytic insights, monitor progress and performance on the go.

4.4.5 Distribution Transformer (33/0.4kV,22/0.4kV,11/0.4 kV)

The number of Distribution Transformers (DT) at all-India level as on 31.03.2022 stood at 1,46,74,261 with an installed capacity of 6,89,192 MVA. During 2022-23 to 2029-30, it is planned to add about 46,57,854 number of DTs with a total added DT capacity of 2,38,464 MVA in the country. These DT additions are planned for meeting the customer's electricity demand growth & using HVDS for reducing the technical losses by bringing HT line closer to the load center. As a result, total DT capacity in the country at the end of 2029-30 would be around 9,27,656 MVA with an increase of 34.6% compared to the DT capacity as on 31.03.2022.

The year wise details are as given in **Table 4.7**.

Table 4.7: Planned DT number and capacity by end of 2029-30

	Status as on 31.03.2022	Yearly addition								Total Addition during 2022-30	Expected capacity/number by 2029-30
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
Number of DT	1,46,74,261	5,53,242	6,14,488	6,20,579	5,80,657	5,63,968	5,59,048	5,75,458	5,90,413	46,57,854	1,93,32,115
Capacity of DT (MVA)	6,89,192	24,621	28,173	31,683	30,610	29,809	31,430	30,869	31,517	2,38,464	9,27,656

State wise and Utility wise break-up of planned DT capacity addition in terms of number and MVA capacity by 2029-30 are given at **Annexure-VII & Annexure-VIII** respectively.

On analysis of the DT capacity addition program of various State/UTs, following salient points are observed:

- Maximum DT capacity addition during 2022-30 are planned in Maharashtra (47,094 MVA)
- Maximum number of DT addition during 2022-30 are planned in Gujarat (7,65,927 No of DTs)
- Average capacity of DT in the country would remain almost same at around 50 kVA both at the end of 2021-22 and at the end of 2029-30.
- As on 31st March 2022 about 38.72 % DT's are metered and it is planned to achieve 100% DT metering (except small DTs of less than 25 KVA) during 2023-24 along with smart metering.
- The peak demand for the year 2029-30 as per 20th EPS is 334811 MW. Considering 10% load is directly fed from 33kV/22kV/11kV level, the peak load at DT level would be around 301330 MW (334811 MVA at 0.9 pf). Hence, the projected DT capacity at the end of 2029-30 (i.e.927656 MVA) will be adequate to meet the peak demand of the country projected for 2029-30 resulting in about 36% aggregate loading of DT's. However, some of the DT's may be loaded more for some time based on the local load conditions. Discoms have to take judicious decisions to install new DTs /augmentation of DTs keeping in view the loading pattern in the areas.

4.4.6 LT Feeders (400V/230V)

As on 31.03.2022, the country has total of about 22,31,495 ckm of LT (1-phase) and 57,14,263 ckm of LT (3-phase) lines. During 2022-23 to 2029-30, it is planned to add about 4,99,556 ckm of LT (1-phase) lines and about 12,69,774 ckm of LT (3-phase) lines in the country. As a result, total LT lines (1ph & 3 Ph) would be around 97,74,634 ckm by 2029-30 but out of the total LT lines, about 69% LT lines would be 3 phase lines in the country.

The year wise details are given in **Table 4.8**.

Table 4.8: Planned LT Feeder length(ckm) of India by end of 2029-30

LT Line	Status as on 31.03.2022	Yearly addition								Total Addition during 2022-30	Expected Length by 2029-30
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
LT (Single Phase) ckt-km	22,31,495	43,629	52,053	50,878	51,161	53,537	52,959	55,529	1,39,809	4,99,556	27,31,050
LT(3 Ph) ckt-km	57,14,263	1,23,803	1,89,688	2,09,578	1,68,626	1,46,326	1,48,583	1,63,510	1,79,205	12,69,774	70,43,583
Total LT lines ckt km	79,45,758	1,67,432	2,41,742	2,60,456	2,19,787	1,99,863	2,01,542	2,19,039	3,19,015	18,28,876	97,74,634

State wise and Utility wise break-up of planned LT feeder capacity addition for 1 phase and 3 phase by end of 2029-30 are given at **Annexure -IX & Annexure-X** respectively.

On analysis of the LT feeder addition program of various State/UTs, following salient points are observed:

- i. Maximum number of LT feeder addition during 2022-30 is planned in Uttar Pradesh.
- ii. The average LT feeder length per DT would be reduced from 0.54 ckm in 2021-22 to 0.51 ckm in 2029-30. Lower length of the LT feeder per DT would improve the voltage profile at the consumer end and would also reduce line losses.

4.4.7 HT/LT RATIO

HT/LT ratio is considered one of the performance indicator for Technical losses in any distribution system. Higher the ratio, the lower will be the technical losses. Further, with higher HT/LT ratio, the low voltage problem suffered by consumer is also reduced. HT/LT ratio of 1 or more is considered to be a good indicator for any distribution system.

Based on data furnished by States/Utilities, it is observed that the HT/LT ratio of the country will decrease is around 0.62 as on 31.03.2022 , which will be around 0.60 as on 31.03.2030. HT/LT ratio of utilities as on 31.03.2022 and 31.03.2030 is given at **Annexure-XI**.

It is advised that the utility may plan their future distribution system to have more HT lines as compared to LT lines to improve the HT/LT ratio which would help the utilities to reduce the T&D losses.

On analysis of the HT/LT ratio of various State/UTs, following salient points are observed:

- Punjab is expected to achieve the highest HT/LT ratio of 1.87 at the end of 2029-30.
- DISCOMs of Arunachal Pradesh, Gujarat, Haryana, Madhya Pradesh, Mizoram, Punjab and Rajasthan are also expected to have HT/LT ratio of more than 1.0 at the end of 2029-30.

4.4.8 CAPACITORS

As per the data furnished by the utilities, there are about 59,255 MVAR of capacitors installed in the distribution system by March 2022. During 2022-23 to 2029-30, it is planned to add about 45,954 MVAR of capacitors in the country. As a result, total MVAR capacity of capacitors in distribution system in the country at the end of 2029-30 would be around 1,05,209 (increase of 77.6%). The details are given in **Table 4.9**.

Table 4.9: Planned Capacity (MVAR) of Capacitors in India by end of 2021-22

Capacitor (MVAR)	Capacity as on 31.03.2022	Yearly addition								Total Addition during 2022-30	Expected capacity by 2029-30
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
	59255	4031	8128	10578	5892	4812	3882	3916	4714	45954	105209

State wise and Utility wise break-up of capacitor addition program at end of 2029-30 are given at **Annexure -XII**.

On the analysis of the capacitor addition programme of various State/UTs, it is observed that the maximum number of capacitor addition during 2022-30 is planned in Rajasthan.

4.4.9 SCADA and RT-DAS

As of March 31, 2022, SCADA systems are operational in approximately 2377 sub-stations across 127 towns, based on data obtained from utility sources. Looking ahead, projections indicate that the implementation of SCADA will expand significantly, with an anticipated coverage of 13553 sub-stations in 1393 towns

Around 3867 sub-stations have RT-DAS covering 894 towns as on 31st March 2022, as per the data received from utilities. It is expected that 1096 towns will have 17384 sub-stations with RT-DAS.

State wise and Utility wise information of SCADA & RTDAS during 2021-22 and at end of 2029-30 are given at **Annexure -XIII**.

4.5 NETWORK ADEQUACY

As per 20th EPS, the expected demand of India at the end of 2029-30 would be around 3,34,811 MW (3,72,012 MVA at 0.9 power factor). To meet the expected demands of Discoms, the adequacy at All India level is as under :

- The planned 66/33/22 KV substation capacity at the end of 2029-30 (i.e.623630 MVA) would be adequate to meet the peak demand of the country during 2021-22 resulting in 60% aggregate loading of substation transformers.
- Considering 10% load is directly fed from 33kV/22kV/11kV level, the peak load at DT level would be around 301330 MW (334811 MVA at 0.9 pf). Hence, the projected DT capacity at the end of 2029-30 (i.e.927656 MVA) will be adequate to meet the peak demand of the country projected for 2029-30 resulting in about 36% aggregate loading of DT's.

The discom wise adequacy was also examined and it is noted that the proposed capacity would be adequate to meet the expected demands of the discoms. However, it is noted that in some utilities, the DT capacity is proposed on higher side, providing DT loading in the range of 20-30%. The Discoms have to use the DT capacity optimally based on the actual field conditions and study of the system.

It may be noted that the higher capacity at 66/33/22 kV S/s and DT level proposed by the utilities may be on account of following grounds:

- Utilities plan their system keeping view the redundancy (like N-1 condition) in the system
- Utilities generally plan their capacity addition keeping in view the requirement of next 10 years, which necessitate some added margin in their capex.
- Higher standard rating of transformers are deployed by utilities to cater to marginal load growth and thus results in extra margin in the capacity addition programme
- As Peak demand at S/Ss, feeders and DTs will not occur simultaneously, which necessitates some extra margin at sub-stations and DTs.

4.6 AT&C LOSSES

The Aggregate Technical and Commercial (AT&C) loss captures the technical & financial performance of distribution utilities. AT&C loss is nothing but the sum total of technical and commercial losses. Central Government is encouraging the States through RDSS to reduce their AT&C losses as RDSS scheme aims to reduce the AT&C losses to Pan-India levels of 12-15% and reduce ACS - ARR gap to zero by 2024-25.

Based on information collected from 71 distribution utilities across the country, the trajectory of AT&C loss reduction is summarized in **Table 4.10**

Table 4.10: Number of distribution utilities across various bands of AT&C Losses(%)

Range	As on 31.03.2022 (PFC- 2021-22 data)	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Loss>25	23	15	8	4	3	1	0	0	0
25<=Loss<20	3	10	11	4	2	4	3	1	1
20<=Loss<15	7	13	15	15	18	11	11	11	7
Loss<=15	38	33	37	48	48	55	57	59	63
Total	71	71	71	71	71	71	71	71	71

Reduction of AT&C losses by various distribution utilities during 2023-30 is given at **Annexure-XIV**.

It may be noted that at the end of 2029-30, all distribution utilities are likely to achieve AT&C loss reduction in the range of 10-12% or below.

4.7 CONSUMER METERING PLAN

Meters are the cash box of electricity distribution sector. Meters installed at consumer end registers the energy consumed by the end-user and help the utilities to bill and collect revenue. 100% metering would help utilities to plug their electricity theft and help them in operating efficiently and sustainably.

From the data collected by the utilities, it is observed that as on 31.03.2022, the country had about 33 crore consumers and out of that, 31 cr consumers are metered resulting into consumer metering of 93.72%. During 2022-30, the country is expected to add another 18.63 crore new customers which are expected to be released through metered connections only. The following table illustrates the consumer details during 2022-30.

Table 4.12: Expected consumer metering at the end of 2029-30

	<i>As on March 2022</i>			<i>Expected consumer by 2029-30</i>	<i>% increase in consumers by the end of 2029-30</i>
	<i>No of Consumers</i>	<i>Metered Customers</i>	<i>% metering</i>		
Agriculture	26677476	10507077	39.39	36152564	35.52
Commercial	29896145	29760642	99.55	50774527	69.84
Domestic	262849071	258516763	98.35	409627107	55.84
Industrial	3959269	3959269	100.00	6384126	61.25
Others	6122109	6055085	98.91	12833622	109.63
All India	329504070	308798835	93.72	515771946	56.53

State-wise addition of consumers upto 2029-30 is at **Annexure-XV**.

4.7.1 Smart Pre-paid /Simple Pre-paid Metering Plan for Consumers

Central Electricity Authority (Installation and Operation of Meters) (Amendment) Regulations, 2022 stipulates that all consumers in areas with communication network, shall be supplied electricity with Smart Meters working in prepayment mode, conforming to relevant IS, within the timelines as specified by the Central Government.

Further, Government of India through Gazette notification fixed the following timeline for installation of smart meters with prepayment feature in place of existing meters:

- All consumers (other than agricultural consumers) in areas with communication network, shall be supplied electricity with Smart Meters working in prepayment mode, conforming to relevant IS, within the timelines specified below:
 - (i) All Union Territories, electrical divisions having more than 50% consumers in urban areas with AT&C losses more than 15% in financial year 2019-20, other electrical divisions with AT&C losses more than 25% in financial year 2019-20, all Government offices at Block level and above, and all industrial and commercial consumers, shall be metered with smart meters with prepayment mode by December, 2023:

Provided that the State Regulatory Commission may, by notification, extend the said period of implementation, giving reasons to do so, only twice but not more than six months at a time, for a class or classes of consumers or for such areas as may be specified in that notification;

- (ii) All other areas shall be metered with smart meters with prepayment mode by March, 2025:

Provided that in areas which do not have communication network, installation of prepayment meters, conforming to relevant IS, may be allowed by the respective State Electricity Regulatory Commission:

- (iii) All consumer connections having current carrying capacity beyond that specified in relevant IS, may be provided with meters with smart meters having AMR facility.

4.8 SUMMARY OF DISTRIBUTION INFRASTRUCTURE PLAN – AS ON MARCH 2022 AND MARCH 2030

Table 4.13: Summary of Distribution infrastructure available in March 2022 and proposed upto March 2030

Sr	Description	Unit	March-22	March-30
1	Substation Count (66/33/22 kV)	<i>Nos</i>	39,965	52,157
2	Substation Capacity (66/33/22 kV)	<i>MVA</i>	482810	624332
3	Feeders (66/33/22kV) Count	<i>No</i>	36,804	54,639
4	Feeders (66/33/22kV) Length	<i>CKM</i>	589304	777994
5	Feeders (11kV) Nos	<i>Nos</i>	230979	323899
6	Feeders (11kV) Length	<i>CKM</i>	4935279	5903782
7	Distribution Transformer(DT) count	<i>Nos</i>	14674261	19332115
8	Distribution Transformer(DT)	<i>MVA</i>	689192	927656
9	LT Feeders (1-Ph & 3 Ph)	<i>CKM</i>	7945758	9774634
10	Capacitor Bank	<i>MVAR</i>	59,255	105209
11	Consumers	<i>Nos</i>	33 Crs	52 Crs

4.9 WORKS APPROVED UNDER RDSS VS PROPOSED REQUIREMENT UPTO 2025

Table 4.14: Infrastructure approved under RDSS and the infrastructure proposed by Utilities upto March 2025

Sr	Description	Unit	Total Addition During 2022-2025	Approved Under RDSS	% Approved
1	Substation Count (66/33/22 kV)	Nos	5462	409.00	7%
2	HT Feeders Length	CKM	505681	273581	54%
3	Distribution Transformer(DT) (11/0.433 KV) count	Nos	1788309	459,718	26%
4	Distribution Transformer(DT) (11/0.433 KV) capacity	MVA	84478	26,609	31%
5	LT Feeders (1-Ph & 3 Ph)	CKM	669630	5446195	81%
6	Capacitor Bank	MVAR	22737	9,021	40%
7	Smart Consumers meters	Nos		19 Crores	

4.10 ESTIMATED FUND REQUIREMENT & AVAILABILITY

Based on the details received from the utilities, about Rs 4.28 lakh crore would be required for upgradation of distribution infrastructure during 2022- 27, out of which, about Rs 1.89 lakh Cr would be available with Discoms including fund sanctioned under RDSS. The available fund would be around 44% of the total investment required upto 2027, as illustrated in the Table 4.15

Table 4.15: Funds required for Distribution Infrastructure upgradation

Investment Required from 2022-27 in Rs lakh Crore	Total Investment available with the Discom from various sources for period 2022-27 (Rs lakh Cr.) including RDSS	Investment Required from 2027-30 in Rs lakh Crore	Total Investment Required from 2022-30 in Rs lakh Crore	% of required investment already sanctioned upto 2027 under RDSS and other schemes
Rs 4.28	Rs 1.89	Rs 2.86	Rs 7.42	44.11

4.11 FUTURE ROAD MAP

After the achievement of 100% Household electrification in the country, State Governments are taking concerted efforts to provide 24x7 reliable and quality power to all the consumers and reducing AT&C losses below 15%. The Central Government is assisting the States to reduce their AT&C losses by providing financial assistance under RDSS Scheme.

However, in order to reduce the AT&C losses further, utilities need to concentrate on reducing technical losses. Improving HT/LT ratio can reduce technical losses as well as improve voltage profile at consumer end. HT/LT ratio can be increased either by adopting HVDS system or increasing HT line length. The use of IT in distribution sector would also enable automated energy accounting & auditing and will play a major role in reducing the AT&C losses and providing reliable power supply to the consumers. The access of consumption data, outages data and fast redressal of their complains would provide more consumer satisfaction.

The present Distribution Perspective Plan 2030 envisages the following, but not limited to-

- 24x7 Reliable, Affordable & Quality power to all
- Power Purchase optimization and adoption of Resource Adequacy Plan
- Availability of Electricity Connections on demand
- AT&C losses around 10% by 2030.
- 100% Feeder, DT and Consumer metering
- Smart pre-paid/Simple pre-paid meters as per CEA Regulation
- Adoption of Automation like SCADA/RT-DAS, DMS, OMS ERP etc in all utilities
- Consumer Care Centers in all utilities up to subdivision levels
- Availability of adequate distribution infrastructure with N-1 redundancy for reliable power to all consumers
- Consumer and employee satisfaction
- Adoption and promotion of Renewable Energy and Energy Efficiency

5

Reforms in Distribution Sector

5.1 RECENT REFORMS UNDERTAKEN IN POWER SECTOR

The power sector in India has witnessed accelerated growth and has successfully achieved many Reforms post enactment of Electricity Act (EA) -2003. With De-licensing policy for adding power generating capacity (excluding hydro), the generation sector has successfully attracted the private sector investment and added sufficient generation capacity, which has helped to bridge the demand supply gap in the country. Due to this, the country has become power surplus and shortages in the country is virtually negligible. The country also has a sufficient spinning reserve capacity today. The whole country has been connected to one grid resulting in “One Nation – One Grid – One Frequency”. The Indian grid has now emerged as the largest integrated grid in the world. The country has also achieved universal electrification by providing electricity to all villages and all willing households and is moving towards providing 24x7 power supply to the consumers.

The following reforms have been undertaken in the country recently for development of power sector including distribution sector:

(i) Reforms for development of Green Power

The power sector also witnessed an unprecedented capacity addition in Renewable Energy (RE) generation resulting in to the future low-carbon regime. India’s COP 21 commitment of achieving 40% of its installed electricity capacity from non-fossil energy sources by 2030 has been realized in November 2021 itself – a full 9 years ahead of our target date. The following major steps are taken by the Government to accelerate the Indian economy’s transition to one powered by green energy include:

- Permitting Foreign Direct Investment (FDI) up to 100 percent under the automatic route for renewable energy projects
- Waiver of Inter State Transmission System (ISTS) charges for inter-state sale of solar and wind power for projects to be commissioned by 30th June 2025
- Declaration of trajectory for Renewable Purchase Obligation (RPO) up to the year 2030
- Setting up of Ultra Mega Renewable Energy Parks, to provide land and transmission to RE developers on a plug and play basis
- Launch of Schemes such as Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM), Solar Rooftop Phase II, 12000 MW CPSU Scheme Phase II, etc.

- Laying of new transmission lines and creating new sub-station capacity under the Green Energy Corridor Scheme for evacuation of renewable power
- Transmission Plan for Integration of 500 GW Renewable Energy capacity by 2030.
- Notification of standards for deployment of solar photovoltaic system/devices,
- Setting up of Project Development Cell for attracting and facilitating investments,
- Standard Bidding Guidelines for tariff based competitive bidding process for procurement of Power from Grid Connected Solar PV and Wind Projects.
- Government has issued orders that power shall be dispatched against Letter of Credit (LC) or advance payment to ensure timely payment by distribution licensees to RE generators.
- Notification of Promoting Renewable Energy through Green Energy Open Access Rules 2022.
- Notification of “The electricity (Late Payment Surcharge and related matters) Rules 2022 (LPS rules).
- Launch of Green Term Ahead Market to facilitate sale of renewable energy power through exchanges
- Conducting skill development programmes to create a pool of skilled manpower for implementation, operation and maintenance of RE projects etc.

(ii) Reforms for development of Transmission system

The development of one national grid (One Nation One Grid One Frequency) by integrating all the regional grids has made it possible to transmit power from any part of the country to any other parts and exchange of power with other countries. Competitive participation in providing transmission services and tariff determination through process of bidding have facilitated the development of transmission system on competitive Bidding process . To Promote competitive procurement of transmission services, to encourage private investment in transmission lines and to facilitate transparency and fairness in procurement processes in transmission sector, the tariff based competitive bidding (TBCB) have been introduced in Transmission sector. Further, power trading through energy exchange is one of the objectives of power sector reforms post EA-2003 by increasing competition in market. At present, 3 power exchanges are working in the country for trading of electricity.

(iii) Reforms for development of Distribution system

The country has achieved universal electrification as every village, every hamlet and every home has now been connected to electricity thereby ensuring universal access. This transformation from an acutely power deficit country, to a situation where we can export electricity to our neighboring countries, has been made possible by the relentless efforts of the Government and all the stakeholders. During the recent past, Govt. of India has implemented several reform programs in the distribution sector viz., Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY), Integrated Power Development Scheme (IPDS),

Decentralized Distributed Generation (DDG), 24x7 Power for All and Saubhagaya schemes etc and these reform programs have significantly contributed for achieving universal electrification and achieving substantial improvement in distribution infrastructure to strengthening the power distribution system both in urban and rural areas. The measures also helped to reduce AT&C losses by various measures like laying of ABC cables in theft prone areas, improvement in metering , billing & efficiency and introduction of automation & ICT in distribution sector for power measurement and control. The DDUGJY scheme, IPDS scheme and Saubhagya scheme stand closed on 31st March, 2022.

Further, Government of India has launched Revamped Distribution Sector Scheme(RDSS) in July 2021 with the objective of improving the quality and reliability of power supply to consumers through a financially sustainable and operationally efficient distribution Sector. The scheme has an outlay of Rs 3,03,758 Crore with an estimated Government Budgetary Support (GBS) of Rs 97,631 Crore. The duration of the scheme is 5 Years (2021-22 to 2025-26). Under the scheme, financial assistance is being provided to the eligible Discoms for upgradation of distribution infrastructure & system modernization including SCADA and communicable system metering along with smart pre-paid /simple pre-paid metering for consumers in the country.

(iv) Reforms for Enforcing Financial Discipline in Power Sector

As a step towards addressing the issue of mounting dues of the State power utilities which had crossed about Rs1,50,000 crore, Ministry of Power issued Electricity, (Late Payment Surcharge and Related Matters) Rules, 2022 (LPS Rules 2022). This initiative is making the power sector to realize & bring financial discipline in the power sector. This is assumed that the end consumer gets reliable and quality uninterrupted supply of electricity, alleviates the interest burden on the power purchase dues by the State utilities and provide for payment of arrears dues by DISCOMs in easy installments. State run financial institutions in the power sector were also advised by the Ministry of Power to extend their support to Discoms for timely payment of their legacy dues under the new LPS rules subject to strict timely payment of current dues.

(v) Reforms for Empowering the Customers – Consumer Right Rules

With the objective of beginning an era of empowering Power Consumers, laying down rights of the consumers and a system of enforcement of these rights, while facilitating ease of doing business in power sector, the Ministry of Power promulgated the Electricity (Right of Consumers) Rules 2020 with the conviction that the power systems exist to serve the consumers and the consumers have rights to get reliable services and quality electricity.

These Rules lay down the time limits and standards for the various services to be provided by the Distribution Companies across the country. The DISCOMs are required to provide services in accordance with standards or pay compensation to their consumers. These

Rules specify the obligations of the licensee and the best practices that must be adopted by the licensee to provide efficient, cost effective, reliable and consumer friendly services to the consumers. These rules are one of the evolving steps to enable the transformation of a DISCOM from a mere power supplying agency to a holistic consumer focused service provider. An amendment to these Rules was notified 21st April, 2022, to specify the parameters to maintain the reliability of supply by the distribution licensee namely System average interruption duration index (SAIDI) and System average interruption frequency index (SAIFI), customer average interruption duration index (CAIDI), customer average interruption frequency index (CAIFI) and momentary average interruption frequency index (MAIFI). Further the consumers, who are using the diesel generator sets as essential back up power are required to shift to cleaner technology such as renewable energy with battery storage and the like in five years from the date of commencement of these rules or as per the timelines given by the State Commission for such replacement based on the reliability of supply in that city.

The rules were further amended vide notification dated 14th June , 2023 wherein certain provisions such as remote reading of smart meters at least once in a day and other pre-payment meters at least once in every three months, increase and decrease in the sanction load & Time of the Day Tariff have been included.

As per Section 57 of Electricity Act, 2003, Consumer Grievances Redressal Forum (CGRF) and Ombudsman are in place in most of the States to protect the interest of consumers.

Further, recognizing the requirement and importance of addressing consumer grievances, financial assistance was provided to Distribution Utilities under various schemes to set up dedicated Centralised Customer care center in each Discom, also accessible through common electricity complaint number across all States/Utilities (i.e. short code telephone number 1912). Most of the Discoms are providing services on this short code telephone number for grievance redressal of the consumers on toll free mode.

The introduction of Information technology including smart distribution system would enable more participation of consumers in load management and consumers would also have the access to the data related to their consumption, outages, etc.

5.2 SPECIFIC REFORMS FOR DISTRIBUTION SECTOR

Although, various reforms/ measures under taken by discoms, have significantly contributed for the development of power distribution infrastructure across the country, however, despite implementation of several rounds of reforms post enactment of Electricity Act 2003, the distribution power sector has not been successful in achieving good financial health. As power being the driver of the economy for any nation, the power sector operating in an unviable manner is a major concern for the development of power sector and overall economic growth. Huge debt level of the state power utilities with sustained losses are the significant contributors for the unviability of the DISCOMs and remains as major concerns for the sectoral development and financial viability of the DISCOMs.

The Discoms continued to make huge losses on sustainable basis primarily due to the huge negative gap between Average Revenue Realized (ARR) and Average Cost of Supply (ACS) due to adoption of non-cost reflective tariff in various States. The state power utilities are not operating on commercial principles and are incurring huge commercial losses, which led to mounting revenue shortage with them. Further, DISCOMs are unable to sustain its power distribution business without government subsidies. DISCOMs are highly dependent for operational subsidy from State governments and huge capital subsidy for infrastructure development from the Central government which makes the power distribution business financially and commercially unviable and unsustainable. High AT&C loss is also one of the primary reasons for the sustained financial losses of the state power utilities.

For the progressive growth of the electricity distribution sector, it is essential that the sector becomes revenue sustainable by adopting following reform measures in true spirit:

- **Optimal procurement of Power as per Resource Adequacy Plan:** This reform measure is to adopt a certain percentage of power requirement from long-term to a shorter time frame as per Resource Adequacy plan. In the past, long-term agreements (of 15 to 25 years duration) for 100% power requirement was made by utilities, however, due to changed scenario this process is less relevant now with power surplus country and an increasingly diverse set of suppliers and consumers. The present environment with sufficient installed power generation capacity, decline in the price of renewable energy and increased competition in the market make the short-term power purchase of a certain amount of power requirement a more attractive option. The growth in variable renewable energy, from large-scale renewable parks to rooftop installations, and the consequent challenge of inter-day swings in production, has made flexible generation more valuable than a long-term contract. It would be more appropriate that Discoms should follow the Resource Adequacy Plan as prepared by CEA for all utilities to optimize their power procurement cost with adequate power availability for supplying to the consumers. To achieve this, a dedicated cell in each discom may be constituted with experienced staff to suggest procurement of optimally priced power by the discom.

- **Public Private Partnership (PPP) in distribution business/ Franchisee :** The financial health of Distribution Utilities has become a matter of grave concern considering that their losses have reached an alarming level. Electricity being a concurrent subject, the reforms in the power sector calls for joint efforts of State Governments and Central Government. Electricity Act 2003 has provided a legal frame-work to attract private sector participation in the power sector. Under Section 14 of Electricity Act, a power distribution company can appoint another entity to supply power in a particular area within its distribution territory without the requirement of a separate distribution license. Since distribution sector is exclusively within the purview

of the State Government, they should provide necessary legal and regulatory framework for smooth implementation of public private partnership (PPP) in the states. A strong political support is also necessary for introducing PPP model in the distribution sector in the states. Consensus building among various stake holders is also vital for the success of PPP. It is important to mobilize support from all the stakeholders for effective implementation of PPP model in the states.

As the regular staff in the State owned Distribution Companies is depleting fast, there is also a need to outsource various activities in distribution sector to increase private participation. In case, Distribution Companies are not in position to make requisite investment in the distribution system to bring improvement in performance, the Public Private Partnership (PPP) Model is seen as one of the feasible solution as this would facilitates investment from private sector to bridge the gap between availability and requirement of funds.

Distribution Franchisee is an emerging PPP model in Indian Distribution power sector. In many States, State government-owned distribution companies are adopting the franchisee model in areas where losses are generally high. While it is not complete privatization, it is a step to leverage best corporate practices, cut down high utility losses, realize predictable cash flows directly from end-consumers and hence offers an attractive big market.

For introducing private participation in the distribution sector in the states, a strong State government support is necessary. A time bound plan for identification of areas for introducing PPP model (like areas where AT&C losses are in excess of 25 %) needs to be worked out by each state and need to initiate implementation of the plan in coordination with all the concerned agencies. This would help to introduce the efficiency in distribution business and would also provide commercial sustainability which is an essential parameter for improving the efficiency of discoms under Uday scheme.

- **Govt Subsidy through Direct Benefit Transfer (DBT)** : Several state governments in India provide electricity at subsidised rates or even free to some sections of consumers including agriculture and other domestic classes . The subsidies are mainly of two type i.e direct subsidy by State Govt and cross-subsidisation, with the other users such as industries and private consumers paying the deficit caused by the subsidised tariff. As per the provisions of Electricity Act, 2003, the State Electricity Regulatory Commissions (SERCs) fix the tariff for the sale of electricity to consumers including agriculture and other classes of consumers . Section 65 of the Act provides that in case the State Government likes to subsidize any consumer or class of consumers, the State Government shall pay to the concerned Utility/licensee the full amount required for the purpose. However, due to non receiving the full subsidy from State Govts, these measures have resulted in many of the state distribution utilities becoming financially weak. Although, the State government is free to give subsidy to provide free power to any class of consumers but the subsidy should be given through

Direct Benefit Transfer (DBT) i.e directly in the bank account of the consumer in place of giving subsidy to the discom to make the consumers as a responsible consumer.

- **Introducing of IT initiatives in distribution sector** : Some of the key technologies extensively adopted by some Discoms utilities are GIS-based consumer indexing and electrical network mapping, Automated Meter Reading (AMR) on all feeders and Distribution transformers for energy auditing & accounting for identifying the theft prone areas, IVRS-based consumer call centre , establishment of data centre, SCADA /DMS in big towns etc. along with smart metering for consumers. It is envisaged under RDSS scheme to install smart meters for all consumers and communicable meters on all feeders & Distribution Transformers (DTs) by March 2025 which would monitor & control the energy flow in various segments of distribution. It would also facilitate to disconnect the consumers remotely and would pave the way for improving collection efficiency by checking the theft and inefficiencies in the system. The smart meter can be used in pre-paid mode , post paid mode or as net meter mode and also has two way communication to facilitate the demand Side management through consumer participation etc.
- **Time of day / dynamic pricing system** : The profile of today's consumption is fast changing with greater urbanization, use of more electric appliances, conservation measures and use of new applications/technologies like on-site storage and electric vehicles etc and to achieve the optimal utilisation of resources, we have to shift to Time-of-the day metering. The need to shift to Time of the day metering in the short-term is of paramount importance to bring the sector back on track and to contain the huge financial losses of DISCOMs. This would also smoothen the load curve and ensure efficient and optimal utilisation of both generation and distribution capacities. Smart meters have the features for implementing TOD metering and these can also be configured as per the existing pricing of the tariff. The consumer can also be informed about the tariff for various slots of the day through an App/ SMS to empower them to control their load as per their choices.

Ministry of Power has already issued the Electricity (Rights of Consumers) Amendment Rules, 2023 vide notification dated 14-06-2023, wherein the rule for Time of Day (ToD) Tariff has also been specified. Under the proposed rules , it is envisaged that the Tariff during solar hours (duration of eight hours in a day as specified by the State Electricity Regulatory Commission) of the day shall be 10%-20% less than the normal tariff, while the tariff during peak hours will be 10 to 20 percent higher. ToD tariff would be applicable for Commercial and Industrial consumers having Maximum demand of 10 KW and above, from 1st April, 2024 and for all other consumers except agricultural consumers, latest from 1st April, 2025. Time of Day tariff shall be made effective immediately after installation of smart meters, for the consumers.

- **Limits of Cross subsidy within $\pm 15\%$** : To supply the power at a reasonable tariff to the consumers, the limits of cross subsidy between various classes on consumers

should be within a reasonable range. As per Tariff Policy 2016, the Appropriate Commission would notify a roadmap such that tariffs are brought within $\pm 20\%$ of the average cost of supply for achieving the objective that the tariff progressively reflects the cost of supply of electricity. However, many a times, the industrial tariff is fixed much higher than the avg. cost of supply to subsidize a class of consumers which makes the tariff for industrial consumer unattractive and uneconomical. Hence, to make the tariff reasonable for all the categories of consumers, the tariffs for all categories of consumers should be brought within the limits of $\pm 15\%$ of average cost of supply.

- **No Regulatory Assets** : Regulatory assets include receivables from consumers not allowed by regulatory authorities in the tariff. Regulatory assets also include previously-incurred losses that are in the nature of deferred expenditure and that can be recovered from consumers in future provided allowed by regulatory authorities. As the accumulation of Regulatory assets creates huge burden on discoms due to impact on their receivables, Discoms should prepare their ARR in such a manner that there should not be any Regulatory Assets which are not agreed by Regulators to pass through in tariff. Regulators should also devise a methodology to liquefy the existing burden of Regulatory assets in a time bound manner.

Penalty on Load shedding : Now a days , Discoms should provide 24x7 power to all consumers (except Agriculture consumers) and there should not be any load-shedding due to non availability of power with the discoms. Hence, discoms should implement the Resource Adequacy Plan in consultation with respective SERC to avoid load shedding due to non availability of power. In the Electricity (Rights of Consumers) Rules, 2020 notified by MOP, there is a provision of Compensation mechanism for consumers detailed as under:

- (1) Consumer shall be automatically compensated for those parameters which can be monitored remotely when it can be successfully established that there is a default in performance of the distribution licensee.
- (2) The Commission shall notify regulations for establishment of mechanism, by the distribution licensee, for automatic payment of compensation amount determined under the provisions of sub-section (2) of section 57 of the Act within six months from the notification of these rules.
- (3) The Commission shall oversee that the distribution licensee designs and maintains its distribution system in such a way that there is a gradual increase in the list of parameters, which can be monitored remotely and for which automatic compensation can be made to the consumer.
- (4) The standards of performance for which the compensation is required to be paid by the distribution licensee include, but are not limited to, the following, namely:-
 - (i) No supply to a consumer beyond a particular duration, to be specified by the Commission;

- (ii) Number of interruptions in supply beyond the limits as specified by the Commission;
 - (iii) Time taken for connection, disconnection, reconnection, shifting;
 - (iv) Time taken for change in consumer category, load;
 - (v) Time taken for change in consumer details;
 - (vi) Time taken for replacement of defective meters;
 - (vii) Time period within which bills are to be served;
 - (viii) Time period of resolving voltage related complaints; and
 - (ix) Bill related complaints.
- (5) The distribution licensee, within six months from the date of notification of the regulations by the Commission under sub-rule (2), shall create an online facility on which consumers may register and claim the compensation amount. The information in this regard shall be widely circulated among consumers through appropriate means including mass media, bills, SMS, e-mails or by uploading on licensee's website.
- (6) In all cases of compensation, the payment of compensation shall be made by adjustment against current or future bills for supply of electricity, within stipulated time from the determination of claim as specified by the Commission.

The imposition of penalty as stipulated under Consumer Right Rules would introduce discipline in the operation of Discom and to make them more responsible and consumer centric. However, the penalty rates may be dynamic in nature which may be reviewed every year by the Regulators.

- **Timely filing of Tariff Petition to SERCs :** For Timely revision of Tariff by the State Electricity Regulatory Commissions (SERCs) , the Discoms should take a pro-active action to file their Tariff Petition for consideration by SERC by August- September every year so that Regulators get sufficient requisite time for examination and revision of tariff for next financial year.
- **Establishment of Special Courts and Police Stations for theft related Cases :** Theft of electricity is one of the major contributing factors impacting the financial health of power utilities. This also contributes to poor quality of power supply, frequent load shedding and unscheduled outages. To enable effective control of theft of electricity, the Electricity Act, 2003 has incorporated specific provisions for detection of theft, speedy trial of theft related offences and also for recovery of the charges of electricity stolen. The State Governments should take necessary steps for setting up of dedicated police stations to deal with electricity theft cases and should also take steps for establishment of Special Courts as provided in Section 153 of the Electricity Act, 2003 for speedy disposal of theft related cases.

The above suggested reforms would create the transitions of Discoms from a monopoly to competition in retail supply, long-term to short-term contracting, introduction of PPP/ franchisee in identified areas and use of smart meters etc, for turning back the economics of Discom finances in near future. This would also create a consumer centric atmosphere with more consumer anticipation and more consumer satisfaction.

6.1 INTRODUCTION

A **best practice** is a method or technique that has been generally accepted as workable superior practice to any other alternatives because it has already been implemented and have produced desired results or because it has become a standard way of achieving the desired targets /doing things.

6.2 CHALLENGES IN DISTRIBUTION SECTOR

6.2.1 Poor Network Conditions

- Sustained outages as no redundancy in the system and restoration takes place only after repair of the faulty section.
- Old and overloaded network resulting in frequent and sustained power outages.
- Inadequate redundancy in the system network to take care of N-1 contingencies resulting power outages & less consumer satisfaction

6.2.2 No Online Network Monitoring

- Acknowledgement/reporting of any breakdown are being handled manually. Either the person manning the substation intimates the field crew if it is a feeder lockout or the customer complains of no supply based on which field crew start investigating and take remedial action. This takes lot of time.
- Lack of Automation in the power distribution system elements poses difficulty in taking preventive/condition based monitoring and maintenance.
- Identification of faulty portion is only by method of elimination using various manual technique or testing instruments, which takes lot of time in fault clearance.

6.2.3 Poor Network Management

- Generally, utilities have a centralized information center, which coordinates telephonically with the field crew after receiving the outage information from the operators manning the sub-stations or from the consumers. The ownership lies with the field crew to restore the supply to consumers based on their area specific expertise.
- The restoration effort takes considerable time due to the fact that everything has human intervention from reporting of breakdown to investigation, identifying the faulty section to isolation and restoration.

6.2.4 Poor Customer Management

- Delay in resolution of customer requests and complaints due to lack of communication between users and utility.
- High Customer to employee ratio due to inefficient process management.
- Processing errors/mistakes due to loosely integrated legacy systems.
- Lack of consistent and correct information on assets and customers resulting in poor utilization of resources.
- Inaccurate accounting due to lack of integration between company ledger and customer account.

6.2.5 Poor Information Management

- On tripping of any feeder/element, the information does not reach to the call center instantaneously.
- Even after information is available, it cannot be put to use for the want of details of the customers, who are affected due to that element going out. Utilities normally do not have customer network hierarchy in real time operating system.
- Centralized call centers are clueless about the status of the outage, when consumer calls up to get the status. It leads to customer dissatisfaction.
- Data discrepancy and absence of seamless information flow between various systems and processes results in high number of grievances related to metering & billing and the resolution is often delayed.
- Absence of extending real time information to customer on billing and payment etc.
- Lack of competent manpower to handle new IT technologies for distribution automation.

6.3 BEST PRACTICES FOLLOWED BY DISCOMS

The best practices followed / implemented by various DISCOMs are categorized among following major categories:

6.3.1 Operation & Maintenance (O&M) Measures

- Focus on Preventive maintenance** Preventive maintenance of transformers, RMUs, substations and other installations should be carried out as per Standard Operating Procedures (SOP) to eliminate untimely power interruptions. Extensive tree branch pruning, erection of interposing poles, strengthening of poles & V cross arms, replacement of insulators and replacement of weak jumpers should be carried out in a preventive and periodic manner to prevent frequent tripping thereby improving system reliability.

Planning of Maintenance

- A dedicated maintenance portal should be created to streamline the entire maintenance work process, including the issuance of Empanelment Orders to agencies, creation of Maintenance Orders for each work location, issuance of Work Orders against Maintenance Orders, joint measures of work completed, invoicing, audit and monitoring
- Any Planned Shutdown (PSD) for General/preventive maintenance should be taken in such a way that it coincides with the Substation shutdown, so as to avoid need of exclusive PSD for preventive maintenance on the feeders emanating from same Substation. The same must be planned on the feeders emanating from Substation.
- The concerned Officer of the DISCOM should prepare an advance planning of PSDs and should submit the same to the concerned Division at the beginning of the month. While giving approval of PSD on any feeder, Division should ensure that NO PSD on same feeder has been taken for any routine/general maintenance work during last 3 months. A web based form for giving approval of PSD should be prepared, which must be used for PSD approval.
- It must be ensured that whenever PSD of Sub-station is taken for General/routine maintenance, all feeders emanating from such Substation should be attended simultaneously by deploying all manpower. The outage period due to S/s shutdown should be optimally used for carrying out the maintenance of all 11 kV feeders emanating from same S/s.
- A team should be assigned the task of patrolling of the feeder and be asked to submit the patrolling report, indicating the location, numbers where maintenance work is urgently required. Based on the patrolling report, the concerned Officer should assess the quantum of work and deploy the manpower for preventive maintenance.

Quality of Maintenance

- In order to improve the quality of maintenance, cross checking of maintenance activities should be done. Where maintenance work is done departmentally, at least 5% of work should be cross checked by the Division Office and 2% of maintenance work should be checked by the Circle Office. However, in cases where maintenance work is outsourced, the cross checking should be done as specified.
- The quality of maintenance should also be assessed by evaluating the performance of feeders in terms of Transient Trippings/shutdown of feeders after maintenance.

- ii. **Thermo-vision Scanning-** Thermo-vision scanning of various power system equipment can be carried out by using Infrared rays (IR) camera to detect various hot spots and abnormal temperature rise in equipment. The technique employed is that every object emits certain amount of IR energy and the intensity of this IR radiation is a function of temperature. Since a naked eye from ground level can miss the hot spots

during an inspection, hence use of these thermal imaging cameras can pin point the hot spots in power lines from far away thereby improving system O&M.

- iii. **Partial Discharge Measurement-** Partial Discharge is one of the major contributors to the degradation and failure of insulation system in electrical assets. Faulty insulators cannot be traced from the ground. But with the use of this technology it is quite easy to find out such insulators and take corrective action. Partial Discharge (PD) measurement can be carried out by using Ultrasonic PD measurement kit.
- iv. **Distribution Failure Information System (DFIS) –** DFIS includes reporting of failed/burnt DTRs at field level through mobile app to centralized call centre and database and intimation of DTRs failures to officer-in-charge and to Area store for issuing new DTRs. This contributes to robust maintenance regime and improves system reliability.
- v. **Dissolved Gas Analysis (DGA)-** Portable DGA kits can be used for detecting various gases & moisture content in transformer oil at site. Oil Filtration Machine can be used to improve transformer oil quality.
- vi. **HT and LT Spacers-** Spacers can be installed where phase to phase clearances are low and pole cannot be erected.
- vii. **Root-cause Analysis-** Root cause analysis of all the major outages, breakdowns and equipment is of utmost important to assess the reason for failure and take preventive corrective action thereof.
- viii. **Tower Wagon-** Tower wagon may be used for effective tree trimming and maintenance activities at height while ensuring complete safety of workers.
- ix. **Replacement with Higher-capacity-** During replacement, it should be ensured that the replaced part or equipment should be of latest technology and adequate capacity rating so as to meet load requirement of near future along with present.
- x. **Inventory Management-** Procurement of the equipment spares should be planned as per modern inventory management techniques.
- xi. **Quality Control-** Technical audit and Quality control of material/work are important in maintaining highest standards of quality and reliability.
- xii. **Use of Covered conductors-** Covered conductors can be used in narrow lanes, congested & highly populated areas, and marketplaces in towns to prevent accidents. In forest areas covered conductors can be used for electrification of Tribal Habitations to avoid cutting and trimming of tress. Vertical formation of covered conductor can be adopted for laying 3 phase 11 kV lines to minimize cutting/trimming of tree branches to safeguard the vegetation in forest areas.
- xiii. **Ultrasonic Cable Height Meters** can be used during line survey for measuring distance between phase-to-phase conductors and phase to ground clearance.
- xiv. **Bird guard** are introduced to eliminate transient fault.

6.3.2 Practices for improving System Capacity & Resiliency

- i. **Digital modelling of Network-** All 33 KV feeders, PSS, Power Transformers, 11 KV feeders, Distribution Transformers and LT feeders may be digitally modelled with GPS mapping along with consumer indexing. The digital model should contain important parameters like conductor sizes and length, feeder wise power flow including peak demand, PTR & DTR ratings including its standard R & X parameters, etc. This will help in better resource planning and network monitoring and augmentation.
- ii. **Replacement of HT conductors with HTLS conductors-** The re-conductoring of 33KV line may be undertaken with an aim to improve the power supply availability and reliability. High Temperature Low Sag (HTLS) conductor carries higher currents with low sag and can withstand high temperatures.
- iii. **Use of Polymer type Pin insulator-** Porcelain type pin insulators can be replaced with Polymer type pin insulators for 33/66 KV I/C line, sub-stations and 11 KV feeders with critical loads and all other power lines on the basis of priority.
- iv. **Use of Automated device-** Auto-reclosers, sectionalizer, Ring main units (RMUs) & Fault passage indicators (FPIs) can be used at critical point in power system network. This automation enables faster identification of faults in the feeders, isolation of faulty section and speedier restoration of the faulty network.
- v. **Intelligent Outage Management system (IOMS)/ Distribution management system (DMS) -** Implementation of IOMS/DMS will help in reducing the down time of outages and ensure consumers get access to reliable electricity.
- vi. **Use of Numerical Relays-** To have better coordination and prevent unwanted tripping, relays can be upgraded to numerical relays. Relay setting standardization also need to be done to prevent uncoordinated tripping.
- vii. **Re-conductoring & Capacity Augmentation-** Re-conductoring of the HT and LT lines with AB cable, capacity augmentation of substations, power lines and distribution transformer, bifurcation of feeders, dedicated feeders for important and critical loads, construction of link lines for bifurcation of loads, etc. can be done to make system more resilient and secure.
- viii. **SCADA-** Implementation of SCADA should be further expanded for real time monitoring and control of the system. This will improve system reliability and reduce fault clearing time.
- ix. **Capacitor Banks-** Installation of capacitor banks at power sub-substations can be carried out to improve system voltage profile.
- x. **Lightning Arrestor-** LAs should be installed in power system network at various critical lightning prone areas.

- xi. **APFC** -Automatic power factor correction panels (APFC) on 11 KV level at grid substations as well as on LT level
- xii. **Covered conductors/AB cable in forest areas-** Covered conductors/AB cable should be preferred for electrification projects in habitations of forest areas to avoid cutting and trimming of trees to safeguard forest resources.
- xiii. Introduction of LT AB cable in place of bare conductors.
- xiv. Introduction of HVDS System in theft prone areas
- xv. **Gas Insulated Switchgear (GIS) substations-** GIS sub-stations can be constructed in cities and towns with space constraints.

6.3.3 Practices for improved Demand Side Management (DSM)

- i. **Energy Efficient Home Appliances-** Replacement of existing fans and Air-conditioners with energy efficient Bureau of Energy Efficiency (BEE) star-rated fans and ACs. This will reduce the peak demand of the DISCOMs which will reduce the capital expenditure on new infrastructure and will reduce CO2 emissions among many benefits.
- ii. **Information, Education and Communication initiatives-** Awareness campaign about energy conservation and potential monetary benefits to consumers due to adoption of energy efficient appliances should be carried out especially in rural areas.
- iii. **Separate DSM Cell-** A dedicated DSM cell for formulation / preparation of DSM Master Plan and implementation in every DISCOMs will go a long way in mainstreaming DSM.
- iv. **Energy Efficient Distribution Transformer-** Procurement of star rated energy efficient Distribution Transformers by DISCOMs as per relevant IS will reduce power losses.
- v. **Agriculture Demand side Management :** Replacement of energy inefficient irrigation pumps with energy efficient ones and creating awareness among farmers to adopt more energy efficient agricultural practices will help country save millions of unit of power.
- vi. **Solar Roof Top Plants and Roof Top geysers-** The distributed generation in the form of Solar roof top plants will help DISCOMs address peak demands situations in a better way. DISCOMs should efficiently implement such projects.

6.3.4 Practices for improving Tariff structures

- i. **Time of Day (ToD) Tariff-** Under the ToD tariff system, tariff during solar hours of the day shall be 10 to 20 percent less than the normal tariff, while the tariff during peak hours will be 10 to 20 percent higher. The TOD tariffs send price signals to consumers to manage their load according to the tariff. With awareness and effective utilization of ToD tariff mechanism, consumers can reduce their electricity bills. The ToD tariff will also incentivize demand increase during the periods of high renewable energy (RE) generation hours.
- ii. **Optimizing Power Purchase Cost-** A judicious mix of power procurement from long term PPA, short term PPA and real-time market will help optimize power purchase cost and hence retail tariffs.

6.3.5 Practices for improving Human Resource of DISCOMs

- i. **Trainings and Exposure-** Regular trainings and exposure visits to officers, employee and O&M staff may be arranged to refresh their knowledge and to update them with advance technical information and modern practices will improve work quality & quantity.
- ii. **Consumer Education-** Imparting consumer education to apply for a new connection / Extension of load, Complaints regarding Low / High Voltage / Failure of supply, Schedule for Bijli Adalat, power shut down announcements, etc.
- iii. Training to employees regarding IT system , cyber security and communication
- iv. **Online Annual Confidential Report (ACR/APR)-** For increasing transparency in the system, ACR can be filled online with fixed timeline for self-appraisal by the officer, reporting officer, reviewing officer and accepting officer. ACR upon acceptance is intimated to the employee through SMS. This ensures that employees can focus on work in a better way.
- v. **E-Office Module –** An e-office module can be adopted for day to day working of the company to enhance transparency and to increase accountability, paperless working and to transform the company's work culture and ethics.
- vi. **Enterprise Resource Planning (ERP) software-** Implementation of ERP software for material management at store, finance activities and HR activities should be carried out as part of modernizing work environment.

6.3.6 Practices for Improving Consumer Services

- i. **IT-based Grievance Redressal Application-** To provide uninterrupted power supply, Discom has to maintain huge infrastructure of electrical network. It is essential that any breakdown should be reported. To conceptualize this, Discom can implement an IT-based module for consumers to lodge various breakdown complaints and bill related

complaints. The module will be fully integrated with centralized call centre and operated in line with the field officers for faster resolution of complaints followed by feedback of consumers. This leads to increase in electricity supply hours due to faster restoration, which will result in better revenue realization.

- ii. **WhatsApp Chat Bot-** A WhatsApp chat-bot can be developed for consumers to lodge electricity related complaints and avail selected consumer services through WhatsApp messages.
- iii. **Voicebot facility-** An AI-based virtual tele-caller/voice bot facility can be implemented for consumers to lodge complaint through 1912/other consumer helpline number. This facility has the potential to increase 1912 call centre's capacity and will consequently bring down the queue waiting period for an incoming call. It can also run outbound calls to consumers regarding their due dates resulting in better revenue realisation.
- iv. **QR Code Bills-** A QR code can be present on the monthly bill given to consumers which can be scanned on any UPI-based payment applications. This will enable consumers to pay monthly bill in a hassle-free way.
- v. **Doorstep Service-** This can be implemented for the convenience of consumers for new connection, load enhancement, name and category change, address correction, etc.
- vi. **Consumer Grievance Redressal Forum (CGRF) -** DISCOMs should strengthen CGRF and other such forums along with increasing awareness among consumers about such forums for grievance redressal.
- vii. **Presence on Social Media-** Use of social sites such as Twitter, Facebook, WhatsApp, etc. with a view to connect with its consumers will help in branding and increase consumer's confidence.
- viii. Centralized Data Centre and 24x7 Centralized Single window Customer care centre in each Discom
- ix. Common electricity complaint number (Toll free) to lodge the complaints by consumers relating to electricity failure including other complaints related to metering, billing, power thefts etc.
- x. **Payment options** – DISCOMs can implement multitude of payment collection mechanism which includes collection counter at departmental office, online payment facilities through NEFT/RTGS, Debit and Credit card, UPI-based mobile app, etc. & Kiosks for bill payment at various locations.
- xi. **Information through SMS-** DISCOMs can send SMS to consumers informing them about planned shutdown, breakdown of feeders, expected time of restoration, bill amount, due date, etc.

6.3.7 Practices for Improving Metering

- i. **Metering of Feeders and Distribution Transformers-** DISCOMs should strive to achieve 100% metering of all feeders and distribution transformers so that proper energy audit can be performed and energy pilferages detected and curbed.
- ii. **Verification of Photo of Meter Reading (PMR) -** A multi-stage verification and audit of Photo Meter Reading (PMR) to ensure correct reading bill distribution to each consumer. Strict, disciplinary actions against metre readers with highest incorrect metre reading should also be taken.
- iii. Installation of AMR meters on feeders, DTs and HT consumers along with centralized MDAS, MDM and Energy Audit applications
- iv. Installation of main & standby metering on selected bulk consumers.
- v. Replacement of defective meters with new meters
- vi. Replacement of existing electronic meters with smart meters as per CEA regulation
- vii. Common Metering System (CMR) for correct and accurate reading

6.3.8 Practices for Loss reduction and Theft control

- i. **AB cable in LT lines-** Bare LT conductors should be replaced with AB cable for reduction in theft and for reduction in commercial losses.
- ii. **High Voltage Distribution System (HVDS) -** HVDS system can be employed in certain high-theft prone area to curb electricity theft and hence reduce technical and commercial power loss.
- iii. **Steps to reduce Power Loss-** Effective energy audit at feeder and transformer level, reducing the technical losses by balancing the load on three phases of power transformer and sale of electricity to HT/EHT customers at seasonal concessional rates during rainy season may be employed to improve system billing and collection efficiency.
- iv. **Vigilance Mobile App with Billing Module-** A mobile-based application with provision to enter all the information along with the photographs at the site after the investigation done by the officials on field related to the FIR in theft cases. The Billing module will calculate various fines/penalties upon entry of parameters like apparatus wise load, billing period, LFDH parameters, etc. This app also uses various AI-based algorithms for detecting irregularities in consumer data which are shown as priority cases for raids/inspections.

- v. **Flying Squad Units-** Checking of thefts & pilferage of energy through Flying Squad units (Head Office & Field Level) will restrict energy pilferage.
- vi. **HT/LT ratio-** DISCOMs should put continuous effort so as to improve ratio of HT lines to LT lines which will help in reducing technical losses.
- vii. Use of ABC cable/ Covered conductor in place of bare conductor in theft prone areas
- viii. Stringent Vigilance Activities to curb theft of electricity.
- ix. Incentive scheme for employee/ people informing theft of electricity.
- x. Establishment of dedicated police stations and courts

6.3.9 Practices for improving Safety

- i. **Safety for workers-** DISCOMs should prioritize the safety of workers/lineman by making safety an integral part of their planning and budget allocation process. Steps such as providing best quality safety kits including helmets, gloves, pliers, safety belts, earth chains and safety shoes, conducting training and awareness programme on safety, etc. should be taken to ensure that workplace safety is given it's due priority.
- ii. **DTR Fencing in critical areas-** DTR fencing and other such safety measures like guarding, road-crossing using heightened pole, replacing the dilapidated conductors, etc. should be undertaken to ensure that safety of common public is not compromised.

6.3.10 Adoption of New Technology

- i. **Integrated Safety Harness with Voltage Detector Safety Helmet-** The entire system of safety harness is interlinked through a wireless communication entirely powered through solar power. The safety harness will blink green only when all compliances- harness wearing, belt tightening, helmet wearing & tightening and anchoring the clamp- are met.
- ii. **Aerial Meter Reading and Surveillance using Fixed Wing Drone-** This innovative technology can be used for generating bills of consumers located deep inside the paddy fields, who are inaccessible, far away from roads & where walking through the land is not possible. For this BLE (Bluetooth Low Energy) meters can be installed and meter reading is being captured by a fixed wing drone and bill on actual reading generated through an android mobile app. Drone meter reading technology is faster

than traditional meter reading in these situations. Drone can also be fitted with night-vision camera for increasing surveillance in cases of area with extensive power theft.

- iii. **Rodent-Disc Barrier-** Animal electrocution (majorly rodents) is one of the major reason for supply interruption. Rodent disc barrier made of polycarbonate fulfils the purpose of restricting the rodent movements from ground to live part. This eliminate short-circuit due to rodent movement.
- iv. **Pole Protector-** Pole in our distribution network is used to support overhead power lines and various other equipment. Poles are generally installed on the road side and are susceptible to damage in case of collision by vehicle. Pole protector is installed around the pole to safeguard it against any such incident. Elastomeric polymer is used which is soft and flexible like rubber. Spring is used to absorb the impact of collision.
- v. **Ultrasonic Cable Height Meters-** This can be used during line survey for measuring distance between phase-to-phase conductors and phase to ground clearance to ensure that proper clearance is maintained.
- vi. **Two Tier/vertical Distribution substation-** DISCOMs can implement vertical distribution sub-station where space constraint prohibits system augmentation to cater increasing load demands.
- vii. **Hybrid power factor correction method (HPFC)-** HPFC may be employed for power factor correction.
- viii. Use of Optic fibre for communication system reliability

6.3.11 Cyber Security Measures

Power sector is the one of the most important critical sector for our nation. Any unwanted disruption in power supply, natural or due to cyber-attack, may affect the other dependent critical sectors badly. The impact of cyber-attack on a power distribution utility may lead to disruption of critical services like hospitals, metro, airports, industries etc. With the rapid implementation of IT and OT enabled services in the sector, the sector has become more and more prone to cyber threats and attacks. Securing ICT devices from cyber-attacks requires preventive and mitigation measures at the utility level.

Ministry of Power (MoP) created six sectoral CERTs, namely CERT-Thermal, CERT-Hydro, CERT–Transmission, CERT–Distribution, CERT-Grid Operation, CERT-Renewable Energy for coordination of cyber security activities. Distribution Planning and Technology Division in CEA is the nodal Division for CERT- Distribution (CERT-D). CERT-D disseminates the advisories/ alerts / vulnerabilities/ information etc. received from MOP/NCIIPC/CERT-In /CISO –MOP etc. to all the Discoms and furnish the status report to MOP/NCIIPC/CERT-In /CISO –MOP etc. CERT-D also handhold/ advise the utility to take up various measures like

appointment of CISO, onboarding CSK, preparation of CCMP, conduction of cyber audits / mock drill, participation in various trainings organized by CERT-In etc.

Further, Ministry of Power (MoP) vide Order dated 02.07.2020 has mandated that all equipment, components, and parts imported for use in the power Supply System and Network shall be tested in the country to check for any kind of embedded malware/trojans/cyber threat and for adherence to Indian Standards.

Central Electricity Authority (CEA) issued CEA (Cyber Security in Power Sector) Guidelines in the month of October, 2021 covering all the main aspects of cyber security such as creating cyber security awareness, creating a secure cyber ecosystem, strengthening the regulatory framework, creating mechanisms for security threat early warning, vulnerability management and response to security threats, securing remote operations and services, protection and resilience of critical information infrastructure, reducing cyber supply chain risks, promotion of research and development in cyber security, human resource development in the domain of Cyber Security, operationalization of the National Cyber Security Policy etc.

Discoms have to abide by the above Guidelines and also complete the following major activities as per the Guidelines:

- Preparation of Cyber Crisis Management Plan (CCMP)
- Identification of Critical Information Infrastructure (CII)
- Implementation of ISO 27001
- CSK onboarding
- Audit and Mock Drill
- Comply with the direction issued by MOP/NCIIPC/CERT-In /CISO –MOP etc.

CSIRT-Power has been set up by Ministry of Power at Central Electricity Authority vide Order dated 5th April, 2023. CSIRT-Power would help the utilities in cyber incident handling and to ensure better cyber security preparedness. An Empowered Committee under the chairmanship of Secretary (Power) and a Standing Committee under the chairmanship of Additional Secretary (Power) also review the cyber security preparedness of power sector periodically.

7.1 INTRODUCTION- SMART DISTRIBUTION

Today, the country needs 24x7 uninterrupted power supply to all the consumers along with transparency in the operation of distribution sector with consumer participation. Since the enactment of the Electricity Act 2003, Indian Power Sector has come a long way but still Distribution utilities are grappling with variety of issues like high technical and commercial losses, financial sustainability , large dues and pending recoveries & subsidies, gap between average cost of supply and average revenue realized, transparent operations, poor asset management, inefficient operation , lack of consumer engagement etc. To overcome these issues, it is pertinent to adopt Smart Distribution system which not only provide multiple benefits to all stakeholders but also empower the end customers.

A Smart Power Distribution is an electricity network enabling a two-way flow of electricity and data using digital and other advanced technologies to monitor and manage the transport of electricity from all generation sources to meet the varying electricity demands of end users and at the same time enabling the grid operator to detect, react and pro-act to changes in usage and multiple issues. The Smart Distribution has the ability to reduce greenhouse gas emissions by application of advanced and controlled large scale integration of renewable energy sources which requires application of advanced distributed control algorithms in order to avoid an unexpected frequency and voltage fluctuations.

7.1.1 Objectives of Smart Distribution

The deployment of Smart Distribution may be done in such a manner to achieve following objective:

- i. Achieving 24x7 reliable & quality power
- ii. Utilization of existing assets to the fullest extent possible efficient manner
- iii. Automation & less human intervention in system operation
- iv. Energy security
- v. Reduction in pollution/carbon footprint
- vi. Clean and sustainable development
- vii. Reduction of AT&C losses – Automation in metering, billing & collection
- viii. Consumer participation
- ix. Increase in energy efficiency
- x. Consumer satisfaction enhancement
- xi. Reduction in number of outages and duration of outages etc.

7.1.2 Benefits of Smart Distribution

The enablement of advanced technologies in operation of Distribution utilities could achieve some of the following benefits:

- i. Revenue enhancement through increase in efficiency in metering, billing & collection & reduction in losses
- ii. Reduction in balancing cost through better forecasts and demand response
- iii. Optimizes asset utilization and operational efficiency by optimizing power purchase cost
- iv. Provides resiliency to disturbances, attacks, and natural disasters
- v. Brings transparency and enables informed participation by consumers
- vi. Automated monitoring & control of network technology
- vii. Promotes competition
- viii. Advanced business analytics to bring out actionable reports
- ix. Remote connect /disconnect of power supply of consumer & use of pre-paid/post-paid facilities with same meter
- x. Peak load management – multiple options from direct load control to price incentives to customers
- xi. Better Asset management by analysis of consumer meter data and other meters data (like DT Meters, Feeder meters etc.)
- xii. Increased grid visibility & adoption of Self-healing grid – faster restoration of electricity after fault through OMS
- xiii. Renewable energy integration/Net Metering / Prosumer enablement
- xiv. Consumer empowerment to control their consumption to enable energy conservation practices
- xv. User friendly and transparent interface with utilities
- xvi. Tariff Optimization with increased visibility of power consumption pattern
- xvii. Introduction of Time of day metering & dynamic pricing readiness

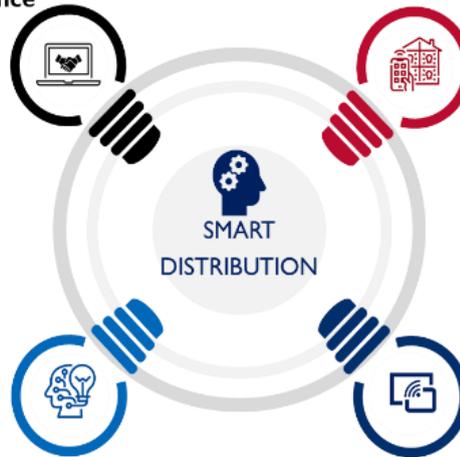
There has been sustained efforts from Ministry of Power for demonstration & adoption of State-of-the-art Smart distribution technologies since early 2010. MoP had sanctioned Smart Grid pilot projects under IPDS (Erstwhile RAPDRP Part C), for demonstration of smart grid functionalities in Indian context at various geographical locations across India with 50% funding. The pilots' outcome was mixed with success stories and lessons learnt ranging from successful demonstration of smart metering, multiple communication technologies (GPRS, RF & PLC), procurement issues to standardized product development, capacity building & regulatory support etc. As a part of learning, the PAN India deployment of smart meters has been adopted under RDSS launched by GOI in 2021.

Enhanced Consumer Experience

- Consumer empowerment
- Value added services
- Distributed energy resources- consumer participation.

System Intelligence

- Advanced analytics & optimization
- Data-driven decision
- Predictive maintenance
- Enhanced cybersecurity



Dynamic Energy Management

- Real-time monitoring & control
- Demand-supply management
- Increased reliability
- Improved efficiency

Adaptive Power Distribution

- Improved resiliency
- Enhanced interoperability & standardization
- Scalability & flexibility
- Future proofing

7.2 SMART DISTRIBUTION TECHNOLOGIES

The major attributes of IT & OT technologies for enablement of a Smart Distribution infrastructure are as follows:

- i. Advanced Metering Infrastructure (AMI)
- ii. Supervisory Control and Data Acquisition (SCADA)
- iii. Mini SCADA - Real Time Data Acquisition System (RTDAS)
- iv. Distribution Management System(DMS)
- v. Advanced Distribution Management System (ADMS)
- vi. Geographical Information System (GIS)
- vii. Customer Relationship Management(CRM)
- viii. Outage Management System (OMS)
- ix. Demand Response(DR)
- x. Enterprise Resource Planning (ERP)
- xi. Distribution Transformer Monitoring System (DTMS)
- xii. Smart Street Lights (with noise and pollution sensors)
- xiii. Smart Battery Storage system
- xiv. Smart Micro Grid
- xv. Home Automation System / Smart Homes
- xvi. Smart EV Charging Stations

➤ NEW EMERGING ADVANCED TECHNOLOGIES FOR POTENTIAL USE IN DISTRIBUTION

- i. Vehicle to Grid (V2G) Charging
- ii. Artificial Intelligence and Robotics for Distribution System
- iii. Block Chain Technology Application
- iv. Monitoring of distribution lines by Drone technology

Following sections describe the details of use of some of the above technologies in the distribution sector:-

7.3 ADVANCED METERING INFRASTRUCTURE (AMI) /SMART METERING

Advanced metering infrastructure (AMI) is an integrated system of smart meters, communications networks, and data management systems that enables two-way communication between utilities data center and smart meters at customer premises to measure, control, collect and analyzes energy usage of consumers either on request or on a schedule. Advanced metering infrastructure (AMI) differs from traditional automatic meter reading (AMR) as it enables two-way communications with the smart meters.

The goal of AMI is to provide real-time data about power consumption at utility data center and allow customers to make informed choices about energy usage based on the price at the time of use etc. The smart meters can also be disconnected or reconnected from the data center in case of payment default by the consumers. Further, smart meters can also be used as pre paid meters, net meters or post paid meters as per the requirement. Smart metering, if implemented in pre-paid mode would help utilities to reduce their cash flow stress and financial losses, by avoiding loss of revenues from defaulting consumers. All the meters including smart meters should be installed as per CEA Regulations as amended up to date.

Building Blocks of AMI: AMI is comprised of various hardware and software components to play the special roles in measuring energy consumption and transmitting information from smart meter to the utility . The main components of AMI include:

- a) **Smart Meters-** It is an Advanced Energy Meter having a communication module and a switch facilitating the energy mete to collect information about energy usage at various intervals, transmitting the data through fixed communication networks to utility, as well as receiving information like connection – disconnection signals from utility to operate accordingly.
- b) **Communication Network:** Advanced communication networks which supports two-way communication enables information from smart meters to utility data center and

vice-versa. A suitable communication technology for smart meters may be adopted as per Is-16444 based on geographical areas of the Discoms.

- c) **Meter Data Management System (MDMS):** MDMS is a host system which receives, stores and analyzes the metering information. It provides a platform to assess the performance of the energy usages on a real-time basis. By using the VEE (Validation, Edit, Estimation) Rule, MDMS generates Business Intelligence Reports, which helps in identifying the underperforming areas and initiate the planning for performance improvement etc.

➤ **SELECTION OF AN APPROPRIATE COMMUNICATION TECHNOLOGY FOR AMI**

At present, the following communication technologies are typically used for AMI systems as per Is 16444, however, the utilities may choose the appropriate technology based on the actual ground conditions and availability of communication network in the operating areas.

- **Power Line Communication (PLC):** Smart Meters may use the power line for data communication between the meter and the Utility's systems. In this system, Smart Meters are connected together in a mesh and transfer the data to the DCU, located in vicinity of Distribution Transformer, which further communicates the data to the control centre (HES/MDAS) through the cellular data network, Optical Fibre Cables, DSL, etc.
- **Radio Frequency (RF):** Smart Meters may also use RF for data communication between the meter and the Utility's systems. In this system, Smart Meters are connected together in a RF mesh and transfer the data to the access point/router/DCU, which further communicates the data to the control centre (HES/MDAS) through the cellular data network, Optical Fibre Cables, DSL, etc. In this case, number of Smart Meters communicating to any access point/router are dynamic in nature. The failure of any access point/router leads to re-designing of the network automatically to use another nearby router/DCU so that data communication is uninterrupted between the meter and the control centre.
- **Cellular Technology (GSM/GPRS/3G/4G/NB-IoT):** In this system, Smart Meters directly communicate the data to the control centre by utilising the Telecom cellular data network (GPRS/3G/4G/NB-IoT) and this system does not require any DCUs. Recently, the use of devices based on 'Internet of Things' (IoT), or simply 'Machine to Machine' (M2M) communication for wide ranging sensory devices have increased on a great pace, which is also a part of GPRS technology.

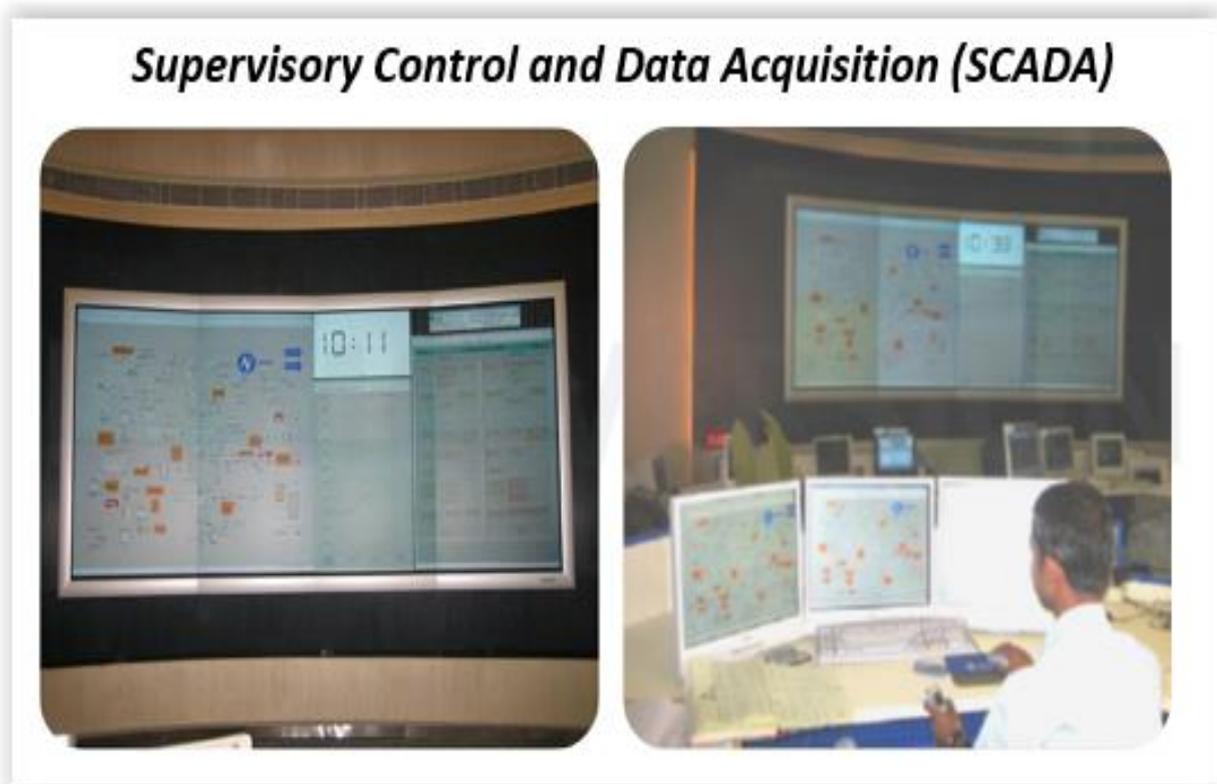
For implementation in the Indian context, wherein the cost of implementation plays a key role in ensuring that the solution is affordable, a suitable communication technology for various smart operations may be selected by the utilities / System Integrator (SI) as per the actual site conditions.

7.4 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

Distribution utilities generally operate three layers of network i.e. Sub transmission (66 KV and 33 KV), Primary Distribution (11 KV) and Secondary Distribution (0.415 KV). Any interruption at sub transmission level accounts for outage to thousands of customers. Thus it is necessary to monitor and control each and every network element in the sub transmission system remotely.

SCADA, which itself stands for Supervisory Control and Data Acquisition, is the software application program for acquiring the data on real time basis from each connected network equipment, be it normal condition or abnormal condition due to any fault, and provides this data to the control center for facilitating decision making for switching operation of network elements remotely for faster action.

Figure : A typical SCADA display



Benefits of SCADA:

- Information readily available within seconds to enable quick actions and faster restoration of supply while ensuring data security
- Enables the understanding of real time health of equipment and assets.
- Provides alerts for significant events, thus facilitate elimination of the risk of equipment damage
- Enhanced safety in working environment
- Improved reliability indices like SAIDI, SAIFI, CAIDI, etc.

- Prepares the system for unmanned grid stations.
- More consistent process for operating the power system at least for sub- transmission system and above.
- Better handling of the reactive power support equipment.
- Replaces erstwhile ad-hoc maintenance practices with a more scientific and reasoned maintenance practices.
- Facilitates reduced manpower matrix, enabled with defined and focused targets to reduce the maintenance cost

7.5 REAL TIME DATA ACQUISITION SYSTEM (RT-DAS)

As the implementation of full SCADA require a major expenditure and time, the utilities may use Mini SCADA i.e RT-DAS in the smaller towns / urban areas for data acquisition purposes. The major areas of concern in the power distribution sector are high AT&C loss and poor power distribution reliability. To address these problems, the real time accurate measurement & diagnosis of the system data is required which may also be possible with the RT-DAS system in place of full SCADA . The objective of the RT-DAS is to accurately measure reliability of power distribution network and facilitate utility to take suitable administrative action for enhancement of power reliability.

FRTU based SAIFI/ SAIDI measurement system in Non-SCADA towns may be taken up with the use of RT-DAS to accurately measure the reliability of the power distribution network and facilitate utility to take suitable administrative action for enhancement of power reliability. It shall also facilitate utility to take appropriate measures for improvement of SAIDI/ SAIFI by knowing the reason of poor values of indices.

Advantages of RT-DAS

- Accurate real time system of measurement
- Rugged and robust to withstand in S/S HV environment
- Notifying S/S and consumer (IT gateway) about outage
- Generation of Reports (SAIFI /SAIDI reports as per regulator defined criteria)
- Operation monitor for switching devices to have preventive maintenance
- Historical data, MIS and analytics
- Future compatibility with SCADA / AMI etc



Figure: RT-DAS- Sub-station Monitoring

7.6 DISTRIBUTION MANAGEMENT SYSTEM (DMS)

Distribution Management System (DMS) is a set of applications designed to monitor and control Medium Voltage distribution network reliably and efficiently. It acts as a decision support system to the network operator stationed in control Center with the monitoring and control of MV distribution system. It accesses real time data and provide all required information on a single console at the control center in an integrated manner. This helps to detect, report and correct outages which includes the estimation of fault Location and Service Restoration System. Application is also used for optimizing the network conditions including the Network Reconfiguration and the Volt-Var Control functions.

Distribution Automation (DA) is a smart distribution technology that is implemented in sync with the Distribution Management System (DMS). It is prudent to identify strategic automation points by doing the reliability analysis with a philosophy of 20% control can restore 80% of the network. This arrangement not only helps in improving the network reliability significantly but also *reduce the Mean time to Restore (MTTR) value by 50%*. In terms of restoration, substations with DA capabilities not only immediately identify that the outage has happened but also pinpoints the switching devices which is experiencing the fault.

The main function perform by DMS are as follows;

- Network Connectivity Analysis (NCA)
- Load Flow Application (LFA)
- Voltage/VAR Control (VVC)
- Fault Management and System Restoration (FMSR)
- Loss Minimization via Feeder Reconfiguration (LMFR)
- Load Balancing via Feeder Reconfiguration (LBFR)

- Operations Monitor
- Short Term Load Forecasting
- Interface to customer information system (CISs)
- Interface to Geographical Information System (GISs)
- Trouble call management and interface to outage management system (OMSs)
- Asset Management systems

Advantages of DMS & DA:

- Improved monitoring and control of Distribution Network.
- Better control of power quality and enhanced use of reactive power sources.
- Chances of manual error can be eliminated, as all grid stations are unmanned and centrally controlled.
- Improved customer service on load shedding feeders through load forecasting and scheduling applications.
- Faster fault isolation and restoration to reduce the interruption time
- Improved reliability Indices at Distribution Network
- Provide for maximum use of the installed equipment in terms of best configuration and/or best settings of controls to reach specific objectives such as minimum losses.
- Provide the real time analysis of the system and provides means to analyze the present and hypothetical operating conditions of the distribution network to respond what if type of questions.



Snapshot of DMS control center

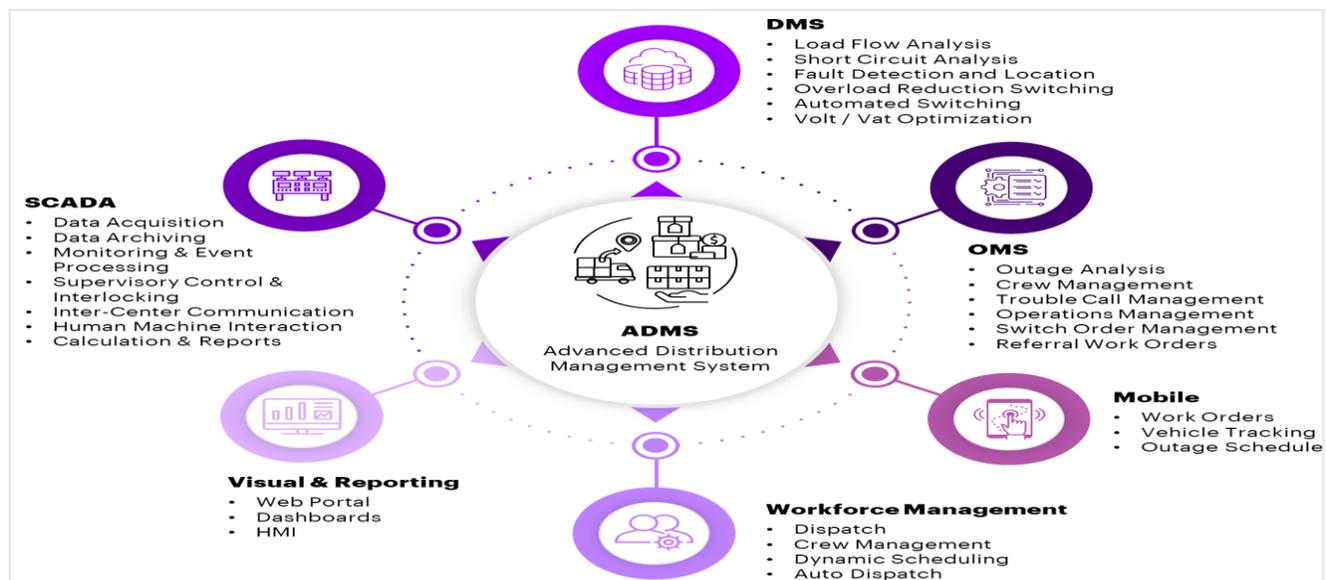
7.7 ADVANCED DISTRIBUTION MANAGEMENT SYSTEM (ADMS)

The latest trend in the distribution utilities is to implement the unified SCADA, DMS and OMS which is solution of the same box. An Advanced Distribution Management System (ADMS) is the software platform that supports the full suite of distribution management and optimization including SCADA, GIS, DMS, OMS and provides advanced control capabilities. An ADMS includes functions that automate outage restoration and optimize the performance of the distribution grid. ADMS functions being developed for electric utilities include fault location, isolation and restoration; volt/var optimization; conservation through voltage reduction; peak demand management; and support for micro grids and electric vehicles.

Applications of ADMS looks for certain data which can be fed to this system through GIS which contains the asset, network and consumer modelling of utility. Based on this data, all applications can be run successfully provided the data in GIS is maintained and updated judiciously and always in live condition as available in field.

The benefits of ADMS are as follows-

- Reduction in the duration of outages
- Improvement in speed and accuracy of outage predictions
- Reduction in crew patrol and drive times through improved outage location identification
- Determine the crew resources necessary to achieve restoration objectives
- Effectively utilize resources between operating regions
- Determine when best to schedule mutual aid crews
- Provide customers with more accurate estimated restoration times
- Improve service reliability by tracking all customers affected by an outage, determining electrical configurations of every device on every feeder, and compiling details about each restoration process
- Quick tracing of crews through Auto Vehicle Location System (AVLS) Increased customer satisfaction

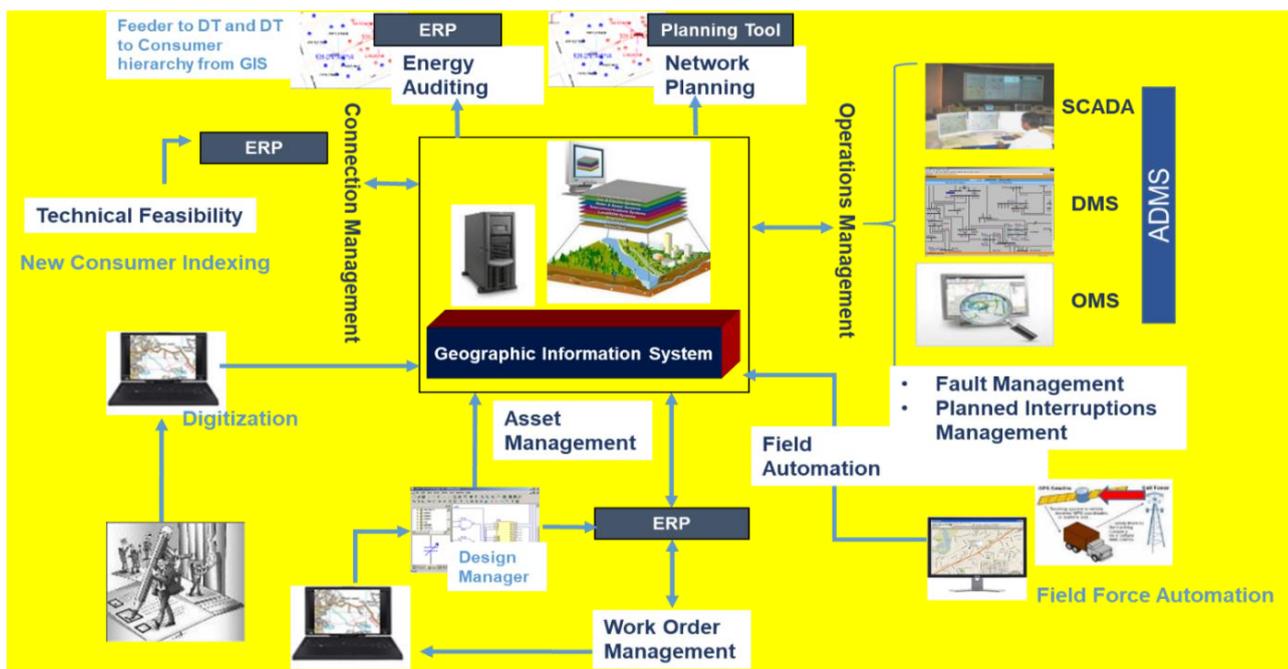


7.8 GEOGRAPHICAL INFORMATION SYSTEM (GIS)

Geographical Information System(GIS) leverages the actual information of lay out of power system on the geographical map digitally. GIS helps in addressing the challenges of utilities whose assets and network are spread across the geography for providing services to their consumers. This is very helpful application for utilities like electric distribution utilities, Gas & water utilities, telecom utilities etc. This is the optimal platform and foundation technology for utilities which contains the complete information as mentioned below:

- Geo coordinates controlled Asset record management.
- Network topology for operation service management.
- Consumer's location and indexing with network and asset for service delivery.
- Field Crew movement and tracking for ease of services to the customers.
- Geo-fencing of the consumers for both commercial and maintenance operations, alongside vigilance activities
- Commercial operations and O&M staff tagged to the assets and consumers with each geo-location

Generally, regular data updation is required in GIS as per changes in the actual field conditions but some time GIS loses its shine due to lack of timely data updation in GIS. With lack of latest data, the integration of GIS with other business systems gets impacted and the overall objective of GIS gets completely derailed. The use of GIS can help various other processes which include SCADA, Distribution Management System, Outage Management System, Network Planning, Energy Auditing, Field Force Automation, Asset Management, Customer Relationship Management and other associated processes. Typical diagram of GIS is as given below:



Some of the important applications of GIS in distribution networks are as under:

Operation management: Network hierarchy along with consumer mapping from GIS can help the network operator using DMS and OMS for further taking decision on operation Management including optimization for commercial operations, vigilance and O&M, based on field data available through the GIS location data of consumers and assets.

Asset Management: All new assets can be mapped and managed in an integrated environment where information can be flow from GIS to System Application and Products (SAP) and vice versa to have a robust asset management.

Commercial management for new connection: Consumer mapping is being utilized for verification of dues and technical feasibility before release of new connection. This would result in to reduction in releasing of new connection cycle time.

Energy Audit: Consumer mapping with Pole No. is being utilized for further indexing with supply points and its linkage with source points for carrying out energy audit at various service level.

Network Planning: Network and consumer mapping can be utilized for carrying out the planning of new network and optimization of investments.

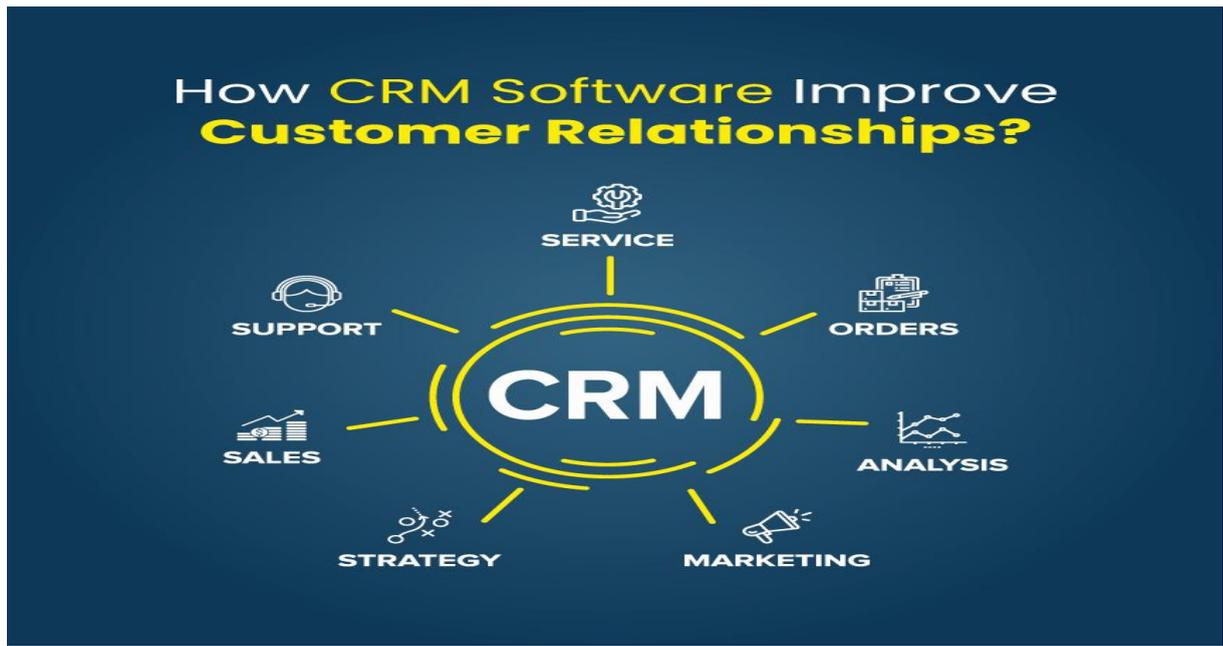
Vehicle Tracking: Tracking of vehicle devices on GIS result in enhancing the productivity and adoption of shortest route, etc.

7.9 CUSTOMER RELATIONSHIP MANAGEMENT (CRM) SYSTEM

CRM system is implemented in the utilities for better consumer interaction and for facilitating in day to day decision making by the Management of the company. CRM Software is a tool which is designed to help the Discoms to build better relationship with consumers by providing a complete picture of consumers, keeping track of sales /billing of consumers, prioritizing their requirement and facilitating collaboration between various deptt of the organization.

The information/option available in CRM can be broadly categorized into following major categories

- Search Options – In CRM, Multiple options are available for searching the consumer
- Fact Sheet – Information w.r.t Business Master Data Technical Master Data of a consumer is available
- Notification – In CRM, User can perform action like new connection, attribute change, billing, metering complaint, no supply and street lighting service requests w.r.t notification.
- Report – User can also view the different reports developed for different departments. These reports are used by user for analyzing consumer account in detail.



Benefits of CRM

- Call Center Executive may use this application for answering the consumer query or registering the consumer complaint due to which productivity of executive is improved. With implementation of CRM, the productivity of call center executive can be improved by about 25 %. The increase in productivity ensures that utility can answer more call without increasing the number of operators in the commercial call center.
- Unified call center to attend to all type of complaints (commercial or operational i.e. No Supply).
- In case of No Supply, Call Center operator is able to identify the consumer and answer the consumer query in very less time due to which the average talk time (ATT) is reduced.

7.10 OUTAGE MANAGEMENT SYSTEM (OMS)

Outage Management System (OMS) provides the capability to efficiently identify and resolve outages and to generate and report valuable information. OMS typically works in conjunction with Geographic Information System (GIS) and Customer Information System (CIS) to give proactive response to the consumer regarding supply restoration status by predicting the location of faulty network component which has contributed to Outage to the consumer. On operational front, it helps in prioritizing the restoration efforts and managing resources based upon the criteria such as locations of emergency facilities, size and duration of Outage. It also helps in analyzing repetitive nature of faults and help maintenance crew in prioritizing their maintenance schedule.

To predict the outages of customer, it is prerequisite to have complete network hierarchy from customer to the LT network followed by distributions transformers, 11 KV substations and 66/33 KV substations. The requirement of complete hierarchy can be obtained through GIS platform by maintaining and sustaining of up to date network, assets and consumer mapping into GIS. Based on the either numbers of calls from customers or outage information from SCADA/DMS trigger the system application to predict the numbers of affected consumers. The list of affected consumers is sent to CIS for providing proactive intimation to consumers experiencing outages and assigning of field crew for early restoration of outages.

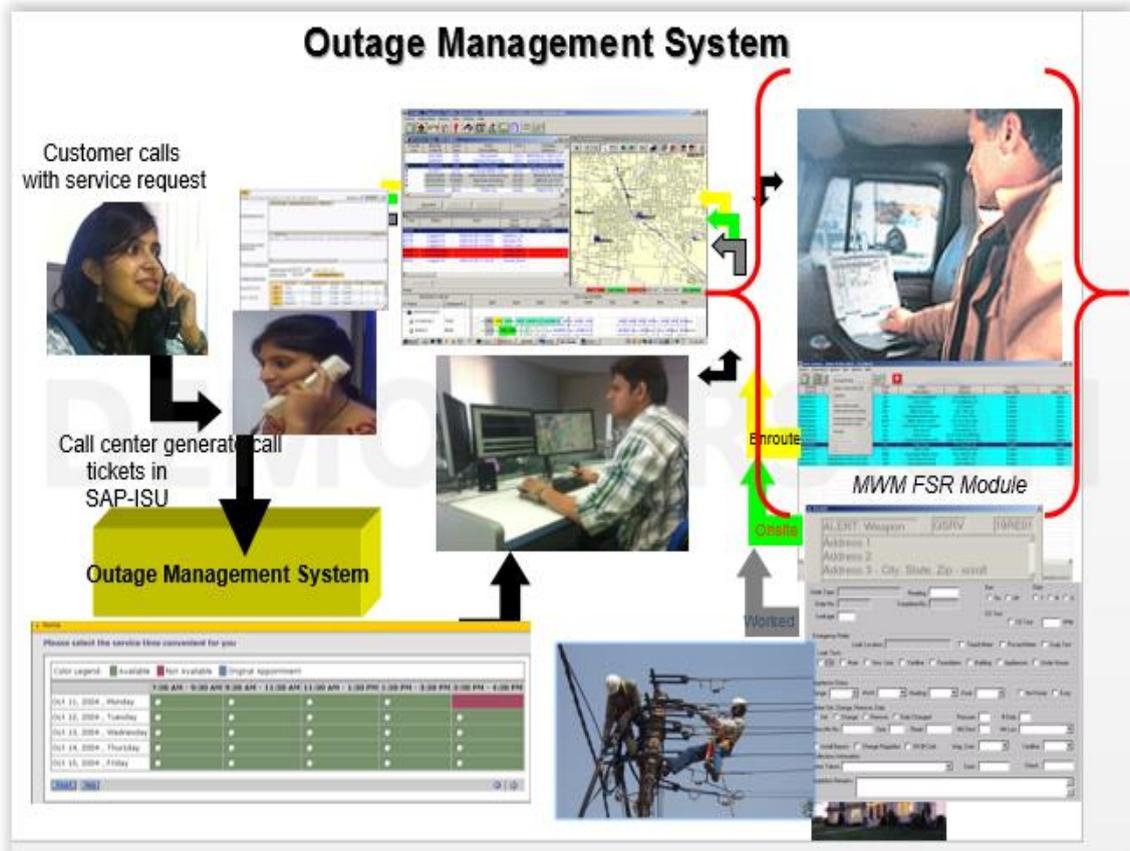
In distribution feeder side, deployment of Ring Main Unit (RMU), Feeder automation using FRTU, Fault passage Indicators (FPIs) further help utilities to facilitate an efficient outage management process –

- **RTU / Feeder RTU (FRTU):** These devices communicate switch status & electrical parameters like voltage, current etc. from different feeder points / DT/ RMU at field locations to control centre. These RTUs / FRTUs receive command from control centre for operation of switches at site to achieve faster restoration / isolation.
- **Distribution Transformer Monitoring Units (DTMUs):** The DTMUs monitor oil levels, oil temperatures, loading conditions and internal fault in distribution transformers. It also helps in taking proactive actions for maintenance of Distribution Transformer.
- **Fault Passage Indicators (FPI):** Fault Passage Indicators identifies location / type of faults through visual indications at control centre. The Identification of section under fault is used to direct maintenance crew for quick recovery of faulty section for subsequent restoration of faulty part.

Benefits of OMS:

- Enables recording of end to end Outage data creating invaluable interruption data
- Predicts the consumer spectrum affected by outages and enables consumer information to be available on a real-time basis
- Improves Quality of service to Customers
- Reduction in Outage duration, Restoration time and Non-outage complaints
- Reduction in O&M costs and better regulatory relations with consumers
- Enables the customer care centre to prioritize the complaint handling sequences for business purposes
- Enables crew management and optimization for maintenance and restoration activities
- Improves performance assurance standards

For Outage Management System to be really effective in improving customer experience, its integration with Customer Information system and GIS is important



7.11 DEMAND RESPONSE (DR)

Numerous contributions to overall improvement of the efficiency of energy infrastructure are anticipated from the deployment of smart technologies, in particular including **demand-side management**, for example turning off air conditioners during peak time / higher electricity price. When Peak Demand is high in the system for the utility or price is high for the consumers, Automatic Demand Response System sends control signals to smart devices installed at the home/business/ industries to cut off some of the non essential load for a short period in order to prevent system overload.

Automatic Demand response system allows interaction between availability of power and loads to interact in an automated fashion in real time, coordinating demand to flatten spikes. Eliminating the peak spikes in demand that may occur for a short time would eliminate the cost of adding reserve generators, and allows users to cut their energy bills by managing low priority devices to use energy only when it is cheapest. Thus, ADR also helps in reducing greenhouse gas emissions by avoiding the need to run expensive peaking plants at the time of system peak. This all would be possible with various smart distribution technologies.

A typical DR implementation would consist of three main entities:

- An entity at the utility which stores the program information, generates and communicates the DR signal to consumer premises.
- An entity at the consumer premises capable of receiving the utility DR signal and controlling the load accordingly.
- An entity for measurement and verification.

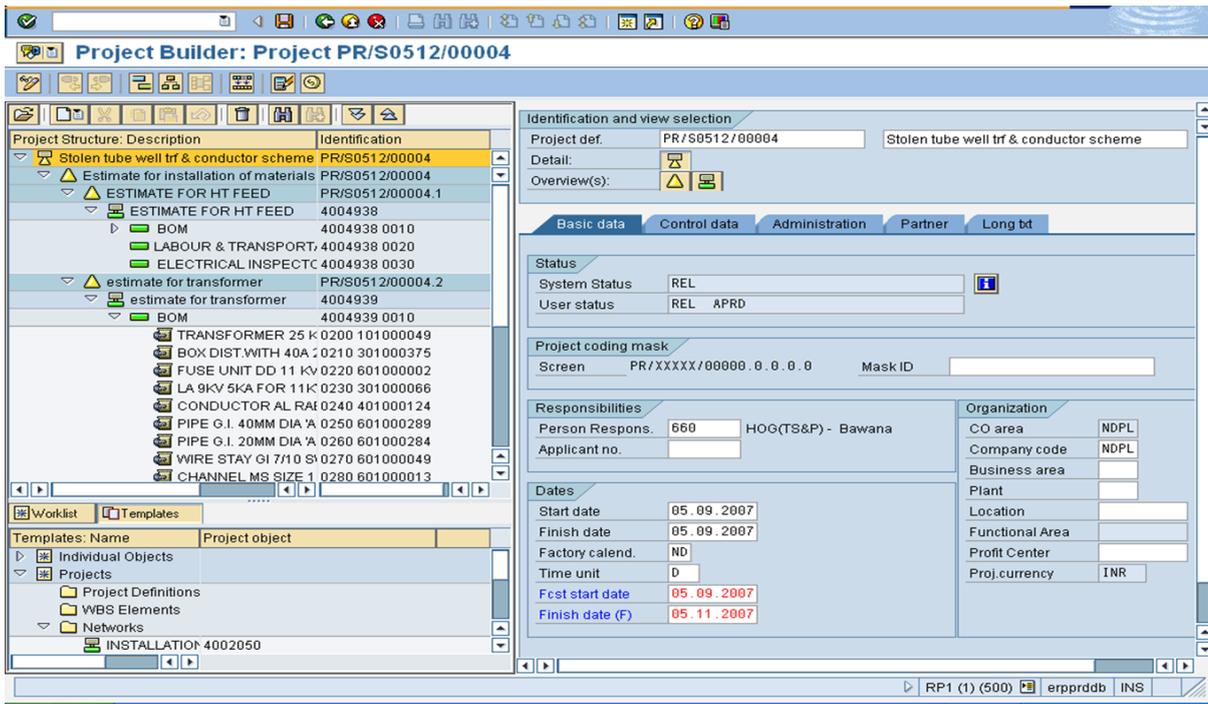


7.12 ENTERPRISE RESOURCE PLANNING (ERP)

The profitability of the distribution sector is directly governed by the 'meter-to-cash' cycle and the total energy accounting process. Utilities require an ERP system to address the challenges that they face today. It includes the integration of connection services, revenue management and customer relationship management to streamline the entire process chain. They require tools to identify operational bottlenecks, improve efficiency, enhance customer satisfaction and facilitate accurate energy audit. ERP solutions includes the Maintenance Management across network layers of Utility. It also enables focused maintenance practices mainly based on the condition monitoring of the assets. The key benefits which can be achieved by ERP solutions are as below:

- Increased efficiency in billing and collections
- Improved revenues through reduction in losses
- Adaptability to future tariff and regulatory changes
- Effective planning and monitoring of cash flows
- Business insights into day-to-day revenue operations and credit control activities
- Real-time, informed and timely decision making
- Improved Work Control.

- Improved Planning and Scheduling.
- Enhanced Preventive and Predictive Maintenance.
- Improved Parts and Materials Availability.
- Improved Materials Management in Integration with GIS and Design Manager Application.
- Improved Reliability Analysis.
- Increased Capability to Measure Performance and Service.

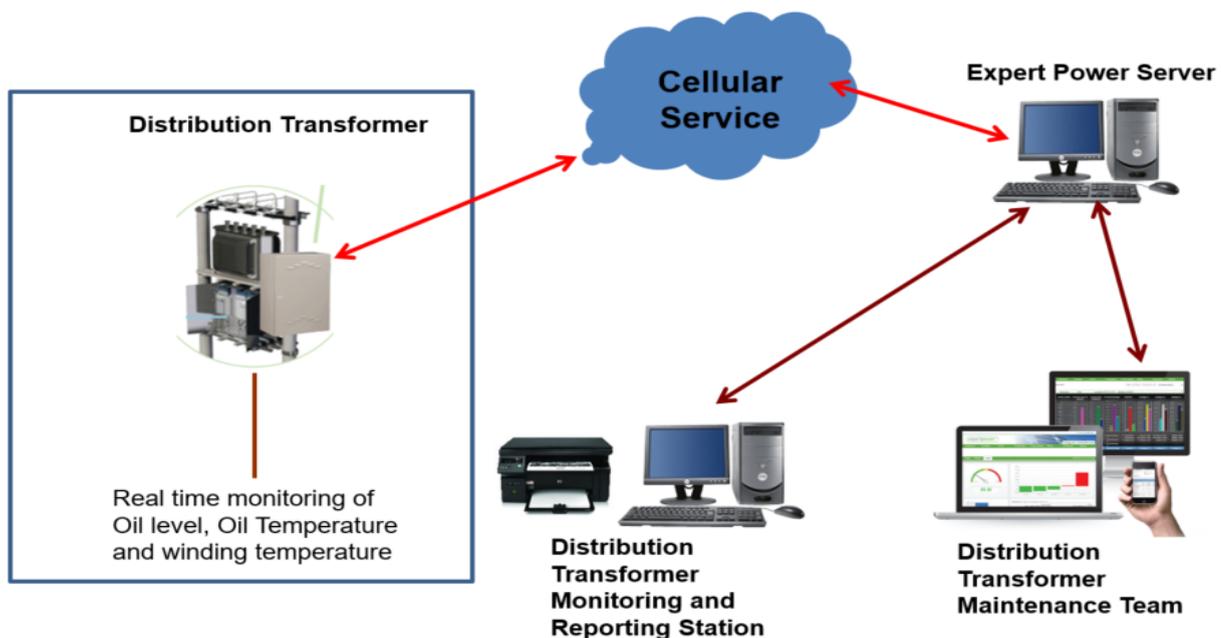


7.13 DISTRIBUTION TRANSFORMER MONITORING SYSTEM (DTMS)

One of the key components in smart distribution system is monitoring of Distribution Transformers (DTs). The failure of distribution transformers (DTs) is one of the major aspect hampering the reliability of power supply to the consumers. Hence, the remote health monitoring of Distribution Transformer will prevent failure of transformers by taking the appropriate action by discoms timely. With DT monitoring systems, overloaded DTs can be identified and replaced with higher capacity DTs as load in the locality increases. Additionally, the actions may be taken by discoms in case the information is available regarding oil level is less or temperature of oil is above threshold limits etc. The monitoring of the health of distribution transformers improves the visibility into the low voltage (LV) network and provides insights that help the utility to utilize the power network in an optimum way.

Transformer monitoring can bring a lot of benefits for utility companies, including the following:

- To recognize when transformers are on the brink of collapse (overloaded) and take remedial performance related actions. Often a utility may lose a transformer because of the lack of information regarding the overloading of transformers.
- To improve visibility of the low voltage power network which helps utility to deliver high quality electricity to customers. The system provides real time information about voltage, power factor, current, harmonics and unbalance from the LV network; and based on this information, utility may take necessary action to solve problems as they occur.
- Decrease outage duration. If one transformer collapses, it normally takes some time as specified in Supply Code by Regulators to replace the Transformer, thus disrupting the power supply for this period. However, the analysis of the health parameters of Distribution transformer may send an emergency signal to the Central system and utility may take necessary action to avoid the failure of transformer. For example, in case, the system identify that a particular transformer is working with more than 90% of its capacity, the utility may take necessary step to augment the transformer as soon as possible.
- The useful information from the transformer monitoring system may be utilized to make decisions about distribution network planning.
- The transformer monitoring information would also be used for asset management and preventive maintenance.
- The energy data at distribution transformer would also be used for energy auditing and accounting purposes and also to pin point the high loss / theft prone areas in the system.



7.14 SMART STREET LIGHTING SYSTEM

Latest entrant in the smart distribution is the adoption of smart street lighting in smart cities. Typical street lights using sodium vapour lamps consume huge amount of power. These are being replaced with LED lamps in many cities and also in small towns. The new LED lights can be remotely controlled and have features like increase/decrease luminosity, switch off alternate lights during lean hours etc are possible. The lights can be connected on GPRS, RF Mesh or WiFi in the city for its remote operation. The newest trend is to install noise sensors and pollution sensors on the street light poles (cobra heads) which will leverage the same communication band-width to transmit the data to the control centres for monitoring noise and air pollution.

7.15 SMART ENERGY STORAGE SYSTEM (ESS)

Energy Storage Systems (ESS) is fast emerging technologies as an essential part of the evolving clean energy systems of the 21st century. India is committed to reducing emission intensity up to 33-35% from the 2005 level by 2030 and set the target of 450 GW of renewable energy by 2030. Integration of such massive amounts of RE which are intermittent and distributed in the power system pose serious challenges to grid stability. ESS is going to play critical role in grid integration and management of RE as the share of RE in the grid increases. The energy storage system may also be used by the utilities at the peak time to reduce the peak power charges. The main technologies being used as energy storage are Battery energy Storage System (BESS) and pumped hydro plants.

Key areas for Energy Storage applications are:

- Integrating renewable energy with transmission grids and distribution grids
- Setting up rural micro grids with diversified loads or stand-alone systems
- Developing storage component for electric mobility plans
- Replacement of DG sets with battery based energy storage systems (BESS)



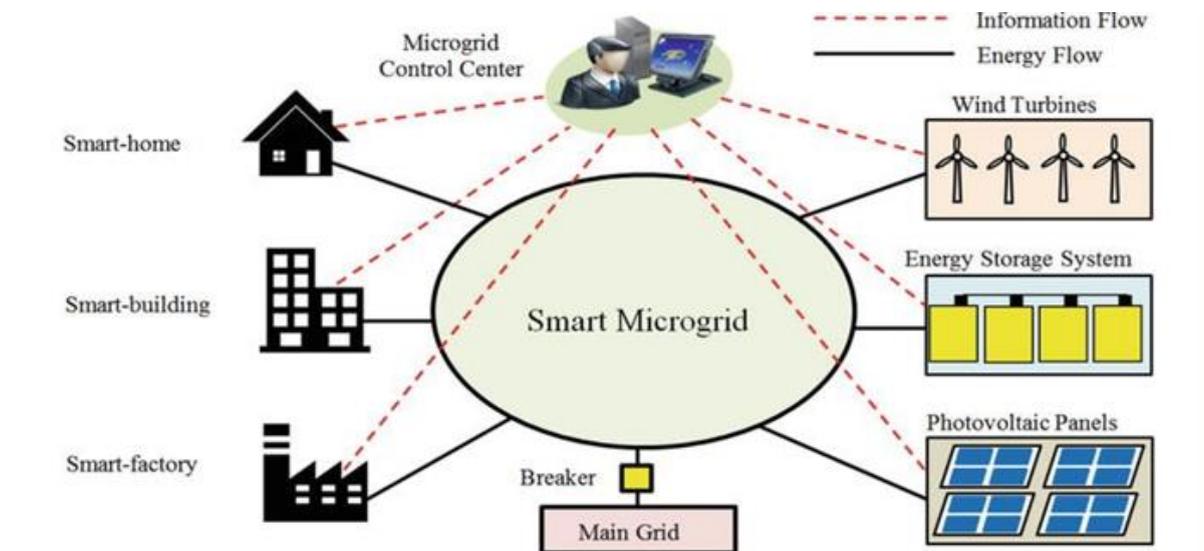
Presently, Grid scale energy storage installations in India are mostly in the form of pumped hydro storage plants, however, the pilots for deployment of large-scale battery energy storage projects has already been started in the country. Many distribution utilities have also installed medium size BESS in their system for grid stabilization, better peak load management, for system flexibility, enhance reliability and to protect critical facilities etc.

7.16 SMART MICRO GRID

Micro grids are an integrated energy system intelligently organizing interconnected loads and distributed energy resources and capable of operating in parallel with, or separately, from the existing utility grid. They achieve specific local goals, such as reliability, carbon emission reduction, diversification of energy sources, and cost reduction, established by the community being served. Like the bulk power grid, smart micro-grids generate, distribute, and regulate the flow of electricity to consumers, but do so locally. Smart micro-grids are an ideal way to integrate renewable resources on the community level and allow for customer participation in the electricity enterprise.

Smart Micro grids may contribute in reducing GHG emissions and help cities meet their climate goals by integration and aggregation of renewable energy sources, thanks to their ability to balance energy production and usage within the microgrid through distributed, controllable generation and storage etc. It would also reduce the transmission losses because of proximity of load to generation point. Smart Microgrids can strengthen and increase resilience of the central grid by reducing grid vulnerability by coping with impending power outages and safeguarding against potential cyber-attacks on energy infrastructure. They may also sustain energy service during emergencies or natural disasters, especially for critical public services etc.

Smart Micro grid leverages the various functionalities of smart automation system to take the decision for providing the green, optimal, reliable and quality power in the area of operation.



The smart microgrids could offer great amount of flexibility to the main grid as follows-

- Smart microgrids can island from the main grid when required and reconnect. During islanded operations, the smart microgrids will switch-off interruptible loads and service the most critical loads for longer durations.
- Smart microgrids can buy electricity from the main grid when the prices are low and store in the energy storage devices as well as EVs connected to the microgrid. It can pump electricity back to the main grid during peak hours at a higher price.

7.17 SMART INVERTERS

As the number of DERs on the grid are increasing, the need for additional inverter functionality has grown to make it smart. Smart inverters go beyond the basic function of inverter to provide grid support functions, such as voltage regulation, frequency support, and ride-through capabilities etc. to increase its resilience, reliability, safety and security of the grid. Instead of just feeding power into the grid, smart inverters can have two-way communication with the utility control systems and these inverters can be remotely controlled as per requirement.

Existing codes and technical standards (International / India) are to be updated to ensure that smart inverter capabilities can be fully realized. BIS is taking up the finalization of Standards for Smart Inverters to adopt IEEE-1547:2018 standards so that all future inverters in India shall be remotely manageable from the Utility control center. This is expected to be issued on fast-track.

The benefits of Smart Inverters are –

- Increased grid reliability and efficiency
- Provision of ancillary services at system and local level
- Reduction in RE curtailment

7.18 HOME AUTOMATION SYSTEM - SMART HOME

Home Automation includes connecting all electrical devices of the home with a common central controlling unit which automates the devices depending on the user inputs. In addition to managing the control of electrical appliances, the concept of Home Automation further extends to managing the security systems of home, controlling programming devices like thermostats and sprinkler systems, operating your garage doors through a one-touch action on your smartphone, etc.

Thus in short explanation, Home Automation helps build what is called as “**Smart Home**”.



One clear advantage of home automation is the unmatched potential for energy savings, and therefore cost savings.

Smart Home

A smart home is a home that includes automated, IOT connected devices connected to mobile applications. Using these IoT devices, users can control many things in their home from lights to security systems to appliances etc. Now a days, many homes are being provided with the smart facilities but technically, any home with an internet connection may be converted into smart home by introducing IoT controlled devices.

Home automation works on three levels:

- **Monitoring:** Monitoring means that users can check in on their devices remotely through an app.
- **Control:** Control means that the user can control these devices remotely, like panning a security camera to see more of a living space.
- **Automation:** Finally, automation means setting up devices to trigger one another, like having a smart siren go off whenever an armed security camera detects motion.

Home automation systems offer a variety of services and functions. Apart from control and monitoring of electrical appliances, the following other services may also be integrated in Smart Home system:

- Fire and carbon monoxide monitoring
- Temperature control of Home
- Appliance control
- Home automation security systems and cameras
- Live video surveillance
- Alarm systems
- Real-time text and email alerts
- Digital personal assistant integration
- Keyless entry
- Voice-activated control

Advantages of Home Automation

- **Energy Savings:** Self-automated light bulbs, fans, and switchboards save energy, cutting utility costs over time.
- Home Safety
- User Convenient
- Better Control
- Remote Access etc.

7.19 SMART EV CHARGING STATIONS

Electric vehicles (EV) can be charged in a variety of ways, depending on location and requirement. However, charging EVs through grid creates a peak load on the grid both at the system and the local level. Since EVs can act as flexible loads and decentralized storage resources, it has the capability to provide additional flexibility to support power system operations through smart charging stations. Smart charging is a technology that optimizes EV charging patterns to get around the limits of our current power system in an efficient, effective and ecological way. Smart charging stations involves EV charging that responds to triggers from utility control center like changes in tariff, power demand, etc. and depending on the inputs, EV charging sessions can start or stop, and charging levels can ramp up or down automatically. “Smart chargers” are capable to carry out active EV charging and can also handle Time-of-Use (ToU) tariffs, in which electricity tariffs are adjusted in real time based on demand.

Smart charging at scale requires uniform communication architecture to allow interactions between the different levels of the system i.e. between EVSEs and charging networks (or central management systems) between different charging networks, and between the Central Management System (CMS) and Distributed Energy Resources Management System (DERMS) hosted by the DISCOM or a third-party aggregator.

An Electric Vehicle Supply Equipment (EVSE) with advanced smart charging capabilities has the following characteristics –

- It can be programmed to respond appropriately and autonomously to signals from DISCOMs (e.g. electricity tariff), Central Management System (CMS), etc., to coordinate with ToD and ToU tariffs
- It can be monitored and managed over an app
- It is equipped with GPRS, 3G/4G or wired connection, and is connected to a cloud service
- It shares a data connection with an EV and a charging network
- It is compatible with the back-end communication protocol

There are three different forms of smart charging infrastructure –

- **V1G** – unidirectional, controlled charging: The vehicles or charging infrastructure adjust their rate of charging based on grid requirements
- **V2G (Vehicle to Grid)** – Bidirectional smart grid-controlled vehicle charging; the vehicle’s battery returns energy to the grid during high demand and charges during off peak times.

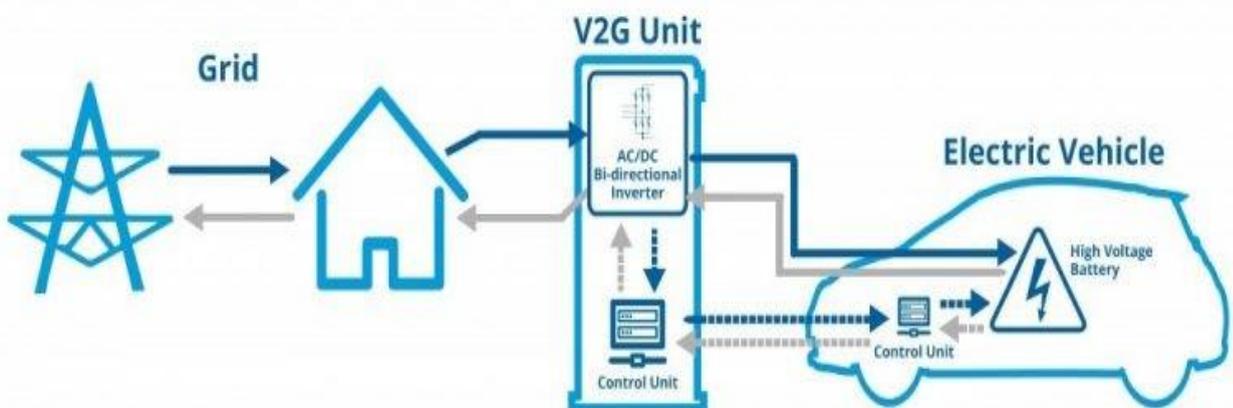
V2H-B (Vehicle to Home/ Building) – Bidirectional smart grid-controlled vehicle charging; stored energy of the vehicle’s battery provides power to the home/ building based on immediate requirements and gets charged when demand is reduced.

7.20 NEW EMERGING SMART TECHNOLOGIES FOR DISTRIBUTION SECTOR

➤ VEHICLE TO GRID (V2G) CHARGING

EV Batteries can be charged to store energy when renewable energy is present in the grid and may feed it back into the grid later, whenever required (V2G). The capacity of using electric vehicle batteries as a distributed storage system to balance generation and load fluctuation depends not only on the connectivity of the car and charger, but also on the capacity of the grid to manage charging and discharging processes. This capacity of the grid can be improved by having access to information about the local status of the grid, which is usually obtained from smart meters. The availability of information concerning the grid (provided by smart meters) allows an optimisation of the EV loading process, by taking into account the needs and limitations of the local grid

EV manufacturers are presently not providing V2G functionality as batteries come with warranty for fixed number of charging-discharging cycles. However, the new generation of batteries have significantly improved the life cycle and new EV models will be launched with V2X functionalities. V2G technologies are maturing fast and are expected to be commercially available in next 2-3 years.



Benefits :

- Avoided cost of grid reinforcement by deferring expensive grid upgrades
- Usage of EVs as flexible load thus allowing peak load shaving
- Increased grid reliability and efficiency; despite high load condition
- Provision of ancillary services at system and local level
- Reduction in RE curtailment
- Can act as backup power (for V2G and V2H-B charging)

➤ ARTIFICIAL INTELLIGENCE AND ROBOTICS FOR DISTRIBUTION SYSTEM

The operations of utilities (electricity, water and gas) have changed drastically in the past few years. There is a greater need for utilities to deploy advanced automation, remote working, remote monitoring, robotics and artificial intelligence to handle business and operational processes. Artificial Intelligence (AI), Data Science (DS), Machine Learning (ML), Virtual Reality (VR), Augmented Reality (AR), and other types of Robots could play crucial roles in utility operations. These new technologies and tools could make the operations more efficient, faster, reliable and economical.

Artificial intelligence (AI) will be able to balance electricity grids, manage demand, negotiate actions, enable self-healing functions and facilitate a host of new products and services leading to the energy transition. It will also enable more efficient and effective utility operations by helping to analyze the massive amounts of data gathered from the digital devices. Robotic Process Automation (RPA) could automate all measurable, repeatable and predictable transactions in utility operations.

Benefits

- Forecasting solar and wind generation and energy demand
- Weather based energy forecasting and outage management
- Predictive maintenance with inputs from sensors and digital twins
- Asset Performance Management
- Revenue maximization from billing/payment/payment mode/customer
- Enhancement of customer experience with utilities

AI USES IN DISTRIBUTION SECTOR

• **Consumer Consumption Behavior** - One of the foremost use of AI in Smart Grids can be for the analysis of consumer consumption behavior. Clustering of consumers, identification of abnormal consumption patterns, general profiling of consumers etc. can be done through AI with ease. With clustering and profiling, personalized services can also be explored. These patterns also help in the Demand Response programs design and implementation

• **Load Forecasting** - Load forecasting makes demand and supply match in real-time for efficient operations and balancing. Forecasting can be short-term, medium-term and long-term. Time series forecasting, deep learning and recurrent neural network models can provide better insights into load forecasting mechanisms.

• **RE Generation Forecasting** - Intermittent RE generation is unpredictable and dependency on RE may lead to unforeseen circumstances. With right set of data and parameters, AI predications can help in understanding the RE generation and assists in timely actions for efficient operation of controllers etc. Flexibility in the system can be achieved with help of AI

- **Stability Assessments** - Stability assessments of multiple parameters/factors like transients, frequency, voltage swell/sag etc. can be done with the help of AI models. This shall help in enhancing quality of supply to the consumers and improving power factor
- **Network Security Protection** - Threat detection and analysis can be done using deep learning techniques to detect malware, intrusion, cyber physical attacks etc. Since the real-time flow of information and power employs dynamic control, strong cyber security protocols and network data analysis should be in place to identify and take immediate data driven actions.

Under the new RDSS scheme, great emphasis has been given on use of advanced ICT, AI, ML etc. in the distribution sector. Under the scheme, Artificial Intelligence would be leveraged to analyse data generated through IT/OT devices including System Meters, prepaid Smart meters to prepare actionable MIS from system generated energy accounting reports every month so as to enable the DISCOMs take informed decisions on loss reduction, demand forecasting, asset management, Time of Day (ToD) tariff, Renewable Energy (RE) Integration, network management, consumer analytics and for other predictive analysis. This would contribute a great deal towards enhancing operational efficiency and financial sustainability of the DISCOMs.

➤ **BLOCK CHAIN TECHNOLOGY APPLICATION**

Blockchain is a distributed, digital transaction technology that allows for securely storing data and executing smart contracts in peer-to-peer networks. These mechanisms, called “smart contracts”, operate on the basis of individually defined rules (e.g. specifications as to quantity, quality, price etc) that enable an autonomous matching of distributed providers and their prospective customers. All information transferred via blockchain are encrypted and recorded at every step which ensures security, transparency and reliability of the data.

Blockchain has attracted the attention of the power industry with it’s potential to unleash an energy revolution in which both utilities and consumers will produce and sell electricity. Some Blockchain use cases have been successfully piloted in the energy industry, the one gaining the most traction at present is peer-to-peer (P2P) power trading, where owners of small-scale generation plants (typically rooftop PV systems) can sell excess generation directly to other consumers. Blockchain is a foundational technology that can be used to create new business models and underpin business, economic, and social infrastructure.

With rooftop solar gaining prominence in India , blockchain provides an opportunity for the prosumers to carry out peer to peer (P2P) trading based on their solar generation with customers with renewable purchase obligations (RPO) or willing to buy green energy from the rooftop solar owners which can be transacted transparently on blockchain platform. P2P trading provides the prosumers and consumers opportunity to buy and sell green electricity at a price lower than the utility tariff and higher than the net metering tariff respectively.

Some of the potential use cases of blockchain technology in the energy sector are mentioned below-

P2P Trading – The trading of electricity produced by prosumers directly with their neighbours and to microgrids leveraging blockchain based solutions is by far the most popular blockchain application in the sector. Two pilot projects on P2P trading of roof top solar in the state Uttar Pradesh and Delhi have also been taken up.

REC trading – The REC accreditation, validation and trading process can be carried out through blockchain. The whole process can be automated over blockchain platform which will also help to maintain the traceability of the energy source.

Wholesale Trading and Settlement – Wholesale electricity trading and settlement market is another emerging area for Blockchain technology. This space has the scope for radical process improvement opportunities. In 2016, the first European energy trade using Blockchain technology was demonstrated by PONTON, which developed the blockchain based Enerchain trading tool to deploy a Smart Market Blockchain solution with a vision to use Blockchain technology as a joint data layer to coordinate market activities such as the submission of buy or sell orders and the execution of trades. Activities in this space is expected to gain momentum faster.

➤ **MONITORING OF DISTRIBUTION LINES BY DRONE TECHNOLOGY**

The inspection of thousands of kilometers of electrical lines with the help of drones are being taken up by various utilities in order to optimize the monitoring and the maintenance plan of the network. A regular mapping allows vegetation monitoring, verification of maintenance works and services performed by operators as well as monitoring of the condition of power lines. Preventive and predictive maintenance of distribution network is one of the important aspect with respect to supply of quality and reliable power by utilities. It also helps in reducing cost and save huge amount of time required for fault identification and maintenance, avoid outages etc.

The drones were fitted with high definition camera for visual inspection and an infrared camera for thermal imaging for identification of the hot-spots. Using high resolution imagery and infra-red thermo scanning, it will involve inspection of the overhead lines and equipment, grid-substations, connections, damaged switches, capacitors, detection of theft of equipment and intelligent line profiling.

Successful adoption of drone technology is a huge step in preventive maintenance exercise, critical for ensuring reliable power supply.

The drone technology will help the utilities leverage the following benefits:

- Faster patrolling
- Accurate capturing of data using high-definition images and videos
- Hot spot identification
- Vegetation management

8.1 INTRODUCTION

Capacity building is the process of enhancing and developing new capabilities, skills, knowledge & instincts of an individual or organization in order to deliver effectively, efficiently and smartly in a fast changing world. It is an investment in enhancing the competencies and skills of an individual to make them more effective as per the need of organization. As power sector is evolving day by day with new technologies and systems, hence, it becomes very necessary to build and develop the capabilities of the power sector professionals with the goal of providing 24x7 quality & reliable power at affordable rates to the consumers with adoption new technologies.

8.2 CAPACITY BUILDING APPROACH

The capacity building approach consist of mainly four components: Assessment, Design, Implementation, and Monitoring (ADIM). The assessment component focuses on identifying the needs and priorities of capacity building for targeted groups or institutions. The design component develops training content in order to execute the plan in coordination with subject matter experts (SME). The implementation component executes the capacity building activity in any of these four formats—standard training, training of trainers, on-the-job training, and exposure learning. The monitoring component helps to identify the participants' expectations, learning achievements, and feedback so as to improve future capacity building events.



FIGURE 1. ADIM—capacity building workflow.

8.3 DETAILS OF VARIOUS STAGES IN CAPACITY BUILDING

1. Assessment

The capacity assessment of the individuals/organizations is very important to identify gaps, requirements, and priority needs for delivering effective capacity building programs. The assessment process helps to gain an understanding about the necessary products and services, physical capabilities (hardware and software) and the available human resources in the organizations along with identifying the priorities for specific applications, products and decision support tools in the relevant areas. It is also necessary to explore potential collaboration with institutions to engage in the implementation of relevant capacity building activities.

2. Design /Development of training material

After understanding the requirements from the assessment process, the Subject Matter Experts (SMEs) may design the curriculum based on background notes, learning objectives, expected outcomes and targeted audience. The necessary materials (theoretical and hands-on exercises), including PPTs, manual, and exercise data, may be prepared in modular approach with real-world examples for each activity. The training program shall be devoted mostly to hands-on activities. There are four types of capacity building activities: on-the-job training (OJT), standard training, training of trainers (ToT), and exposure learning.

On-the-job training (OJT) activities are semi-structured, focusing on building the capacity of individuals to enhance their capacity to develop, operate and maintain specific job profile related applications and services. These courses are designed keeping in view the background and skills of the participants. After OJT, independent assignments related to specific applications are given to the participants which needs to be finished within a given period of time, along with the submission of a report.

In the case of ToTs, these courses are designed for trainer's/teaching staff from organizations/academic institutions and focus not only on content but also on skills related to the delivery of training (e.g., communication and presentation). After receiving such training, it is expected that the participants will be able to transfer knowledge to wider audiences in their respective organisations. In ToT, the participants are also engaged in refining training materials, for instance, in the development of hands-on exercises with local data and case studies. A ToT program is different from a standard training program as it includes additional contents in the form of specific training, scientific communication, and monitoring and evaluation; also, back-end support is rendered to the participants of ToT while they conduct trainings in their home organisations.

As regards "exposure learning," this course is of a short term and designed to make the participants aware of current development, applications, benefits, and future prospects. These activities are often organized alongside professional conferences, workshops, competitions and technical exchanges etc. In exposure learning, the competitions were meant for the youth; the conferences and workshops for decision- and policymaking professionals; and the technical exchanges for high-tech professionals.

While OJT and ToT were considered as institutional capacity building activities, the other two training are considered as individual capacity building activities. The institutional capacity building activities were very specific and focused on the requirements of particular institutions; while the individual capacity building activities are more general in nature, linking thematic applications with common topics that cater to a wider audience.

3. Implementation

This refers to the execution of a capacity building activity. It must ensure that the relevant training opportunities reached the targeted group of people; gender-sensitive language was used to encourage the maximum participation of women.

4. Monitoring

Monitoring and evaluation is an important part of any capacity building event. It helps to improve performance and achieve better results. Monitoring and evaluation has to do with the quality and relevance of capacity building efforts. Structured pre- and post-assessment tools shall be developed and used for each type of capacity building activity, except for the exposure learning type, in order to monitor a participant's expectations, his or her progress in understanding the contents, and to get feedback for continuous improvement.

8.4 PROVISIONS OF THE ACT AND CEA REGULATION MANDATING TRAINING OF POWER SECTOR PERSONNEL

The clause (g) of section 73 of the Electricity Act, 2003 mandates Central Electricity Authority to promote measures for advancing the skills of persons engaged in the electricity industry. Accordingly, the provisions for training for the personnel engaged in the operation and maintenance of distribution systems have been made mandatory under the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023 . The provisions have been made under regulation 8 of the Safety Regulations for mandatory training of the personnel engaged in operation and maintenance of Transmission & Distribution Systems. As per the requirement of Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations, 2023 , the personnel engaged for the Operation & Maintenance of Distribution systems shall require to be imparted statutory training from the institutes recognized by the Central Electricity Authority (CEA) for ensuring safe, secure, reliable and economic operations of the distribution systems.

The relevant provision in Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023 are as under:-

“8. Safety measures for operation and maintenance of transmission and distribution systems. – (1) The Engineers or Supervisors engaged or appointed to operate or undertake maintenance of transmission and distribution systems shall hold degree or diploma in appropriate trade of Engineering from a recognised institute or university.

(2) The Engineers and Supervisors engaged or appointed to operate or undertake maintenance of transmission and distribution systems shall have successfully undergone the type of training specified in guidelines as per sub regulation (4), within two years from the date of engagement or appointment.

(3) The Technicians to assist Engineers or Supervisors shall possess a certificate in appropriate trade, preferably with a two years course from an Industrial Training Institute recognised by the Central Government or State Government and should have successfully undergone the type of training as specified in guidelines as per sub regulation (4), within two years from the date of engagement or appointment:

Provided that the existing employees, as on the date of notification of these regulations, who are extending technical assistance to Engineers or Supervisors and do not have requisite qualification as mentioned in this regulation, shall have to undergo the training either from Power Sector Skill Council or from training institute recognised by the Authority for carrying out trade specific course as per the guidelines issued by the Authority and get certificate as mentioned above within two years from the date of notification of these regulations.

(4) The Authority shall issue guidelines for the training for operation and maintenance of Transmission & Distribution systems within six months of the notification of these regulations:

Provided that the duration and content of the training course shall be as specified in the guidelines.

(5) Owner of every transmission or distribution system shall arrange for training of their personnel engaged or appointed to operate and undertake maintenance of transmission and distribution system, in his own institute or any other institute recognised by the Authority or State Government as per the guidelines and shall maintain records of the assessment of these personnel issued by the training institute in the format prescribed in guidelines and such records shall be made available to the Electrical Inspector, as and when required.”

8.5 ORGANIZATION STRUCTURE OF A DISCOM

For a well-functioning DISCOM, it is imperative to have multiple functional levels to achieve its objective . However, the focus should be on minimum government, maximum governance. This section proposes an indicative organizational layering with functions across the various levels. Further, to optimize the functioning while ensuring efficient operation, the indicative structure includes four levels, namely, Headquarter, Circles, Divisions and Subdivisions. The number of levels in a Discom may be more initially depending on their maturity level and ground experience and the Discom may work towards improving the same to arrive at the optimized structure as follows:

HQ level

- Revenue cycle managemnt
- Customer Relations
- Connection & Metering
- Theft Booking
- Energy Audit

- Testing and repair workshops
- Projects
- O&M
- Safety
- Network Planning

- Corporate Services
- Finance & Cash
- HR & Admin
- Legal & Regulatory
- Contracts & Materials
- IT
- Power Purchase & scheduling
- Vigilance

Circle Level

- Revenue cycle management
- Customer Relations
- Theft Booking

- Projects
- O&M
- Safety

- HR & Admin
- Contracts & Materials

Division level

- Revenue cycle management
- Customer Relations
- Connection & Metering

- Projects
- O&M
- Safety
- Network Planning

- Finance & Cash
- HR & Admin
- Contracts & Materials

Sub-Division level

- Connection & Metering
- Theft Booking

- O&M
- Safety

- HR & Admin
- IT

➤ **RIGHT BALANCE OF OUTSOURCING AND IN-HOUSE EMPLOYEES:**

Further to the above, a right balance of outsourcing and in-house reliance shall also be taken into consideration by a Discom. While almost all DISCOMs use the outsourcing model, some DISCOMs limit outsourcing only to non-key functions (like security, house-keeping) and others do it for key business areas as well (such as Metering- Billing -Collection, HT/LT maintenance and network operations etc.). Both sets have shown fair amount of success in implementation. DISCOMs must evaluate the decision of outsourcing based on existing cost structures, QC mechanisms, risk due to change in skill requirements and growing Digital penetration. It is suggested that a balanced approach be adopted by DISCOMs with right mix of outsourcing based on the outcome and cost savings. Penalties for outsourced function (comprehensively defined contracts, SLAs and reward & penalties provisions) with regular monitoring should be adopted to ensure optimum performance by the outsourced agencies.

While Quality control of outsourced function may be seen as a key challenge, outsourcing reduces the degree of operation lever (content of fixed costs in the structure) for DISCOMs in terms of employee salaries/terminal benefits. Outsourcing also enable DISCOMs in their quest to become lean and flexible and reduce the requirement of support functions even meeting the same/enhanced level of operations.

8.6 VARIOUS PROGRAMS FOR TRAINING OF DISCOM PERSONNEL

In the face of the rapidly evolving landscape of the utility industry, it is pertinent to continuously invest in up-skilling and enhancing the knowledge of the workforce/Manpower. More focus on imparting better skill-set regarding operation, maintenance and management coupled with improving on the infrastructure shall be more effective in improving the performance of a Discom. Keeping these important facets in mind, Discoms have been investing considerable resources for the capacity building of its workforce, which not only keeps the employees motivated, but also equips them to take-on the evolving challenges and seizing emerging opportunities. The training programs should be such that it clearly meets organization objectives and is measurable in terms of Return-on-Investment e.g. Customer Delight, Reduction of Transformer failures, Reductions in Power breakdowns, AT&C Loss reduction etc.

In general, trainings programs can be broadly categorized based on the training needs under following heads:

- Technical
- Functional
- Behavioral
- Need based
- Seminars/Conferences
- External Programs
- Others

For the training of the workforce, one needs to ensure that the trainings are being planned and imparted on the basis of a few parameters:

1. **Induction and Orientation Program:** Induction and Orientation Program should entail the complete orientation of all functions of the Organization. An introduction with the Leadership, the cultural acclimatization, orientation about the Industry, Organization Vision, Mission and Values should be included, with special focus on Compliance and Integrity along with examples. A detailed orientation of policies, touch points and processes and interdependence with other departments. Alignment with Government policies and updates particularly for regulated businesses.
2. **Training Need Identification:** The training planning should be based on methodological collection of inputs and customization needed for requisite trainings. This should be based on a detailed exercise on “**Training Need Identification**” i.e:
 - a. Inputs from Annual Appraisals of the employees, if the same is digitized.
 - b. Inputs through elaborate Focus Group Discussions (FGD) with Department Heads along with their teams to understand the training requirement for the year.
 - c. Individual training needs, if any, from the Reporting Managers.
3. **Training mapping:** Informed call should be taken for training mapping based on the following:
 - a. Whether in-house training with Internal Trainers or In-house training with the help of External Faculty
 - b. Nomination to the External Programs
 - c. Nature of Training (Technical, Functional, Behavioural, Compliance related, Updates etc)
 - d. Training mapping to be shared with the concerned Departmental Heads e. Modifications, if any, with the inputs further received.
4. **Annual Training Calendar:** Annual Training Calendar to be prepared based on Training Mapping and should be shared with the various Department Heads. Necessary budgetary approvals to be obtained. Monthly/Quarterly/Half-yearly training calendar may also be made and shared with the entire organization with complete details of Trainings planned, dates, duration, venue, faculty, coordinator’s details etc.
5. **Training Assessment:** Assessment of effectiveness of the training imparted is also important for measuring its utility as well as improving on it. For this, following measures may be taken:
 - a. Pre and post Assessment for trainings of 8 hours and beyond and all critical trainings.

- b. Training Effectiveness through departmental portals/ official communication/presentations etc. post a gap of the training execution for all critical programs to understand the retention of learning.
- c. Gauge any improvements needed in the content, delivery, faculty, admin arrangements based on the feedback and improvise in the trainings to be conducted in future.
- d. Measure the effectiveness of training imparted through improvements in areas e.g. Loss Reduction etc. , thus supporting the Organization’s objectives.
- e. Development of knowledge portal for online learning tie-ups, international and national level trainings, and linking training participation to annual increments and promotions.

6. **Focus on upcoming technologies:** In addition to the conventional topics, there can be focussed approach on the upcoming technologies e.g. Smart Meters, Renewables, Machine Learning, CEA Regulations, Safety Programs – “Zero Accidents”, Digitalization etc., Customer delight programs, partnering with RWAs and consumers on updates, safety etc. Roof-Top Solar, Net-Metering and BESS, EV and EV charging infrastructure along with on-site, online and class room sessions by Original Equipment Manufacturers (OEMs) on operational parameters of Fuzzy logic/ FLC, efficient relay settings of HT / LT Switchgear, testing of RMUs, Testing of Transformers and Maintenance, Power Quality and Harmonics, Preventive Maintenance, Enforcement, SAP, MS Projects, MS Skills etc.

7. **Behavioral Programs:** Various Behavioral Programs to develop the competency of the employees like Focused Personal Development Program, Leadership Programs, Interpersonal Skills, “Mission, Vision and Values”, Managerial Effectiveness Program, Communication Skills, Interpersonal Skills to promote an interdependent healthy culture, Inclusive Culture and Diversity, Gender Equality, Image Management, Etiquettes and Grooming, Mentor-Mentee, Leadership Coaching, Performance Management Coaching, Team Management, and many such other interventions helping employees to enhance their competency levels may be taken up .

8. **Apprentice Training:** A dedicated training center for undertaking Apprentice Training could also be established with a structured on- boarding and a detailed induction program for the apprentices under qualified and experienced faculty. The laid down curriculum needs to be adhered to. Periodic tests and a robust feedback mechanism need to be in place to assess the performance of the apprentices for better coaching and training. Work diaries need to be maintained for each and every apprentice, which should be regularly monitored. Training on Safety and First Aid needs special focus and should be an important part of their induction curriculum.



8.7 RECOGNITION OF TRAINING INSTITUTE BY CEA

As per the latest Guidelines issued by Central Electricity Authority (Authority) for Recognition of Training Institutes in the field of Distribution of Electricity including details of training Curriculum for Engineers, Supervisors and Technicians, the following procedure is to be adopted by Training Institutes for recognition by Authority:

1. Application by the Training institute for Fresh recognition by the Authority:

- (1) The training institute shall apply to the Authority, furnishing the required information, for its recognition in the prescribed format, for last financial year , attached in the guidelines issued by Authority.

- (2) The following shall be the mandatory requirements for the recognition of training institute for Engineers, Supervisors and Technicians engaged for the Operation & Maintenance of Distribution systems :
 - i. The training institute shall have a full time Principal/Director and teaching staff.
 - ii. There should be a separate building which shall be solely used for the purpose of training. The building shall either be owned by the institute or on lease. However, in case the building is on lease then the lease period shall be more than the period of recognition.
 - iii. The training institute shall have at least 2 faculties (core/empaneled/guest) in relevant specialized topics/subjects of the curriculum given in these guidelines.
 - iv. The training institute shall give an undertaking that on recognition for 3 years initially, the institute shall follow the curriculum as per these guidelines
 - v. The training institute shall have institutional tie up for simulator training/labs/workshops, if not having in-house.
 - vi. The training institute shall have the facilities of providing training on simulator and slide shows & multimedia etc.
 - vii. The training institute shall score a least 60% in the evaluation criteria for getting its recognition from the Authority.
 - viii. The training institute shall have CCTV facility at the examination hall for conducting the term end exam.
 - ix. The training institute shall have medical facilities and high speed internet facilities in its premises.
 - x. The budget provision and control of expenditure for training program shall be distinctly and exclusively earmarked for the institute.

- (3) The requisite fee for recognition of the training institute for application for recognition including renewal of recognition shall be levied from the training institute. The details regarding payment of fees shall be as per the fee schedule issued by the Central Electricity Authority from time to time.
- (4) On receipt of the complete application with information specified above, CEA shall examine the eligibility of the same and if the application is found to be eligible for recognition by Authority, the institute has to submit the above-mentioned fee to the Authority for processing the application for its recognition.
- (5) After receipt of the fee and information specified above, the team of CEA officers shall visit the institute on a date mutually agreed upon by the visiting team and the institute and the Team shall have its assessment on the various aspects in accordance with laid down criteria/norms as specified in the guidelines.
- (6) The application for recognition shall be accepted through online portal i.e. National Single Window System (NSWS) of Govt of India and entire process of recognition shall also be completed through this system.

2. Application by the Training institute for Renewal of recognition by the Authority:

- (1) The training institute shall apply three months before the expiry of the earlier recognition to the Authority for its recognition furnishing the required information in the prescribed format enclosed in Guidelines issued by CEA for last three financial years separately.
- (2) The following shall be the mandatory requirements for renewal of recognition of training institute for Engineers, Supervisors and Technicians engaged for the Operation & Maintenance of Distribution systems :
 - (i) The training institute shall have a full time Principal/Director and teaching staff.
 - (ii) There should be a separate building which shall be solely used for the purpose of training. The building shall either be owned by the institute or on lease. However, in case the building is on lease then the lease period shall be more than the period of recognition.

- (iii) The training institute shall have at least 2 faculties (core/empaneled/guest) in relevant specialized topics/subjects of the curriculum given in these guidelines.
 - (iv) The training institute shall have institutional tie up for simulator training/labs/workshops, if not having in-house
 - (v) The training institute shall have the facilities of providing training on simulator and slide shows & multimedia etc.
 - (vi) The training institute shall score at least 60% in the evaluation criteria for getting its recognition from the Authority.
 - (vii) The training institute shall be conducting induction course and as per the curriculum given in these guidelines.
 - (viii) The training institute shall have CCTV facility at the examination hall for conducting the certification exam.
 - (ix) The training institute shall have medical facilities and high speed internet facilities in its premises.
 - (x) The budget provision and control of expenditure for training program shall be distinctly and exclusively earmarked for the institute.
- (3) The requisite fee for recognition of the training institute for application for recognition including renewal of recognition shall be levied from the training institute. The details regarding payment of fees shall be as per the fee schedule issued by the Central Electricity Authority from time to time.
- (4) On receipt of the complete application with information specified above, CEA shall examine the eligibility of the same and if the application is found to be eligible for recognition by Authority, the institute has to submit the above-mentioned fee to Authority for processing the application for recognition
- (5) After receipt of the fee, the team of CEA officers shall visit the institute on a date mutually agreed upon by the visiting team and the institute and the Team shall have its assessment on the various aspects like institutional arrangements, organization and staffing, training methodology, instructional capability, training contents, performance appraisal system etc.
- (6) The training institutes applying for renewal of recognition after the date of expiry of earlier recognition shall be treated as institute seeking for fresh recognition and shall be charged a fee same as that for fresh recognition as mentioned above.

- (7) The training institutes applying for renewal of recognition after the date of expiry of earlier recognition shall not be displayed in the list of training institutes recognized by CEA.
- (8) The application for recognition shall be accepted through online portal i.e. National Single Window System (NSWS) of Govt of India and entire process of recognition shall also be completed through this system.

3. Recognition (Fresh and Renewal) of a Training Institutes with multiple Fields of Training:

- I. The Training institute willing to be recognised or willing for renewal of the recognition in the field of Distribution of Electricity, along with other fields of Power Sector, such as training in the field of Generation and Transmission, shall have to follow the procedure provided that all these fields of Training are available in the Institute at same Location.
- II. The Institute shall submit a combined application in the prescribed formats i.e, in prescribed Forms for fresh recognition or renewal of recognition for each field of training as mentioned in the relevant Guidelines issued by CEA.
- III. The Institute shall fulfil all the mandatory conditions and general conditions prescribed in each field of training as mentioned in the relevant Guidelines of CEA.
- IV. The Institute shall submit a consolidated Fee to be prescribed by CEA from time to time, provided that all these fields of Training are available in the Institute at same Location.
- V. CEA on receipt of a combined application and fee, shall carry out site visit of the Institute, evaluate and grade each field of Training Institutes, i.e, Distribution, Generation and Transmission separately.

4. Cancellation of Recognition

- (1) The recognition of any training institute shall stand cancelled automatically due to the following reasons: -
 - (i) Change in the ownership of the institute by sale or transfer of the institute.
 - (ii) Change / shift in the location of the institute.
- (2) In case of cancellation of recognition due to any reasons as stated above, the institute may apply for its recognition as in the case of a fresh recognition.

8.8 BASIC STRUCTURE OF CURRICULUM FOR OPERATION & MAINTENANCE OF DISTRIBUTION SYSTEM

The basic structure of various courses & content for Distribution sector personnel may be as under :

(1) Types of Courses

➤ Induction Course (mandatory)

i) **Common Courses** for all the trainees shall include the following topics:

- a. Safety Management
 - Overview of Safety Management
 - Causes and factors of accident
 - Statutory requirement
 - Firefighting equipment and Fire prevention
- b. First Aid
- c. Values and Work culture
- d. Relevant regulations and relevant sections of Electricity Act (EA) and CEA Regulations , SERC/JERC Rules & Regulations etc
- e. Necessary permissions/Clearances
- f. IT Applications and Cyber Security Awareness/overview
- g. Disaster management
- h. Electrical Vehicle-Charging
- i. Batteries Storage
- j. Renewable overview
- k. Contracts and Materials Management
- l. Consumer engagement

ii) **Basic courses** for Engineers, diploma holders and ITI personnel engaged in O&M work of the electrical installations in Distribution Electricity is given hereunder.

- a. **Class Room Training-** Visuals/Media Usage for imparting training along with Models and Computer Based Training (CBT) packages to understand the Fundamentals separately for Post based curriculum
- b. **Visits-**sites for understanding layout, identification of equipment, Manufacturing Units separately for Post based curriculum.

c. Practical, separately for Post based curriculum

(i) **Operations**-through Simulators and Observer in control room for better understanding

(ii) **Maintenance-**

Practical /working with Engineers. It shall be ensured that the Degree/Diploma holder is rotated so that trainees observe and understand each activities such as

- Preventive maintenance/ Schedule of maintenance
- Trouble Shooting and repair
- Drawings and tracing the equipment's,
- Manuals,
- Familiarizes with tools required for maintenance
- Safety Aspects
- Team work with Diploma holders/ITI

(iii) **On job Training**

- Drawings and tracing the wires/cables
- Preventive maintenance
- Analyzes fault
- calibrations
- Quality of work done
- Team work with Diploma holders/ITI
- Process for permits and clearances
- mix of degree, diploma and ITI for building team work, improved communication and understanding.
- Awareness regarding Mock drill exercises considering various emergency situations may be added

➤ **Refresher Course-**

- Requirement basis/Need basis (Recommended by the immediate superior/ Employee itself).
- New technologies as and when adopted/implemented by the Power Utility.
- Higher training for experienced employees
- Revenue Management & Loss reduction technique in Distribution system.
- Advance Technology including Smart meters and Net Metering, Gross Metering
- Smart Grid Concepts in Distribution system and Automation
- Distribution Management with SCADA & Communication system.

- Grid Discipline and effective energy management
- Distribution network planning for UG Cable system, AB cables, Ring Main system,
- Development of Micro grid and Macro grid.
- Peak Load management including Energy Efficiency, Feeder separation, and Rostering etc.
- Power quality and Reliability, Reliability Indices
- Integration of Renewables such as Solar, wind etc., Battery storage and EV charging system
- Various Regulations of CEA and appropriate SERC
- Consumers care and Grievances
- Cyber Security aspects
- Surge Impedance Loading
- Insulation Coordination
- HVDC
- Energy efficiency
- Mission LIFE
- Predictive maintenance
- Distribution Asset management etc.

8.9 CAPACITY BUILDING IN INFORMATION & COMMUNICATION TECHNOLOGY

The successful deployment of smart distribution system in the Discoms would depend on availability of trained Human Resources which is IT centric as smart technology deployment is basically a combination of Information Technology (IT) combined with communication & related software while the Distribution utilities now a days are dependent on the service providers/ outsourced staff as they do not have adequate IT capable work force. Further, for Disseminating information to Consumers and answering all their queries, DISCOM personnel's need to be well aware about the Smart technologies benefits and its functionalities so that the consumers can be informed rightly.

Series of IT enabling training programs have to be planned & carried out for the targeted group in the organization. Technical training needs to be imparted in two steps – one the initial overview of the technicalities of the Smart technologies should be targeted for implementation processes in field while the other module of training should be deployment centric. Such trainings, may be provided by the service provider and the contract document in such cases needs to elaborated milestone-based trainings / evaluation & competence development clearly. Moreover, Induction of fresh workforce, with IT Competence & technology adoption capabilities is also required in the distribution

utilities. The curriculum of these programs is to be professionally designed by experts in order to create the right kind of vibes in the target group.

The concerned employees starting from the Technician levels to up to the Top Management levels, need to go through a series of Awareness Programs on the Use cases of Smart distribution technologies deployment. The visits of Distribution utility teams may also be arranged to various Smart technology deployments in other utilities in the country/abroad which have implemented the smart technology projects for learning the experience from those utilities which have already taken up such projects. The sharing of challenges encountered on the way to implementation the smart technologies would be very useful for the utilities to select the right technology for implementation in their organization. Further, a suitable awareness and knowledge enhancement program of discom employees regarding adoption of change management in the system through adoption of smart technologies should also be organized so that the changes are truly managed in the utility. A suitable budget may also be earmarked for such programs in all the utilities.

As Smart distribution interventions begin in Discoms, a dedicated group has to be constituted in the organization level engaging in re-defining various business process changes, due to implementation of various smart/automated functionalities in the system. The group should also focus on setting up the new methodologies on the sidelines, so that, the migration of old system to new system does not lag the deployment & benefits are ready to be harnessed by the utility and the consumers within a short period of time.

8.10 DISTRIBUTION SECTOR CAPACITY BUILDING PROGRAMMES

➤ CAPACITY BUILDING UNDER RDSS

Revamped Distribution Sector Scheme (RDSS) was launched by Govt. of India to support Discoms to undertake reforms and improve performance in a time bound manner. It seeks to improve the operational efficiencies and financial sustainability, by providing financial assistance to DISCOMs based on meeting pre-qualifying criteria and achieving basic minimum benchmarks in reforms. Part-B of the RDSS guidelines focusses on the up-gradation of human skills; process improvements; awards; incentives and evaluation. This includes the capacity building in frontier technologies such as smart metering system and also on institutional capacity building. Training in good corporate governance practices, technical matters, advance technology intervention areas, new business processes, etc. for the personnel involved in execution of scheme at the field level are envisaged under the scheme. It is also envisaged the creation of IT wing within DISCOM for management of IT/OT services or engaging knowledge partners / consultants for the same.

Some of the main areas included for training of discom personnel under the scheme are-

- Reduction of AT&C losses-Increase in Billing and Collection Efficiency - Reduction in theft / line losses etc
- Enhancing the Reliability of Power supply
- Enhancing the consumer satisfaction -Consumer rights and grievance redressal
- Operation and working of smart metering system (AMI)
- New Technologies like SCADA, RTDAS, DMS, OMS, GIS Mapping , CRM, ERP
- DT metering & Feeder Metering
- Energy Accounting and Auditing
- Feeder Segregation
- Corporate Governance
- Adoption of PPP mode
- Tariff reforms- outstanding dues, regulatory Assets etc
- Cyber Security etc.

➤ **NPTI TRAININGS AND CERTIFICATION COURSE**

National Power Training Institute (NPTI), an ISO 9001 & ISO 14001 organization under Ministry of Power, Government of India is a National Apex body for Training and Human Resources Development in Power Sector. NPTI is providing its dedicated service for more than five decades for training of power sector personnel. NPTI conducts long-term, medium-term & short-term Training Programs for Engineers & Supervisors on various technical and managerial topics pertaining to the power sector. The training programs are either NPTI's regular training programs or customized training programs to suit the training needs of the client organizations. To achieve the objective of providing Energy Sector training, different types of learning situations are created/ being organized by NPTI like.

- Class room lectures for imparting formal, theoretical and technical knowledge.
- On-line Training
- Case studies/Group discussions.
- Practical hands-on training in corrective maintenance methods and techniques.
- Simulation techniques and on-job training in Power Stations/Power Systems.

NPTI conducts various programs and trainings in Distribution sector like efficiency improvement in sub-transmission and distribution system, smart grid technologies, O&M of distribution transformers, Cyber Security etc. NPTI has been entrusted to

provide training to Discoms officers & supervisors etc under RDSS scheme of Govt of India.

➤ **TRAINING AT SMART GRID KNOWLEDGE CENTER (SGKC)**

The Smart Grid Knowledge Center (SGKC) developed by POWERGRID with funding from Ministry of Power is being used as a Resource Centre for NSGM for providing technical support to the discom personnel for imparting training in development of technical manpower, capacity building, outreach, technical education etc. for their capacity building. NSGM has also developed a smart grid training course for the utility professionals which also been recognized internationally (accepted by ISGAN as an important resource) with the support of USAID, Academicians and Industry experts. Further, NSGM has been regularly organizing training and capacity building programs for utility personnel through MoUs with CPRI, SGKC and IIT Kanpur.

ANNEXURES

ANNEXURE-I

No. of Power Substation (66/11 kV, 33/11 kV, 22/11 kV)

Sr. No	State/UTs (Discom/Power Department)	No of S/S as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Number by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
1	Andhra Pradesh	4242	125	115	133	134	119	130	135	151	1042.00	5284.00		
	APEPDCL	935	30	49	66	74	62	79	83	93	536.00	1471.00		
	APCPDCL	871	55	36	32	35	32	26	27	33	276.00	1147.00		
	APSPDCL	2436	40	30	35	25	25	25	25	25	230.00	2666.00		
2	Arunachal Pradesh	87	41	22	19	38	23	21	13	16	193.00	280.00		
	Department of Power - Arunachal Pradesh	87	41	22	19	38	23	21	13	16	193.00	280.00		
3	ASSAM	555	0	60	67	55	22	18	26	35	283.00	838.00		
	APDCL	555	0	60	67	55	22	18	26	35	283.00	838.00		
4	Bihar	1221	25	25	30	110	24	26	26	26	292.00	1513.00		
	NBPDCL	625	7	15	20	98	10	10	10	10	180.00	805.00		
	SBPDCL	596	18	10	10	12	14	16	16	16	112.00	708.00		
5	Chattisgarh	1332	32	96	63	22	0	0	0	0	213.00	1545.00		
	CSPDCL	1332	32	96	63	22	0	0	0	0	213.00	1545.00		
6	Goa	51	2	2	2	2	1	2	1	2	14.00	65.00		
	Goa Electricity Department	51	2	2	2	2	1	2	1	2	14.00	65.00		
7	GUJARAT	1984	111	113	119	102	109	92	89	90	825.00	2809.00		
	DGVCL	326	12	57	39	37	29	16	12	17	219.00	545.00		
	MGVCL	267	13	12	11	14	14	11	12	10	97.00	364.00		
	PGVCL	796	50	23	32	30	40	40	40	38	293.00	1089.00		
	UGVCL	531	35	16	21	20	26	24	24	24	190.00	721.00		
	TPL - Ahmedabad	48	1	2	13	1	0	0	1	0	18.00	66.00		
	TPL - Dahej	2	0	1	0	0	0	0	0	1	2.00	4.00		
	TPL - Dholera	1	0	1	0	0	0	1	0	0	2.00	3.00		
	TPL - Surat	13	0	1	3	0	0	0	0	0	4.00	17.00		
8	Haryana	824	32	65	73	56	42	30	22	25	345.00	1169.00		
	DHBVNL	422	11	40	43	30	17	12	10	15	178.00	600.00		
	UHBVNL	402	21	25	30	26	25	18	12	10	167.00	569.00		
9	Himachal Pradesh	272	37	34	42	24	15	21	22	20	215.00	487.00		
	HPSEBL	272	37	34	42	24	15	21	22	20	215.00	487.00		
10	Jharkhand	501	4	5	13	18	24	4	4	5	77.00	578.00		

Sr. No	State/UTs (Discom/Power Department)	No of S/S as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Number by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	JBVNL	501	4	5	13	18	24	4	4	5	77.00	578.00		
11	Karnataka	1074	15	21	33	31	40	17	17	17	191.00	1265.00		
	BESCOM	433	5	5	5	5	5	5	5	5	40.00	473.00		
	CESCOM	233	4	4	4	4	4	4	4	4	32.00	265.00		
	GESCOM	177	1	5	13	15	22	6	6	6	74.00	251.00		
	HESCOM	183	3	4	4	4	3	0	0	0	18.00	201.00		
	MESCOM	48	2	3	7	3	6	2	2	2	27.00	75.00		
12	Kerala	219	0	176	155	49	30	65	58	78	611.00	830.00		
	KSEBL	219	0	176	155	49	30	65	58	78	611.00	830.00		
13	Madhya Pradesh	4119	58	155	237	161	40	60	77	85	873.00	4992.00		
	MPPKVVCL	1470	29	34	34	25	30	25	35	35	247.00	1717.00		
	MPPKVVCL EZ	1163	5	17	37	37	10	15	17	20	158.00	1321.00		
	MPMKVVCL	1486	24	104	166	99	0	20	25	30	468.00	1954.00		
14	Maharashtra	4238	41	101	335	226	75	114	124	134	1150.00	5388.00		
	MSEDCL	4046	35	95	328	222	71	110	120	130	1111.00	5157.00		
	Adani Electricity Mumbai Ltd	99	3	2	3	0	0	0	0	0	8.00	107.00		
	BEST	60	1	2	2	2	2	2	2	2	15.00	75.00		
	Tata Power, Mumbai	33	2	2	2	2	2	2	2	2	16.00	49.00		
15	Manipur	62	1	4	3	3	5	4	4	3	27.00	89.00		
	MSPDCL	62	1	4	3	3	5	4	4	3	27.00	89.00		
16	Meghalaya	93	5	6	7	9	8	8	7	7	57.00	150.00		
	MEPDCL	93	5	6	7	9	8	8	7	7	57.00	150.00		
17	Mizoram	64	1	2	3	3	4	3	3	4	23.00	87.00		
	Department of Power - Mizoram	64	1	2	3	3	4	3	3	4	23.00	87.00		
18	Nagaland	121	0	7	4	2	5	4	4	2	28.00	149.00		
	Department of Power - Nagaland	121	0	7	4	2	5	4	4	2	28.00	149.00		
19	Odisha	1136	37	104	16	10	10	9	7	6	199.00	1335.00		
	TPCODL	361	12	29	4	1	2	2	1	1	52.00	413.00		
	TPNODL	236	11	8	9	6	4	3	2	1	44.00	280.00		
	TPSODL	245	9	25	1	1	2	2	2	2	44.00	289.00		
	TPWODL	294	5	42	2	2	2	2	2	2	59.00	353.00		
20	PUNJAB	816	14	36	36	50	13	11	11	12	183.00	999.00		
	PSPCL	816	14	36	36	50	13	11	11	12	183.00	999.00		

Sr. No	State/UTs (Discom/Power Department)	No of S/S as on 31.03.2022	Yearly Addition-proposed							Total addition during 2022-30	Expected Number by 2030	
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29			2029-30
21	Rajasthan	6198	282	334	277	196	178	157	141	145	1710.00	7908.00
	AVVNL	1972	23	75	70	40	40	40	40	40	368.00	2340.00
	JdVVNL	2335	200	205	150	100	80	70	60	60	925.00	3260.00
	JVVNL	1891	59	54	57	56	58	47	41	45	417.00	2308.00
22	Sikkim	29	0	4	6	3	4	4	2	3	26.00	55.00
	SPDCL	29	0	4	6	3	4	4	2	3	26.00	55.00
23	Tamil Nadu	776	16	24	30	22	22	15	15	15	159.00	935.00
	TANGEDCO	776	16	24	30	22	22	15	15	15	159.00	935.00
24	Telangana	3166	80	133	175	164	88	89	99	114	942.00	4108.00
	TSNPDCL	1467	41	54	57	46	48	50	52	54	402.00	1869.00
	TSSPDCL	1699	39	79	118	118	40	39	47	60	540.00	2239.00
25	TRIPURA	75	0	5	6	4	5	2	3	4	29.00	104.00
	TSECL	75	0	5	6	4	5	2	3	4	29.00	104.00
	Union Territory										0.00	0.00
26	Andaman & Nicobar Elect. Dept	2	0	0	0	1	0	2	0	0	3.00	5.00
27	Chandigarh Elect. Dept	18	0	0	1	1	0	0	1	1	4.00	22.00
28	DNH&DDPDCL	23	0	1	1	1	0	0	0	0	3.00	26.00
29	Delhi	258	7	5	5	6	5	7	7	8	50.00	308.00
	BRPL	87	4	2	3	2	2	3	3	3	22.00	109.00
	BYPL	53	1	1	1	1	1	1	2	2	10.00	63.00
	NDMC	38	1	2	1	2	1	2	2	2	13.00	51.00
	TPDDL	80	1	0	0	1	1	1	0	1	5.00	85.00
30	Jammu & Kashmir	696	34	35	54	58	40	33	36	35	325.00	1021.00
	JPDCL	405	22	27	29	30	30	27	30	29	224.00	629.00
	KPDCL	291	12	8	25	28	10	6	6	6	101.00	392.00
31	Ladakh, Electricity Dept.	14	3	4	5	3	1	1	1	2	20.00	34.00
32	Lakshadweep Elect. Dept	0	0	0	0	0	0	0	0	0	0.00	0.00
33	Puducherry Elect. Dept	17	0	0	1	1	0	2	1	1	6.00	23.00
34	Uttar Pradesh	4366	154	283	270	254	236	229	178	200	1804.00	6170.00
	DVVNL	1051	4	4	38	60	56	0	0	0	162.00	1213.00
	MVVNL	963	32	75	80	40	50	80	70	60	487.00	1450.00

Sr. No	State/UTs (Discom/Power Department)	No of S/S as on 31.03.2022	Yearly Addition-proposed								Total addition during 2022-30	Expected Number by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
	Pu VVNL	846	28	65	57	60	60	57	43	49	419.00	1265.00
	PVVNL	1361	87	131	87	89	87	87	60	86	692.00	2053.00
	KESCO	93	0	3	4	1	1	1	1	1	12.00	105.00
	NPCL	52	3	5	4	4	4	4	4	4	32.00	84.00
35	Uttarakhand	368	2	10	24	5	5	5	5	5	61.00	429.00
	UPCL	368	2	10	24	5	5	5	5	5	61.00	429.00
36	West Bengal	948	14	16	41	46	37	33	16	6	209.00	1157.00
	WBSEDCL	825	14	12	37	42	32	28	11	1	177.00	1002.00
	CSEC	123	0	4	4	4	5	5	5	5	32.00	155.00
	Grand Total	39965	1173	2003	2286	1870	1230	1218	1155	1257	12192	52157

ANNEXURE-II

Capacity (MVA) of Sub station

Sr. No	State/UTs (Discom/Power Department)	Capacity as on 31.03.2022	Yearly Addition-proposed										Total Addition during 2022-30	Expected Capacity power by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
1	Andhra Pradesh	30235.80	923.00	686	724	704	670	678	733	2805	7923.00	38158.80		
	APEPDCL	8647.10	254.00	357	412	373	408	455	2497	5067.00	13714.10			
	APCPDCL	7665.30	409.00	142	167	172	145	153	183	1578.00	9243.30			
	ASPDCL	13923.40	260.00	225	125	125	125	125	125	1278.00	15201.40			
2	Arunachal Pradesh	335.15	70.20	103.55	87.4	82.1	54.75	86.9	51.2	88.3	624.40	959.55		
	Department of Power - Arunachal Pradesh	335.15	70.20	103.55	87.4	82.1	54.75	86.9	51.2	88.3	624.40	959.55		
3	ASSAM	5398.32	0.00	590	580	185	185	230	320	450	2875.00	8273.32		
	APDCL	5398.32	0.00	590	580	185	185	230	320	450	2875.00	8273.32		
4	Bihar	19396.78	430.00	400	2200	480	520	520	200	200	3380.00	25016.78		
	NBPDCL	9742.40	70.00	200	1960	200	200	200	200	200	3380.00	13122.40		
	SBPCL	9654.38	360.00	200	240	280	320	320	320	2240.00	11894.38			
5	Chattisgarh	8737.00	110.05	416.7	787.5	0	0	0	0	0	1991.75	10728.75		
	CSPDCL	8737.00	110.05	416.7	787.5	0	0	0	0	0	1991.75	10728.75		
6	Goa	976.80	90.00	60	30	20	40	20	20	40	350.00	1326.80		
	Goa Electricity Department	976.80	90.00	60	30	20	40	20	20	40	350.00	1326.80		
7	GUJARAT	69460.00	3485.00	3622	4260	3490	3580	3180	2835	2890	27342.00	96802.00		
	DGVCL	12420.00	480.00	2280	1560	1480	1160	760	480	680	8880.00	21300.00		
	MGVCL	8083.00	390.00	360	420	420	420	330	360	300	2910.00	10993.00		
	PGVCL	27255.00	1500.00	414	960	900	1200	1200	1200	1140	8514.00	35769.00		
	UGVCL	18169.00	1050.00	288	630	600	780	720	720	720	5508.00	23677.00		
	TPL- Ahmedabad	2123.00	40.00	80	520	40	0	50	75	0	805.00	2928.00		
	TPL-Dahej	90.00	0.00	30	0	0	20	0	0	50	100.00	190.00		
	TPL-Dholera	40.00	0.00	40	0	0	0	40	0	0	80.00	120.00		
	TPL- Surat	1280.00	25.00	130	260	50	0	80	0	0	545.00	1825.00		
8	Haryana	14571.90	1145.10	1626.4	1658.3	1444	1042.5	1095	907.5	928	9846.80	24418.70		
	DHBVNL	6487.70	496.40	989	884.5	714.5	366	270	327.5	408	4455.90	10943.60		
	UHBVNL	8084.20	648.70	637.4	773.8	729.5	676.5	825	580	520	5390.90	13475.10		
9	Himachal Pradesh	2693.39	256.05	266.75	285.7	181.2	96.15	90.8	143.59	132.9	1453.14	4146.53		
	HPSEBL	2693.39	256.05	266.75	285.7	181.2	96.15	90.8	143.59	132.9	1453.14	4146.53		

Sr. No	State/UTs (Discom/Power Department)	Capacity as on 31.03.2022	Yearly Addition-proposed										Total Addition during 2022-30	Expected Capacity power by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
10	Jharkhand	6949.60	40.00	50	139	178	238	40	40	40	40	50	775.00	7724.60
	JBVNL	6949.60	40.00	50	139	178	238	40	40	40	40	50	775.00	7724.60
11	Karnataka	8943.30	205.00	261	370.5	331	412	206	206	206	206	206	2197.50	11140.80
	BESCOM	13816.00	70.00	70	70	70	70	70	70	70	70	70	560.00	14376.00
	CESCOM	4579.30	60.00	60	60	60	60	60	60	60	60	60	480.00	5059.30
	GESCOM	1867.00	5.00	50	124	140	210	60	60	60	60	60	709.00	2576.00
	HESCOM	1952.00	30.00	40	40	40	30	0	0	0	0	0	180.00	2132.00
	MESCOM	545.00	40.00	41	76.5	21	42	16	16	16	16	16	268.50	813.50
12	Kerala	3163.60	0.00	623	693	212	131	340	340	340	428	428	2802.00	5965.60
	KSEBL	3163.60	0.00	623	693	212	131	340	340	340	428	428	2802.00	5965.60
13	Madhya Pradesh	36428.00	521.25	1142.9	1552.15	805	200	462	462	462	306.2	306.2	5536.50	41964.50
	MPPKVCL	13071.00	145.00	170	170	125	150	125	125	125	175	175	1235.00	14306.00
	MPPKVCL_EZ	10785.00	25.00	85	185	185	50	75	75	75	85	100	790.00	11575.00
	MPMKVCL	12572.00	351.25	887.9	1197.15	495	0	262	262	262	31.2	31.2	3511.50	16083.50
14	Maharashtra	46239.50	486.00	1249	2887	1773	538	662	662	662	762	762	9069.00	55308.50
	MSEDCL	39002.00	280.00	1057	2615	1661	426	550	550	550	600	600	7839.00	46841.00
	Adani Electricity Mumbai Ltd	4357.00	110.00	80	160	0	0	0	0	0	0	0	350.00	4707.00
	BEST	1510.00	16.00	32	32	32	32	32	32	32	32	32	240.00	1750.00
	Tata Power, Mumbai	1196.00	80.00	80	80	80	80	80	80	80	80	80	640.00	1836.00
15	Manipur	1005.25	5.00	51	39	43	81	43	43	43	21	21	322.00	1327.25
	MSPDCL	1005.25	5.00	51	39	43	81	43	43	43	21	21	322.00	1327.25
16	Meghalaya	600.00	50.00	60	70	90	80	80	80	80	70	70	570.00	1170.00
	MEPDCL	600.00	50.00	60	70	90	80	80	80	80	70	70	570.00	1170.00
17	Mizoram	280.00	5.00	32.6	30	45.2	42.8	15	15	15	27.6	27.6	220.80	500.80
	Department of Power - Mizoram	280.00	5.00	32.6	30	45.2	42.8	15	15	15	27.6	27.6	220.80	500.80
18	Nagaland	653.55	0.00	70	48.2	41.6	120	70	70	70	15	15	419.80	1073.35
	Department of Power - Nagaland	653.55	0.00	70	48.2	41.6	120	70	70	70	15	15	419.80	1073.35
19	Odisha	12938.80	424.35	1172.7	232	124	124	102	102	102	70	70	2325.05	15263.85
	TPCODL	4752.00	116.30	395	82	16	32	26	26	26	16	16	693.30	5445.30
	TPNODL	2418.85	110.00	98	120	78	52	36	36	36	14	14	534.00	2952.85
	TPSODL	2491.95	148.05	259.7	10	10	20	20	20	20	20	20	507.75	2999.70
	TPWODL	3276.00	50.00	420	20	20	20	20	20	20	20	20	590.00	3866.00

Sr. No	State/UTs (Discom/Power Department)	Capacity as on 31.03.2022	Yearly Addition-proposed										Total Addition during 2022-30	Expected Capacity power by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
20	PUNJAB	24295.00	354.00	570	570	650	253	205	205	205	225	3032.00	27327.00	
	PSPCL	24295.00	354.00	570	570	650	253	205	205	205	225	3032.00	27327.00	
21	Rajasthan	35472.40	2588.40	2685.75	1938.5	1459.5	1387.5	1391	1326	1366	14142.65	49615.05		
	AVVNL	10702.25	370.40	505.75	408.5	295.5	295.5	600	600	600	3675.65	14377.90		
	JdVVNL	12018.00	1630.00	1646	960	604	512	350	300	300	6302.00	18320.00		
	JVVNL	12752.15	588.00	534	570	560	580	441	426	466	4165.00	16917.15		
22	Sikkim	317.50	0.00	60	75	50	82.5	20	10	30	327.50	645.00		
	SPDCL	317.50	0.00	60	75	50	82.5	20	10	30	327.50	645.00		
23	Tamil Nadu	12592.00	197.00	285	490	352	352	240	240	240	2396.00	14988.00		
	TANGEDCO	12592.00	197.00	285	490	352	352	240	240	240	2396.00	14988.00		
24	Telangana	33348.00	614.50	1089	1513.5	1458.5	649.5	659.5	751.4	884.25	7620.15	40968.15		
	TSNPDCL	12367.00	205.00	270	285	230	240	250	260	270	2010.00	14377.00		
	TSSPDCL	20981.00	409.50	819	1228.5	1228.5	409.5	409.5	491.4	614.25	5610.15	26591.15		
25	TRIPURA	723.25	0.00	90	176	100	110	20	80	150	726.00	1449.25		
	TSECL	723.25	0.00	90	176	100	110	20	80	150	726.00	1449.25		
	Union Territory										0.00	0.00		
26	Andaman & Nicobar Elect. Dept	38.90	0.00	0	0	20	0	30	0	0	50.00	88.90		
27	Chandigarh Elect. Dept	842.00	0.00	37.5	40	100	100	50	50	50	427.50	1269.50		
28	DNH&DDPDCL	1294.00	0.00	60	60	60	0	0	0	0	180.00	1474.00		
29	Delhi	15701.00	412.50	394	372	466.5	407	596.5	476	545	3669.50	19370.50		
	BRPL	5318.00	209.00	126	189	126	126	189	189	189	1343.00	6661.00		
	BYPL	3930.00	59.00	105	110	113	125	129.5	135	141	917.50	4847.50		
	NDMC	1496.00	50.00	100	50	100	50	100	100	100	650.00	2146.00		
	TPDDL	4957.00	94.50	63	23	127.5	106	178	52	115	759.00	5716.00		
30	Jammu & Kashmir	8153.60	360.20	434.9	587.5	624.4	445	330	360	350	3492.00	11645.60		
	JPDCI	4060.20	220.00	270	290	300	300	270	300	290	2240.00	6300.20		
	KPDCL	4093.40	140.20	164.9	297.5	324.4	145	60	60	60	1252.00	5345.40		
31	Ladakh, Electricity Dept.	135.00	12.60	38.9	37.8	18.9	20	6.3	6.3	11.3	152.10	287.10		
32	Lakshadweep Elect. Dept	0.00	0.00	0	0	0	0	0	0	0	0.00	0.00		
33	Puducherry Elect. Dept	718.00	0.00	55	113	145	63	118	64.5	84	642.50	1360.50		

Sr. No	State/UTs (Discom/Power Department)	Capacity as on 31.03.2022	Yearly Addition-proposed								Total Addition during 2022-30	Expected Capacity power by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
34	Uttar Pradesh	55475.00	1511.50	2576	2077	1965	1870	1900	1404	1917	15220.50	70695.50
	DVVNL	12388.00	30.00	20	270	450	420	0	0	0	1190.00	13578.00
	MVVNL	12347.00	220.00	500	500	300	300	500	450	600	3370.00	15717.00
	Pu VVNL	11062.00	200.00	450	380	390	420	445	300	365	2950.00	14012.00
	PVVNL	17012.00	1024.00	1501	827	765	670	895	594	892	7168.00	24180.00
	KESCO	1746.00	0.00	30	50	10	10	10	10	10	130.00	1876.00
	NPCL	920.00	37.50	75	50	50	50	50	50	50	412.50	1332.50
35	Uttarakhand	4971.00	12.00	200	480	50	80	80	80	80	1062.00	6033.00
	UPCL	4971.00	12.00	200	480	50	80	80	80	80	1062.00	6033.00
36	West Bengal	19726.35	214.35	818.51	1224.16	1227.76	994.22	855.42	505.97	277.82	6118.21	25844.56
	WBSEDCL	15782.35	214.35	690.25	1095.9	1099.5	833.9	695.1	345.65	117.5	5092.15	20874.50
	CSEC	3944.00	0.00	128.26	128.26	128.26	160.32	160.32	160.32	160.32	1026.06	4970.06
	Grand Total	482809.74	14523.05	21878.16	24628.21	21889.16	14908.92	14442	13232.06	16020.37	141522.35	624332.09

ANNEXURE-III

66kV/33kV/22kV Feeder Count-(Nos)

Sr. No	State/UTs (Discom/Power Department)	No of Feeders as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected No. of Feeders by 2030			
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30							
1	Andhra Pradesh	1813	80	96	107	97	70	60	60	68						638	2451
	APEPDCL	617	39	32	44	37	35	32	32	35						286	903
	APCPDCL	406	28	23	23	24	29	23	23	28						200	606
	APSPDCL	790	13	41	40	36	6	5	5	5						152	942
2	Arunachal Pradesh	100	26	22	19	20	18	17	17	7						144	244
	Department of Power - Arunachal Pradesh	100	26	22	19	20	18	17	17	7						144	244
3	ASSAM	748	0	69	76	61	22	18	18	35						307	1055
	APDCL	748	0	69	76	61	22	18	18	35						307	1055
4	Bihar	1426	25	32	42	118	32	30	30	30						339	1765
	NBPDCL	736	7	22	28	102	14	10	10	10						203	939
	SBPDCL	690	18	10	14	16	18	20	20	20						136	826
5	Chattisgarh	745	11	38	59	69	7	7	7	7						205	950
	CSPDCL	745	11	38	59	69	7	7	7	7						205	950
6	Goa	166	2	4	4	4	2	4	4	4						26	192
	Goa Electricity Department	166	2	4	4	4	2	4	4	4						26	192
7	GUJARAT	1213	42	39	53	51	39	12	12	14						261	1474
	DGVCL	196	2	4	5	6	4	5	5	7						39	235
	MGVCL	70	5	4	6	8	10	0	0	0						33	103
	PGVCL	8	12	11	12	14	16	0	0	0						65	73
	UGVCL	762	7	6	7	6	6	0	0	0						32	794
	TPL-Ahmedabad	129	13	12	21	15	0	3	3	1						67	196
	TPL-Dahej	12	0	0	0	0	1	0	0	2						3	15
	TPL-Dholera	2	3	2	2	2	2	4	4	4						22	24
	TPL-Surat	34	0	0	0	0	0	0	0	0						0	34
8	Haryana	830	32	65	73	56	42	30	30	25						345	1175
	DHBVNL	428	11	40	43	30	17	12	12	15						178	606
	UHBVNL	402	21	25	30	26	25	18	18	10						167	569

Sr. No	State/UTs (Discom/Power Department)	No of Feeders as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected No. of Feeders by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
9	Himachal Pradesh HPSEBL	566	32	75	71	54	56	34	32	30	384	950		
10	Jharkhand JBVNIL	682	10	282	30	45	54	13	13	14	461	1143		
11	Karnataka BESCOM	1897	283	516	590	679	699	115	105	115	3102	4999		
	BESCOM	1351	19	19	19	19	20	20	20	21	157	1508		
	CEFCOM	29	1	1	1	2	2	2	2	3	14	43		
	GESCOM	207	2	3	1	2	2	1	1	1	13	220		
	HESCOM	246	260	492	567	655	673	90	80	88	2905	3151		
	MESCOM	64	1	1	1	1	2	2	2	2	13	77		
12	Kerala KSEBL	412	6	105	172	72	33	88	90	90	656	1068		
13	Madhya Pradesh MPPKVVCL	2570	42	99	134	52	14	20	26	31	418	2988		
	MPPKVVCL_EZ	953	25	27	27	8	6	7	8	8	116	1069		
	MPPKVVCL	740	5	18	36	32	8	10	14	18	141	881		
	MPMKWVCL	877	12	54	71	12	0	3	4	5	161	1038		
14	Maharashtra MSEDCL	4411	47	454	773	398	80	116	126	136	2130	6541		
	Adani Electricity Mumbai Ltd	3656	12	440	749	392	74	110	120	130	2027	5683		
	BEST	258	14	8	18	0	0	0	0	0	40	298		
	Tata Power, Mumbai	143	1	2	2	2	2	2	2	2	15	158		
15	Manipur MSPDCL	90	4	5	5	5	6	6	7	7	45	135		
16	Meghalaya MEPDCL	214	8	8	9	9	9	10	10	12	75	289		
17	Mizoram Department of Power - Mizoram	214	8	8	9	9	9	10	10	12	75	289		
	Department of Power - Mizoram	70	0	1	2	1	1	1	1	1	8	78		
18	Nagaland Department of Power - Nagaland	70	0	1	2	1	1	1	1	1	8	78		
	Department of Power - Nagaland	78	0	7	4	2	5	4	4	2	28	106		
19	Odisha TPCODL	597	112	71	50	41	39	27	23	22	385	982		
	TPNODL	216	63	19	23	18	14	4	2	2	145	361		
	TPNODL	99	4	8	9	7	7	6	5	4	50	149		

Sr. No	State/UTs (Discom/Power Department)	No of Feeders as on 31.03.2022	Yearly Addition-proposed								Total addition during 2022-30	Expected No. of Feeders by 2030	
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30			
33	Puducherry Elect. Dept	74	0	0	0	0	0	0	0	0	0	0	74
34	Uttar Pradesh	4667	246	448	371	302	271	302	263	303	2506	7173	
	DVVNL	1049	12	25	96	30	35	25	42	35	300	1349	
	MVVNL	1013	51	123	102	115	99	127	113	121	851	1864	
	Pu VVNL	779	39	66	62	64	65	60	46	51	453	1232	
	PVVNL	1667	133	206	83	76	66	84	56	90	794	2461	
	KESCO	123	0	10	10	9	1	1	1	1	33	156	
	NPCL	36	11	18	18	8	5	5	5	5	75	111	
35	Uttarakhand	652	2	10	24	5	5	5	5	5	61	713	
	UPCL	652	2	10	24	5	5	5	5	5	61	713	
36	West Bengal	2334	38	61	102	115	91	84	52	32	575	2909	
	WBSEDCL	1611	15	37	78	90	65	57	24	3	369	1980	
	CSEC	723	23	24	24	25	26	27	28	29	206	929	
	Grand Total	36804	1680	3307	3790	2892	2047	1408	1311	1400	17835	54639	

ANNEXURE-IV

66kV/33kV/22kV Feeder (ckm)

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
1	Andhra Pradesh APEPDCL APCPDCL APSPDCL	28987.27 8310.25 7673.94 13003.08	638.18 198.18 257.00 183.00	750.17 146.17 242.00 362.00	833.20 216.20 297.00 320.00	780.46 212.46 256.00 312.00	529.96 177.96 312.00 40.00	422.66 164.66 223.00 35.00	445.66 181.66 222.00 42.00	510.89 189.89 283.00 38.00	4911.18 1487.18 2092.00 1332.00	33898.45 9797.43 9765.94 14335.08		
2	Arunachal Pradesh Department of Power -Arunachal Pradesh	2698.55	317.50	352.08	428.35	468.00	489.00	219.50	114.90	115.00	2504.33	5202.88		
3	ASSAM APDCL	9626.18 9626.18	0.00 0.00	622.49 622.49	861.91 861.91	668.90 668.90	180.00 180.00	190.00 190.00	280.00 280.00	370.00 370.00	3173.30 3173.30	12799.48 12799.48		
4	Bihar NBPDCCL SBPDCL	18398.80 9631.00 8767.80	187.91 61.32 126.59	515.60 424.00 91.60	550.24 422.00 128.24	2462.56 2316.00 146.56	304.88 140.00 164.88	283.20 100.00 183.20	283.20 100.00 183.20	4870.79 3663.32 1207.47	23269.59 13294.32 9975.27			
5	Chattisgarh CSPDCL	23773.00 23773.00	628.00 628.00	1005.00 1005.00	3193.00 3193.00	3548.00 3548.00	200.00 200.00	200.00 200.00	200.00 200.00	200.00 200.00	9174.00 9174.00	32947.00 32947.00		
6	Goa Goa Electricity Department	1583.00 1583.00	39.94 39.94	20.00 20.00	20.00 20.00	20.00 20.00	10.00 10.00	20.00 20.00	10.00 10.00	20.00 20.00	159.94 159.94	1742.94 1742.94		
7	GUJARAT DGVCL MGVCL PGVCL UGVCL TPL - Ahmedabad TPL-Dahej TPL-Dholera TPL - Surat	12550.54 1364.49 2681.00 250.05 7483.00 563.03 59.00 10.94 139.03	242.95 49.25 21.30 53.25 48.15 43.00 0.00 28.00 0.00	299.11 51.47 33.60 84.00 50.40 51.00 4.00 12.00 12.64	412.73 38.45 50.00 125.00 75.00 93.00 3.00 12.00 16.28	382.96 40.56 48.00 128.00 76.00 77.00 0.00 12.00 1.40	383.65 47.59 84.00 160.00 76.00 0.00 1.00 12.00 3.06	93.46 50.46 0.00 0.00 0.00 18.00 1.00 24.00 0.00	84.87 53.87 0.00 0.00 0.00 12.00 1.00 18.00 0.00	93.47 60.47 0.00 0.00 0.00 6.00 3.00 24.00 0.00	1993.20 392.12 236.90 550.25 325.55 300.00 13.00 142.00 33.38	14543.74 1756.61 2917.90 800.30 7808.55 863.03 72.00 152.94 172.41		
8	Haryana DHBVNL UHBVNL	7890.86 4335.97 3554.89	294.51 116.01 178.50	612.50 400.00 212.50	685.00 430.00 255.00	521.00 300.00 221.00	382.50 170.00 212.50	273.00 120.00 153.00	202.00 100.00 102.00	235.00 150.00 85.00	3205.51 1786.01 1419.50	11096.37 6121.98 4974.39		
9	Himachal Pradesh HPSEBL	12504.68 12504.68	288.74 288.74	614.36 614.36	400.39 400.39	315.39 315.39	207.45 207.45	332.47 332.47	185.83 185.83	181.55 181.55	2526.18 2526.18	15030.86 15030.86		
10	Jharkhand	11312.73	170.00	4936.00	559.00	849.00	1045.00	217.00	228.00	239.00	8243.00	19555.73		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	JBVNL	11312.73	170.00	4936.00	559.00	849.00	1045.00	217.00	228.00	239.00	8243.00	19555.73		
11	Karnataka	24516.89	1604.36	2736.86	3446.98	3801.24	3981.65	775.15	727.15	793.40	17866.80	42383.69		
	BESCOM	15810.00	222.34	222.34	222.34	222.34	234.05	234.05	234.05	245.75	1837.25	17647.25		
	CESCOM	451.00	15.55	15.55	31.10	31.10	31.10	31.10	31.10	46.65	217.71	668.71		
	GESCOM	3661.00	31.00	19.00	20.00	22.00	10.00	10.00	12.00	11.00	136.00	3797.00		
	HESCOM	3578.34	1300.00	2460.00	3145.00	3505.00	3630.00	450.00	400.00	440.00	15330.00	18908.34		
	MESCOM	1016.55	35.47	19.97	53.09	22.80	64.50	50.00	50.00	50.00	345.83	1362.38		
12	Kerala	4032.91	45.15	935.31	1515.67	667.50	442.00	1128.00	967.00	967.00	6667.63	10700.54		
	KSEBL	4032.91	45.15	935.31	1515.67	667.50	442.00	1128.00	967.00	967.00	6667.63	10700.54		
13	Madhya Pradesh	58505.00	878.00	2715.00	3961.92	1944.00	323.00	518.00	677.00	817.00	11833.92	70338.92		
	MPPKVCL	19211.00	381.00	406.00	403.00	111.00	85.00	111.00	122.00	125.00	1744.00	20955.00		
	MPPKVCL EZ	20183.00	70.00	534.00	1072.00	1072.00	238.00	307.00	430.00	542.00	4265.00	24448.00		
	MPMKVCL	19111.00	427.00	1775.00	2486.92	761.00	0.00	100.00	125.00	150.00	5824.92	24935.92		
14	Maharashtra	89333.16	388.13	3169.15	7985.09	5340.49	620.08	1119.00	1219.00	1319.00	21159.94	110493.10		
	MSEDCL	86314.00	288.63	3133.15	7909.09	5321.49	601.08	1100.00	1200.00	1300.00	20853.44	107167.44		
	Adani Electricity Mumbai Ltd	1100.00	33.00	17.00	57.00	0.00	0.00	0.00	0.00	0.00	107.00	1207.00		
	BEST	525.50	2.50	5.00	5.00	5.00	5.00	5.00	5.00	5.00	37.50	563.00		
	Tata Power, Mumbai	1393.66	64.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	162.00	1555.66		
15	Manipur	1753.20	77.91	97.39	97.39	97.39	97.39	116.86	136.34	136.34	876.48	2629.68		
	MSPDCL	1753.20	77.91	97.39	97.39	97.39	97.39	116.86	136.34	136.34	876.48	2629.68		
16	Meghalaya	3169.00	118.47	118.47	133.28	133.28	133.28	148.08	148.08	177.70	1110.63	4279.63		
	MEPDCL	3169.00	118.47	118.47	133.28	133.28	133.28	148.08	148.08	177.70	1110.63	4279.63		
17	Mizoram	1532.28	0.00	38.40	60.00	48.00	30.00	17.00	50.00	22.00	265.40	1797.68		
	Department of Power - Mizoram	1532.28	0.00	38.40	60.00	48.00	30.00	17.00	50.00	22.00	265.40	1797.68		
18	Nagaland	1978.50	0.00	83.20	47.00	27.00	52.00	27.00	35.50	12.50	284.20	2262.70		
	Department of Power - Nagaland	1978.50	0.00	83.20	47.00	27.00	52.00	27.00	35.50	12.50	284.20	2262.70		
19	Odisha	15569.13	1414.26	1101.50	522.10	458.00	526.00	300.00	253.00	238.00	4812.86	20381.99		
	TPCODL	3916.13	988.97	228.50	203.10	185.00	165.00	20.00	10.00	10.00	1810.57	5726.70		
	TPNODL	2653.00	35.00	81.00	99.00	70.00	61.00	56.00	40.00	25.00	467.00	3120.00		
	TPSODL	3808.00	190.29	552.00	100.00	83.00	180.00	104.00	83.00	83.00	1375.29	5183.29		
	TPWODL	5192.00	200.00	240.00	120.00	120.00	120.00	120.00	120.00	120.00	1160.00	6352.00		
20	PUNJAB	10686.00	172.00	322.00	174.00	179.00	146.00	134.00	118.00	128.00	1373.00	12059.00		
	PSPCL	10686.00	172.00	322.00	174.00	179.00	146.00	134.00	118.00	128.00	1373.00	12059.00		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
21	Rajasthan	59024.50	2289.98	2592.24	2098.22	1614.86	1366.98	1222.59	1171.28	1148.01	13504.16	72528.66		
	AVVNL	16820.30	175.46	450.00	420.00	240.00	240.00	240.00	240.00	240.00	2245.46	19065.76		
	JdVVNL	25266.00	1600.00	1640.00	1200.00	800.00	640.00	560.00	480.00	480.00	7400.00	32666.00		
	JVVNL	16938.20	514.52	502.24	478.22	574.86	486.98	422.59	451.28	428.01	3858.70	20796.90		
22	Sikkim	280.00	5.00	53.80	34.00	38.00	36.00	21.00	18.00	19.00	224.80	504.80		
	SPDCL	280.00	5.00	53.80	34.00	38.00	36.00	21.00	18.00	19.00	224.80	504.80		
23	Tamil Nadu	58050.20	2594.00	2895.00	2922.00	1321.00	1254.00	1117.00	775.00	803.00	13681.00	71731.20		
	TANGEDCO	58050.20	2594.00	2895.00	2922.00	1321.00	1254.00	1117.00	775.00	803.00	13681.00	71731.20		
24	Telangana	27363.00	602.60	1225.19	1717.79	1662.79	717.60	727.60	833.12	986.39	8473.07	35836.07		
	TSNPDCL	11167.00	125.00	270.00	285.00	230.00	240.00	250.00	260.00	270.00	1930.00	13097.00		
	TSSPDCL	16196.00	477.60	955.19	1432.79	1432.79	477.60	477.60	573.12	716.39	6543.07	22739.07		
25	TRIPURA	910.50	0.00	139.00	291.00	191.00	157.00	157.00	157.00	157.00	1249.00	2159.50		
	TSECL	910.50	0.00	139.00	291.00	191.00	157.00	157.00	157.00	157.00	1249.00	2159.50		
	Union Territory										0.00	0.00		
26	Andaman & Nicobar Elect. Dept	524.85	0.00	0.00	0.00	25.00	0.00	0.00	10.00	0.00	35.00	559.85		
27	Chandigarh Elect. Dept	154.80	0.00	4.10	7.20	34.00	23.00	8.00	2.00	17.00	95.30	250.10		
28	DNH&DDPDCL	368.60	0.00	3.00	3.00	3.00	3.00	1.00	1.00	1.00	15.00	383.60		
29	Delhi	3354.09	79.00	108.00	101.00	55.00	49.00	50.00	82.00	50.00	574.00	3928.09		
	BRPL	1440.00	50.00	50.00	30.00	10.00	10.00	10.00	10.00	10.00	180.00	1620.00		
	BYPL	667.00	14.00	19.00	25.00	25.00	25.00	26.00	20.00	20.00	174.00	841.00		
	NDMC	231.01	11.00	11.00	14.00	11.00	14.00	14.00	14.00	16.00	105.00	336.01		
	TPDDL	1016.08	4.00	28.00	32.00	9.00	0.00	0.00	38.00	4.00	115.00	1131.08		
30	Jammu & Kashmir	5291.86	161.00	217.00	295.00	318.00	200.00	181.00	196.00	191.00	1759.00	7050.86		
	JPDC	3214.11	110.00	135.00	145.00	150.00	150.00	121.00	136.00	131.00	1078.00	4292.11		
	KPDCL	2077.75	51.00	82.00	150.00	168.00	50.00	60.00	60.00	60.00	681.00	2758.75		
31	Ladakh, Electricity Dept.	292.35	221.00	245.00	226.00	51.60	34.40	20.00	15.00	12.00	825.00	1117.35		
32	Lakshadweep Elect. Dept	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
33	Puducherry Elect. Dept	1811.46	0.00	0.00	40.00	25.00	0.00	25.00	3.00	3.00	96.00	1907.46		
34	Uttar Pradesh	65497.45	3980.79	5692.59	5765.60	3728.75	3529.21	4382.33	3769.34	3825.38	34673.99	100171.44		
	DVVNL	14522.00	121.00	379.25	1456.32	454.80	530.60	379.00	636.72	530.60	4488.29	19010.29		
	MVVNL	14392.88	1159.80	2252.90	1892.50	1840.00	1687.75	2285.60	1913.70	1918.15	14950.40	29343.28		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed								Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
	Pu VVNL	12098.97	1102.00	889.49	933.29	744.42	736.50	776.43	706.96	680.48	6569.57	18668.54
	PVVNL	22606.40	1558.01	2042.75	1354.29	627.43	549.36	915.30	486.96	672.15	8206.25	30812.65
	KESCO	773.50	0.00	59.20	30.10	5.00	5.00	6.00	5.00	4.00	168.50	942.00
	NPCL	1103.70	39.98	69.00	32.00	20.00	20.00	20.00	20.00	20.00	290.98	1394.68
35	Uttarakhand	5779.00	18.00	154.00	224.00	60.00	80.00	80.00	80.00	80.00	776.00	6555.00
	UPCL	5779.00	18.00	154.00	224.00	60.00	80.00	80.00	80.00	80.00	776.00	6555.00
36	West Bengal	20200.07	217.02	571.87	1142.19	1347.77	1026.71	919.40	426.45	45.00	5696.40	25896.47
	WBSEDCL	18469.07	161.95	515.06	1083.56	1287.28	964.30	855.00	360.00	45.00	5272.15	23741.22
	CESC	1731.00	55.07	56.81	58.63	60.49	62.41	64.40	66.45	0.00	424.25	2155.25
	Grand Total	589304.41	17674.40	34945.38	40754.23	33187.94	18580.21	15446.30	13904.71	14196.83	188690.00	777994.41

ANNEXURE-V

Number of 11 kV Feeders

Sr. No	State/UTs (Discom/Power Department)	No of Feeders as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected No. Feeders by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
1	Andhra Pradesh	13090	1007	1608	1374	1647	463	380	468	507	7454	20544		
	APEPDCL	3811	414	201	200	204	130	214	235	1946	5757			
	APCPDCL	3457	287	193	180	155	146	151	170	1588	5045			
	APSPDCL	5822	907	980	1267	104	104	103	102	3920	9742			
2	Arunachal Pradesh	511	142	204	106	97	107	106	104	983	1494			
	Department of Power - Arunachal Pradesh	511	204	106	97	117	107	106	104	983	1494			
3	ASSAM	2034	0	431	472	423	98	104	140	1740	3774			
	APDCL	2034	431	472	423	98	72	104	140	1740	3774			
4	Bihar	5980	243	256	228	184	200	208	216	1727	7707			
	NBPDCL	2907	171	216	228	184	200	208	216	1615	4522			
	SBPDCCL	3073	72	40	0	0	0	0	0	112	3185			
5	Chattisgarh	5251	77	320	470	530	28	28	28	1509	6760			
	CSPDCL	5251	77	320	470	530	28	28	28	1509	6760			
6	Goa	320	6	10	10	10	5	10	5	66	386			
	Goa Electricity Department	320	6	10	10	10	5	10	5	66	386			
7	GUJARAT	19867	971	1021	1024	1048	1058	1058	1067	1085	8332	28199		
	DGVCL	2554	230	252	249	265	264	271	267	272	2070	4624		
	MGVCL	2416	69	75	75	75	75	70	70	70	579	2995		
	PGVCL	6977	349	349	349	349	349	349	349	349	2792	9769		
	UGVCL	6097	260	271	281	293	304	315	328	340	2392	8489		
	TPL- Ahmedabad	1358	40	40	40	40	40	40	40	40	320	1678		
	TPL-Dahej	23	3	2	2	0	0	0	0	0	7	30		
	TPL-Dholera	0	0	2	3	3	3	5	6	6	28	28		
	TPL- Surat	442	20	30	25	23	23	8	7	8	144	586		
8	Haryana	11841	431	527	707	735	579	565	582	636	4762	16603		
	DHBVNL	5827	89	165	325	330	150	110	100	125	1394	7221		
	UHBVNL	6014	342	362	382	405	429	455	482	511	3368	9382		
9	Himachal Pradesh	1276	108	167	144	114	88	92	73	70	856	2132		
	HPSEBL	1276	108	167	144	114	88	92	73	70	856	2132		

Sr. No	State/UTs (Discom/Power Department)	No of Feeders as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected No. Feeders by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
10	Jharkhand	2549	36	113	179	89	106	46	48	50	667	3216		
	JBVNL	2549	36	113	179	89	106	46	48	50	667	3216		
11	Karnataka	15224	1057	1425	1126	1200	1344	602	614	627	7995	23219		
	BESCOM	5918	337	281	258	245	255	222	208	239	2045	7963		
	CESCOM	2159	96	96	98	89	91	87	85	82	724	2883		
	GESCOM	2186	9	36	64	64	109	30	30	29	371	2557		
	HESCOM	3687	517	911	602	696	780	151	176	160	3993	7680		
	MESCOM	1274	98	101	104	106	109	112	115	117	862	2136		
12	Kerala	2844	90	140	160	135	130	125	135	140	1055	3899		
	KSEBL	2844	90	140	160	135	130	125	135	140	1055	3899		
13	Madhya Pradesh	18389	210	921	1396	814	58	49	52	61	3561	21950		
	MPPKVVCL	6825	101	112	110	26	23	26	27	31	456	7281		
	MPPKVVCL_EZ	5172	5	159	297	319	35	23	25	30	893	6065		
	MPMKVVCL	6392	104	650	989	469	0	0	0	0	2212	8604		
14	Maharashtra	23389	481	5351	4505	239	248	363	393	423	12003	35392		
	MSEDCL	20616	389	5317	4455	221	230	345	375	405	11737	32353		
	Adani Electricity Mumbai Ltd	1291	20	16	32	0	0	0	0	0	68	1359		
	BEST	991	50	0	0	0	0	0	0	0	50	1041		
	Tata Power, Mumbai	491	22	18	18	18	18	18	18	18	148	639		
15	Manipur	212	9	10	10	11	11	12	12	14	89	301		
	MSPDCL	212	9	10	10	11	11	12	12	14	89	301		
16	Meghalaya	594	18	18	20	20	22	22	22	22	164	758		
	MEPDCL	594	18	18	20	20	22	22	22	22	164	758		
17	Mizoram	192	10	14	27	32	24	34	34	37	212	404		
	Department of Power - Mizoram	192	10	14	27	32	24	34	34	37	212	404		
18	Nagaland	295	0	16	7	7	15	15	12	6	75	370		
	Department of Power - Nagaland	295	0	16	7	7	15	15	12	6	75	370		
19	Odisha	4022	243	392	122	106	101	82	82	82	1210	5232		
	TPCODL	1243	147	75	72	68	68	68	68	68	634	1877		
	TPNODL	797	44	32	36	24	16	0	0	0	152	949		
	TPSODL	889	32	117	6	6	9	0	0	0	170	1059		
	TPWODL	1093	20	168	8	8	8	14	14	14	254	1347		

Sr. No	State/UTs (Discom/Power Department)	No of Feeders as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected No. Feeders by 2030	
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30					
20	PUNJAB	12506	168	286	375	382	390	396	403	390	390	403	390	2790	15296
	PSPCL	12506	168	286	375	382	390	396	403	390	390	403	390	2790	15296
21	Rajasthan	30496	2054	2187	1835	1305	1027	973	1347	1320	12048	42544	11682		
	AVVNL	9386	296	434	406	232	232	232	232	232	2296	11682			
	JdVVNL	11690	1000	1025	750	500	400	350	300	300	4625	16315			
	JVVNL	9420	758	728	679	573	395	391	815	788	5127	14547			
22	Sikkim	427	10	26	30	28	27	22	21	21	185	612			
	SPDCL	427	10	26	30	28	27	22	21	21	185	612			
23	Tamil Nadu	8145	632	784	705	302	252	252	219	215	3361	11506			
	TANGEDCO	8145	632	784	705	302	252	252	219	215	3361	11506			
24	Telangana	13518	551	947	1310	1268	576	586	667	782	6687	20205			
	TSNPDCL	6242	171	216	228	184	192	200	208	216	1615	7857			
	TSSPDCL	7276	380	731	1082	1084	384	386	459	566	5072	12348			
25	TRIPURA	467	0	12	17	23	19	14	11	14	110	577			
	TSECL	467	0	12	17	23	19	14	11	14	110	577			
	Union Territory														
26	Andaman & Nicobar Elect. Dept	59	0	0	0	8	0	0	0	0	8	67			
27	Chandigarh Elect. Dept	270	11	6	5	2	2	3	1	3	33	303			
28	DNH&DDPDCL	564	2	2	2	2	2	2	2	2	16	580			
29	Delhi	4086	118	119	116	116	125	130	133	135	992	5078			
	BRPL	1622	76	59	54	58	62	65	62	62	498	2120			
	BYPL	964	17	35	36	38	39	41	43	45	294	1258			
	NDMC	210	5	5	6	6	6	6	8	8	50	260			
	TPDDL	1290	20	20	20	14	18	18	20	20	150	1440			
30	Jammu & Kashmir	2194	146	159	220	234	180	53	53	53	1098	3292			
	JPDC	1132	110	135	145	150	150	35	35	35	795	1927			
	KPDCL	1062	36	24	75	84	30	18	18	18	303	1365			
31	Ladakh, Electricity Dept.	90	7	10	5	35	42	2	1	1	103	193			
32	Lakshadweep Elect. Dept	33	0	0	0	0	0	2	2	2	6	39			
33	Puducherry Elect. Dept	125	0	0	13	5	0	0	0	0	18	143			

Sr. No	State/UTs (Discom/Power Department)	No of Feeders as on 31.03.2022	Yearly Addition-proposed								Total addition during 2022-30	Expected No. Feeders by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
34	Uttar Pradesh	21325	1376	1662	1074	1028	985	1025	893	995	9038	30363
	DVVNL	4784	382	342	117	121	134	134	134	134	1498	6282
	MVVNL	4465	316	451	400	390	343	354	350	398	3002	7467
	Pu VVNL	4292	107	202	181	174	216	139	159	142	1320	5612
	PVVNL	6848	527	602	306	299	264	370	221	292	2881	9729
	KESCO	593	0	40	40	20	4	4	5	5	118	711
	NPCL	343	44	25	30	24	24	24	24	24	219	562
35	Uttarakhand	1873	8	40	96	20	20	20	20	20	244	2117
	UPCL	1873	8	40	96	20	20	20	20	20	244	2117
36	West Bengal	6921	186	343	252	285	233	214	129	81	1723	8644
	WBSEDCL	5431	162	319	228	260	208	188	103	55	1523	6954
	CSEC	1490	24	24	24	25	25	26	26	26	200	1690
	Grand Total	230979	10408	19527	18142	12484	8567	7553	7947	8292	92920	323899

ANNEXURE-VI

Length (ckm) of 11 kV lines

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
1	Andhra Pradesh APEPDCL APCPDCL APSPDCL	277509.47 60660.47 77507.00 139342.00	8377.22 1426.22 3255.00 3696.00	14476.46 2388.46 2377.00 9711.00	13266.85 1447.85 1785.00 10034.00	16076.35 1369.35 1519.00 13188.00	2809.12 1356.12 1168.00 285.00	2202.07 766.07 1149.00 287.00	2960.09 1416.09 1264.00 280.00	3282.12 1484.12 1519.00 279.00	63450.28 11654.28 14036.00 37760.00	340959.75 72314.75 91543.00 177102.00		
2	Arunachal Pradesh Department of Power - Arunachal Pradesh	16122.73	934.08	1139.30	819.95	664.11	677.24	668.77	581.50	618.80	6103.75	22226.48		
3	ASSAM APDCL	98001.91 98001.91	0.00 0.00	1609.00 1609.00	1652.00 1652.00	1752.62 1752.62	1028.00 1028.00	705.00 705.00	1010.00 1010.00	1358.00 1358.00	9114.62 9114.62	107116.53 107116.53		
4	Bihar NBPDC SBPDCL	117209.00 57821.00 59388.00	3539.71 309.00 3230.71	6687.14 424.00 6263.14	6652.14 481.00 6171.14	6455.49 375.00 6080.49	6552.00 394.00 6158.00	6710.00 432.00 6278.00	6752.00 414.00 6338.00	6862.00 431.00 6431.00	50210.48 3260.00 46950.48	167419.48 61081.00 106338.48		
5	Chattisgarh CSPDCL	126447.94 126447.94	4600.00 4600.00	4800.00 4800.00	6200.00 6200.00	6400.00 6400.00	3500.00 3500.00	3500.00 3500.00	3500.00 3500.00	3500.00 3500.00	36000.00 36000.00	162447.94 162447.94		
6	Goa Goa Electricity Department	4984.07 4984.07	107.28 107.28	50.00 50.00	50.00 50.00	50.00 50.00	25.00 25.00	50.00 50.00	25.00 25.00	50.00 50.00	407.28 407.28	5391.35 5391.35		
7	GUJARAT DGVCL MGVCL PGVCL UGVCL TPL - Ahmedabad	474413.27 54660.00 63758.62 231465.60 115990.81 6801.17	6552.66 1020.00 241.50 549.73 4527.19 140.00	6794.42 1040.00 265.50 578.66 4703.01 140.00	7031.24 1059.00 264.00 607.60 4886.99 140.00	7254.63 1074.00 266.50 637.98 5078.00 140.00	7504.64 1097.00 264.00 669.98 5275.01 140.00	7741.52 1113.00 247.00 703.37 5482.00 140.00	8038.19 1156.00 247.00 738.54 5696.00 140.00	8327.32 1187.00 247.00 775.47 5918.00 140.00	59244.62 8746.00 2042.50 5261.33 41566.20 1120.00	533657.89 63406.00 65801.12 236726.93 157557.01 7921.17		
	TPL - Dahej TPL - Dholera TPL - Surat	75.83 0.00 1661.25	7.40 0.00 66.84	6.00 11.00 50.25	4.50 17.00 52.15	2.50 17.00 38.65	3.00 17.00 38.65	2.50 28.00 25.65	3.00 33.00 24.65	2.50 33.00 24.35	31.40 156.00 321.19	107.23 156.00 1982.44		
8	Haryana DHBVNL UHBVNL	144744.29 80833.29 63911.00	2074.26 534.00 1540.26	2732.38 1155.00 1577.38	3890.39 2275.00 1615.39	3964.32 2310.00 1654.32	2744.19 1050.00 1694.19	2505.02 770.00 1735.02	2476.83 700.00 1776.83	2694.66 875.00 1819.66	23082.05 9669.00 13413.05	167826.34 90502.29 77324.05		
9	Himachal Pradesh HPSEBL	24836.08 24836.08	780.89 780.89	822.58 822.58	464.03 464.03	356.65 356.65	289.74 289.74	237.08 237.08	214.40 214.40	180.46 180.46	3345.83 3345.83	28181.91 28181.91		
10	Jharkhand	72903.00	324.00	3763.00	6033.00	1325.00	1614.00	414.00	432.00	450.00	14355.00	87258.00		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	JBVNL	72903.00	324.00	3763.00	6033.00	1325.00	1614.00	414.00	432.00	450.00	14355.00	87258.00		
11	Karnataka	504781.28	11135.27	13554.55	12430.60	12273.83	12968.17	9095.98	9263.63	9459.51	90181.56	594962.84		
	BESCOM	96322.40	1929.00	1840.00	2138.00	1809.00	1716.00	1036.00	962.00	1213.00	12643.00	108965.40		
	CESCOM	203449.61	4137.00	4191.00	4248.00	3798.00	3894.00	3717.00	3669.00	3516.00	31170.00	234619.61		
	GESCOM	73153.00	27.00	393.41	190.00	205.00	322.00	300.00	300.00	300.00	2037.41	75190.41		
	HESCOM	83636.00	2585.00	4550.00	3010.00	3475.00	3900.00	750.00	875.00	800.00	19945.00	103581.00		
	MESCOM	48220.27	2457.27	2580.14	2844.60	2986.83	3136.17	3292.98	3457.63	3630.51	24386.15	72606.42		
12	Kerala	66485.84	2200.00	2200.00	2200.00	2200.00	2200.00	2200.00	2200.00	2200.00	17600.00	84085.84		
	KSEBL	66485.84	2200.00	2200.00	2200.00	2200.00	2200.00	2200.00	2200.00	2200.00	17600.00	84085.84		
13	Madhya Pradesh	462509.00	3095.90	12322.59	18228.49	10839.00	1355.00	1100.00	1220.00	1348.00	49508.98	512017.98		
	MPPKVCL	136119.00	1520.00	1663.00	1625.00	355.00	317.00	355.00	391.00	428.00	6654.00	142773.00		
	MPPKVCL EZ	164299.00	160.00	4780.00	8919.00	957.00	1038.00	685.00	754.00	830.00	26723.00	191022.00		
	MPMKVCL	162091.00	1415.90	5879.59	7684.49	927.00	0.00	60.00	75.00	90.00	16131.98	178222.98		
14	Maharashtra	344603.80	3262.59	44837.58	46071.60	8617.41	1617.56	1994.80	2144.80	2294.80	110841.14	455444.94		
	MSEDCL	337352.00	2982.79	44570.78	45791.80	8347.61	1347.76	1725.00	1875.00	2025.00	108665.74	446017.74		
	Adani Electricity Mumbai Ltd	3899.00	220.00	217.00	230.00	220.00	220.00	220.00	220.00	220.00	1767.00	5666.00		
	BEST	2174.00	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	38.40	2212.40		
	Tata Power, Mumbai	1178.80	55.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	370.00	1548.80		
15	Manipur	7847.00	333.00	370.14	370.14	407.15	407.15	444.17	444.17	518.20	3294.12	11141.12		
	MSPDCL	7847.00	333.00	370.14	370.14	407.15	407.15	444.17	444.17	518.20	3294.12	11141.12		
16	Meghalaya	16069.00	487.00	487.00	541.04	541.04	595.15	595.15	595.15	595.15	4436.68	20505.68		
	MEPDCL	16069.00	487.00	487.00	541.04	541.04	595.15	595.15	595.15	595.15	4436.68	20505.68		
17	Mizoram	5585.58	42.21	63.21	88.17	130.17	114.08	129.00	129.00	153.00	848.84	6434.42		
	Department of Power - Mizoram	5585.58	42.21	63.21	88.17	130.17	114.08	129.00	129.00	153.00	848.84	6434.42		
18	Nagaland	6052.00	0.00	361.72	331.52	166.26	90.00	87.00	78.00	48.00	1162.50	7214.50		
	Department of Power - Nagaland	6052.00	0.00	361.72	331.52	166.26	90.00	87.00	78.00	48.00	1162.50	7214.50		
19	Odisha	174503.23	3165.89	5519.95	2643.98	2559.98	2544.98	2682.64	2682.64	2682.64	24482.70	198985.93		
	TPCODL	38639.50	2207.78	2104.98	2081.98	2081.98	2081.98	2081.98	2081.98	2081.98	16804.64	55444.14		
	TPNODL	37591.00	308.00	224.00	252.00	168.00	108.00	100.00	100.00	100.00	1360.00	38951.00		
	TPSODL	47180.26	350.11	670.97	190.00	190.00	235.00	290.66	290.66	290.66	2508.06	49688.32		
	TPWODL	51092.48	300.00	2520.00	120.00	120.00	120.00	210.00	210.00	210.00	3810.00	54902.48		
20	PUNJAB	252968.22	2924.00	4962.05	6522.05	6653.00	6753.00	6854.00	6957.00	7061.00	48686.10	301654.32		
	PSPCL	252968.22	2924.00	4962.05	6522.05	6653.00	6753.00	6854.00	6957.00	7061.00	48686.10	301654.32		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
21	Rajasthan	604383.00	33843.00	34869.00	24550.00	18027.20	14399.00	13893.00	13483.00	12774.00	165838.20	770221.20		
	AVVNL	161205.00	12998.00	6840.00	4915.20	4080.00	3930.00	3930.00	3930.00	3930.00	52005.20	213210.20		
	JdVVNL	218287.00	15375.00	11250.00	7500.00	6000.00	5250.00	4500.00	4500.00	4500.00	69375.00	287662.00		
	JVVNL	224891.00	7461.00	6496.00	5612.00	4319.00	4713.00	5053.00	4344.00	4344.00	44458.00	269349.00		
22	Sikkim	3368.00	37.00	459.00	462.00	480.00	136.00	122.00	131.00	2264.00	5632.00			
	SPDCL	3368.00	37.00	459.00	462.00	480.00	136.00	122.00	131.00	2264.00	5632.00			
23	Tamil Nadu	130632.00	7800.00	9885.00	11111.00	1155.00	1512.00	1333.00	1128.00	3580.00	166432.00			
	TANGEDCO	130632.00	7800.00	9885.00	11111.00	1155.00	1512.00	1333.00	1128.00	3580.00	166432.00			
24	Telangana	202815.87	3440.12	6344.25	9190.37	3597.12	3653.12	4207.34	5073.70	44608.41	247424.28			
	TSNPDCL	91498.00	309.00	424.00	375.00	394.00	432.00	414.00	431.00	3260.00	94758.00			
	TSSPDCL	111317.87	3131.12	5920.25	8727.37	3203.12	3221.12	3793.34	4642.70	41348.41	152666.28			
25	TRIPURA	18886.23	0.00	215.00	386.00	220.00	138.00	137.00	180.00	1518.00	20404.23			
	TSECL	18886.23	0.00	215.00	386.00	220.00	138.00	137.00	180.00	1518.00	20404.23			
	Union Territory													
26	Andaman & Nicobar Elect. Dept	748.08	0.00	0.00	40.00	0.00	0.00	0.00	0.00	40.00	788.08			
27	Chandigarh Elect. Dept	905.62	27.82	15.57	11.40	4.10	3.75	5.50	0.50	7.50	76.13	981.75		
28	DNH&DDPDCL	1281.32	4.00	4.00	4.00	4.00	3.00	3.00	3.00	29.00	1310.32			
29	Delhi	17639.73	385.00	351.00	336.00	337.00	367.00	384.00	385.00	388.00	2933.00	20572.73		
	BRPL	8344.37	303.00	236.00	217.00	230.00	248.00	262.00	250.00	250.00	1996.00	10340.37		
	BYPL	3123.00	20.00	53.00	54.00	57.00	59.00	62.00	65.00	68.00	438.00	3561.00		
	NDMC	1059.24	12.00	12.00	15.00	15.00	15.00	15.00	20.00	20.00	124.00	1183.24		
	TPDDL	5113.11	50.00	50.00	50.00	35.00	45.00	45.00	50.00	50.00	375.00	5488.11		
30	Jammu & Kashmir	40450.78	420.00	465.00	622.50	660.00	525.00	150.00	150.00	150.00	3142.50	43593.28		
	JPDC	24372.27	330.00	405.00	435.00	450.00	450.00	105.00	105.00	105.00	2385.00	26757.27		
	KPDCL	16078.51	90.00	60.00	187.50	210.00	75.00	45.00	45.00	45.00	757.50	16836.01		
31	Ladakh, Electricity Dept.	3736.78	145.94	108.00	43.98	227.75	227.75	6.00	1.00	1.00	761.42	4498.20		
32	Lakshadweep Elect. Dept	113.00	0.00	0.00	0.50	0.50	0.50	4.00	4.00	4.00	13.50	126.50		
33	Puducherry Elect. Dept	2350.91	0.00	0.00	54.00	25.00	0.00	0.00	0.00	0.00	79.00	2429.91		
34	Uttar Pradesh	513539.52	11099.89	16077.24	9794.43	9353.63	9049.35	8831.40	9227.57	9430.10	82863.61	596403.13		
	DVVNL	147462.59	4525.00	4014.00	1363.00	1404.00	1509.00	1509.00	1509.00	1509.00	17342.00	164804.59		
	MVVNL	140266.92	2868.75	5782.36	4877.87	4492.75	4228.29	4110.78	4264.08	4529.47	35154.35	175421.27		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	Pu VVNL	126330.17	1051.04	1473.60	1139.44	1151.74	1304.68	1068.24	892.26	842.14	8923.14	135253.31		
	PVVNL	95146.00	2566.10	4629.08	2223.92	2194.69	1949.38	2085.38	2501.23	2488.49	20638.27	115784.27		
	KESCO	1623.00	0.00	132.20	64.45	12.00	12.00	12.00	15.00	15.00	382.85	2005.85		
	NPCL	2710.84	89.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	423.00	3133.84		
35	Uttarakhand	45708.00	9.00	209.00	281.00	60.00	60.00	60.00	60.00	60.00	799.00	46507.00		
	UPCL	45708.00	9.00	209.00	281.00	60.00	60.00	60.00	60.00	60.00	799.00	46507.00		
36	West Bengal	150143.86	675.08	4217.27	920.31	1029.23	1049.08	1081.90	1169.74	1237.65	11380.27	161524.13		
	WBSEDCL	142975.86	324.00	3849.00	534.00	624.00	624.00	636.00	702.00	747.00	8040.00	151015.86		
	CESC	7168.00	351.08	368.27	386.31	405.23	425.08	445.90	467.74	490.65	3340.27	10508.27		
	Grand Total	4935279.40	111822.81	200772.40	193085.68	130281.80	86526.58	79774.12	81987.55	84251.62	968502.57	5903781.97		

ANNEXURE-VII

Number of Distribution Transformer (11/0.4 kV)

Sr. No	State/UTs (Discom/Power Department)	No of DTs as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected No of DTs by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
1	Andhra Pradesh	1182795	84961	87603	89934	89357	90975	85365	87143	89146	70484	1887279		
	APEPDCL	272649	22031	23913	25727	27485	23040	24663	26476	193671	466320			
	APCPDCL	258969	14655	13921	13630	13790	12325	12480	109143	368112				
	APSPDCL	651177	49970	52100	50000	49700	50000	50000	401670	1052847				
2	Arunachal Pradesh	9000	502	854	608	537	497	433	462	531	13424			
	Department of Power - Arunachal Pradesh	9000	502	854	608	537	497	433	462	531	13424			
3	ASSAM	131288	0	2226	3086	3355	535	810	1500	2030	144830			
	APDCL	131288	0	2226	3086	3355	535	810	1500	2030	144830			
4	Bihar	324841	5595	18362	22442	11101	740	740	11101	11101	426745			
	NBPDCL	192298	414	8000	12081	740	740	740	740	740	216493			
	SBPDCL	132543	5181	10362	10361	10361	10361	10361	10361	10361	210252			
5	Chattisgarh	204171	10417	14246	14943	14237	10000	10000	10000	10000	298014			
	CSPDCL	204171	10417	14246	14943	14237	10000	10000	10000	10000	298014			
6	Goa	8057	366	315	331	273	291	311	332	354	10630			
	Goa Electricity Department	8057	366	315	331	273	291	311	332	354	10630			
7	GUJARAT	1762255	76076	82668	87788	93553	99544	102334	108559	115405	2528182			
	DGVCL	200056	20005	24206	26870	30096	33436	33467	36813	40495	425439			
	MGVCL	174631	10568	11068	11568	12068	12568	13068	13568	14068	273175			
	PGVCL	1014042	24297	24951	25627	26322	27044	27786	28557	29531	1228157			
	UGVCL	361688	20855	22058	23330	24674	26099	27603	29194	30878	566379			
	TPL - Ahmedabad	9090	300	300	310	310	310	310	310	310	11550			
	TPL - Dahej	8	1	2	0	0	0	1	0	1	13			
	TPL - Dholera	0	0	21	21	18	19	34	50	54	217			
	TPL - Surat	2740	50	62	62	65	68	65	67	68	3247			
8	Haryana	631823	24982	18906	20097	19851	20727	23237	26396	24720	810739			
	DHBVNL	315673	11632	7500	7740	6448	6170	7407	9161	5934	377665			
	UHBVNL	316150	13350	11406	12357	13403	14557	15830	17235	18786	433074			
9	Himachal Pradesh	37112	1073	2334	1726	1451	1228	793	758	931	47406			
	HPSEBL	37112	1073	2334	1726	1451	1228	793	758	931	47406			
10	Jharkhand	133340	3605	5907	7693	5031	5471	4387	4561	4744	174739			

Sr. No	State/UTs (Discom/Power Department)	No of DTs as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected No of DTs by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	JBVNL	13340	3605	5907	7693	5031	5471	4387	4561	4744	41399	174739		
11	Karnataka	1085278	53630	56214	58660	56379	57704	57536	58825	60929	457077	1542355		
	BESCOM	455604	38000	38000	38000	38000	38000	38000	38000	38000	304000	759604		
	CESCOM	164018	8050	8050	8050	8050	8050	8050	8050	8050	64400	228418		
	GESCOM	119229	450	398	454	213	407	436	308	742	3408	122637		
	HESCOM	250837	1374	3266	2001	1778	1778	280	200	145	10822	261659		
	MESCOM	95590	5756	6500	7355	8338	9469	10770	12267	13992	74447	170037		
12	Kerala	84786	2200	2200	2150	2150	2200	2200	2200	2200	17500	102286		
	KSEBL	84786	2200	2200	2150	2150	2200	2200	2200	2200	17500	102286		
13	Madhya Pradesh	944606	3920	11059	16051	13927	6190	4623	5019	5498	66287	1010893		
	MPPKVCL	291059	585	2789	4248	5367	2550	487	489	528	17043	308102		
	MPPKVCL EZ	244401	2280	4279	6828	8560	3640	4056	4450	4890	38983	283384		
	MPMKVCL	409146	1055	3991	4975	0	0	80	80	80	10261	419407		
14	Maharashtra	811017	28192	49506	60827	49979	48528	48173	48143	46992	380340	1191357		
	MSEDCL	799513	27960	49269	60592	49894	48443	48088	48058	46907	379211	1178724		
	Adani Electricity Mumbai Ltd	7141	147	152	150	0	0	0	0	0	449	7590		
	BEST	3340	40	40	40	40	40	40	40	40	320	3660		
	Tata Power, Mumbai	1023	45	45	45	45	45	45	45	45	360	1383		
15	Manipur	9553	320	330	330	350	350	350	350	350	2730	12283		
	MSPDCL	9553	320	330	330	350	350	350	350	350	2730	12283		
16	Meghalaya	13013	380	395	410	420	430	430	430	430	3325	16338		
	MEPDCL	13013	380	395	410	420	430	430	430	430	3325	16338		
17	Mizoram	2385	62	65	69	68	56	70	70	70	530	2915		
	Department of Power - Mizoram	2385	62	65	69	68	56	70	70	70	530	2915		
18	Nagaland	5861	0	367	367	184	365	401	421	468	2573	8434		
	Department of Power - Nagaland	5861	0	367	367	184	365	401	421	468	2573	8434		
19	Odisha	282586	4506	4325	4067	4157	4246	2696	2675	2655	29327	311913		
	TPCODL	74703	1859	1859	1859	1859	1859	1859	1859	1859	14872	89575		
	TPNODL	72323	645	614	565	541	520	495	474	454	4308	76631		
	TPSODL	55875	1465	1615	1385	1425	1525	0	0	0	7415	63290		
	TPWODL	79685	537	237	258	332	342	342	342	342	2732	82417		
20	PUNJAB	1173488	4308	6461	10768	6460	6138	5524	5248	4723	49630	1223118		
	PSPCL	1173488	4308	6461	10768	6460	6138	5524	5248	4723	49630	1223118		

Sr. No	State/UTs (Discom/Power Department)	No of DTs as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected No of DTs by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
21	Rajasthan	1781612	105443	115509	77917	72530	69961	71071	71415	73389	657235	2438847		
	AVVNL	527946	45020	51300	21300	16300	13300	12800	12800	12800	185620	713566		
	JdVVNL	470581	16700	15500	15900	16000	15800	16300	16800	16350	129350	599931		
	JVVNL	783085	43723	48709	40717	40230	40861	41971	41815	44239	342265	1125350		
22	Sikkim	3199	35	158	159	174	167	148	76	70	987	4186		
	SPDCL	3199	35	158	159	174	167	148	76	70	987	4186		
23	Tamil Nadu	373178	21269	22482	23762	25117	26548	28063	29662	31353	208256	581434		
	TANGEDCO	373178	21269	22482	23762	25117	26548	28063	29662	31353	208256	581434		
24	Telangana	804730	28213	30314	32346	32678	29673	30072	30830	31780	245906	1050636		
	TSNPDCL	311431	6520	6930	7270	7600	7980	8380	8800	9240	62720	374151		
	TSSPDCL	493299	21693	23384	25076	25078	21693	21692	22030	22540	183186	676485		
25	TRIPURA	17431	520	484	495	335	210	245	205	185	2679	20110		
	TSECL	17431	520	484	495	335	210	245	205	185	2679	20110		
	Union Territory													
26	Andaman & Nicobar Elect. Dept	940	0	25	25	25	25	0	0	0	100	1040		
27	Chandigarh Elect. Dept	2351	78	43	33	30	31	4	3	4	226	2577		
28	DNH&DDPDCL	2245	15	15	15	15	15	10	10	10	105	2350		
29	Delhi	84690	855	1071	1125	1185	1295	1300	1307	1312	9450	94140		
	BRPL	38808	549	674	722	775	879	877	877	877	6230	45038		
	BYPL	14948	44	135	140	147	153	159	165	170	1113	16061		
	NDMC	665	12	12	13	13	13	14	15	15	107	772		
	TPDDL	30269	250	250	250	250	250	250	250	250	2000	32269		
30	Jammu & Kashmir	80767	4052	7235	8400	5900	6010	3710	3810	4210	43327	124094		
	JPDCL	42030	2017	2370	2600	2850	3200	1100	1300	1500	16937	58967		
	KPDCL	38737	2035	4865	5800	3050	2810	2610	2510	2710	26390	65127		
31	Ladakh, Electricity Dept.	1962	80	42	21	187	69	10	10	10	429	2391		
32	Lakshadweep Elect. Dept	110	0	0	2	2	2	2	2	2	12	122		
33	Puducherry Elect. Dept	3286	30	25	25	135	135	135	162	162	809	4094.6		
34	Uttar Pradesh	2114062	78314	68654	71512	64162	58383	58409	58845	59994	518274	2632336		
	DVVNL	547891	24075	25519	27051	23895	19880	20676	21503	22363	184962	732853		
	MVVNL	577350	23883	23312	25105	21721	19097	18671	16667	16307	164764	742114		

Sr. No	State/UTs (Discom/Power Department)	No of DTs as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected No of DTs by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	Pu VVNL	523441	15423	8798	8176	7465	7512	7238	7957	8064	70633	594074		
	PVVNL	452532	14728	10439	10573	10634	11559	11462	12314	12822	94531	547063		
	KESCO	5784	0	372	187	50	50	50	60	60	1151	6935		
	NPCL	7064	205	214	235	260	285	313	344	378	2234	9298		
35	Uttarakhand	80883	2965	1658	1488	1450	1400	1400	1500	1400	13261	94144		
	UPCL	80883	2965	1658	1488	1450	1400	1400	1500	1400	13261	94144		
36	West Bengal	485560	6278	2430	3707	3912	3468	3695	3428	3255	30173	515733		
	WBSEDCL	476727	6211	2362	3639	3844	3399	3626	3358	3185	29624	506351		
	CSEC	8833	67	68	68	68	69	69	70	70	549	9382		
	Grand Total	14674261	553242	614488	620579	580657	563968	559048	575458	590413	4657854	19332115		

ANNEXURE-VIII

Capacity (MVA) of Distribution Transformer (11/0.4 kV)

Sr. No	State/UTs (Discom/Power Department)	Capacity(MVA) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Capacity (MVA) by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
1	Andhra Pradesh	38990.01	793.34	829.57	799.32	804.10	816.91	858.60	836.59	852.32	6590.74	45580.75		
	APEPDCL	10839.90	229.59	229.65	232.52	236.15	310.21	276.33	278.44	2027.22	12867.12			
	APCPDCL	10202.38	561.55	597.42	564.30	578.05	545.69	557.36	571.38	4542.81	14745.19			
	APSPDCL	17947.73	2.20	2.50	2.50	2.70	2.70	2.90	2.50	20.70	17968.43			
2	Arunachal Pradesh	484.66	43.68	176.14	149.50	244.18	916.29	133.04	130.64	136.87	1930.34	2415.00		
	Department of Power - Arunachal Pradesh	484.66	43.68	176.14	149.50	244.18	916.29	133.04	130.64	136.87	1930.34	2415.00		
3	ASSAM	5799.43	0.00	164.96	227.30	242.21	37.90	90.00	168.00	224.00	1154.37	6953.80		
	APDCL	5799.43	0.00	164.96	227.30	242.21	37.90	90.00	168.00	224.00	1154.37	6953.80		
4	Bihar	21727.98	310.62	950.41	1192.38	875.25	540.94	540.94	540.94	540.94	5492.42	27220.39		
	NBPDCL	11436.00	40.18	409.53	651.44	334.31	0.00	0.00	0.00	0.00	1435.46	12871.46		
	SBPDCL	10291.98	270.44	540.88	540.94	540.94	540.94	540.94	540.94	540.94	4056.96	14348.93		
5	Chattisgarh	11710.00	1071.00	1436.00	1494.00	1423.00	1000.00	1000.00	1000.00	1000.00	9424.00	21134.00		
	CSPDCL	11710.00	1071.00	1436.00	1494.00	1423.00	1000.00	1000.00	1000.00	1000.00	9424.00	21134.00		
6	Goa	1699.82	70.95	77.00	81.00	69.00	74.00	79.00	85.00	91.00	626.95	2326.77		
	Goa Electricity Department	1699.82	70.95	77.00	81.00	69.00	74.00	79.00	85.00	91.00	626.95	2326.77		
7	GUJARAT	56722.73	3932.22	4145.31	4301.94	4447.66	4694.88	4887.40	5012.06	5040.91	36462.39	93185.11		
	DGVCL	5465.00	60.12	66.73	74.07	82.29	91.42	100.57	110.62	121.68	707.50	6172.50		
	MGVCL	6486.51	406.00	431.00	460.00	488.00	519.00	530.00	530.00	530.00	3894.00	10380.51		
	PGVCL	22406.55	2304.56	2370.76	2439.38	2510.38	2583.96	2660.16	2739.26	2821.48	20429.91	42836.46		
	UGVCL	16707.62	963.39	1058.00	1103.00	1141.00	1272.00	1362.52	1389.18	1321.59	9610.68	26318.30		
	TPL-Ahmedabad	4039.00	165.00	165.00	171.00	171.00	171.00	171.00	171.00	171.00	1356.00	5395.00		
	TPL-Dahej	2.05	0.16	0.32	0.00	0.00	0.00	0.16	0.00	0.16	0.80	2.85		
	TPL-Dholera	0.00	0.00	10.50	10.50	9.00	9.50	17.00	25.00	27.00	108.50	108.50		
	TPL-Surat	1616.00	33.00	43.00	44.00	46.00	48.00	46.00	47.00	48.00	355.00	1971.00		
8	Haryana	32371.26	1683.13	1482.10	1598.75	1684.92	1808.03	1934.43	2172.53	2106.48	14470.35	46841.61		
	DHBVNL	17110.63	597.13	458.10	485.75	474.92	491.03	500.43	608.53	402.48	4018.35	21128.99		
	UHBVNL	15260.63	1086.00	1024.00	1113.00	1210.00	1317.00	1434.00	1564.00	1704.00	10452.00	25712.63		
9	Himachal Pradesh	12175.42	117.08	250.60	183.35	159.08	139.05	94.80	92.00	108.44	1144.39	13319.81		

Sr. No	State/UTs (Discom/Power Department)	Capacity(MVA) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Capacity (MVA) by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	HPSEBL	12175.42	117.08	250.60	183.35	159.08	139.05	94.80	92.00	108.44	1144.39	13319.81		
10	Jharkhand	8157.00	227.00	239.40	184.43	118.59	152.41	277.00	287.00	299.00	1784.82	9941.82		
	JBVNL	8157.00	227.00	239.40	184.43	118.59	152.41	277.00	287.00	299.00	1784.82	9941.82		
11	Karnataka	59979.77	867.21	1051.40	1101.08	1186.24	1305.82	1333.56	1428.90	1550.80	9825.00	69804.77		
	BESCOM	25598.00	351.66	447.34	543.02	638.70	734.38	830.06	925.74	1021.42	5492.30	31090.30		
	CESCOM	7094.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	1840.00	8934.00		
	GESCOM	6211.84	25.97	25.81	29.85	17.03	32.32	25.43	18.78	37.33	212.52	6424.36		
	HESCOM	16139.14	65.00	146.00	88.00	82.00	82.00	12.00	9.00	7.00	491.00	16630.14		
	MESCOM	4936.79	194.58	202.25	218.51	227.12	236.07	245.38	255.05	275.00	1789.18	6725.97		
12	Kerala	11272.31	263.00	275.00	270.00	270.00	270.00	270.00	290.00	275.00	2203.00	13475.31		
	KSEBL	11272.31	263.00	275.00	270.00	270.00	270.00	270.00	290.00	275.00	2203.00	13475.31		
13	Madhya Pradesh	47739.38	748.99	913.65	1328.58	1180.70	529.00	799.89	831.89	903.89	7236.59	54975.97		
	MPPKVVCL	17080.38	585.00	278.90	424.80	536.70	255.00	487.00	489.00	528.00	3584.40	20664.78		
	MPPKVVCL_EZ	12500.00	81.00	322.00	514.00	644.00	274.00	306.00	336.00	369.00	2846.00	15346.00		
	MPMKVCL	18159.00	82.99	312.75	389.78	0.00	0.00	6.89	6.89	6.89	806.19	18965.19		
14	Maharashtra	79435.56	3375.81	4811.06	6717.35	6345.20	6296.88	6444.59	6540.98	6562.18	47094.05	126529.61		
	MSEDCL	70220.00	3166.81	4622.06	6532.35	6260.20	6211.88	6359.59	6455.98	6477.18	46086.05	116306.05		
	Adani Electricity Mumbai Ltd	5300.60	124.00	104.00	100.00	0.00	0.00	0.00	0.00	0.00	328.00	5628.60		
	BEST	2736.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	320.00	3056.00		
	Tata Power, Mumbai	1178.96	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	360.00	1538.96		
15	Manipur	671.00	10.38	10.71	10.71	12.36	12.36	12.36	12.36	12.36	93.59	764.59		
	MSPDCL	671.00	10.38	10.71	10.71	12.36	12.36	12.36	12.36	12.36	93.59	764.59		
16	Meghalaya	807.00	44.00	46.00	50.00	52.00	55.00	55.00	55.00	55.00	412.00	1219.00		
	MEPDCL	807.00	44.00	46.00	50.00	52.00	55.00	55.00	55.00	55.00	412.00	1219.00		
17	Mizoram	311.35	8.56	8.56	8.81	8.56	8.03	8.60	8.60	8.60	68.32	379.67		
	Department of Power - Mizoram	311.35	8.56	8.56	8.81	8.56	8.03	8.60	8.60	8.60	68.32	379.67		
18	Nagaland	478.10	0.00	29.60	29.60	14.69	36.50	40.10	42.10	46.80	239.39	717.49		
	Department of Power - Nagaland	478.10	0.00	29.60	29.60	14.69	36.50	40.10	42.10	46.80	239.39	717.49		
19	Odisha	14785.06	451.96	427.87	419.43	423.86	428.31	346.40	345.40	343.40	3186.61	17971.67		
	TPODL	5364.08	265.00	265.00	265.00	265.00	265.00	265.00	265.00	265.00	2120.00	7484.08		
	TPNODL	2656.33	61.76	58.85	54.05	51.74	49.70	46.00	45.00	43.00	410.10	3066.43		
	TPSODL	2735.99	70.75	82.20	76.38	73.62	78.21	0.00	0.00	0.00	381.14	3117.13		

Sr. No	State/UTs (Discom/Power Department)	Capacity(MVA) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Capacity (MVA) by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	TPWODL	4028.66	54.45	21.83	24.00	33.50	35.40	35.40	35.40	35.40	35.40	35.40	275.38	4304.04
20	PUNJAB	38995.00	318.78	478.10	796.82	478.04	478.04	454.20	338.05	338.05	388.34	388.34	3601.83	42596.83
	PSPCL	38995.00	318.78	478.10	796.82	478.04	478.04	454.20	338.05	338.05	388.34	388.34	3601.83	42596.83
21	Rajasthan	52506.92	2086.46	2188.90	1694.07	1612.87	1567.83	1627.96	1638.21	1638.21	1627.96	1627.96	14119.63	66626.55
	AVVNL	18012.62	713.40	785.00	365.00	295.00	253.00	246.00	246.00	246.00	246.00	246.00	3149.40	21162.02
	JdVVNL	17358.00	501.00	465.00	477.00	480.00	474.00	474.00	489.00	489.00	504.00	504.00	3880.50	21238.50
	JVVNL	17136.30	872.06	938.90	852.07	837.87	840.83	840.83	903.21	903.21	877.96	877.96	7089.73	24226.03
22	Sikkim	407.40	2.95	29.00	31.00	35.50	34.00	34.00	28.00	28.00	27.00	27.00	213.45	620.84
	SPDCL	407.40	2.95	29.00	31.00	35.50	34.00	34.00	28.00	28.00	27.00	27.00	213.45	620.84
23	Tamil Nadu	47547.16	2206.56	2332.39	2465.11	2605.84	2753.34	2753.34	2911.34	2911.34	3077.32	3077.32	21604.63	69151.78
	TANGEDCO	47547.16	2206.56	2332.39	2465.11	2605.84	2753.34	2753.34	2911.34	2911.34	3077.32	3077.32	21604.63	69151.78
24	Telangana	29507.00	898.93	1051.02	1204.98	1219.31	959.68	959.68	974.77	974.77	1084.32	1084.32	8610.41	38117.41
	TSNPDCL	11104.38	261.00	275.15	291.17	305.50	321.75	321.75	336.84	336.84	418.80	418.80	2720.71	13825.09
	TSSPDCL	18402.62	637.93	775.87	913.81	913.81	637.93	637.93	637.93	637.93	665.52	665.52	5889.70	24292.32
25	TRIPURA	1278.12	33.69	35.28	23.72	23.80	23.80	19.28	22.50	22.50	19.20	19.20	194.97	1473.09
	TSECL	1278.12	33.69	35.28	23.72	23.80	23.80	19.28	22.50	22.50	19.20	19.20	194.97	1473.09
	Union Territory													
26	Andaman & Nicobar Elect. Dept	174.00	0.00	6.60	6.60	6.60	6.60	6.60	6.60	6.60	0.00	0.00	33.00	207.00
27	Chandigarh Elect. Dept	771.70	24.57	13.55	10.72	10.09	9.77	9.77	1.26	1.26	0.95	0.95	72.15	843.85
28	DNH&DDPDCL	500.00	4.73	4.73	4.73	4.73	4.73	4.73	3.15	3.15	3.15	3.15	33.08	533.08
29	Delhi	16956.37	441.00	569.00	597.00	626.00	678.00	678.00	683.00	683.00	690.00	697.00	4981.00	21937.37
	BRPL	6612.00	254.00	311.00	333.00	357.00	405.00	405.00	405.00	405.00	405.00	405.00	2875.00	9487.00
	BYPL	3575.00	34.00	105.00	109.00	114.00	118.00	118.00	123.00	123.00	128.00	135.00	866.00	4441.00
	NDMC	863.33	18.00	18.00	20.00	20.00	20.00	20.00	20.00	20.00	22.00	22.00	160.00	1023.33
	TPDDL	5906.04	135.00	135.00	135.00	135.00	135.00	135.00	135.00	135.00	135.00	135.00	1080.00	6986.04
30	Jammu & Kashmir	9413.24	218.78	259.59	284.30	306.85	342.30	342.30	119.70	119.70	140.50	161.70	1833.72	11246.96
	JPDCL	4536.24	217.31	254.39	279.70	303.55	339.40	339.40	117.00	117.00	138.00	159.00	1808.35	6344.59
	KPDCL	4877.00	1.47	5.20	4.60	3.30	2.90	2.90	2.70	2.70	2.50	2.70	25.37	4902.37
31	Ladakh, Electricity Dept.	195.00	9.60	5.04	2.52	22.44	8.28	8.28	1.50	1.50	2.00	2.00	53.38	248.38
32	Lakshadweep Elect. Dept	17.16	0.00	0.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	1200.00	1217.16

Sr. No	State/UTs (Discom/Power Department)	Capacity(MVA) as on 31.03.2022	Yearly Addition-proposed							Total addition during 2022-30	Expected Capacity (MVA) by 2030	
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29			2029-30
33	Puducherry Elect. Dept	782.55	8.25	6.06	8.85	36.20	36.20	36.20	51.03	51.03	233.82	1016.37
34	Uttar Pradesh	62882.12	3374.04	2979.69	3106.08	2792.61	2556.02	4202.41	2646.98	2702.90	24360.74	87242.86
	DVVNL	5139.42	1516.73	1607.70	1704.21	1505.39	1252.44	1302.59	1354.69	1408.87	11652.61	16792.03
	MVVNL	20017.67	159.36	150.05	157.84	125.79	114.97	104.65	98.24	96.64	1007.54	21025.21
	Pu VVNL	18918.14	848.16	463.00	454.02	430.93	461.29	2080.46	413.96	407.81	5559.62	24477.76
	PVVNL	16101.89	821.79	609.85	637.91	633.71	667.32	649.72	708.09	712.58	5440.97	21542.86
	KESCO	1992.00	0.00	119.10	119.10	59.80	20.00	20.00	24.00	24.00	386.00	2378.00
	NPCL	713.00	28.00	30.00	33.00	37.00	40.00	45.00	48.00	53.00	314.00	1027.00
35	Uttarakhand	4916.00	211.00	105.00	101.25	64.75	63.50	63.50	67.90	63.50	740.40	5656.40
	UPCL	4916.00	211.00	105.00	101.25	64.75	63.50	63.50	67.90	63.50	740.40	5656.40
36	West Bengal	17024.89	762.79	784.08	997.97	1002.70	972.69	993.90	961.97	910.31	7138.15	24163.04
	WBSEDCL	13922.89	732.79	753.79	967.39	971.83	941.52	962.42	930.19	878.22	7138.15	21061.04
	CSEC	3102.00	30.00	30.29	30.58	30.87	31.17	31.48	31.78	32.09	248.26	3350.26
	Grand Total	689192.44	24621.04	28173.36	31683.23	30609.91	29808.70	31429.80	30868.58	31517.30	238463.64	927656.08

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030	
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30					
	JBVNL	1543.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1543.00
11	Karnataka	268498.94	1962.71	1990.36	2081.65	2240.92	2498.85	2654.51	2779.03	2938.21	19146.24	19146.24	2938.21	19146.24	287645.18
	BESCOM	66356.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66356.17
	CESCOM	99695.86	1234.99	1219.54	1270.67	1379.39	1565.04	1659.73	1760.96	1869.31	11959.63	11959.63	1869.31	11959.63	111655.49
	GESCOM	50473.91	0.00	0.00	0.00	0.00	0.00	23.31	0.00	0.00	23.31	0.00	0.00	23.31	50497.22
	HESCOM	33950.00	23.71	30.06	31.56	41.43	25.89	16.18	12.94	11.33	193.10	193.10	11.33	193.10	34143.10
	MESCOM	18023.00	704.01	740.76	779.42	820.10	907.92	955.29	1005.13	1057.57	6970.20	6970.20	1057.57	6970.20	24993.20
12	Kerala	155736.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	155736.20
	KSEBL	155736.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	155736.20
13	Madhya Pradesh	21189.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21189.00
	MPPKVCL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MPPKVCL EZ	7038.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7038.00
	MPMKVCL	14151.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14151.00
14	Maharashtra	37823.00	98.00	88.00	68.00	50.00	30.00	25.00	25.00	25.00	409.00	409.00	25.00	409.00	38232.00
	MSEDCL	34147.00	90.00	80.00	60.00	50.00	30.00	25.00	25.00	25.00	385.00	385.00	25.00	385.00	34532.00
	Adani Electricity Mumbai Ltd	3676.00	8.00	8.00	8.00	0.00	0.00	0.00	0.00	0.00	24.00	24.00	0.00	24.00	3700.00
	BEST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Tata Power, Mumbai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	Manipur	7084.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7084.00
	MSPDCL	7084.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7084.00
16	Meghalaya	7174.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7174.00
	MEPDCL	7174.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7174.00
17	Mizoram	121.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	121.13
	Department of Power - Mizoram	121.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	121.13
18	Nagaland	1859.00	0.00	10.00	10.00	15.00	15.00	15.00	20.00	20.00	105.00	105.00	20.00	105.00	1964.00
	Department of Power - Nagaland	1859.00	0.00	10.00	10.00	15.00	15.00	15.00	20.00	20.00	105.00	105.00	20.00	105.00	1964.00
19	Odisha	78559.43	20.00	20.00	10.00	10.00	10.00	10.00	10.00	10.00	100.00	100.00	10.00	100.00	78659.43
	TPCODL	25800.17	20.00	20.00	10.00	10.00	10.00	10.00	10.00	10.00	100.00	100.00	10.00	100.00	25900.17
	TPNODL	30061.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30061.11
	TPSODL	17434.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17434.15
	TPWODL	5264.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5264.00
20	PUNJAB	15235.00	0.00	29.00	50.00	0.00	0.00	0.00	0.00	0.00	79.00	79.00	0.00	79.00	15314.00
	PSPCL	15235.00	0.00	29.00	50.00	0.00	0.00	0.00	0.00	0.00	79.00	79.00	0.00	79.00	15314.00

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
21	Rajasthan	269154.00	6803.00	6383.00	6413.00	6367.00	6464.00	6331.00	6152.00	6164.00	51077.00	320231.00		
	AVVNL	156756.00	4710.00	4125.00	4125.00	4125.00	4125.00	4125.00	4125.00	4125.00	33585.00	190341.00		
	JdVVNL	20784.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.00	20874.00			
	JVVNL	91614.00	2093.00	2258.00	2288.00	2242.00	2339.00	2206.00	2027.00	1949.00	17402.00	109016.00		
22	Sikkim	1135.00	52.00	131.00	92.00	102.00	161.00	126.00	135.00	117.00	916.00	2051.00		
	SPDCL	1135.00	52.00	131.00	92.00	102.00	161.00	126.00	135.00	117.00	916.00	2051.00		
23	Tamil Nadu	141640.27	2064.90	2087.84	2110.78	2133.73	2156.67	2179.61	2202.56	2225.49	17161.58	158801.85		
	TANGEDCO	141640.27	2064.90	2087.84	2110.78	2133.73	2156.67	2179.61	2202.56	2225.49	17161.58	158801.85		
24	Telangana	82976.00	1186.00	1100.00	1040.00	960.00	800.00	700.00	620.00	560.00	6966.00	89942.00		
	TSNPDCL	70021.00	1186.00	1100.00	1040.00	960.00	800.00	700.00	620.00	560.00	6966.00	76987.00		
	TSSPDCL	12955.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12955.00		
25	TRIPURA	3928.00	0.00	100.00	200.00	250.00	175.00	0.00	0.00	0.00	725.00	4653.00		
	TSECL	3928.00	0.00	100.00	200.00	250.00	175.00	0.00	0.00	0.00	725.00	4653.00		
	Union Territory										0.00	0.00		
26	Andaman & Nicobar Elect. Dept	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
27	Chandigarh Elect. Dept	1658.80	2.82	2.95	2.30	1.80	1.80	1.10	1.10	0.80	14.67	1673.47		
28	DNH&DDPDCL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
29	Delhi	351.79	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	40.00	391.79		
	BRPL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	BYPL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	NDMC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	TPDDL	351.79	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	40.00	391.79		
30	Jammu & Kashmir	62483.91	1324.51	2436.00	2500.00	2370.00	2250.00	2750.00	2480.00	2500.00	18610.51	81094.42		
	JPDC	45869.21	1050.00	1300.00	1550.00	1420.00	1500.00	1550.00	1380.00	1400.00	11150.00	57019.21		
	KPDCL	16614.70	274.51	1136.00	950.00	950.00	750.00	1200.00	1100.00	1100.00	7460.51	24075.21		
31	Ladakh, Electricity Dept.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
32	Lakshadweep Elect. Dept	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
33	Puducherry Elect. Dept	0.00	0.00	0.00	18.00	35.00	35.00	35.00	35.00	35.00	193.00	193.00		
34	Uttar Pradesh	291498.87	13666.30	14703.91	14700.73	15732.02	19751.01	20011.68	22534.01	24063.57	145163.22	436662.09		
	DVVNL	107387.42	343.00	343.00	344.00	344.00	345.00	346.00	346.00	347.00	2758.00	110145.42		
	MVVNL	114202.38	5154.70	5778.92	6464.10	6936.91	7911.85	9001.85	10144.75	11820.65	63213.73	177416.10		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed								Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
	Pu VVNL	61154.08	6253.07	6981.06	6896.84	7745.24	9844.61	9111.16	10777.77	11539.65	69149.40	130303.48
	PVVNL	8754.99	1915.53	995.80	705.87	1649.55	1552.67	1265.49	356.27	10042.10	18797.09	
	KESCO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	NPCL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
35	Uttarakhand	27732.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27732.80
	UPCL	27732.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27732.80
36	West Bengal	127860.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127860.00
	WBSEDCL	127860.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127860.00
	CSEC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Grand Total	2231494.82	43629.28	52053.46	50877.91	51160.65	53536.88	52959.08	55528.92	139809.47	499555.65	2731050.47

ANNEXURE-X

Length (ckm) of 3 phase LT (400V) Feeders

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
1	Andhra Pradesh APEPDCL APCPDCL APSPDCL	215041.56 53231.38 54494.61 107315.57	8442.74 2279.29 2423.45 3740.00	14009.15 2338.25 2510.90 9160.00	12272.03 2450.88 2341.15 7480.00	13683.65 2574.20 2400.45 8709.00	6395.39 2002.49 2530.90 1862.00	5924.62 1609.62 2105.00 2210.00	6346.31 1615.21 2441.10 2290.00	6143.96 1799.66 2564.30 1780.00	73217.85 16669.60 19317.25 37231.00	288259.40 69900.97 73811.86 144546.57		
2	Arunachal Pradesh Department of Power - Arunachal Pradesh	6301.62	2511.90	667.80	557.88	524.34	388.06	338.08	356.89	370.07	5715.01	12016.64		
3	ASSAM APDCL	129007.07	0.00	892.51	611.01	400.00	400.00	400.00	5900.00	7090.00	18523.52	147530.59		
4	Bihar NBPDC SBPDCL	331921.00 191237.00 140684.00	6031.00 3794.00 2237.00	18116.70 13641.47 4475.23	25054.33 20579.10 4475.23	5552.03 1052.03 4500.00	5498.25 998.25 4500.00	5444.47 944.47 4500.00	5390.69 890.69 4500.00	5336.90 836.90 4500.00	76424.36 42736.90 33687.46	408345.36 233973.90 174371.46		
5	Chattisgarh CSPDCL	36950.31	1790.00	2243.00	2334.00	2243.00	1300.00	1300.00	1300.00	1300.00	13810.00	50760.31		
6	Goa Goa Electricity Department	8112.83	227.09	346.00	331.00	273.00	291.00	311.00	332.00	354.00	2465.09	10577.92		
7	GUJARAT DGVCL MGVCL PGVCL UGVCL TPL - Ahmedabad TPL-Dahej TPL-Dholera TPL - Surat	248428.62 48502.04 43409.71 84407.20 41962.00 30112.67 35.00 0.00 0.00	5682.96 1169.13 1150.00 835.63 633.00 1800.00 2.20 0.00 93.00	6135.90 1478.13 1265.00 827.27 660.00 1800.00 3.50 9.00 93.00	6684.15 1943.15 1391.50 819.00 676.00 1750.00 2.50 9.00 93.00	6916.85 2156.89 1530.65 810.81 565.00 1750.00 2.50 8.00 93.00	7306.58 2394.16 1683.72 802.70 572.00 1750.00 2.00 9.00 93.00	7744.28 2657.51 1852.09 794.68 580.00 1750.00 2.00 15.00 93.00	8227.87 2949.84 2037.30 786.73 587.00 1750.00 2.00 22.00 93.00	8758.21 3274.32 2241.03 778.86 595.00 1750.00 2.00 24.00 93.00	57456.81 18023.13 13151.29 6455.69 4868.00 14100.00 18.70 96.00 744.00	305885.43 66525.17 56561.00 90862.89 46830.00 44212.67 53.70 96.00 744.00		
8	Haryana DHBVNL UHBVNL	123781.73 66662.73 57119.00	2292.64 1500.00 792.64	2011.58 1208.00 803.58	3993.67 3179.00 814.67	2135.91 1310.00 825.91	1487.31 650.00 837.31	1473.87 625.00 848.87	1475.58 615.00 860.58	1422.46 550.00 872.46	16293.02 9637.00 6656.02	140074.75 76299.73 63775.02		
9	Himachal Pradesh HPSEBL	26915.86	847.78	1713.86	1156.20	1198.30	1085.61	701.97	694.23	749.17	8147.11	35062.97		
10	Jharkhand	227138.00	265.00	13949.00	20879.00	1574.00	1896.00	603.00	635.00	667.00	40468.00	267606.00		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
11	JBVNL	227138.00	265.00	13949.00	20879.00	1574.00	1896.00	603.00	635.00	667.00	40468.00	267606.00		
	Karnataka	607020.03	9733.80	10797.20	13018.91	13434.86	12151.64	12789.50	13508.52	14323.32	99757.74	706777.77		
	BESCOM	120158.20	1978.58	1978.58	1978.58	1978.58	1978.58	1978.58	1978.58	1978.58	15828.64	135986.84		
	CESCOM	270460.70	4010.66	4478.91	4873.00	5486.49	5745.28	6252.34	6804.98	7407.39	45059.05	315519.75		
	GESCOM	42996.29	1956.00	2426.34	4154.48	3801.34	2150.00	2230.00	2300.00	2400.00	21418.15	64414.44		
12	HESCOM	101688.07	145.87	184.94	194.20	254.89	159.29	99.56	79.65	69.69	1188.09	102876.16		
	MESCOM	71716.77	1642.69	1728.43	1818.65	1913.56	2118.49	2229.02	2345.31	2467.66	16263.81	87980.58		
	Kerala	142385.20	3040.00	2950.00	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00	23990.00	166375.20		
	KSEBL	142385.20	3040.00	2950.00	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00	23990.00	166375.20		
	Madhya Pradesh	501413.00	1054.99	5048.99	6678.99	7676.00	4849.00	4988.00	5108.00	5226.00	40629.97	542042.97		
13	MPPKVVCL	249126.00	83.99	80.99	85.99	85.00	67.00	85.00	86.00	81.00	654.97	249780.97		
	MPPKVVCL EZ	138587.00	115.00	1545.00	2316.00	3091.00	182.00	203.00	222.00	245.00	7919.00	146506.00		
	MPMKVVCL	113700.00	856.00	3423.00	4277.00	4500.00	4600.00	4700.00	4800.00	4900.00	32056.00	145756.00		
	Maharashtra	691633.73	6113.00	11944.00	17627.00	14565.00	5212.00	5267.00	5395.00	5490.00	71613.00	763246.73		
	MSEDCL	665654.00	5078.00	10904.00	16587.00	13520.00	4162.00	4212.00	4335.00	4425.00	63223.00	728877.00		
14	Adani Electricity Mumbai Ltd	14590.00	845.00	850.00	850.00	855.00	860.00	865.00	870.00	875.00	6870.00	21460.00		
	BEST	9148.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	520.00	9668.00		
	Tata Power, Mumbai	2241.73	125.00	125.00	125.00	125.00	125.00	125.00	125.00	125.00	1000.00	3241.73		
	Manipur	6974.00	0.00	100.00	175.00	200.00	225.00	254.00	285.00	320.00	1559.00	8533.00		
	MSPDCL	6974.00	0.00	100.00	175.00	200.00	225.00	254.00	285.00	320.00	1559.00	8533.00		
15	Meghalaya	15082.00	0.00	250.00	375.00	625.00	625.00	625.00	625.00	625.00	3750.00	18832.00		
	MEPDCL	15082.00	0.00	250.00	375.00	625.00	625.00	625.00	625.00	625.00	3750.00	18832.00		
	Mizoram	3506.74	23.00	29.00	31.00	25.00	29.00	32.00	30.00	36.00	235.00	3741.74		
	Department of Power - Mizoram	3506.74	23.00	29.00	31.00	25.00	29.00	32.00	30.00	36.00	235.00	3741.74		
	Nagaland	3904.50	23.00	210.68	210.68	130.34	225.00	250.50	260.50	289.00	1599.71	5504.21		
16	Department of Power - Nagaland	3904.50	23.00	210.68	210.68	130.34	225.00	250.50	260.50	289.00	1599.71	5504.21		
	Odisha	131395.16	3078.00	2924.50	2725.10	2848.00	2973.30	3093.69	3214.38	3335.07	24192.04	155587.20		
	TPCODL	24249.91	1050.00	1050.00	1050.00	1050.00	1050.00	1050.00	1050.00	1050.00	8400.00	32649.91		
	TPNODL	36611.00	117.00	120.00	126.00	132.00	138.00	144.00	150.00	156.00	1083.00	37694.00		
	TPSODL	21836.17	1381.00	1535.00	1307.10	1343.00	1449.30	1563.69	1678.38	1793.07	12050.54	33886.71		
17	TPWODL	48698.08	530.00	219.50	242.00	323.00	336.00	336.00	336.00	336.00	2658.50	51356.58		
	PUNJAB	137124.00	274.00	1093.00	1366.00	1393.00	1420.00	1279.00	1152.00	1036.00	9013.00	146137.00		
	PSPCL	137124.00	274.00	1093.00	1366.00	1393.00	1420.00	1279.00	1152.00	1036.00	9013.00	146137.00		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
21	Rajasthan	271874.00	11404.00	11943.75	9254.50	6807.00	5885.00	5407.50	4871.00	4828.00	60400.75	332274.75		
	AVVNL	41814.00	583.00	450.00	450.00	450.00	450.00	450.00	450.00	0.00	3283.00	45097.00		
	JdVVNL	166225.00	9750.00	9993.75	7312.50	4875.00	3900.00	3412.50	2925.00	2925.00	45093.75	211318.75		
	JVVNL	63835.00	1071.00	1500.00	1482.00	1535.00	1545.00	1496.00	1496.00	1903.00	12024.00	75859.00		
22	Sikkim	3471.00	45.00	282.00	239.00	311.00	272.00	272.00	265.00	286.00	1922.00	5393.00		
	SPDCL	3471.00	45.00	282.00	239.00	311.00	272.00	272.00	265.00	286.00	1922.00	5393.00		
23	Tamil Nadu	475212.01	6935.10	7012.16	7089.22	7166.28	7243.34	7206.74	7397.44	7474.51	57524.79	532736.80		
	TANGEDCO	475212.01	6935.10	7012.16	7089.22	7166.28	7243.34	7206.74	7397.44	7474.51	57524.79	532736.80		
24	Telangana	330775.80	2456.75	3003.49	3590.24	3470.24	1876.75	1716.75	1742.09	1855.12	19711.41	350487.21		
	TSNPDCL	105033.00	1780.00	1650.00	1560.00	1440.00	1200.00	1040.00	930.00	840.00	10440.00	115473.00		
	TSSPDCL	225742.80	676.75	1353.49	2030.24	2030.24	676.75	676.75	812.09	1015.12	9271.41	235014.21		
25	TRIPURA	28972.82	1100.00	2600.00	4560.00	3850.00	2020.00	1950.00	2930.00	3500.00	22510.00	51482.82		
	TSECL	28972.82	1100.00	2600.00	4560.00	3850.00	2020.00	1950.00	2930.00	3500.00	22510.00	51482.82		
	Union Territory													
26	Andaman & Nicobar Elect. Dept	3462.88	144.58	0.00	0.00	10.00	0.00	0.00	0.00	0.00	154.58	3617.46		
27	Chandigarh Elect. Dept	1731.01	19.20	15.35	13.95	12.75	10.75	2.18	2.08	3.05	79.30	1810.32		
28	DNH&DDPDCL	2860.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	37.00	2897.00		
29	Delhi	30727.88	808.00	732.00	766.25	809.25	882.50	886.00	895.00	901.00	6680.00	37407.88		
	BRPL	13609.02	507.00	436.00	466.25	500.25	567.50	567.00	567.00	567.00	4178.00	17787.02		
	BYPL	5766.00	111.00	106.00	110.00	114.00	120.00	124.00	128.00	134.00	947.00	6713.00		
	NDMC	4286.73	15.00	15.00	15.00	20.00	20.00	20.00	25.00	25.00	155.00	4441.73		
	TPDDL	7066.13	175.00	175.00	175.00	175.00	175.00	175.00	175.00	175.00	1400.00	8466.13		
30	Jammu & Kashmir	40097.90	781.77	5298.00	5534.49	5354.00	3950.00	2420.00	2450.00	2350.00	28138.26	68236.16		
	JPDC	14275.85	370.00	650.00	850.00	770.00	750.00	720.00	850.00	850.00	5810.00	20085.85		
	KPDCL	25822.05	411.77	4648.00	4684.49	4584.00	3200.00	1700.00	1600.00	1500.00	22328.26	48150.31		
31	Ladakh, Electricity Dept.	3249.10	217.13	521.75	417.40	20.00	15.00	50.00	40.00	30.00	1311.28	4560.38		
32	Lakshadweep Elect. Dept	320.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	128.00	448.00		
33	Puducherry Elect. Dept	4105.22	45.81	30.00	116.80	138.00	138.00	138.00	138.00	138.00	882.61	4987.83		
34	Uttar Pradesh	632196.51	43444.99	51249.49	54225.10	58418.48	63481.46	65856.01	75230.93	87664.85	499571.31	1131767.82		
	DVVNL	111770.58	766.00	769.00	772.00	774.00	777.00	780.00	783.00	785.00	6206.00	117976.58		
	MVVNL	129486.19	24732.05	26243.46	29675.41	33112.44	37917.68	43282.68	50186.23	57901.15	303051.10	432537.29		

Sr. No	State/UTs (Discom/Power Department)	Length(ckm) as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Length (ckm). by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	Pu VVNL	188951.97	7738.97	11537.71	12408.83	13643.09	13987.02	12963.04	15083.37	17375.27	104737.30	293689.27		
	PVVNL	194450.77	10079.93	12093.50	10758.04	10536.04	10615.76	8641.29	8972.33	11391.43	83088.33	277539.10		
	KESCO	4118.00	0.00	525.82	262.91	100.00	100.00	100.00	100.00	100.00	1714.55	5832.55		
	NPCL	3419.00	128.03	80.00	90.00	84.00	84.00	89.00	106.00	112.00	774.03	4193.03		
35	Uttarakhand	41599.20	2550.00	3717.00	3486.00	2530.00	2350.00	2600.00	2750.00	2650.00	22633.00	64232.20		
	UPCL	41599.20	2550.00	3717.00	3486.00	2530.00	2350.00	2600.00	2750.00	2650.00	22633.00	64232.20		
36	West Bengal	249571.00	2398.81	7829.21	1381.67	1382.91	1408.17	1408.17	1541.44	1632.72	18775.36	268346.36		
	WBSEDCL	235615.00	2268.81	7698.00	1248.00	1248.00	1248.00	1272.00	1404.00	1494.00	17700.81	253315.81		
	CSEC	13956.00	130.00	131.21	133.67	134.91	136.17	137.44	137.44	138.72	1074.55	15030.55		
	Grand Total	5714263.28	123803.02	189688.07	168625.95	146325.83	148583.32	163509.94	179205.41	1329319.88	7043583.15			

HT/LTRatio (11kV/LT)

Sr. No	State/UTs (Discom/Power Department)	As on 31.03.2022			As on 31.03.2030		
		HT Length(ckm)	LT Length(ckm)	Ratio	HT Length(ckm)	LT Length(ckm)	Ratio
1	Andhra Pradesh	277509.47	306052.83	0.91	340959.75	418783.02	0.81
	APEPDL	60660.47	86484.72	0.70	72314.75	113153.24	0.64
	APCPDL	77507.00	73946.39	1.05	91543.00	99281.06	0.92
	APSPDL	139342.00	145621.72	0.96	177102.00	206348.72	0.86
2	Arunachal Pradesh	16122.73	8563.42	1.88	22226.48	16485.32	1.35
	Department of Power - Arunachal Pradesh	16122.73	8563.42	1.88	22226.48	16485.32	1.35
3	ASSAM	98001.91	327644.00	0.30	107116.53	350191.25	0.31
	APDCL	98001.91	327644.00	0.30	107116.53	350191.25	0.31
4	Bihar	117209.00	332276.00	0.35	167214.48	408700.36	0.41
	NBPDCL	57821.00	191237.00	0.30	61081.00	233973.90	0.26
	SBPDCL	59388.00	141039.00	0.42	106133.48	174726.46	0.61
5	Chattisgarh	126447.94	217354.74	0.58	162447.94	308006.74	0.53
	CSPDCL	126447.94	217354.74	0.58	162447.94	308006.74	0.53
6	Goa	4984.07	8112.83	0.61	5391.35	10577.92	0.51
	Goa Electricity Department	4984.07	8112.83	0.61	5391.35	10577.92	0.51
7	GUJARAT	474413.27	359978.29	1.32	533657.89	525427.41	1.02
	DGVCL	54660.00	52536.86	1.04	63406.00	158377.75	0.40
	MGVCL	63758.62	72176.34	0.88	65801.12	91408.28	0.72
	PGVCL	231465.60	118688.09	1.95	236726.93	127765.68	1.85
	UGVCL	115990.81	76810.00	1.51	157557.01	88688.00	1.78
	TPL- Ahmedabad	6801.17	39732.00	0.17	7921.17	58282.00	0.14
	TPL-Dahej	75.83	35.00	2.17	107.23	53.70	2.00
	TPL-Dholera	0.00	0.00	0.00	156.00	108.00	1.44
	TPL- Surat	1661.25	0.00	0.00	1982.44	744.00	2.66
8	Haryana	144744.29	125869.73	1.15	167826.34	142162.75	1.18
	DHBVNL	80833.29	68431.73	1.18	90502.29	78068.73	1.16
	UHBVNL	63911.00	57438.00	1.11	77324.05	64094.02	1.21
9	Himachal Pradesh	24836.08	66861.44	0.37	28181.91	83280.71	0.34
	HPSEBL	24836.08	66861.44	0.37	28181.91	83280.71	0.34
10	Jharkhand	72904.00	228681.00	0.32	87259.00	269149.00	0.32
	JBVNL	72904.00	228681.00	0.32	87259.00	269149.00	0.32

Sr. No	State/UTs (Discom/Power Department)	As on 31.03.2022			As on 31.03.2030		
		HT Length(ckm)	LT Length(ckm)	Ratio	HT Length(ckm)	LT Length(ckm)	Ratio
11	Karnataka	504781.28	875518.97	0.58	594962.84	994422.95	0.60
	BESCOM	96322.40	186514.37	0.52	108965.40	202343.01	0.54
	CESCOM	203449.61	370156.56	0.55	234619.61	427175.24	0.55
	GESCOM	73153.00	93470.20	0.78	75190.41	114911.66	0.65
	HESCOM	83636.00	135638.07	0.62	103581.00	137019.26	0.76
	MESCOM	48220.27	89739.77	0.54	72606.42	112973.78	0.64
	Kerala	66485.84	298121.40	0.22	84085.84	322111.40	0.26
	KSEBL	66485.84	298121.40	0.22	84085.84	322111.40	0.26
	Madhya Pradesh	462509.00	522602.00	0.89	512017.98	563231.97	0.91
	MPPKVCL	136119.00	249126.00	0.55	142773.00	249780.97	0.57
12	MPPKVCL EZ	164299.00	145625.00	1.13	191022.00	153544.00	1.24
	MPMKVCL	162091.00	127851.00	1.27	178222.98	159907.00	1.11
	Maharashtra	344603.80	729456.73	0.47	455444.94	801478.73	0.57
	MSEDCL	337352.00	699801.00	0.48	446017.74	763409.00	0.58
	Adani Electricity Mumbai Ltd	3899.00	18266.00	0.21	5666.00	25160.00	0.23
	BEST	2174.00	9148.00	0.24	2212.40	9668.00	0.23
	Tata Power, Mumbai	1178.80	2241.73	0.53	1548.80	3241.73	0.48
	Manipur	7847.00	14058.00	0.56	11141.12	15617.00	0.71
	MSPDCL	7847.00	14058.00	0.56	11141.12	15617.00	0.71
	Meghalaya	16069.00	22256.00	0.72	20505.68	26006.00	0.79
13	MEPDCL	16069.00	22256.00	0.72	20505.68	26006.00	0.79
	Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Department of Power - Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Department of Power - Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Odisha	174503.23	209954.59	0.83	198985.93	234246.63	0.85
	TPCODL	38639.50	50050.08	0.77	55444.14	58550.08	0.95
	TPNODL	37591.00	66672.11	0.56	38951.00	67755.11	0.57
	TPSODL	47180.26	39270.32	1.20	49688.32	51320.86	0.97
	TPWODL	51092.48	53962.08	0.95	54902.48	56620.58	0.97
14	PUNJAB	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	PSPCL	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	Rajasthan	604383.00	541028.00	1.12	770221.20	652505.75	1.18
	AVVNL	161205.00	198570.00	0.81	213210.20	235438.00	0.91
	Department of Power - Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Department of Power - Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Odisha	174503.23	209954.59	0.83	198985.93	234246.63	0.85
	TPCODL	38639.50	50050.08	0.77	55444.14	58550.08	0.95
	TPNODL	37591.00	66672.11	0.56	38951.00	67755.11	0.57
TPSODL	47180.26	39270.32	1.20	49688.32	51320.86	0.97	
TPWODL	51092.48	53962.08	0.95	54902.48	56620.58	0.97	
15	PUNJAB	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	PSPCL	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	Rajasthan	604383.00	541028.00	1.12	770221.20	652505.75	1.18
	AVVNL	161205.00	198570.00	0.81	213210.20	235438.00	0.91
	Department of Power - Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Department of Power - Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Odisha	174503.23	209954.59	0.83	198985.93	234246.63	0.85
	TPCODL	38639.50	50050.08	0.77	55444.14	58550.08	0.95
	TPNODL	37591.00	66672.11	0.56	38951.00	67755.11	0.57
TPSODL	47180.26	39270.32	1.20	49688.32	51320.86	0.97	
TPWODL	51092.48	53962.08	0.95	54902.48	56620.58	0.97	
16	PUNJAB	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	PSPCL	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	Rajasthan	604383.00	541028.00	1.12	770221.20	652505.75	1.18
	AVVNL	161205.00	198570.00	0.81	213210.20	235438.00	0.91
	Department of Power - Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Department of Power - Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Odisha	174503.23	209954.59	0.83	198985.93	234246.63	0.85
	TPCODL	38639.50	50050.08	0.77	55444.14	58550.08	0.95
	TPNODL	37591.00	66672.11	0.56	38951.00	67755.11	0.57
TPSODL	47180.26	39270.32	1.20	49688.32	51320.86	0.97	
TPWODL	51092.48	53962.08	0.95	54902.48	56620.58	0.97	
17	PUNJAB	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	PSPCL	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	Rajasthan	604383.00	541028.00	1.12	770221.20	652505.75	1.18
	AVVNL	161205.00	198570.00	0.81	213210.20	235438.00	0.91
	Department of Power - Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Department of Power - Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Odisha	174503.23	209954.59	0.83	198985.93	234246.63	0.85
	TPCODL	38639.50	50050.08	0.77	55444.14	58550.08	0.95
	TPNODL	37591.00	66672.11	0.56	38951.00	67755.11	0.57
TPSODL	47180.26	39270.32	1.20	49688.32	51320.86	0.97	
TPWODL	51092.48	53962.08	0.95	54902.48	56620.58	0.97	
18	PUNJAB	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	PSPCL	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	Rajasthan	604383.00	541028.00	1.12	770221.20	652505.75	1.18
	AVVNL	161205.00	198570.00	0.81	213210.20	235438.00	0.91
	Department of Power - Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Department of Power - Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Odisha	174503.23	209954.59	0.83	198985.93	234246.63	0.85
	TPCODL	38639.50	50050.08	0.77	55444.14	58550.08	0.95
	TPNODL	37591.00	66672.11	0.56	38951.00	67755.11	0.57
TPSODL	47180.26	39270.32	1.20	49688.32	51320.86	0.97	
TPWODL	51092.48	53962.08	0.95	54902.48	56620.58	0.97	
19	PUNJAB	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	PSPCL	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	Rajasthan	604383.00	541028.00	1.12	770221.20	652505.75	1.18
	AVVNL	161205.00	198570.00	0.81	213210.20	235438.00	0.91
	Department of Power - Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Department of Power - Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Odisha	174503.23	209954.59	0.83	198985.93	234246.63	0.85
	TPCODL	38639.50	50050.08	0.77	55444.14	58550.08	0.95
	TPNODL	37591.00	66672.11	0.56	38951.00	67755.11	0.57
TPSODL	47180.26	39270.32	1.20	49688.32	51320.86	0.97	
TPWODL	51092.48	53962.08	0.95	54902.48	56620.58	0.97	
20	PUNJAB	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	PSPCL	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	Rajasthan	604383.00	541028.00	1.12	770221.20	652505.75	1.18
	AVVNL	161205.00	198570.00	0.81	213210.20	235438.00	0.91
	Department of Power - Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Department of Power - Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Odisha	174503.23	209954.59	0.83	198985.93	234246.63	0.85
	TPCODL	38639.50	50050.08	0.77	55444.14	58550.08	0.95
	TPNODL	37591.00	66672.11	0.56	38951.00	67755.11	0.57
TPSODL	47180.26	39270.32	1.20	49688.32	51320.86	0.97	
TPWODL	51092.48	53962.08	0.95	54902.48	56620.58	0.97	
21	PUNJAB	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	PSPCL	252968.22	152359.00	1.66	301654.32	161451.00	1.87
	Rajasthan	604383.00	541028.00	1.12	770221.20	652505.75	1.18
	AVVNL	161205.00	198570.00	0.81	213210.20	235438.00	0.91
	Department of Power - Mizoram	5585.58	3627.87	1.54	6434.42	3862.87	1.67
	Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Department of Power - Nagaland	6052.00	5763.50	1.05	7214.50	7468.21	0.97
	Odisha	174503.23	209954.59	0.83	198985.93	234246.63	0.85
	TPCODL	38639.50	50050.08	0.77	55444.14	58550.08	0.95
	TPNODL	37591.00	66672.11	0.56	38951.00	67755.11	0.57
TPSODL	47180.26	39270.32	1.20	49688.32	51320.86	0.97	
TPWODL	51092.48	53962.08	0.95	54902.48	56620.58	0.97	

Sr. No	State/UTs (Discom/Power Department)	As on 31.03.2022				As on 31.03.2030			
		HT Length(ckm)	LT Length(ckm)	Ratio	HT Length(ckm)	LT Length(ckm)	Ratio	HT Length(ckm)	
	JdVNL	218287.00	187009.00	1.17	287662.00	232192.75	1.24		
	JVVNL	224891.00	155449.00	1.45	269349.00	184875.00	1.46		
22	Sikkim	3368.00	4606.00	0.73	5632.00	7444.00	0.76		
	SPDCL	3368.00	4606.00	0.73	5632.00	7444.00	0.76		
23	Tamil Nadu	130632.00	616852.28	0.21	166432.00	691538.65	0.24		
	TANGEDCO	130632.00	616852.28	0.21	166432.00	691538.65	0.24		
24	Telangana	202815.87	413751.80	0.49	247424.28	440429.21	0.56		
	TSNPDCL	91498.00	175054.00	0.52	94758.00	192460.00	0.49		
	TSPDCL	111317.87	238697.80	0.47	152666.28	247969.21	0.62		
25	TRIPURA	18886.23	32900.82	0.57	20404.23	56135.82	0.36		
	TSECL	18886.23	32900.82	0.57	20404.23	56135.82	0.36		
	Union Territory								
26	Andaman & Nicobar Elect. Dept	748.08	3462.88	0.22	788.08	3617.46	0.22		
27	Chandigarh Elect. Dept	905.62	3389.81	0.27	981.75	3483.78	0.28		
28	DNH&DDPDCL	1281.32	2860.00	0.45	1310.32	2897.00	0.45		
29	Delhi	17639.73	31079.67	0.57	20572.73	37799.67	0.54		
	BRPL	8344.37	13609.02	0.61	10340.37	17787.02	0.58		
	BYPL	3123.00	5766.00	0.54	3561.00	6713.00	0.53		
	NDMC	1059.24	4286.73	0.25	1183.24	4441.73	0.27		
	TPDDL	5113.11	7417.92	0.69	5488.11	8857.92	0.62		
30	Jammu & Kashmir	40450.78	102581.81	0.39	43593.28	149330.58	0.29		
	JPDCL	24372.27	60145.06	0.41	26757.27	77105.06	0.35		
	KPDCL	16078.51	42436.75	0.38	16836.01	72225.52	0.23		
31	Ladakh, Electricity Dept.	3736.78	3249.10	1.15	4498.20	4560.38	0.99		
32	Lakshadweep Elect. Dept	113.00	320.00	0.35	126.50	448.00	0.28		
33	Puducherry Elect. Dept	2350.91	4105.22	0.57	2429.91	5180.83	0.47		
34	Uttar Pradesh	51359.52	923695.38	0.56	596403.13	1568429.92	0.38		
	DVVNL	147462.59	219158.00	0.67	164804.59	228122.00	0.72		
	MVVNL	140266.92	243688.57	0.58	175421.27	609953.39	0.29		
	PuVVNL	126330.17	250106.05	0.51	135253.31	423992.75	0.32		
	PVVNL	95146.00	203205.76	0.47	115784.27	296336.19	0.39		
	KESCO	1623.00	4118.00	0.39	2005.85	5832.55	0.34		
	NPCL	2710.84	3419.00	0.79	3133.84	4193.03	0.75		
35	Uttarakhand	45708.00	69332.00	0.66	46507.00	91965.00	0.51		
	UPCL	45708.00	69332.00	0.66	46507.00	91965.00	0.51		

Sr. No	State/UTs (Discom/Power Department)	As on 31.03.2022			As on 31.03.2030		
		HT Length(ckm)	LT Length(ckm)	Ratio	HT Length(ckm)	LT Length(ckm)	Ratio
36	West Bengal	150143.86	377431.00	0.40	161524.13	396206.36	0.41
	WBSEDCL	142975.86	363475.00	0.39	151015.86	381175.81	0.40
	CSEC	7168.00	13956.00	0.51	10508.27	15030.55	0.70
	Grand Total	4935279.40	7945758.10	0.62	5903577.97	9774633.62	0.60

ANNEXURE-XII

Capacity (MVAR) of Capacitors

Sr. No	State/UTs (Discom/Power Department)	Capacity as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Capacity by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
1	Andhra Pradesh	4140.04	154.35	187.40	281.25	231.00	129.00	149.00	171.00	198.00	1501.00	5641.04		
	APEPDCL	1056.04	58.35	87.40	201.25	147.00	51.00	86.00	104.00	121.00	856.00	1912.04		
	APCPDCL	884.00	76.00	70.00	50.00	58.00	38.00	42.00	438.00	1322.00				
	APSPDCL	2200.00	20.00	30.00	30.00	26.00	25.00	207.00	2407.00					
2	Arunachal Pradesh	290.72	170.41	299.15	329.40	419.83	485.91	543.20	605.65	3189.53	3480.25			
	Department of Power - Arunachal Pradesh	290.72	170.41	299.15	329.40	419.83	485.91	543.20	605.65	3189.53	3480.25			
3	ASSAM	200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	200.00			
	APDCL	200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	200.00			
4	Bihar	443.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	453.00			
	NBPDCL	252.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	262.00			
	SBPDCL	191.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	191.00			
5	Chattisgarh	666.41	9.27	171.23	161.97	74.03	0.00	0.00	0.00	416.50	1082.91			
	CSPDCL	666.41	9.27	171.23	161.97	74.03	0.00	0.00	0.00	416.50	1082.91			
6	Goa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	Goa Electricity Department	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
7	GUJARAT	4902.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4902.66			
	DGVCL	450.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	450.00			
	MGVCL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	PGVCL	1800.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1800.00			
	UGVCL	1501.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1501.00			
	TPL - Ahmedabad	770.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	770.00			
	TPL - Dahej	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	TPL - Dholera	10.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.66			
	TPL - Surat	371.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	371.00			
8	Haryana	3766.86	438.39	375.69	585.05	535.43	461.27	394.28	281.42	280.62	3352.15	7119.01		
	DHBVNL	1818.32	224.30	165.33	329.67	294.67	238.00	122.00	90.00	109.00	1572.97	3391.29		
	UHBVNL	1948.54	214.09	210.36	255.38	240.76	223.27	272.28	191.42	171.62	1779.18	3727.72		

Sr. No	State/UTs (Discom/Power Department)	Capacity as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Capacity by 2030
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
9	Himachal Pradesh	130.23	32.63	201.62	64.48	67.31	27.89	31.11	33.58	28.58	487.20	617.43		
	HPSEBL	130.23	32.63	201.62	64.48	67.31	27.89	31.11	33.58	28.58	487.20	617.43		
10	Jharkhand	0.00	0.00	38.00	58.00	0.00	0.00	0.00	0.00	96.00	96.00			
	JBVNL	0.00	0.00	38.00	58.00	0.00	0.00	0.00	0.00	96.00	96.00			
11	Karnataka	1827.92	11.60	34.80	156.60	139.20	188.50	52.20	52.20	687.30	2515.22			
	BESCOM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	CESCOM	2.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.98			
	GESCOM	1175.00	2.90	29.00	130.50	130.50	171.10	46.40	46.40	603.20	1778.20			
	HESCOM	314.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	314.69			
	MESCOM	335.26	8.70	5.80	26.10	8.70	17.40	5.80	5.80	84.10	419.36			
12	Kerala	140.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	140.00			
	KSEBL	140.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	140.00			
13	Madhya Pradesh	4318.80	444.00	970.00	1143.00	390.00	0.00	0.00	0.00	2947.00	7265.80			
	MPPKVCL	1218.00	0.00	333.00	389.00	390.00	0.00	0.00	0.00	1112.00	2330.00			
	MPPKVCL_EZ	625.80	273.00	258.00	299.00	0.00	0.00	0.00	0.00	830.00	1455.80			
	MPMKVCL	2475.00	171.00	379.00	455.00	0.00	0.00	0.00	0.00	1005.00	3480.00			
14	Maharashtra	7276.79	197.04	1654.36	3308.12	2.40	2.40	2.40	2.40	5171.52	12448.31			
	MSEDCL	5833.28	162.00	1630.20	3262.20	0.00	0.00	0.00	0.00	5054.40	10887.68			
	Adani Electricity Mumbai Ltd	1006.51	32.64	21.76	43.52	0.00	0.00	0.00	0.00	97.92	1104.43			
	BEST	437.00	2.4	2.4	2.4	2.4	2.4	2.4	2.4	19.20	456.20			
	Tata Power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
15	Manipur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	MSPDCL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
16	Meghalaya	480.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	480.00			
	MEPDCL	480.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	480.00			
17	Mizoram	68.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.00			
	Department of Power - Mizoram	68.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.00			
18	Nagaland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	Department of Power - Nagaland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
19	Odisha	0.00	3.00	67.00	75.00	65.00	70.00	30.00	40.00	380.00	380.00			

Sr. No	State/UTs (Discom/Power Department)	Capacity as on 31.03.2022	Yearly Addition-proposed								Total addition during 2022-30	Expected Capacity by 2030	
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30			
	TPCDDL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TPNODL	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00
	TPSODL	0.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	40.00	40.00
	TPWODL	0.00	55.00	65.00	55.00	60.00	60.00	30.00	30.00	30.00	40.00	335.00	335.00
20	PUNJAB	7614.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7614.00
	PSPCL	7614.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7614.00
21	Rajasthan	384.00	703.14	1521.28	1626.91	1704.60	1240.05	1334.06	1437.47	11623.79	12007.79	2965.00	2965.00
	AVVNL	0.00	465.00	1000.00	750.00	750.00	0.00	0.00	0.00	0.00	0.00	2965.00	2965.00
	JdVVNL	384.00	350.00	350.00	100.00	100.00	300.00	300.00	300.00	2150.00	2534.00	2534.00	2534.00
	JVVNL	0.00	353.14	706.28	776.91	854.60	940.05	1034.06	1137.47	6508.79	6508.79	6508.79	6508.79
22	Sikkim	0.00	0.00	2.00	1.00	0.00	3.00	3.00	2.00	11.00	11.00	11.00	11.00
	SPDCL	0.00	0.00	2.00	1.00	0.00	3.00	3.00	2.00	11.00	11.00	11.00	11.00
23	Tamil Nadu	5083.67	213.45	341.90	284.76	284.00	225.96	242.18	272.61	2208.89	7292.56	7292.56	7292.56
	TANGEDCO	5083.67	213.45	344.03	284.76	284.00	225.96	242.18	272.61	2208.89	7292.56	7292.56	7292.56
24	Telangana	6030.60	182.00	328.00	356.00	382.00	268.20	283.84	303.30	2491.34	8521.94	8521.94	8521.94
	TSNPDCL	3011.60	182.00	288.00	256.00	282.00	230.00	238.00	246.00	1968.00	4979.60	4979.60	4979.60
	TSSPDCL	3019.00	0.00	100.00	100.00	100.00	38.20	45.84	57.30	523.34	3542.34	3542.34	3542.34
25	TRIPURA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TSECL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Union Territory												
26	Andaman & Nicobar Elect. Dept	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	Chandigarh Elect. Dept	129.68	6.97	3.56	3.37	4.08	3.15	3.04	3.38	33.34	163.02	163.02	163.02
28	DNH&DDPDCL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	Delhi	5402.84	118.80	81.00	81.00	86.40	117.00	88.20	102.60	748.80	6151.64	6151.64	6151.64
	BRPL	0.00	86.40	64.80	43.20	43.20	64.80	64.80	64.80	475.20	475.20	475.20	475.20
	BYPL	138.44	10.80	16.20	16.20	21.60	16.20	16.20	16.20	129.60	268.04	268.04	268.04
	NDMC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TPDDL	5264.40	21.60	0.00	21.60	21.60	36.00	7.20	21.60	144.00	5408.40	5408.40	5408.40
30	Jammu & Kashmir	400.60	100.00	548.12	414.40	362.12	170.00	120.00	120.00	2241.80	2642.40	2642.40	2642.40
	JPDCCL	400.60	100.00	340.00	190.00	170.00	170.00	120.00	120.00	1440.00	1840.60	1840.60	1840.60
	KPDCL	0.00	0.00	208.12	224.4	192.12	0.00	0.00	0.00	801.80	801.80	801.80	801.80

Sr. No	State/UTs (Discom/Power Department)	Capacity as on 31.03.2022	Yearly Addition-proposed										Total addition during 2022-30	Expected Capacity by 2030	
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30					
31	Ladakh, Electricity Dept.	37.07	3.09	3.09	3.09	3.09	3.09	3.09	3.09	3.09	3.09	3.09	3.09	24.71	61.78
32	Lakshadweep Elect. Dept	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33	Puducherry Elect. Dept	69.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.00
34	Uttar Pradesh	4210.60	1232.38	1465.81	725.76	1223.59	687.16	706.92	725.02	8029.20	12239.80	27.72	27.72		
	DVVNL	27.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.72
	MVVNL	1227.80	267.85	178.25	113.76	107.76	108.74	212.92	207.74	1402.78	2630.58	205.76	205.76	1402.78	2630.58
	Pu VVNL	1591.11	126.87	453.36	390.08	374.33	362.55	369.14	313.54	2696.57	4287.68	306.70	306.70	2696.57	4287.68
	PVVNL	1152.115	837.66	822.32	210.04	737.54	207.95	116.94	195.82	3870.45	5022.56	742.17	742.17	3870.45	5022.56
	KESCO	211.86	0.00	11.88	11.88	3.96	7.92	7.92	7.92	59.40	271.26	7.92	7.92	59.40	271.26
	NPCL	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	Uttarakhand	1037.40	0.00	0.00	252.20	0.00	0.00	0.00	0.00	252.20	1289.60	0.00	0.00	252.20	1289.60
	UPCL	1037.40	0.00	0.00	252.20	0.00	0.00	0.00	0.00	252.20	1289.60	0.00	0.00	252.20	1289.60
36	West Bengal	204.00	0.00	20.00	31.00	0.00	0.00	0.00	0.00	51.00	255.00	0.00	0.00	51.00	255.00
	WBSEDCL	0.00	0.00	20.00	31.00	0.00	0.00	0.00	0.00	51.00	255.00	0.00	0.00	51.00	255.00
	CSEC	204.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	204.00	0.00	0.00	0.00	204.00
	Grand Total	59254.90	4030.52	8128.08	10577.92	5892.47	4812.34	3882.27	3916.23	45954.27	105209.17	4714.44	4714.44	45954.27	105209.17

ANNEXURE-XIII

Sr. No	State/UTs (Discom/Power Department)	SCADA						RT-DAS					
		Till 2021-22			Till 2029-30			Till 2021-22			Till 2029-30		
		Total number of Towns with SCADA	Total number of Sub-stations covered	Total number of Towns with SCADA	Total number of Sub-stations covered	Total number of Towns with SCADA	Total number of Sub-stations covered	Total number of Towns with RT-DAS	Total number of Sub-stations covered	Total number of Towns with RT-DAS	Total number of Sub-stations covered		
1	Andhra Pradesh	7	70	46	404	6	13	13	67	10	67	67	
	APEPDCL	6	13	7	67	6	13	6	109	0	0	0	
	APCPDCL	0	44	0	109	0	228	0	44	0	17	17	
	APSPDCL	1	13	39	228	0	44	0	17	0	17	17	
2	Arunachal Pradesh	0	0	22	44	0	44	0	44	7	17	17	
	Department of Power - Arunachal Pradesh			22	44	0	44	0	44	7	17	17	
3	ASSAM	1	6	8	140	90	118	90	118	90	118	118	
	APDCL	1	6	8	140	90	118	90	118	90	118	118	
4	Bihar	0	0	0	0	0	0	0	0	0	0	0	
	NBPDCL			0	0	0	0	0	0	0	0	0	
	SBPDCL			0	0	0	0	0	0	0	0	0	
5	Chattisgarh	2	99	2	99	0	99	0	99	0	0	0	
	CSPDCL	2	99	2	99	0	99	0	99	0	0	0	
6	Goa	0	3	22	77	0	77	0	77	14	75	75	
	Goa Electricity Department			22	77	0	77	0	77	14	75	75	
7	GUJARAT	10	209	111	1447	1	1447	1	1447	1	1308	1308	
	DGVCL	1	24	1	47	0	47	0	47	0	0	0	
	MGVCL	1	20	45	70	0	70	0	70	0	0	0	
	PGVCL	3	32	3	157	0	157	0	157	0	0	0	
	UGVCL	1	19	41	104	0	104	0	104	0	0	0	
	TPL-Ahmedabad	2	77	18	800	0	800	0	800	0	0	0	
	TPL-Dahej	1	20	1	31	0	31	0	31	0	0	0	
	TPL-Dholera	0	0	1	217	0	217	0	217	0	0	0	
	TPL-Surat	1	17	1	21	1	21	1	21	1	1308	1308	

Sr. No	State/UTs (Discom/Power Department)	SCADA						RT-DAS			
		Till 2021-22			Till 2029-30			Till 2021-22		Till 2029-30	
		Total number of Towns with SCADA	Total number of Sub-stations covered	Total number of Towns with SCADA	Total number of Sub-stations covered	Total number of Towns with RT-DAS	Total number of Sub-stations covered	Total number of Towns with RT-DAS	Total number of Sub-stations covered		
8	Haryana	1	3	42	409	174	765	174	1256		
	DHBVNL	0	0	6	164	43	152	43	643		
	UHBVNL	1	3	36	245	131	613	131	613		
9	Himachal Pradesh	12	87	51	194	12	32	13	34		
	HPSEBL	12	87	51	194	12	32	13	34		
10	Jharkhand	3	0	40	54	0	0	0	0		
	JBVNL	3	0	40	54	0	0	0	0		
11	Karnataka	33	33	256	278	1	113	1	113		
	BESCOM	0	0	0	0	1	113	1	113		
	GESCOM	0	0	0	0	0	0	0	0		
	GESCOM	0	0	192	208	0	0	0	0		
	HESCOM	0	0	0	0	0	0	0	0		
	MESCOM	33	33	64	70	0	0	0	0		
12	Kerala	3	50	60	258	63	124	63	124		
	KSEBL	3	50	60	258	63	124	63	124		
13	Madhya Pradesh	5	301	118	557	108	196	108	1318		
	MPPKVVCL	2	92	111	322	0	0	0	0		
	MPPKVVCL_EZ	1	47	3	55	0	0	0	0		
	MPMKVVCL	2	162	4	180	108	196	108	1318		
14	Maharashtra	9	315	10	889	2	463	2	7000		
	MSEDCL	8	283	8	784	0	0	0	3257		
	Adani Electricity Mumbai Ltd	0	0	0	0	0	0	0	0		
	BEST	1	32	2	105	1	0	1	3040		
	Tata Power	0	0	0	0	1	463	1	703		
15	Manipur	0	0	0	0	0	0	0	0		
	MSPDCL	0	0	0	0	0	0	0	0		
16	Meghalaya	0	0	0	19	0	0	0	0		
	MEPDCL	0	0	0	19	0	0	0	0		
17	Mizoram	1	2	2	16	21	34	29	70		

Sr. No	State/UTs (Discom/Power Department)	SCADA				RT-DAS			
		Till 2021-22		Till 2029-30		Till 2021-22		Till 2029-30	
		Total number of Towns with SCADA	Total number of Sub-stations covered	Total number of Towns with SCADA	Total number of Sub-stations covered	Total number of Towns with RT-DAS	Total number of Sub-stations covered	Total number of Towns with RT-DAS	Total number of Sub-stations covered
29	Delhi	1	63	1	71	1	200	1	1003
	BRPL			0	0			0	0
	BYPL	1	63	1	71	1	200	1	1003
	NDMC			0	0			0	0
	TPDDL			0	0			0	0
30	Jammu & Kashmir	1	54	5	304	54	54	112	388
	JPDCL	1	54	5	304	54	54	112	388
	KPDCL			0	0			0	0
31	Ladakh, Electricity Dept.	0	0	0	0	0	0	2	28
32	Lakshadweep Elect. Dept	0	0	0	0	0	0	0	0
33	Puducherry Elect. Dept	1	5	1	5			0	0
34	Uttar Pradesh	2	52	49	1938	221	969	243	3377
	DVVNL			0	0			0	0
	MVVNL	0	0	37	1350	62	222	62	2528
	Pu VVNL	1	0	7	152	23	172	45	274
	PVVNL	0	0	3	248	135	497	135	497
	KESCO	0	0	1	104	1	78	1	78
	NPCL	1	52	1	84			0	0
35	Uttarakhand	1	23	20	160	66	106	66	372
	UPCL	1	23	20	160	66	106	66	372
36	West Bengal	0	0	0	0	0	0	0	0
	WBSEDCL			0	0			0	0
	CSEC	0		0	0			0	0
	Grand Total	246	4744	2766	27078	1788	7734	2190	34740

AT&C Loss (%)

Sr. No	State/UTs (Discom/Power Department)	AT&C loss as on 31.03.2022	Yearly Addition-proposed																	
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30										
1	Andhra Pradesh																			
			APEPDCL	7.77%	12.00%	11.00%	9.01%	8.55%	8.50%	8.30%	8.10%									
			APCPDCL	10.03%	14.13%	11.54%	10.83%	10.09%	9.83%	9.49%	9.10%									
2	Arunachal Pradesh																			
			APSPDCL	13.58%	20.01%	15.00%	12.78%	12.75%	12.65%	12.55%	12.46%									
			Department of Power - Arunachal Pradesh	48.89%	35.00%	28.00%	22.00%	21.36%	18.36%	15.36%	12.36%									
3	ASSAM																			
			APDCL	16.95%	16.55%	15.80%	13.00%	12.95%	12.60%	12.40%	12%									
4	Bihar																			
			NBPDCL	28.90%	22.00%	19.00%	16.00%	15.50%	15.25%	15.00%	14.50%									
			SBPDCL	35.27%	31.00%	25.00%	20.00%	19.50%	18.50%	17.00%	16.50%									
5	Chattisgarh																			
			CSPDCL	18.13%	15.90%	14.32%	13.10%	13.10%	13.10%	13.10%	13.10%									
6	Goa																			
			Goa Electricity Department	13.28%	12.00%	11%	10.25%	10.00%	9.50%	9.25%	9.00%									
7	GUJARAT																			
			DGVCL	4.75%	7.90%	7.80%	7.70%	7.10%	7.05%	7%	6.95%									
			MGVCL	8.73%	10.31%	9.81%	9.31%	9.06%	8.81%	8.56%	8.31%									
			PGVCL	16.70%	17.22%	16.22%	15%	14.50%	13.50%	13%	12.50%									
			UGVCL	6.71%	7.30%	7.25%	7.20%	7.10%	7.05%	7%	6.95%									
			TPL - Ahmedabad		6.24%	6.24%	6.24%	6.24%	6.24%	6.24%	6.24%									
			TPL - Dahej		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%									
TPL - Dholera		2.49%	2.49%	2.49%	2.49%	2.49%	2.49%	2.49%												
8	Haryana																			
			TPL - Surat	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%									
			DHBVNL	13.55%	14.50%	13.50%	12.50%	11.75%	11.50%	11.25%	11.00%									
9	Himachal Pradesh																			
			UHBVNL	13.96%	14.50%	13.50%	12.5%	11.75%	11.50%	11.25%	11.00%									
10	Jharkhand																			
			HPSEBL	12.90%	12.70%	11.53%	10.15%	10.10%	9.95%	9.85%	9.75%									

Sr. No	State/UTs (Discom/Power Department)	AT&C loss as on 31.03.2022	Yearly Addition-proposed							
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
11	JBVNL	33.79%	30.00%	24.00%	19.00%	17.00%	15.00%	12.00%	11.00%	10.00%
	Karnataka									
	BESCOM	11.23%	11.96%	11.71%	11.68%	11.20%	10.50%	10.25%	10%	
	CESCOM	11.32%	18.44%	17.93%	17.42%	16.90%	16.38%	15.86%	15.34%	
	GESCOM	10.54%	10.40%	10.35%	10.30%	10.25%	10.20%	10.15%	10.10%	
	HESCOM	13.50%	13.50%	12.90%	12.20%	11.70%	11.20%	10.70%	10.20%	
MESCOM	9.02%	11.30%	10%	10%	10%	10%	10%	10%		
12	Kerala									
	KSEBL	7.69%	11.50%	10.50%	10.10%	9.62%	9.50%	9.40%	9.30%	
13	Madhya Pradesh									
	MPPKVVCL	11.61%	16.09%	13.40%	13.40%	13.40%	13.40%	13.40%	13.40%	
	MPPKVVCL_EZ	30.98%	24.27%	19.49%	17%	16%	15%	15%	14%	
	MPMKVVCL	26.40%	26.99%	19.57%	19.02%	18.50%	18.20%	18%	17.80%	
14	Maharashtra									
	MSEDCL	15.46%	15.50%	13.00%	12.80%	12.60%	12.50%	12.30%	12.10%	
	Adani Electricity Mumbai Ltd	6.75%	6.80%	6.55%	6.45%	6.35%	6.25%	6.15%	6.05%	
	BEST	8.41%	7.60%	7.50%	6.45%	6.42%	6.40%	6.37%	6.35%	
15	Tata Power, Mumbai	2.07%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	
	Manipur									
	MSPDCL	23.62%	17.00%	15.00%	14.75%	14.50%	14.25%	14.00%	13.75%	
	Meghalaya									
16	MEPDCL	27.30%	21.00%	18.00%	17.50%	17.00%	16.50%	16.00%	15.50%	
	Mizoram									
	Department of Power - Mizoram	36.23%	17.50%	14.00%	13.90%	13.80%	13.70%	13.60%	13.50%	
	Nagaland									
17	Department of Power - Nagaland	41.28%	34.00%	25.60%	25%	24.60%	24.30%	24.10%	24%	
	Odisha									
	TPCODL	33.54%	21.98%	20.19%	18.69%	17.39%	16.39%	15.64%	15.14%	
	TPNODL	27.13%	20.80%	17.80%	15.50%	12.50%	12.40%	12.30%	12.20%	
	TPSODL	34.26%	32.80%	30%	26.75%	22%	20.00%	18.00%	15.00%	
	TPWODL	30.20%	22.50%	20.50%	18.50%	14.50%	12.50%	11.00%	9.50%	
18	PUNJAB									
	PSPCL	11.67%	15.00%	13.50%	13.30%	13.10%	12.90%	12.70%	12.50%	

Sr. No	State/UTs (Discom/Power Department)	AT&C loss as on 31.03.2022	Yearly Addition-proposed									
			2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30		
	Pu VVNL	40.33%	27.84%	22.75%	18.49%	15.46%	13.44%	11.03%	9.62%	8.54%		
	PVVNL	22.29%	17.41%	15.06%	12.69%	17.87%	16.14%	14.54%	12.80%	11.86%		
	KESCO	15.54%	13.49%	10.65%	8.07%	8.07%	8.07%	8.07%	8.07%	8.07%		
	NPCL	8.50%	7.98%	7.90%	7.80%	7.75%	7.70%	7.65%	7.60%	7.55%		
35	Uttarakhand											
	UPCL	14.15%	16.10%	14.99%	13.96%	13.50%	13.30%	13.10%	13.00%	12.75%		
36	West Bengal											
	WBSIEDCL	16.67%	17.50%	15.50%	12.11%	12.10%	12.00%	11.90%	11.80%	11.70%		
	CSEC	8.10%	8.05%	8.00%	7.95%	7.90%	7.85%	7.80%	7.75%	7.70%		

ANNEXURE-XV

No of Consumers

Sr. No	State/UTs (Discom/Power Department)	Existing Consumer as on 31.03.2022	Metered Consumer	Yearly Addition-proposed											Total addition during 2022-30	Expected No of Consumers by 2030
				2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30					
1	Andhra Pradesh	18629331	17173824	814548	848649	907159	867130	1007414	907754	1036880	1087600	7477134	26106465			
	APEPDCL	6641855	6479621	398997	413663	452019	438216	436184	449657	459282	480430	3528448	10170303			
	APCPDCL	5189123	4971220	212371	220755	229135	190361	319289	211605	353742	371571	2108829	7297952			
	APSPDCL	6798353	5722983	203180	214231	226005	238553	251941	246492	223856	235599	1839857	8638210			
2	Arunachal Pradesh	295744	161986	8837	9105	11872	9746	10010	10311	10622	10622	81125	376869			
	Department of Power - Arunachal Pradesh	295744	161986	8837	9105	11872	9746	10010	10311	10622	10622	81125	376869			
3	ASSAM	6317736	6317736	435197	460826	118426	198903	179145	192572	135162	132290	1852521	8170257			
	APDCL	6317736	6317736	435197	460826	118426	198903	179145	192572	135162	132290	1852521	8170257			
4	Bihar	17919402	1777661	1053889	627219	651345	652900	378821	445370	516991	590230	4916765	22836167			
	NBPDCL	11382946	11376812	587334	504874	498093	468741	156850	177085	191922	195474	2780373	14163319			
	SBPDCL	6536456	6400849	466555	122345	153252	184159	221971	268285	325069	394756	2136392	8672848			
5	Chattisgarh	6025930	6025930	337034	358931	350390	456628	434384	462913	493427	506368	3400075	9426005			
	CSPDCL	6025930	6025930	337034	358931	350390	456628	434384	462913	493427	506368	3400075	9426005			
6	Goa	680292	680292	16507	22183	23126	24108	25187	26327	27528	28829	193795	874087			
	Goa Electricity Department	680292	680292	16507	22183	23126	24108	25187	26327	27528	28829	193795	874087			
7	GUJARAT	19744861	19251353	3816640	3872149	3929673	3982929	4051419	4116201	4183854	4254625	32213853	51958714			
	DGVCL	3507119	3464417	106201	111716	117751	124369	131640	139665	148523	158340	1038205	4545324			
	MGVCL	3922352	3896870	3444722	3479999	3515639	3551641	3588013	3624759	3661879	3699377	28566029	32488381			
	PGVCL	5712645	5456481	103312	113646	125010	137511	151261	166386	183026	201328	1181480	6894125			
	UGVCL	3936861	3767701	118107	121650	125298	129059	132929	136917	141025	145258	1050243	4987104			
	TPL- Ahmedabad	2038912	2038912	33048	33626	34222	34828	35447	36081	36730	37393	281375	2320287			
	TPL-Dahej	111	111	0	0	0	0	0	0	0	0	0	111			
	TPL-Dholera	0	0	0	55	87	47	70	100	140	153	652	652			
	TPL- Surat	626861	626861	11250	11457	11666	11837	12059	12293	12531	12776	95869	722730			
8	Haryana	7382836	7159602	336621	343427	359527	374416	391128	410704	431689	448625	3096137	10478973			
	DHBVNL	3960463	3873024	198289	199126	208993	217369	227278	239746	253302	262478	1806581	5767044			

Sr. No	State/UTs (Discom/Power Department)	Existing Consumer as on 31.03.2022	Metered Consumer	Yearly Addition-proposed										Total addition during 2022-30	Expected No of Consumers by 2030
				2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	UHBVNL	3422373	3286578	138332	144301	150534	157047	163850	170958	178387	186147	1289556	4711929		
9	Himachal Pradesh	2499965	2499965	200896	148789	163302	166033	168800	147734	152104	158117	1305775	3805740		
10	Jharkhand	5102349	4740753	352518	385563	296998	250846	197344	203572	210007	216649	2113497	7215846		
	JBVNL	5102349	4740753	352518	385563	296998	250846	197344	203572	210007	216649	2113497	7215846		
11	Karnataka	26243311	23296870	1000646	1143237	1248457	1314515	1389495	1480886	1547885	1620907	10746028	36989339		
	BESCOM	10974599	10037644	526781	592628	632135	671645	711155	763831	790171	816510	5504856	16479455		
	CESCOM	3583588	3147531	97005	129687	140383	140383	146805	153585	158978	166528	1133354	4716942		
	GESCOM	3456904	2838684	81384	84025	86761	89598	92535	95585	98746	102029	730663	4187567		
	HESCOM	5663978	4820953	234589	274288	324786	346654	370861	397773	427835	461575	2838361	8502339		
	MESCOM	2564242	2452058	60887	62609	64392	66235	68139	70112	72155	74265	538794	3103036		
12	Kerala	13422642	13422642	301140	301140	301140	301140	301140	301140	301140	301140	2409120	15831762		
	KSEBL	13422642	13422642	301140	301140	301140	301140	301140	301140	301140	301140	2409120	15831762		
13	Madhya Pradesh	17118019	13096010	621684	686835	697680	709068	721028	733596	746818	760721	5677430	22795449		
	MPPKVVCL	5794529	4405146	141450	146303	151378	156690	162253	168086	174214	180645	1281019	7075548		
	MPPKVVCL_EZ	6409597	4965999	418513	418513	418513	418513	418513	418513	418513	418513	3348104	9757701		
	MPMKVVCL	4913893	3724865	61721	122019	127789	133865	140262	146997	154091	161563	1048307	5962200		
14	Maharashtra	33147490	31586961	1176133	1197773	1219837	1241551	1264518	1288819	1312689	1337036	10038356	43185846		
	MSEDCL	28867787	27307258	1074853	1096350	1118277	1140643	1163454	1186725	1210459	1234667	9225428	38093215		
	Adani Electricity Mumbai Ltd	2508709	2508709	76183	76183	76183	76183	76183	76183	76183	76183	609464	3118173		
	BEST	1028922	1028922	3982	4125	4262	3610	3766	4796	4932	5071	34544	1063466		
	Tata Power, Mumbai	742072	742072	21115	21115	21115	21115	21115	21115	21115	21115	168920	910992		
15	Manipur	506202	464533	10653	6375	6733	7114	7534	7994	8492	9037	63932	570134		
	MSPDCL	506202	464533	10653	6375	6733	7114	7534	7994	8492	9037	63932	570134		
16	Meghalaya	402202	283561	53532	66080	46538	42278	31467	31377	22186	26409	319867	722069		
	MEPDCL	402202	283561	53532	66080	46538	42278	31467	31377	22186	26409	319867	722069		
17	Mizoram	276328	275294	12338	12891	13274	11587	9950	7689	5901	3711	77341	353669		
	Department of Power - Mizoram	276328	275294	12338	12891	13274	11587	9950	7689	5901	3711	77341	353669		
18	Nagaland	317210	235361	15861	16700	17537	18417	19342	20313	21494	22404	152068	469278		

Sr. No	State/UTs (Discom/Power Department)	Existing Consumer as on 31.03.2022	Metered Consumer	Yearly Addition-proposed										Total addition during 2022-30	Expected No of Consumers by 2030
				2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30				
	Department of Power - Nagaland	317210	235361	15861	16700	17537	18417	19342	20313	21494	22404	152068	469278		
19	Odisha	9491485	9332282	2811040	2893083	2986344	3080244	3174858	3269472	3367381	3466969	25049391	34540876		
	TPCODL	2927466	2915624	173906	184376	195473	207251	219734	232217	244700	257183	1714840	4642306		
	TPNODL	2089083	2010757	101122	92578	94625	96630	98644	100658	102713	102959	789929	2879012		
	TPSODL	2386112	2386112	2466229	2546346	2626463	2706580	2786697	2866814	2950185	3037044	21986358	24372470		
	TPWODL	2088824	2019789	69783	69783	69783	69783	69783	69783	69783	69783	558264	2647088		
20	PUNJAB	10180349	8802804	152527	154814	157139	159493	161885	164313	166777	169281	1286229	11466578		
	PSPCL	10180349	8802804	152527	154814	157139	159493	161885	164313	166777	169281	1286229	11466578		
21	Rajasthan	15013822	14965337	653876	584372	592107	649849	710959	784236	858820	918871	5753090	20766912		
	AVVNL	5431063	5428935	217019	108613	162924	217233	271546	325855	380167	434477	2117834	7548897		
	JVVNL	4543999	4509906	223206	213606	153923	143592	135938	139734	144071	133081	1287151	5831150		
	JVVNL	5038760	5026496	213651	262153	275260	289024	303475	318647	334582	351313	2348105	7386865		
22	Sikkim	119203	111877	2385	2624	2742	2265	1941	1669	1431	1312	16369	135572		
	SPDCL	119203	111877	2385	2624	2742	2265	1941	1669	1431	1312	16369	135572		
23	Tamil Nadu	32454287	30188142	910358	938247	966266	993279	991787	1019187	1049145	1097600	7965869	40420156		
	TANGEDCO	32454287	30188142	910358	938247	966266	993279	991787	1019187	1049145	1097600	7965869	40420156		
24	Telangana	15945505	13352188	499510	504250	509165	514162	518915	523635	529560	534620	4133817	20079322		
	TSNPDCL	6349628	5098835	199510	204250	209165	214162	218915	223635	229560	234620	1733817	8083445		
	TSSPDCL	9595877	8253353	300000	300000	300000	300000	300000	300000	300000	300000	2400000	11995877		
25	TRIPURA	953217	951217	53532	66080	46538	42278	31467	31377	22186	26409	319867	1273084		
	TSECL	953217	951217	53532	66080	46538	42278	31467	31377	22186	26409	319867	1273084		
	Union Territory														
26	Andaman & Nicobar Elect. Dept	146171	146171	5847	5313	5305	5681	5971	5893	6070	6149	46229	192400		
27	Chandigarh Elect. Dept	260305	260305	4723	3906	3805	3956	3906	149	161	155	20761	281066		
28	DNH&DDPDCL	154776	154776	5930	6337	6653	6986	7338	7709	8101	8515	57569	212345		
29	Delhi	6657194	6657194	2168786	2275752	2388027	2506074	2629898	2759932	2896498	3039978	20664945	27322139		
	BRPL	2874519	2874519	121793	127202	132869	138920	145207	151827	158835	166255	1142908	4017427		
	BYPL	1829109	1829109	54914	56871	58902	61090	63329	65680	68123	70712	499621	2328730		
	NDMC	56455	56455	113	113	113	114	114	114	114	115	910	57365		
	TPDDL	1897111	1897111	1991966	2091566	2196143	2305950	2421248	2542311	2669426	2802896	19021506	20918617		

Sr. No	State/UTs (Discom/Power Department)	Existing Consumer as on 31.03.2022	Metered Consumer	Yearly Addition-proposed									Total addition during 2022-30	Expected No of Consumers by 2030
				2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30			
30	Jammu & Kashmir	2203677	1080298	70609	78370	87217	95376	104425	83411	85171	87291	691870	2895547	
	JPDC	1107697	748131	15810	20830	26800	31940	38450	14800	14500	14500	177630	1285327	
	KPDC	1095980	332167	54799	57540	60417	63436	65975	68611	70671	72791	514240	1610220	
31	Ladakh, Electricity Dept.	59634	58812	1226	1257	1301	1340	1399	1453	1520	1588	11084	70718	
32	Lakshadweep Elect. Dept	26449	26449	960	1037	1125	1218	1326	997	1039	1089	8791	35240	
33	Puducherry Elect. Dept	488010	481803	24401	25621	25682	25685	25685	25685	25685	25685	204126	692136	
34	Uttar Pradesh	31434834	29895544	2451133	2171533	2307876	2468819	2662903	2798863	3109000	3487137	21457264	52892098	
	DVVNL	6407148	6376260	511189	524097	572179	626014	686697	755669	834870	926970	5437685	11844833	
	MVVNL	8561675	8326160	453150	489140	520874	557666	601819	657006	729109	827584	4836348	13398023	
	Pu VVNL	8980771	8585821	917681	587554	631857	685109	752115	840899	964922	1146836	6526973	15507744	
	PVVNL	6694682	5819235	520220	504459	527372	558395	577907	497944	529509	531624	4247430	10942112	
	KESCO	672805	672805	31432	36764	22228	22899	23582	24292	25021	25770	211988	884793	
	NPCL	117753	115263	17461	29519	33366	18736	20783	23053	25569	28353	196840	314593	
35	Uttarakhand	2800214	2800214	136707	143629	150879	158659	165132	173619	182598	192104	1303327	4103541	
	UPCL	2800214	2800214	136707	143629	150879	158659	165132	173619	182598	192104	1303327	4103541	
36	West Bengal	25083088	25083088	880734	1002249	1160380	1315171	1476751	1633293	1719813	1916118	11104509	36187597	
	WBSEDCL	21499052	21499052	782234	901042	1056392	1208325	1366773	1520493	1603913	1797033	10236205	31735257	
	CSEC	3584036	3584036	98500	101207	103988	106846	109978	112800	115900	119085	868304	4452340	
	Grand Total	329504070	308798835	21401006	21368134	21764329	22670093	23269776	24086595	25203252	26504657	186267876	515771946	

Acronyms

ABC	Aerial Bunched Cable
ACS	Average Cost of Supply
ADB	Asian Development Bank
ADMS	Automatic Demand Management System
ADR	Automatic Demand Response
AMI	Advanced Metering Infrastructure
AMR	Automatic Meter Reading
APDRP	Accelerated Power Development and Reforms Programme
APFC	Automatic Power Factor Correction
ARR	Annual Revenue Requirement
AT&C	Aggregate Technical and Commercial
CAGR	Compound Annual Growth Rate
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CGS	Central Generating Stations
CRM	Customer Relationship Management
DA	Distribution Automation
DCU	Data Concentrator Unit
DDUGJY	Deen Dayal Upadhyaya Gram Jyoti Yojana
DEEP	Discovery of Efficient Electricity Price
DER	Distributed Energy Resources
DISCOM	Distribution Company
DMS	Distribution Management System
DPP	Distribution Perspective Plan
DR	Demand Response
DSM	Demand Side Management
DT	Distribution Transformer

EESL	Energy Efficiency Services Limited
EPS	Electric Power Survey
ERP	Enterprise Resource Planning
ESCO	Energy Service Company
EV	Electric Vehicle
FI	Financial Institution
GIS	Gas Insulated Substation
GPRS	General Packet Radio Service
GPS	Global Positioning System
HT	High Tension
HVDS	High Voltage Distribution System
IED	Intelligent Electronic Device
IPDS	Integrated Power Development Scheme
IT	Information Technology
JICA	Japanese International Cooperation Agency
LT	Low Tension
MDMS	Meter Data Management System
MSDE	Ministry of Skill Development Enterprise
MU	Million Unit
MW	Mega Watt
NEF	National Electricity Fund
O&M	Operation and Maintenance
OFC	Optical Fibre Communication
OMS	Outage Management System
PFA	Power For All
PFC	Power Finance Corporation
PLC	Programmable Logic Controller
PMKVY	Pradhan Mantri Kaushal Vikash Yojana
PPP	Private Public Partnership

PSDF	Power System Development Fund
RAPDRP	Restructured Accelerated Power Development and Reforms Programme
RDSS	Revamped Distribution Sector Scheme
REC	Rural Electrification Corporation
RF	Radio Frequency
RMU	Ring Main Unit
RPO	Renewable Purchase Obligation
SAS	Substation Automation System
SAUBHAGYA	Pradhan Mantri Sahaj Bijli Har Ghar Yojana
SCADA	Supervisory Control and Data Acquisition
SERC	State Electricity Regulatory Commission
SLDC	State Load Despatch Centre
SOP	Standard of Performance
T&D	Transmission and Distribution
TBCB	Tariff Based Competitive Bidding
ToD	Time of Day
UDAY	Ujwal DISCOM Assurance Yojana
UT	Union Territory
