Andhra Pradesh
Electricity Regulatory Commission

4th Floor, Singareni Bhavan, Red Hills, Lakdi-ka-pul, Hyderabad 500004.

ORDER

In the matter of

Approval of Load Forecasts and Resource Plans
(Distribution Plans, Power Procurement Plans & Transmission Plans),
comments on the State Electricity Plan for the
4th Control Period (FY2019-20 to FY2023-24)
and Indicative Forecasts & Plans for the
5th Control Period (FY2024-25 to FY2028-29)

In respect of
Transmission Corporation of A.P.LTD.
(APTRANSCO)
Eastern Power Distribution Company of A.P. LTD.
(APEPDCL)
Southern Power Distribution Company of A.P. LTD.
(APSPDCL)

15th April, 2019

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ANDHRA PRADESH ELECTRICITY REGULATORY COMMISSION

4th Floor, Singareni Bhavan, Red Hills, Hyderabad 500004

MONDAY, THE FIFTEENTH DAY OF APRIL
TWO THOUSAND AND NINETEEN

Present

Justice G. Bhavani Prasad, Chairman

Dr. P. Raghu, Member

Sri P. Rama Mohan, Member

In the matter of

Approval of detailed Load Forecasts and Resource Plans (Distribution Plans, Power Procurement Plans & Transmission Plans) of AP DISCOMs & AP TRANSCO respectively and comments on the State Electricity Plan of AP TRANSCO for the 4th Control Period (FY2019-20 to FY2023-24) and Indicative Forecasts & Plans for the 5th Control Period (FY2024-25 to FY2028-29)

PREFACE

The Andhra Pradesh Electricity Regulatory Commission promulgated the guidelines for Load Forecasts, Resource Plans and Power Procurement Plan in December, 2006 in the place of earlier guidelines in existence. The Andhra Pradesh Electricity Regulatory Commission (Terms and Conditions for Determination of Tariff for Wheeling and Retail Sale of Electricity) Regulation, 4 of 2005 made it mandatory by Clause 9 the filing of a resource plan containing the Sales Forecast, Load Forecast, Power Procurement Plan and a Distribution Plan (Capital Investment Plan) by the Distribution Licensee before the Commission which is consistent with the Commission's guidelines on Load Forecast and Resource Plan as amended from time to time. Clause 9.2 further mandates that the Commission shall approve the Resource

Plan as per the Guidelines and the Distribution Licensee shall adopt them in the Multi-Year and Annual filings for the Control Period. As per Clause 16 of the Regulation, the Commission has to adopt the Capital Investment Plan as part of the Resource Plan in terms of Clause 9 for determining the Regulated Rate Base (RRB). The Andhra Pradesh Electricity Regulatory Commission (Terms and Conditions for Determination of Transmission Tariff) Regulation 5 of 2005, in Clause 9, similarly made it mandatory for the Transmission Licensee to file a Resource Plan before the Commission which contains the Load Forecast and a Transmission Plan (Capital Investment Plan) consistent with the requirements of the Guidelines on Load Forecast and Resource Plan as approved by the Commission from time to time. Clause 9.2 lays down that the Commission shall approve the Resource Plan as per the Guidelines and the Transmission Licensee shall adopt them in the Multi-Year filings for the Control Period. Clause 14 of the Regulation mandates the Commission to adopt the Capital Investment Plan approved as part of the Resource Plan in terms of clause 9 for determining the Regulated Rate Base (RRB). The Andhra Pradesh Electricity Regulatory Commission(Terms and Conditions for determination of tariff for supply of electricity by a generating company to a distribution licensee and purchase of electricity by distribution licensees) Regulation, 1 of 2008 directs in Clause 3, the Distribution Licensee to prepare a Power Procurement Plan as per the Commission's Guidelines on Load Forecasts, Resource Plans and Power Procurement to be submitted for the Commission's approval as specified in Clause 9 of Regulation 4 of 2005. The Andhra Pradesh Electricity Regulatory Commission (Distribution License) Regulation, 10 of 2013 provided in Clause 35 that the Distribution Licensee shall prepare year-wise demand forecast for two control periods in accordance with the guidelines/regulations issued by the Commission from time to time and the Distribution Licensees shall also submit prospective power procurement plan and Distribution Plan. Clause 37 of the Regulation provides for the Licensees submitting long term investment plan for 10 years including detailed investment plan for 5 years, year by year in accordance with Load Forecast and Demand Forecast.

2. This Commission after its constitution in 2014, found in the course of review of various aspects of the functioning of the Commission that the Guidelines on Load Forecasts, Resource Plans and Power Procurement issued by the Commission in 2006 and the corresponding provisions of the above referred to regulations appeared to have been observed only in breach and not in compliance and desired the Licensees to comply with the requirement of submitting detailed and indicative forecasts and plans

for the 3rd and 4th Control Periods in compliance with the guidelines and the Regulations. The proceedings for approval of such forecasts and plans in detail for the 3rd Control Period and indicatively for the 4th Control Period were prolonged beyond the expiry of the 3rd Control Period and hence those proceedings were closed as superfluous and *infructuous* by efflux of time. However, an identical exercise in respect of the 4th Control Period in detail and the 5th Control Period indicatively initiated on time has resulted in the appropriate filings being made by 01.08.2018 and the public consultation process commenced from 06.10.2018. Sri K. Gopal Choudary, Advocate, was requested by the Commission to assist in the matter as an *Amicus Curiae* for which he has graciously consented and lent his expertise and experience in collecting, consolidating and refining all the required data and information. The views of the various stakeholders received in writing and orally during public hearings, the responses of the licensees to the same and the research and study by the officers of the Commission formed part of the comprehensive consideration. The contribution of Sri K. Gopal Choudary, learned *Amicus Curiae* and Sri P. Shiva Rao, learned Standing Counsel for the licensees to the deliberations apart from the submissions of Sri M. Venugopala Rao and Sri M. Thimma Reddy and other learned objectors needs to be placed on record with appreciation. The devotion and commitment with which Sri P. Solomon Herme, Joint Director (Planning & Power Procurement), Sri D. Ramanaiah Setty, Deputy Director (Tariff Engineering), Sri M.S.Vidyasagar, Deputy Director (Planning & Power Procurement) working in APERC, Sri A.V.L.K. Jagannadha Sarma, Dy.E.E./Commercial/APPCC, Sri P.V. Ramana Rao, Dy.E.E./ Construction / AP Transco, Sri B.V.L.S. Ramprasad, Dy.E.E./LTSS/AP Transco, Smt. V. Satyavani, AEE / Commercial/APPCC, Sri T.S. Rajasekhar Reddy, E.E. / RAC / APSPDCL and Sri L. Parthasarathi, Dy.E.E./APSLDC toiled hard in making a deep analysis of the vast information and data and arriving at rational conclusions duly cross checking the same with the views of the various stake holders which helped the Commission in arriving at a rational and reasonable decision, need a special mention. These observations of this Commission and the meritorious services rendered by the above officers in this regard shall be recorded as outstanding in their personal files by the concerned organizations.

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The matter has come up for public hearing lastly on 08.02.2019 in the presence of Sri P. Shiva Rao, learned Standing Counsel for the utilities and Sri M. Venugopal Rao, learned objector. After carefully considering the material available on record and after hearing the arguments of all the parties, Commission passed this:

COMMON ORDER

CHAPTER - I

LICENSEES' FILINGS

Eastern Power Distribution Company of Andhra Pradesh Ltd. (APEPDCL) on 31.07.2018 and Southern Power Distribution Company of Andhra Pradesh Ltd. (APSPDCL) on 02.08.2018 have filed their respective Load Forecasts and Resource Plans for the 4th and 5th Control Periods stated to be in compliance with the relevant tariff regulations and guidelines issued by the Commission.

2. Transmission Corporation of AP Ltd. (AP Transco) has submitted their Resource Plan for the 4th Control Period (FY2019-20 to FY2023-24) and 5th Control Period (FY2024-25 to FY2028-29) on 1st August 2018, stated to be based on the AP Discoms' and AP Genco's perspective plan and it consists of (a) Consolidated Sales Forecast (b) Loss Trajectory (c) Consolidated Load Forecast (d) Consolidated Power Procurement Plan and (e) Capital Investment Plan (Transmission plan) in compliance with the relevant tariff regulations and guidelines issued by the Commission.

3. According to the filings, Andhra Pradesh is one of the States in the country selected for implementation of 'Power for All'- flagship program of Govt. of India. The objective of the above program is to supply 24x7 quality, reliable and affordable power supply to all domestic, commercial and industrial consumers within a fixed timeframe. This program covers the entire gamut of power sector, including generation, transmission, distribution, consumer initiatives, renewable energy, energy efficiency measures, financial health of the utilities and support required from Govt. of India to achieve the objectives of the program. The program is being implemented jointly by Govt. of India & Govt. of Andhra Pradesh as partners.

4. The total installed capacity of Andhra Pradesh is 17,905 MW as per power allocation after State bifurcation as on 31-03-2018. The total number of consumers in the State is 178.11 lakhs which includes 143.38 lakhs of domestic, 13.49 lakhs of commercial, 1.55 lakhs of industrial, 17.20 lakhs of agricultural categories as on 31.3.2018. The per capita consumption of Andhra Pradesh as on 31st March 2017 was 1085 units. The total energy consumption (at utility periphery) in Andhra Pradesh during FY2017-18 was 58,793 MU. The peak demand reached 8,983 MW.

5. The installed capacity of 17,905 MW comprises 5,010 MW of AP Genco thermal, 1,798 MW of AP Genco hydel, 251 MW of APGPCL & AP Discom Gas, 2,330 MW of CGS Share, 1905 MW of IPP's & others and 6522 MW of NCE's. The transmission infrastructure consists of 11 Nos. of 400 kV substations, 91 Nos. of 220 kV substations, 206 Nos. of 132 kV substations and 26,314 Circuit Kilometers (Ckm) of EHT lines as on 31.03.2018. The transmission loss during FY2017-18 was 3.17%. There are 2898 Nos. of 33/11 kV substations and 25,827 Ckm of 33 KV lines as on 31.03.2018.

6. Power is being supplied to Domestic, Commercial & Industrial consumers along with Agricultural consumers in rural areas through mixed feeders. There are 706 Nos. of dedicated/express industrial feeders. 7 hours three phase power supply is being given to agricultural consumers mostly in single/two spells and supply timings are rotated every 7 days. Three phase supply to rural areas for Domestic, Commercial & Industrial consumers is along with 7 hrs. Agricultural supply only. Whereas, balance 17 hrs. supply is given to rural areas through single phase power supply. As a result, most of the consumers, other than Agricultural in rural areas on mixed feeders get 24 hours of supply every day. Agricultural feeders have been separated from Domestic feeders in 14 mandals on pilot basis during 2011. In these mandals, domestic consumers are being extended 3-Phase supply depending upon availability of power. However, there is a system in Andhra Pradesh which enables single phase supply to be extended to all domestic consumers through suitable control mechanism at the substations. Since 2014, all rural areas have been extended 24 hours single phase/ three phase power supply to all Domestic, Commercial & Industrial consumers. The segregation of Agricultural feeders would enable extension of 24x7, reliable 3-Phase supply to all domestic, commercial & industrial consumers.

7. The other background details leading upto the above submissions are as hereunder:

i. The Resource Plans in terms of Regulation 4 of 2005 shall contain (a) Sales Forecast (b) Load Forecast (c) Power Procurement Plan and (d) Distribution Plan (Capital Investment Plan).

ii. The Resource Plan approved by the Commission shall be adopted by the Distribution Licensees in the Multi-year Tariff Filings (MYT) and Annual Filings (ARR) for the respective Control Period.

iii. The Guidelines for Load Forecasts, Resource Plans, And Power Procurement released by Commission in December, 2006 state that the licensees shall submit a Resource Plan for a period of two control periods. The 4th Control Period starts from 1st April, 2019 and ends on 31st March, 2024 while the 5th Control Period starts from 1st April, 2024 and ends on 31st March, 2029. The detailed Resource plans for 4th Control Period under consideration are for tariff review purpose and that for 5th Control Period are indicative plans.

iv. The resource plans for the 4th and 5th Control Periods were due for submission by 31st March, 2018. The licensees sought permission of the Commission to extend the date of submission by four (4) months as the data was under finalisation. The Commission considered the request and granted permission for submission till 31st July, 2018. Accordingly, the licensees submitted Resource Plans for the 4th and 5th Control Periods for review and approval of the Commission.

v. Public hearing proceedings were being continued on the Load forecasts, Resource plans (Distribution plan and Power Procurement plan for the Distribution Licensees and Transmission plan for APTRANSCO) for the balance period of the 3rd Control Period beginning from 1st April 2017, (detailed forecast/plan for the remaining period of 3rd Control Period and simple forecast/plan for the 4th Control Period) filed by the licensees in July 2017, before the Commission.

vi. The Commission has appointed Senior Advocate Sri K. Gopal Chowdary as *Amicus Curiae* in the matter for sensitizing the licensees with regard to the necessity of arriving of Load Forecasts, Generation Planning based on Grid Demand rather than on Energy. Several rounds of discussions have taken place between the officials of licensees, APSLDC and APPCC with the *Amicus Curiae* on the following objectives: (a) To Sensitize the APDISCOMs about the necessity and importance of Generation Planning (projection) on the basis of annual Peak Demand (MW) to be met and Capacity (MW) expansion required, instead of estimating deficit/surplus situation on annual energy basis (MU basis) and (b) To devise a draft on Power Procurement Guidelines that may be notified by the Commission after due regulatory process, for implementing by the DISCOMs as a standard procedure for power procurement.

vii. The *Amicus Curiae*, at the behest of Commission was pursuing the matter to evolve a comprehensive power procurement policy for the State that could be implemented by the APDISCOMs & APTRANSCO for Long Term / Medium Term and for meeting seasonal exigencies. The above proceedings were being continued

and further hearing on this matter was posted on 4th August, 2018. Record of discussions with Amicus Curiae appointed by the Commission, in the Proceedings on Load Forecast, Resource Plan and Investment Plan filed by the APDISCOMs for the balance period of 3rd control Period (FY2017-18 to FY2018-19) and 4th Control Period (FY2019-24) in July 2017 along with draft power procurement guidelines (for Short Term and Medium Term & Long Term) have been submitted to the Commission and all objectors in the proceedings.

viii. Considering the salient points of the discussions, suggestions and guidance given by the learned Amicus Curiae in the matter, the Load Forecast, Resource Plan & Power Procurement Plans for the 4th and 5th Control Periods are filed in compliance with the relevant tariff regulations and the guidelines issued by the Commission.

8. Summary of the Load Forecasts & Resource plans submitted by the distribution licensees for the 4th and 5th Control Periods:

Table 1 – Summary of Projected Sales

Sales (MUs)	FY18 (Actuals)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	CAGR
		4th Control Period						5th Control Period					
SPDCL	31335	34439	36946	39752	42886	46384	50300	54697	59701	65409	71922	79360	8.8%
EPDCL	18,351	19,863	22,201	23,963	25,905	28,043	30,402	33,008	35,920	39,179	42,823	46,857	8.9%

Table 2 – Summary of State Load Forecast – 4th Control Period

Parameter	FY18 (Actuals)	FY19	FY20	FY21	FY22	FY23	FY24
Energy input (MUs)	56,209	64,030	68,606	73,212	79,146	85,776	93,106
State Load (MW) (Load factor Method)	8,983	10,532	11,450	12,219	13,209	14,315	15,539

Table 3 – Summary of State Load Forecast – 5th Control Period

Load Forecast (MW)	FY18 (Actuals)	FY25	FY26	FY27	FY28	FY29	CAGR
Energy input (MUs)	56,209	1,01,306	1,10,561	1,21,302	1,33,594	1,47,599	9.2%
State Load (MW) (Load factor Method)	8,983	16,907	18,452	20,245	22,296	24,633	9.6%

Table 4 – Summary of Capital Investment (New Infrastructure + Ongoing schemes)

New Capital Investment (Rs.Cr.)	FY18 (Actuals)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	CAGR
		4th Control Period						5th Control Period					
SPDCL	2169	2320	2664	2462	2743	2862	3206	3711	4464	5305	6303	7537	12%
EPDCL	988	1414	1372	991	1103	1286	1462	1679	1930	2309	2709	3153	11.1%

SPDCL: Though the CAGR growth in projected capital expenditure is 12% when adjusted for inflation rate of 5.34% it amounts to 6.66% only.

8.1 Overall approach for the resource plans:

The overall approach for preparing the resource plans is stated to be categorized into four major sections i.e. sales forecast, load forecast, power procurement plan and capital investment plan. The steps involved for preparation of the resource plans are a) Approach for Sales forecast b) Approach for Resource plan. As regards approach to sales forecast, it involves taking historical sales (Compounded Annual Growth Rate i.e. CAGR approach) and forecasting using CAGR duly taking into account the impact of other sales and development activities such as (i) Government Lift Irrigation schemes for HT-IV Agriculture category (ii) Off-grid solar pumps in LT-V Agriculture category (iii) Solar Roof top projects LT-I,II,III,IV,VI and VII and HT-I, II and III (iv) 50% of EV (Electric vehicles) consumption for LT-II category and 50% of Electric Vehicles (EVs) consumption under open access sales for arriving the total projected sales. As regards the approach for resource plan, the various steps involved include: (i) For computing energy input at circle level, the total projected sales (adding Open Access sales) grossed up by losses at circle level (LT, 11 kV & 33 kV) is considered. This Circle level energy input is considered for determination of DISCOM level energy input and then State level energy Input. (ii) For computing energy requirement for Power Procurement, projected sales are grossed up by losses at circle level (LT, 11 kV & 33 kV) and considered for determining energy input at circle level and then at DISCOM and finally at State level. The energy input thus determined at State level (excluding OA sales) is grossed up with AP Transco and PGCIL losses for arriving the energy for power procurement. (iii) For determining the demand forecast, demands (Peak) at circle and DISCOM levels are determined by converting energy input determined above at point (i) to non-coincident peak demands by dividing with load factor (assumed based on representative data of FY2017-18). (iv) For drawing up Power procurement plan, power supply position is projected considering PLF & upcoming/retiring capacities. (v) To arrive at surplus/deficit scenario, demand is projected through time series analysis for 365 days X 24 hours supply position by considering PLFs and upcoming/retiring capacities. Load duration curve is plotted and surplus / deficit situation is assessed for 365 days X 24 hours for deriving future capacities to be procured (v) Distribution plan is drawn up with due regard to Year on Year (YoY) growth in circle level non-coincident peak demands

determined at point-(iii) considered for determining capital investment requirements based on technical improvements, network elements addition & escalation in per unit cost.

8.2 Sales forecast

Sales Forecast is stated to be a complex exercise since factors such as policy matters, individual consumer conditions, consumption pattern, weather / seasonal variations, economic growth, inflation, time period of forecast, historical trend etc. which affect actual consumption are numerous and often beyond the control of the licensees. Therefore, an accurate point-estimate of the consumption (sales by licensees) is stated to be not possible.

In view of the above, to reduce the complexities, the licensees have undertaken two approaches i.e. Trend Method and End-User Method for capturing inherent characteristics of various categories at different voltage levels. Trend Method captures historical trend in growth of sales and assumes continuation of the trend in future also. In addition, End User Method tries to overcome deficiencies of the trend method by considering growth drivers such as enhanced economic activities due to development of certain areas, increased penetration of de-centralised renewable energy, upcoming initiatives for promoting use of electric vehicles, infrastructural requirements for meeting open access consumers coming on to the grid, weather conditions etc. The approaches are as mentioned below.

8.3 Historical sales for Non-Scheduled Consumers

Actual sales of each category of consumers in last six (6) years for the period from FY2012-13 to FY2017-18 have been considered for capturing historical growth. Circle-wise sales have been aggregated for each category of the consumers for determining historical sales. The licensees have also captured growth rate in category-wise sales by determining Compounded Annual Growth Rate (CAGR) for each category of consumer.

Summary of sales for each category of consumers in SPDCL & EPDCL is shown below:

Table 5 - Historical Sales (MU) - SPDCL

Category	**FY13**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**CAGR**
LT Category:							
LT-I Domestic	5,155	5,436	6,133	6,954	7,599	8,167	9.6%
LT-II Non-domestic/Commercial	1,212	1,221	1,360	1,551	1,656	1,750	7.6%
LT-III Industrial	1,209	1,113	1,428	1,466	1,686	2,038	11.0%
LT-IV Cottage Industries	30	30	34	37	40	40	6.4%
LT-V Agriculture	7,018	8,010	8,362	8,480	9,269	8,640	4.2%
LT-VI Street Lighting & PWS	566	491	517	540	639	700	4.3%
LT-VII General Purpose	71	70	81	89	96	101	7.4%
LT-VIII Temporary Supply	1.1	1.2	23.6	0.7	1.5	1.3	2.3%
LT Total	**15,262**	**16,373**	**17,939**	**19,116**	**20,986**	**21,438**	**7.0%**
HT Category:							
HT-I Industry	5,208	5,741	6,792	7,269	6,586	6,455	4.4%
HT-I (B) Ferro-Alloys	201	340	434	236	301	398	14.7%
HT-II Others (Commercial)	474	498	562	693	703	774	10.3%
HT-III Public Infrastructure and Tourism	1	11	20	22	49	56	112.8%
HT - IV Agriculture	124	345	565	339	1,011	1,079	54.2%
HT-V Railway Traction	610	652	752	693	650	740	3.9%
HT-VI Townships and Residential Colonies	48	41	38	42	35	26	0.0%
HT-VII Green Power	0	0	0	0	0	0	0.0%
HT-VII RESCOs	239	265	284	298	413	369	9.1%
HT-VIII Temporary Supply	0.28	0.67	0.91	0.00	0.07	0.48	11.4%
HT Total	**6,905**	**7,894**	**9,446**	**9,593**	**9,748**	**9,897**	**7.5%**
LT+HT Total	**22,167**	**24,267**	**27,385**	**28,710**	**30,734**	**31,335**	**7.2%**

Table 6 - Historical Sales (MU) - EPDCL

Category	FY13	FY14	FY15	FY16	FY17	FY18	CAGR
LT Category							
LT-I Domestic	3,207	3,435	3,709	4,420	4,607	5,031	9.4%
LT-II Non-Domestic /Commercial	636	647	685	831	898	979	9.0%
LT-III Industrial	435	495	622	770	891	1,283	24.2%
LT-IV Cottage Industries	2.9	1.8	1.9	2.2	2.1	2.3	0.0%
LT-V Agriculture	1,528	1,752	2,167	2,149	2,399	2,188	7.4%
LT-VI Street Lighting & PWS	268	236	224	232	214	226	0.0%
LT-VII General Purpose	36	37	39	47	49	54	8.6%
LT-VIII Temporary Supply	1.22	0.68	0.50	1.72	0.45	0.64	0.0%
LT Total	6,115	6,605	7,448	8,454	9,062	9,764	9.8%
HT Category							
HT-I Industry	2,683	2,688	3,244	3,916	3,866	4,032	8.5%
HT-I (B) Ferro-Alloys	1,194	1,372	1,307	856	1,417	2,467	15.6%
HT-II Others (Commercial)	446	496	517	644	564	591	5.8%
HT-III Public Infrastructure and Tourism	1	14	14	14	41	42	137.5%
HT - IV Agriculture	56	60	103	108	261	411	49.2%
HT-V Railway Traction	565	620	628	652	634	674	3.6%
HT-VI Townships and Residential Colonies	29	28	28	32	32	31	1.3%
HT-VII Green Power	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
HT-VII RESCOs	212	235	229	294	290	331	9.3%
HT-VIII Temporary Supply	0.00	0.00	0.00	0.00	5.28	8.20	0.0%
HT Total	**5,185**	**5,514**	**6,069**	**6,516**	**7,112**	**8,587**	**10.6%**
LT+HT Total	**11,300**	**12,119**	**13,517**	**14,969**	**16,174**	**18,351**	**10.2%**

From the historical sales data the following key observations are identified by the licensees:

- **LT-III Industrial:**

  In SPDCL, the category witnessed a very high growth of 21% in FY2017-18 over FY2016-17 whereas CAGR for the last five years preceding FY2017-18 was 8.7%. Such high growth in FY2017-18 has been due to increased sales in Vijayawada and Nellore circles which contributed 22% and 28% of sales in this category.

  In EPDCL, the category witnessed a very high growth of 44% in FY2017-18 over FY2016-17 whereas CAGR for the last five years preceding FY2017-18 was 19.6%. Such high growth in FY2017-18 has been due to increased sales in Eluru which contributed 54% of the sales in this category due to a surge in Aquaculture & allied activities.

- **HT-I (B) Ferro Alloys:**

  In SPDCL, the category witnessed high growth rate with CAGR of 14.7% due to very high growth in sales in FY2013-14 (2-year CAGR of 70%), FY2016-17 (2-year CAGR of 27.5%) and FY2017-18 (2-year CAGR of 32%). The high growth rate was due to increase in sales in Nellore, Tirupati, Kadapa and Anantapur in various voltage categories.

  In EPDCL, the category witnessed high growth rate with CAGR of 15.6% due to very high growth in sales between FY2015-16 and FY2017-18. The 3-year CAGR is 70% due to increase in sales in Vizianagaram due to revival of the Ferro Alloy units.

- **HT-III Public Infrastructure and Tourism:**

  In SPDCL, the category witnessed high growth rate with CAGR of 112.8% due to very high growth in sales in FY2013-14 (2-year AGR of 756%) and FY2016-17 (2-year CAGR of 124%). The high growth rate in FY2013-14 was due to increase in sales due to contribution from Anantapur (43%). The high growth rate in FY2016-17 was due to increase in sales in Vijayawada (38% contribution) and Tirupati (27% contribution) circles.

  In EPDCL, the category witnessed high growth rate with CAGR of 137.5% due to very high growth in sales in FY2013-14 (2-year CAGR of 2470%) and FY2016-17 (2-year CAGR of 205%). The high growth rate in FY2016-17 was due to increase in sales in Visakhapatnam (67% contribution).

- **HT - IV Agriculture:**

  In SPDCL, the category is showing high sales CAGR @ 54.2% in last 6 years due to increased sales under Govt. Lift Irrigation Schemes in FY2016-17 in Kadapa, Anantapur and Kurnool circles. The Sales due to Govt. Lift Irrigations schemes have increased from 339 MUs in FY2015-16 to 1011 MUs in FY2016-17.

  In EPDCL, the category is showing high sales CAGR @ 49.2% in last 6 years due to increased sales under Govt. Lift Irrigation Schemes in FY2016-17 and FY2017-18 in Eluru circle. The sales in Eluru are 166 MUs in FY2016-17 and 305 MUs in FY2017-18 due to the commissioning of Pattiseema Lift irrigation scheme and Purushottapatnam scheme.

8.4 Sales Forecast for non-scheduled consumers

Licensees have undertaken the following approaches for predicting future growth in sales for each category:

8.4.1 Trend Method

This method is a non-casual model of demand forecasting which assumes that the underlying factors, which drive the demand for electricity, are expected to follow the same trend as in the past. These trends shall continue in future in majority of categories except certain category of consumers such as Lift Irrigation, Ferro Alloys, etc. Following factors are considered for determination of sales forecast for the 4th & 5th Control Periods:

Base Sales Data: Category-wise and voltage wise actual unrestricted sales in the last six (6) years i.e. from FY2012-13 to FY2017-18.

Growth rates: For identifying outliers/exceptions, CAGRs, in addition to the CAGR determined, have also been determined for other periods as indicated herein after (i) 5 years (FY2017-18 over FY2013-14), (ii) 4 years (FY2017-18 over FY2014-15), (iii) 3 years (FY2017-18 over FY2015-16), (iv) 2 years (FY2017-18 over FY2016-17). SPDCL has also factored-in the increased developmental activities and recent changes in certain circles due to addition of new city of Amaravathi.

8.4.2 End-User Method

In addition to the Trend Method, Licensees have also used End-user method that takes into consideration various economic and Central / State level initiatives which affect the forecasted sales for certain categories. For projecting circle-wise sales the licensees have factored growth in economic conditions due to growth

drivers such as enhanced economic activities due to development of certain areas, increased penetration of decentralized renewable energy, upcoming initiatives for promoting use of electric vehicles, infrastructural requirements for meeting open access consumers coming on to the grid, weather conditions etc. Historically, in past years, sudden increase in demand and lower availability on supply side compelled the Licensees to resort to load relief measures. This has been considerably reduced in recent past and Licensees shall be supplying 24 hours power to non – Agricultural consumers and 7 hours to Agricultural consumers with no load restriction in 4th & 5th Control Periods. The determinants for future sales are as discussed below:

8.5 Govt. Lift Irrigation Schemes

There has been abnormal growth in Sales of HT-IV Government Lift Irrigation category in both SPDCL & EPDCL. Under Govt. Lift Irrigation schemes planned in FY2018-19, additional sales to be met in SPDCL & EPDCL are as mentioned below:

Table 7 – Ongoing Lift irrigation Projects for FY2018-19 – APSPDCL

S. No.	Project	Sales (MU)
1	HNSS Phase-I	1,198
2	KC Canal	62
3	Madakasira Branch Canal	909
4	Guru Raghavendra LIS	46
5	Vedadri - Kanchala LIS	11
6	Gandikota LIS	56
7	Siddapuram LIS	17
Total		2,299

Table 8 – Ongoing Lift irrigation Projects – APEPDCL

S. No.	Ongoing Projects for FY2018-19	Sales (MU)
1	220/11kV Purushotapuram SS	109.44
2	220/11kV Ramavaram SS	74.50
Total		183.94
Ongoing Projects for FY2019-20		
1	Tadipudi 220/11 Kv	186.43
2	Guddigudem 400/220/11 kV	509.18
3	Reddyganapavaram 132/11 kV	28.03
4	Routhugudem 132/11 kV	37.63
Total		761.28

In SPDCL, after FY2018-19, the growth rate in HT Lift Irrigation Schemes is considered at a CAGR of 7% which is the rate of growth in FY2017-18 over FY2016-17 as stabilisation in sales growth has been achieved during this period only. This CAGR is same for both 4th and 5th Control Periods.

In EPDCL, after FY2018-19, the growth rate in HT Lift Irrigation Schemes is considered at a CAGR of 3% which is the growth rate between the years when there were not many sales from lift irrigation schemes. Once the schemes in the pipeline are commissioned, there would not be any steep growth, except normal operations until new projects are implemented. This CAGR is same for both 4th and 5th Control Periods.

The impact of Govt. Lift Irrigation schemes on overall sales forecast in SPDCL & EPDCL is as shown below:

Table 9 – Impact on Sales due to Govt. Lift Irrigation Schemes – SPDCL

SPDCL Sales (MU)	FY18 (Actuals)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	CAGR
Without GLI schemes	30,399	32,149	34,517	37,165	40,131	43,449	47,172	51,362	56,146	61,617	67,878	75,045	8.6%
With GLI schemes	31,335	34,439	36,946	39,752	42,886	46,384	50,300	54,697	59,701	65,409	71,922	79,360	8.8%

Table 10 – Impact on Sales due to Govt. Lift Irrigation Schemes – EPDCL

EPDCL Sales (MUs)	FY18 (Actuals)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	CAGR
Without GLI schemes	18,351	19,793	21,377	23,116	25,027	27,131	29,447	32,000	34,816	37,925	41,359	45,117	8.5%
With GLI schemes	18,351	19,863	22,201	23,963	25,905	28,043	30,402	33,008	35,920	39,179	42,823	46,857	8.9%

8.6 Electric Vehicles (EVs)

GoI has set an ambitious target of 100% incremental EV sales by 2030 which is estimated to result in oil imports savings of $ 60-70 billion annually. In line with efforts made by GoI, AP State Government has also signed MoU with EESL for procurement of 1 lakh electric vehicles with operational investment of Rs 2,000 Cr. per year for 1 lakh electric vehicles. In FY2018-19, demand for Electrical Vehicles in AP is very low as it is still in nascent phase, but is expected to grow gradually in 4th and 5th Control Periods. For forecasting the sales to EVs, it has been assumed that

mostly the existing vehicles shall be replaced with the EVs. The Electric Vehicles estimated to be added in the State and corresponding Sales in the State and for the Licensees are mentioned below:

Table 11 – Projections for EV installations (Thousands)

Number of Conventional Vehicles		FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Stage Carriages	APSRTC / Hire with APSRTC	10	10	10	10	10	10	10	10	10	10	10
	Private	5	5	5	5	6	6	6	6	6	7	7
Goods Carriage	3 Wheel Goods Vehicles	90	103	118	136	152	171	192	213	236	262	291
Cabs	Maxi cabs	29	32	35	39	42	46	50	54	59	63	68
	Other than Maxi Cabs	66	70	74	78	82	86	90	94	98	102	107
Auto Rickshaw	Auto Rickshaw	637	718	810	914	1,013	1,123	1,244	1,363	1,494	1,637	1,794
Passenger Vehicles	Private Service vehicles	2	2	2	3	3	3	3	3	3	3	4
2 Wheelers	Motor Cycles	9,559	10,695	11,966	13,389	14,742	16,232	17,872	19,465	21,201	23,091	25,150
4 Wheelers	Jeep	11	11	11	11	11	11	11	11	11	12	12
	Motor Cars	725	808	901	1,005	1,103	1,211	1,329	1,443	1,568	1,703	1,850
Total EVs required		11,134	12,455	13,934	15,589	17,164	18,898	20,809	22,665	24,688	26,891	29,292

Table 12 - Projections for EV Sales

EV Consumption Points		FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Stage Carriages	APSRTC / Hire with APSRTC	1	21	60	120	189	268	357	625	1,074	1,702	2,510
	Private	-	-	1	3	5	7	11	17	28	43	63
Goods Carriage	3 Wheel Goods Vehicles	-	1	8	17	28	42	59	110	206	354	565
Cabs	Maxi cabs	-	-	2	5	10	17	27	42	64	94	133
	Other than Maxi Cabs	-	-	2	6	11	19	29	43	64	91	126
Auto Rickshaw	Auto Rickshaw	-	4	24	69	134	230	363	571	885	1,322	1,904
Passenger Vehicles	Private Service vehicles	-	-	-	-	-	1	1	2	2	3	4
2 Wheelers	Motor Cycles	1	9	54	155	300	512	804	1,257	1,937	2,879	4,124
4 Wheelers	Jeep	-	-	-	-	-	-	-	-	-	1	1
	Motor Cars	-	3	21	40	58	78	122	242	455	777	1,225
Total EVs Consumption (MUs)		2	39	173	416	736	1,174	1,771	2,909	4,713	7,264	10,654
50% available for consumption consideration		1	20	86	208	368	587	886	1,455	2,356	3,632	5,327
50% sales to Licensees		1	10	43	104	184	293	443	727	1,178	1,816	2,664
65% sales to SPDCL		0	6	28	68	120	191	288	473	766	1,180	1,731
35% sales to EPDCL		0	3	15	36	64	103	155	255	412	636	932

'*' – EV sales for the Licensees has been kept in the ratio of power purchase allocation between both Discoms (SPDCL & EPDCL) i.e. 65:35 respectively.

It is assumed that around 50% of the demand for EVs will generate. It is also assumed that of the generated demand only 50% shall be met by the consumers through open access and therefore only 50% of Sales, shown in the table above, will have to be met through distribution system. The impact of increased sales due to EVs has been considered in LT II – Commercial Category for sales projections.

8.7 Off Grid Solar Pump set Scheme

With the objective of providing financial and water security to farmers, GoI has also announced KUSUM (Kisan Urja Suraksha evam Utthaan Mahabhiyan) scheme for setting up of 10,000 MW of Decentralized Ground Mounted Grid Connected Solar Power Plants, installation of 17.50 Lakh Stand-alone Solar Pumps and Solarisation

of 10 Lakh Grid Connected Agriculture Pumps and 50 Thousand Tube-wells/Lift Irrigation Projects by FY2021-22.

AP is eagerly waiting for launch of the KUSUM scheme. However, AP has supported its farmers by running innovative schemes for promotion of use of solar pump-sets. In line with this, AP started Off-grid Solar Pump Scheme in FY2013-14. Under this scheme, new agriculture consumers are provided with off-grid solar pumps. Till 31st March, 2018, around 26,190 pumps have been installed in the State. The use of solar pumps is going to relieve the Licensees from supplying power to the farmers during day-time which will reduce future sales for farmers especially, LT-V Agriculture category. Due to implementation of off-grid solar pumps and energy efficient pumps, agriculture sales have been decelerating in the last 3 years in almost 9 out of 13 circles. Therefore, impact of such reduced sales has been factored during estimation of sales in 4th & 5th Control Periods.

The historical growth in number of installations of solar pump-sets from FY2015-16 has been captured below:

Table 13 – Off-grid solar pumps installations – Historical

Off grid Solar scheme	FY16	FY17	FY18	CAGR
Cumulative Installations in the State (Nos.)	3,310	9,439	24,397	171.5%
Installations (Nos.) SPDCL	1,991	5,391	12,963	155.2%
Installations (Nos.) EPDCL	1,319	4,048	11,434	194.4%

Licensees expect the off-grid pumps to be installed in the State @ 15% per year in 4th and 5th Control Periods. The Licensees assume that such solar agriculture pump with an average capacity of 5 HP for 7 hours of operations per day consumes around 6,000 Units per year. This will lead to a total consumption of around 292 MUs by end of 4th Control Period. The consumption of solar pump-sets is mentioned below:

Table 14 – Off-grid solar pumps installations – 4th Control Period

Off grid Solar scheme	FY18	FY19	FY20	FY21	FY22	FY23	FY24
Projected Installations in SPDCL (Nos.)	12,963	1,944	2,236	2,572	2,957	3,401	3,911
Projected Installations in EPDCL (Nos.)	11,434	1,715	1,972	2,268	2,608	3,000	3,450
Projected Installations in the State (Nos.)	24,397	3,660	4,208	4,840	5,566	6,401	7,361
Cumulative Installations (Nos.)	24,397	28,057	32,265	37,105	42,671	49,071	56,432
Total Power Consumption (MUs)	146	247	284	327	376	432	497
Power Consumption - SPDCL (MUs)*	78	168	194	223	256	294	339
Power Consumption - EPDCL (MUs)*	69	79	91	104	120	138	159

Table 15 – Off-grid solar pumps installations – 5th Control Period

Off grid Solar scheme	FY25	FY26	FY27	FY28	FY29
Projected Installations in SPDCL (Nos.)	4,498	5,172	5,948	6,840	7,866
Projected Installations in SPDCL (Nos.)	3,967	4,562	5,247	6,034	6,939
Projected Installations in the State (Nos.)	8,465	9,734	11,195	12,874	14,805
Cumulative Installations (Nos.)	64,897	74,631	85,826	98,699	113,504
Total Power Consumption (MUs)	572	658	756	870	1,000
Power Consumption - SPDCL (MUs)*	389	448	515	592	681
Power Consumption - EPDCL (MUs)*	182	210	241	278	319

In view of the above, licensees expect reduction in sales for LT-V category and accordingly projected lower CAGR for Sales growth in 4th and 5th Control Periods.

8.8 Solar Roof-top Scheme

Government of India is focusing on promoting renewable energy with a target of installing 227 GW of renewable sources of energy by 2022. This entails nearly 113 GW through solar power. In line with GoI targets, the State of Andhra Pradesh (AP) has also set ambitious target of achieving 10,000 MW of renewable energy by 2018 and 18,000 MW by 2022. For promoting solar Rooftop systems on large scale, AP State Govt. has set a target of installing 2,000 MW by year 2022. GoAP has also

announced solar policy for both Net metering and Gross metering facilities for Grid Connected Solar rooftop systems. As per the provisions of AP Solar Power Policy, 2015, grid connected solar roof top systems of capacity upto 1000 kWp is allowed at single location.

The targets given by MNRE to the State of Andhra Pradesh and historical installations in the State against the target are shown below:

Table 16 – MNRE Targets upto FY 2021-22 & Progress

Particulars	FY 16	FY 17	FY18	FY19	FY20	FY21	FY22
MNRE Targets (MW)	10	240	250	300	350	400	450
Installations (MW) in APSPDCL	41.80	28.42	50.26	-	-	-	-
Installations (MW) in APEPDCL	3.24	6.50	8.18	-	-	-	-

The rooftop installations in the Licensees' area have been undertaken in different consumer categories both in LT and HT. Category-wise Solar rooftop projects installed in SPDCL & EPDCL are shown below:

Table 17 – Solar Rooftop Projects Installed Capacity (MW)

Consumer Category	SPDCL				EPDCL			
	FY16	FY17	FY18	CAGR	FY16	FY17	FY18	CAGR
LT I	0.67	19.89	15.57	383.0%	0.20	0.54	0.64	76.4%
LT II	38.91	1.27	20.05	-28.2%	1.99	2.45	1.15	-23.8%
LT III	0.28	0.05	0.11	-37.2%	0.00	0.00	0.04	0.0%
LT VI	0.00	0.03	0.06	0.0%	0.01	0.00	0.01	0.0%
LT VII	0.14	0.22	0.53	93.0%	0.15	0.38	0.15	1.0%
HT I	0.39	2.00	2.87	170.0%	--	--	--	--
HT II	1.47	4.97	11.08	174.5%	0.89	3.13	6.19	163.1%

It is evident from the above tables that LT-II and HT-II are major contributing categories with 40% and 22% of total installed capacity in SPDCL and 30% and 60% of total installed capacity in EPDCL, respectively, in the Licensees' area. The Licensees have projected CAGR for the sales to such consumers for 4th and 5th Control Periods by undertaking the assumptions that in case of SPDCL, the historical CAGR is very high which shall not be sustainable for long term, and in case of EPDCL the historical CAGR is either very high or negative which shall not be

sustainable for long-time. Therefore, Licensees expect moderation in growth in 4th and 5th Control Periods.

On the basis of historical growth, the Licensees have projected reduction in sales to such consumers for 4th and 5th control periods by undertaking following assumptions. CUF of 22% has been considered for the calculation purpose:

Table 18 – CAGR Projections for Capacity to be installed in future

Consumer Category	CAGR - APSPDCL	CAGR - APEPDCL
LT I	10%	10%
LT II	5%	5%
LT III	10%	10%
LT VI	10%	10%
LT VII	5%	1%
HT I	20%	--
HT II	20%	20%

Considering the above assumptions, the projected installed capacity and consumption in SPDCL and EPDCL are been shown below:

Table 19 - Projections for Solar Roof-top installations (kW) - SPDCL

Consumer Categories	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
LT I	3,613	3,974	4,371	4,808	5,289	5,818	6,400	7,040	7,744	8,518	9,370
LT II	3,011	3,162	3,320	3,486	3,660	3,843	4,035	4,237	4,449	4,672	4,905
LT III	44	49	54	59	65	71	78	86	95	104	115
LT VI	9	10	11	12	13	14	16	18	19	21	23
LT VII	45	47	49	52	54	57	60	63	66	69	73
HT I	1,053	1,264	1,516	1,820	2,184	2,620	3,144	3,773	4,528	5,433	6,520
HT II	3,503	4,203	5,044	6,052	7,263	8,716	10,459	12,550	15,061	18,073	21,687
Total	11,278	12,708	14,365	16,289	18,528	21,140	24,193	27,767	31,961	36,891	42,693

Table 20 - Projections for Solar Roof-top installations (kW) - EPDCL

Consumer Categories	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
LT I	64	70	77	85	93	102	112	124	136	150	165
LT II	58	60	64	67	70	74	77	81	85	89	94
LT III	4	5	5	6	6	7	8	8	9	10	11
LT VI	1	1	1	1	1	1	1	1	1	1	1
LT VII	2	2	2	2	2	2	2	2	2	2	2
HT II	1,238	1,486	1,783	2,139	2,567	3,081	3,697	4,436	5,323	6,388	7,665
Total	1,365	1,623	1,930	2,298	2,739	3,266	3,896	4,652	5,556	6,640	7,938

Table 21 – Cumulative Consumption due to Solar Roof-top installations (MUs) SPDCL

Consumer Categories	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
LT I	76.6	84.2	92.7	101.9	112.1	123.3	135.7	149.2	164.2	180.6	198.6
LT II	121.9	128.0	134.4	141.1	148.1	155.5	163.3	171.5	180.1	189.1	198.5
LT III	0.9	1.0	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.2	2.4
LT VI	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5
LT VII	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.7	2.8	2.9
HT I	12.2	14.6	17.5	21.0	25.2	30.3	36.4	43.6	52.4	62.8	75.4
HT II	40.5	48.6	58.3	70.0	84.0	100.8	120.9	145.1	174.1	209.0	250.8
Total	254	279	306	338	373	414	461	514	576	647	729

Table 22 – Cumulative Consumption due to Solar Roof-top installations (MUs) SPDCL

Consumer Categories	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
LT I	2.79	2.92	3.07	3.23	3.41	3.61	3.82	4.06	4.33	4.61	4.93
LT II	10.88	10.99	11.12	11.25	11.38	11.52	11.67	11.83	11.99	12.16	12.34
LT III	0.09	0.10	0.11	0.12	0.13	0.15	0.16	0.18	0.20	0.21	0.24
LT VI	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04
LT VII	1.32	1.33	1.33	1.33	1.34	1.34	1.34	1.34	1.35	1.35	1.35
HT-I	--	--	--	--	--	--	--	--	--	--	--
HT II	22.06	24.92	28.36	32.48	37.43	43.37	50.49	59.04	69.30	81.61	96.38
Total	37	40	44	48	54	60	68	76	87	100	115

Impact of reduction in sales for corresponding categories due to such installations have been considered for determining future projections for sales growth.

8.9 Key Assumptions for Sales Forecast:

(i) The key assumptions for Sales Forecast in SPDCL:

- **LT-I & LT-II Domestic & Non-Domestic Categories:** CAGR for LT-I and LT-II categories in Vijayawada circle in the last six (6) years is 9.31% and 7.17% respectively whereas in Guntur circle it is 9.59% and 8.25% respectively. As the new capital city of Amaravathi and neighbouring areas are going to be formed which is expected to enhance both residential and commercial loads, CAGRs for respective categories have been increased by 3.5% to 4%. In addition, there shall also be an impact due to increase in sales to EVs for these categories and reduction in sales due to solar rooftop schemes, as discussed in previous sub-section. Therefore, at DISCOM level, CAGRs of 11.3% & 9.8 % have been considered for future projections for sales in LT-I and LT-II, respectively, compared to historical 6 yr. CAGRs of 9.6% and 7.6% respectively.
- **LT-III Industrial Category:** Vijayawada & Nellore have witnessed phenomenal CAGRs of 22.5% & 25.8% respectively, in the last six (6) years. Licensee expects moderation of this growth rate in 4th & 5th Control Periods and has forecasted for 18% and 20.5% growth rates in Vijayawada & Nellore respectively. However, for Guntur circle the CAGR has been increased from 1.85% to 13% for capturing growth due to establishment of Amaravathi city and neighbouring areas. In addition, there shall be reduction in sales due to roof top projects. Therefore, at DISCOM level, a CAGR of 14.4% has been considered for future projections compared to historical 6 yr. CAGR of 11%.
- **LT-IV Cottage Industries:** The sales for this category have been growing at a CAGR of 6.4% in last 5 years with major contribution from Tirupati (60%) and Anantapur (30%) circles. However, a CAGR of 7.8% has been considered for future projections compared to historical 6 yr. CAGR of 6.4% in order to capture growth of cottage industries in new Amaravathi city and neighbouring areas.
- **LT-V Agriculture:** Historically, sales have been witnessing trend in reduction of sales and the 2-year, 3-year and 4-years CAGRs have been negative. With GoAP policy for promotion of off-grid solar pumps it is expected to reduce further. Therefore, at DISCOM level, a CAGR of 2.0% has been considered for future projections compared to historical 6 yr. CAGR of 4.2%.

- **HT-I Industry and HT-II Commercial Categories:** There is an abnormal trend observed in all voltage level sales in all the circles. The abnormal CAGRs observed due to increased sales in FY2012-13 and FY2017-18 and has been moderated for projections. However, in Guntur circle, CAGR for last six (6) years has been increased by 8% to 20% for HT-I Industrial category and by 1.5% to 10% for HT-II (Commercial) category in order to factor-in the upcoming industrial loads due to formation of new district of Amaravati. The overall DISCOM CAGR is 6.6% and 9.6% respectively.
- **HT-I(B) Ferro Alloys category:** Anantapur and Kurnool district observed very high growth rate in FY2016-17 and FY2017-18. In Anantapur, 2-year CAGR is 31.5% and 3-year CAGR is 88% for HT 33 kV voltage level whereas for Kurnool 2year CAGR is 426% and 3-year CAGR is 216% for HT 132 kV category. Such high CAGRs are sustainable only for short term. Therefore, the historical 6 yr. CAGR has been moderated from 14.7% to 6.9% for sales projections.
- **HT-III Public Infrastructure and Tourism:** There has been a substantial growth (756% growth between FY13 to FY14, 124% growth between FY16 to FY17 and 14% growth between FY17 to FY18) in historical sales in most of the circles. Licensee has moderated these rates to consider sustainable rates and include impact of rooftop projects. Therefore, the historical 6 yr. CAGR has been moderated from 112.8% to 5.2% for sales projections.
- **HT-IV Agriculture:** The government LI schemes are expected to come in FY2018-19. For future years, the CAGR due to impact of upcoming government LI schemes, as discussed above, has been considered @ 7% per year.

(ii) The key assumption for Sales Forecast in EPDCL:

- **Non-Domestic Category:** There shall be an impact due to increase in sales to EVs for this category and reduction in sales due to solar rooftop schemes. Therefore, at DISCOM level, a CAGR of 10.5% has been considered for future projections for sales in LT-II category compared to historical 6 yr. CAGR of 9%.
- **LT-III Industrial Category:** Eluru has witnessed phenomenal CAGR of 34.7% in the last six (6) years. Licensee expects moderation of this growth rate in 4th & 5th Control Periods and has forecasted for 15% growth rate. Therefore, at DISCOM level, a CAGR of 14.5% has been considered for future projections compared to historical 6 yr. CAGR of 24.2%.

- **LT-V Agriculture:** Historically, sales have been witnessing trend in reduction of sales and the 2-year, 3-year and 4-years CAGRs have been negative. With GoAP policy for promotion of off-grid solar pumps it is expected to reduce further. Therefore, at DISCOM level, a CAGR of 3.0% has been considered for future projections compared to historical 6 yr. CAGR of 7.4%.
- **HT-I Industry:** There is an abnormal trend observed in all voltage level sales in all the circles. The abnormal CAGRs observed due to increased sales in FY2014-15 and FY2015-16 and FY2017-18 and has been moderated for projections. The overall DISCOM CAGR is 5.8%.
- **HT-I(B) Ferro Alloys category:** Vizianagaram district observed very high growth rate in FY2016-17 and FY2017-18. In Vizianagaram, 2-year CAGR is 51% and 3-year CAGR is 53% for HT 33 kV voltage level and 100% CAGR for HT 132 kV category due to revival of sick units which have now come to operation in full. Such high CAGR are sustainable only for short term. Therefore, the historical DISCOM level 6 yr. CAGR has been moderated from 15.6% to 11.3% for sales projections.
- **HT-III Public Infrastructure and Tourism:** Visakhapatnam observed a very high growth rate between FY203-14 to FY2016-17. The 3-year, 4-year and 5-year CAGRs are all more than 100%. Licensee has moderated these rates to consider sustainable rates and include impact of rooftop projects. Therefore, the historical 6-year CAGR has been moderated from 1375% to 5.3% for sales projections.
- **HT-IV Agriculture:** The government LI schemes are expected to come in FY2018-19 and FY2019-20. For future years, the CAGR due to impact of upcoming government LI schemes has been considered @ 3% per year. Once the schemes in the pipeline are commissioned, there would not be any steep growth, except normal operations until new projects are implemented.

HT-V Railway Traction: Both SPDCL and EPDCL stated that during public hearings on Retail Supply Tariffs for FY2017-18, Railways had raised objections/concerns for reduction in the tariffs and had requested the Commission to exempt railways from cross subsidy surcharge as deemed licensee. Licensees do not expect Railways to continue purchasing power for all forecasted years and hence expect a moderate sales growth rate of 2% for sales projections.

Based on the above methodologies and key considerations, the licensees have determined sales at circle level for each consumer category and projected sales for 4th and 5th Control Periods.

9. Sales projections for non-scheduled consumers

Based on projected CAGRs, category-wise sales projections for 4th & 5th Control Periods for SPDCL & EPDCL are shown below:

Table 23 - Sales projections for 4th Control Period (MU) - SPDCL

Consumer Category	FY 18 (Actual)	FY 19	FY20	FY21	FY22	FY23	FY24	CAGR
LT Category								
LT-I Domestic	8,167	9,020	10,051	11,203	12,491	13,930	15,541	11.3%
LT-II Non-domestic/Commercial	1,750	1,795	1,977	2,193	2,447	2,735	3,067	9.8%
LT-III Industrial	2,038	2,309	2,628	3,001	3,440	3,956	4,563	14.4%
LT-IV Cottage Industries	40	43	47	50	54	59	63	7.8%
LT-V Agriculture	8,640	8,688	8,885	9,086	9,290	9,497	9,707	2.0%
LT-VI Street Lighting & PWS	700	732	767	803	842	882	925	4.8%
LT-VII General Purpose	101	107	115	123	133	142	153	7.1%
LT-VIII Temporary Supply	1.3	1.30	1.35	1.39	1.44	1.49	1.55	3.5%
LT Total	21,438	22,696	24,471	26,462	28,698	31,203	34,020	8.0%
HT Category								
HT-I Industry	6,455	6,832	7,259	7,731	8,254	8,834	9,480	6.6%
HT-I (B) Ferro-Alloys	398	424	453	484	517	554	595	6.9%
HT-II Others (Commercial)	774	809	887	977	1,080	1,201	1,342	9.6%
HT-III Public Infrastructure and Tourism	56	59	62	65	68	72	76	5.2%
HT - IV Agriculture	1,079	2,436	2,579	2,742	2,916	3,102	3,302	20.5%
HT-V Railway Traction	740	754	769	785	801	817	833	2.0%
HT-VI Townships and Residential Colonies	26	27	28	29	30	31	32	3.4%
HT-VII Green Power	0	0	0	0	0	0	0	0.0%
HT-VII RESCOs	369	402	438	478	521	569	620	9.1%
HT-VIII Temporary Supply	0.48	0	0	0.51	0.52	0.53	0.54	2.0%
HT Total	9,897	11,743	12,476	13,290	14,188	15,180	16,280	8.6%
LT+HT Total	31,335	34,439	36,946	39,752	42,886	46,384	50,300	8.2%

Table 24 - Sales projections for 4th Control Period (MU) – EPDCL

Consumer Category	FY 18 (Actual)	FY 19	FY20	FY21	FY22	FY23	FY24	CAGR
LT Category								
LT-I Domestic	5,031	5,502	6,022	6,590	7,212	7,894	8,640	9.4%
LT-II Non-domestic/Commercial	979	1,061	1,165	1,288	1,432	1,594	1,780	10.5%
LT-III Industrial	1,283	1,467	1,678	1,921	2,199	2,520	2,888	14.5%
LT-IV Cottage Industries	2.3	2.37	2.40	2.42	2.44	2.47	2.49	1.0%
LT-V Agriculture	2,188	2,195	2,272	2,353	2,436	2,522	2,610	3.0%
LT-VI Street Lighting & PWS	226	231	235	240	245	250	255	2.0%
LT-VII General Purpose	54	57	61	66	71	76	82	7.2%
LT-VIII Temporary Supply	0.64	0.66	0.67	0.68	0.69	0.71	0.72	2.0%
LT Total	9,764	10,515	11,437	12,461	13,598	14,858	16,258	8.9%
HT Category								
HT-I Industry	4,032	4,258	4,501	4,761	5,040	5,339	5,661	5.8%
HT-I (B) Ferro-Alloys	2,467	2,744	3,052	3,397	3,782	4,211	4,691	11.3%
HT-II Others (Commercial)	591	602	635	669	705	743	783	4.8%
HT-III Public Infrastructure and Tourism	42	44	47	49	52	55	58	5.3%
HT - IV Agriculture	411	609	1,388	1,430	1,472	1,517	1,562	24.9%
HT-V Railway Traction	674	687	701	715	729	744	759	2.0%
HT-VI Townships and Residential Colonies	31	31	32	33	34	35	36	2.6%
HT-VII Green Power	0	0	0	0	0	0	0	0.0%
HT-VII RESCOs	331	364	400	440	484	533	586	10.0%
HT-VIII Temporary Supply	8.20	8.3	8.4	8.5	8.6	8.7	8.8	1.1%
HT Total	8,587	9,348	10,764	11,502	12,307	13,185	14,144	8.7%
LT+HT Total	18,351	19,863	22,201	23,963	25,905	28,043	30,402	8.8%

Table 25 - Sales projections for 5th Control Period (MU) – SPDCL

Consumer Category	FY 18 (Actual)	FY 25	FY26	FY27	FY28	FY29	CAGR
LT Category							
LT-I Domestic	8,167	17,342	19,358	21,615	24,142	26,972	11.5%
LT-II Non-domestic/Commercial	1,750	3,452	3,954	4,599	5,401	6,380	12.5%
LT-III Industrial	2,038	5,278	6,121	7,116	8,291	9,680	15.2%
LT-IV Cottage Industries	40	69	75	81	88	96	8.2%
LT-V Agriculture	8,640	9,918	10,130	10,342	10,554	10,764	2.0%
LT-VI Street Lighting & PWS	700	970	1,017	1,068	1,121	1,177	4.8%
LT-VII General Purpose	101	165	177	190	204	220	7.3%
LT-VIII Temporary Supply	1.3	1.60	1.66	1.73	1.79	1.86	3.6%
LT Total	21,438	37,194	40,834	45,012	49,803	55,291	9.0%
HT Category							
HT-I Industry	6,455	10,200	11,004	11,905	12,916	14,052	7.3%
HT-I (B) Ferro-Alloys	398	638	686	739	796	858	7.2%
HT-II Others (Commercial)	774	1,510	1,711	1,954	2,252	2,620	11.7%
HT-III Public Infrastructure and Tourism	56	80	84	89	94	100	5.4%
HT - IV Agriculture	1,079	3,515	3,742	3,986	4,247	4,525	13.9%
HT-V Railway Traction	740	850	867	884	902	920	2.0%
HT-VI Townships and Residential Colonies	26	33	34	35	36	38	3.5%
HT-VII Green Power	0	0	0	0	0	0	0.0%
HT-VII RESCOs	369	676	738	804	877	956	9.1%
HT-VIII Temporary Supply	0.48	0.55	0.56	0.57	0.59	0.60	2.0%
HT Total	9,897	17,502	18,867	20,396	22,119	24,069	8.4%
LT+HT Total	31,335	54,697	59,701	65,409	71,922	79,360	8.8%

Table 26 - Sales projections for 5th Control Period (MU) – EPDCL

Consumer Category	FY 18 (Actual)	FY 25	FY26	FY27	FY28	FY29	CAGR
LT Category							
LT-I Domestic	5,031	9,457	10,351	11,330	12,403	13,577	9.4%
LT-II Non-domestic/Commercial	979	1,995	2,273	2,627	3,066	3,599	12.6%
LT-III Industrial	1,283	3,311	3,798	4,358	5,002	5,744	14.6%
LT-IV Cottage Industries	2.3	2.52	2.54	2.57	2.59	2.62	1.0%
LT-V Agriculture	2,188	2,701	2,795	2,892	2,990	3,091	3.2%
LT-VI Street Lighting & PWS	226	260	265	270	276	281	2.0%
LT-VII General Purpose	54	88	95	102	110	119	7.4%
LT-VIII Temporary Supply	0.64	0.74	0.75	0.77	0.78	0.80	2.0%
LT Total	9,764	17,816	19,581	21,583	23,850	26,414	9.5%
HT Category							
HT-I Industry	4,032	6,006	6,378	6,778	7,208	7,635	6.0%
HT-I (B) Ferro-Alloys	2,467	5,227	5,826	6,496	7,245	8,083	11.4%
HT-II Others (Commercial)	591	825	868	913	960	1,007	5.0%
HT-III Public Infrastructure and Tourism	42	61	65	69	73	78	5.7%
HT - IV Agriculture	411	1,609	1,657	1,707	1,758	1,811	14.4%
HT-V Railway Traction	674	774	789	805	821	834	2.0%
HT-VI Townships and Residential Colonies	31	37	38	39	40	42	2.8%
HT-VII Green Power	0	0	0	0	0	0	0.0%
HT-VII RESCOs	331	645	709	780	858	944	10.0%
HT-VIII Temporary Supply	8.20	8.9	9.0	9.1	9.2	9.3	1.1%
HT Total	8,587	15,192	16,340	17,596	18,973	20,442	8.2%
LT+HT Total	18,351	33,008	35,920	39,179	42,823	46,857	8.9%

10. Historical Sales for Scheduled (Open Access) Consumers

In each circle of the licensees, demand from Open Access (OA) consumers for the period between FY2012-13 to FY2017-18 has been considered for determining historical growth. The OA sales have been captured for 3rd Party sales, IEX sales and intrastate transfer. Accordingly, actual OA sales have been aggregated for these categories of consumers to arrive at total OA sales for the Licensees. Table below summarizes the OA sales for the Licensees and its CAGR:

Table 27 – Historical Open Access Sales (MU) - SPDCL

Historical Sales	FY13	FY14	FY15	FY16	FY17	FY18	CAGR
3rd Party	206	261	298	315	318	470	17.9%
IEX	0	75	499	238	773	1,156	726.3%
Intrastate	0	1	29	99	228	272	518.5%
Total	206	337	826	651	1,318	1,897	55.8%

Table 28 – Historical Open Access Sales (MU) – EPDCL

Historical Sales	FY13	FY14	FY15	FY16	FY17	FY18	CAGR
3rd Party	227	264	220	240	230	324	7.3%
IEX	203	329	237	209	512	321	9.6%
Intrastate	0	0	0	133	143	178	0.0%
Total	430	593	458	582	885	823	13.9%

The following key observations have been identified by the licensees:

- **IEX Sales**: IEX sales have increased at very high growth rate with a CAGR of 726% in SPDCL and 9.6% in EPDCL. Since the growth in sales through power exchange is highly dependent upon Minimum Clearing Prices (MCP) licensee made an attempt to analyse growth in IEX sales w.r.t. MCP from FY2012-13 to FY2017-18. Based on the analysis it is evident that in FY2014-15 and FY2017-18 IEX sales have increased unexpectedly w.r.t. previous year's MCP which was lower than its levels in FY2014-15 & FY2017-18.
- **Intrastate Sales**: The intrastate sales were nil in FY2012-13 and FY2013-14 but increased significantly in FY2016-17 and FY2017-18 resulting in growth at CAGR of 518.5% in SPDCL and 15.5% in EPDCL.

10.1 Sales Forecast for Scheduled Consumers

Open Access (OA) sales depend on energy rates available through other sources such as IEX, bilateral transactions, 3rd party contracts etc. Licensees expect 3rd party consumer contracts to expire in FY2018-19 and get renewed for 4th and 5th Control Periods. Historically both IEX sales and Intrastate sales have shown exponential growth. With growing impetus towards reduction of cross subsidy, Licensees do not expect same growth rate to continue for the forecasted period and hence have moderated it to a CAGR of 10% per annum.

Open Access sales projections shall also include sales to EVs upcoming in both the Control Periods to proportion mentioned in previous sub-section. Since such demand shall be for short intervals, such EV sales are expected to be met through IEX.

Based on the above assumptions, below are the forecasts of the open access sales in EPDCL & SPDCL.

Table 29 - Sales projections for 4th Control Period (MU) – SPDCL

OA Categories	FY19	FY20	FY21	FY22	FY23	FY24
3rd Party	470	470	470	470	470	470
IEX	1,271	1,398	1,538	1,692	1,861	2,047
Intrastate	299	329	361	398	437	481
EVs (To be met by IEX)	0	7	30	73	129	205
Total (MUs)	2041	2204	2400	2633	2898	3204

Table 30 - Sales projections for 4th Control Period (MU) – EPDCL

OA Categories	FY19	FY20	FY21	FY22	FY23	FY24
3rd Party	324	324	324	324	364	364
IEX	353	389	427	470	517	569
Intrastate	196	215	237	261	287	315
EVs (To be met by IEX)	0	3	13	31	55	88
Total (MUs)	873	931	1001	1086	1223	1336

Table 31 - Sales projections for 5th Control Period (MU) – SPDCL

OA Categories	FY25	FY26	FY27	FY28	FY29
3rd Party	470	470	470	470	470
IEX	2,252	2,477	2,725	2,998	3,297
Intrastate	529	582	640	704	775
EVs (To be met by IEX)	310	509	825	1271	1864
Total (MUs)	3561	4039	4660	5443	6407

Table 32 - Sales projections for 5th Control Period (MU) – EPDCL

OA Categories	FY25	FY26	FY27	FY28	FY29
3rd Party	364	364	364	364	364
IEX	626	688	757	833	916
Intrastate	347	381	420	462	508
EVs (To be met by IEX)	133	218	353	545	799
Total (MUs)	1470	1652	1894	2203	2587

11. Forecast for growth in number of consumers

In each circle of the licensees, no. of consumers for major consumer categories for the last 6 years i.e. from FY2012-13 to FY2017-18 and corresponding CAGRs have been considered as shown below:

Table 33 – Historical Number of consumers (Nos.) – SPDCL

Category	FY13	FY14	FY15	FY16	FY17	FY18	CAGR
LT Category							
LT-I Domestic	7,285,365	7,517,200	6,906,713	7,094,020	7,503,966	7,885,445	1.6%
LT-II Non-domestic/Commercial	747,382	776,844	672,448	703,511	722,720	773,983	0.7%
LT-III Industrial	65,857	66,038	66,645	68,285	79,950	73,587	2.2%
LT-IV Cottage Industries	9,792	10,194	10,538	10,816	11,942	11,858	3.9%
LT-V Agriculture	765,064	1,137,884	1,191,895	1,257,874	1,317,187	1,364,684	12.3%
LT-VI Street Lighting & PWS	72,275	77,203	79,118	80,728	120,939	103,861	7.5%
LT-VII General Purpose	60,165	61,116	53,679	54,170	55,053	59,759	0.0%
LT-VIII Temporary Supply	188	230	442	575	538	510	22.1%
LT total	9,006,088	9,646,709	8,981,478	9,269,979	9,812,296	10,273,687	2.7%
HT Category							
HT-I Industry	2,724	3,409	3,317	3,411	3,630	3,675	6.2%
HT-I (B) Ferro-Alloys	15	17	17	15	26	16	1.3%
HT-II Others (Commercial)	1,199	1,194	1,318	1,412	1,462	1,837	8.9%
HT-III Public Infrastructure and Tourism	1	31	34	35	80	69	133.2%
HT - IV Agriculture	401	417	452	461	622	546	6.4%
HT-V Railway Traction	14	15	16	16	17	26	13.2%
HT-VI Townships and Residential Colonies	42	37	37	39	40	51	4.0%
HT-VII Green Power	0	0	0	0	0	0	0.0%

Category	FY13	FY14	FY15	FY16	FY17	FY18	CAGR
HT-VIII RESCOs	1	1	1	1	1	1	0
HT-VIII Temporary Supply	4	8	10	0	1	5	0.0%
HT Total	4,401	5,129	5,202	5,390	5,880	6,226	7.2%
LT+HT Total	9,010,489	9,651,838	8,986,680	9,275,369	9,818,176	10,279,913	2.7%

Table 34 – Historical Number of consumers (Nos.) – EPDCL

Category	FY13	FY14	FY15	FY16	FY17	FY18	CAGR
LT Category							
LT-I Domestic	4,206,860	4,308,930	4,380,321	4,595,025	4,793,433	4,928,121	3.2%
LT-II Non-domestic/Commercial	397,777	420,178	404,232	424,131	453,549	486,345	4.1%
LT-III Industrial	28,187	31,769	30,439	31,278	33,753	37,954	6.1%
LT-IV Cottage Industries	3,226	2,039	1,571	1,601	1,555	1,568	0.0%
LT-V Agriculture	203,659	210,169	202,647	209,267	215,012	219,214	1.5%
LT-VI Street Lighting & PWS	50,358	39,443	42,931	44,003	45,534	49,381	0.0%
LT-VII General Purpose	60,773	40,326	42,152	42,648	44,576	46,358	0.0%
LT-VIII Temporary Supply	28	29	0	50	68	49	11.8%
LT total	4,950,868	5,052,883	5,104,293	5,348,003	5,587,480	5,768,990	3.1%
HT Category							
HT-I Industry	1,329	1,474	1,622	1,656	1,733	1,846	6.8%
HT-I (B) Ferro-Alloys	16	16	18	15	20	21	5.5%
HT-II Others (Commercial)	973	1,001	1,057	1,139	1,214	1,341	6.6%
HT-III Public Infrastructure and Tourism	1	21	22	21	47	46	114.4%
HT - IV Agriculture	119	128	139	152	166	176	8.2%
HT-V Railway Traction	16	16	16	17	17	17	1.2%
HT-VI Townships and Residential Colonies	37	39	39	37	40	41	1.9%
HT-VII Green Power	0	0	0	0	0	0	0.0%
HT-VIII RESCOs	2.00	2.00	2.00	2.00	2.00	2.00	0.0%
HT-VIII Temporary Supply	0	0	0	0	14.0	19.0	0.0%
HT Total	2,493	2,697	2,915	3,039	3,253	3,509	7.1%
LT+HT Total	4,953,361	5,055,580	5,107,208	5,351,042	5,590,733	5,772,499	3.1%

For forecasting the number of consumers, licensees have used the trend method adopted for forecasting of the sales. The licensees have worked out circle wise CAGR for each category and adopted moderated/suitable CAGR removing exceptions/outliers due to sudden increase/decrease in sales starting from 2012-13 to 2017-18 duly observing CAGR of 6 Years, 5 Years, 4 Years, 3 Years and 2 Years. The projections are as shown below:

Table 35 – Projections of number of consumers for 4th Control Period – SPDCL

Category	FY18	FY19	FY20	FY21	FY22	FY23	FY24	CAGR
LT Category								
LT-I Domestic	7,885,445	8,145,708	8,416,093	8,697,022	8,988,932	9,292,282	9,607,549	3.3%
LT-II Non-domestic/ Commercial	773,983	788,759	804,847	822,235	840,915	860,884	882,141	2.2%
LT-III Industrial	73,587	75,355	77,200	79,125	81,136	83,235	85,429	2.5%
LT-IV Cottage Industries	11,858	12,398	12,990	13,639	14,351	15,134	15,996	5.1%
LT-V Agriculture	1,364,684	1,404,439	1,445,870	1,489,061	1,534,100	1,581,081	1,630,102	3.0%
LT-VI Street Lighting & PWS	103,861	111,903	120,648	130,164	140,524	151,811	164,116	7.9%
LT-VII General Purpose	59,759	60,668	61,591	62,530	63,485	64,455	65,442	1.5%
LT-VIII Temporary Supply	510	536	562	590	620	651	683	5.0%
LT total	10,273,687	10,599,765	10,939,801	11,294,365	11,664,062	12,049,534	12,451,459	3.3%
HT Category								
HT-I Industry	3,675	3,910	4,165	4,444	4,747	5,079	5,442	6.8%
HT-I (B) Ferro-Alloys	16	16	17	17	18	18	19	3.0%
HT-II Others (Commercial)	1,837	2,008	2,200	2,414	2,654	2,923	3,225	9.8%
HT-III Public Infrastructure and Tourism	69	73	77	82	87	93	100	6.3%
HT - IV Agriculture	546	646	593	620	649	680	714	4.6%
HT-V Railway Traction	26	27	27	28	28	29	29	2.0%
HT-VI Townships and Residential Colonies	51	53	55	58	60	63	65	4.2%
HT-VII Green Power	0	0	0	0	0	0	0	0.0%
HT-VIII RESCOs	1	1	1	1	1	1	1	0.0%
HT-VIII Temporary Supply	5	5	5	5	5	6	6	2.0%
HT Total	6,226	6,739	7,141	7,669	8,250	8,892	9,601	7.5%
LT+HT Total	10,279,913	10,606,505	10,946,943	11,302,034	11,672,312	12,058,425	12,461,060	3.3%

Table 36 – Projections of number of consumers for 4th Control Period – EPDCL

Category	FY18	FY19	FY20	FY21	FY22	FY23	FY24	CAGR
LT Category								
LT-I Domestic	4,928,121	5,089,818	5,256,960	5,429,737	5,608,342	5,792,976	5,983,849	3.3%
LT-II Non-domestic/ Commercial	486,345	508,413	531,497	555,647	580,911	607,342	634,994	4.5%
LT-III Industrial	37,954	40,243	42,694	45,319	48,130	51,142	54,369	6.2%
LT-IV Cottage Industries	1,568	1,583	1,598	1,613	1,628	1,644	1,659	0.9%
LT-V Agriculture	219,214	221,523	223,857	226,216	228,600	231,009	233,444	1.1%
LT-VI Street Lighting & PWS	49,381	49,875	50,374	50,877	51,386	51,900	52,419	1.0%
LT-VII General Purpose	46,358	46,822	47,290	47,763	48,240	48,723	49,210	1.0%
LT-VIII Temporary Supply	49	51	54	57	60	63	66	5.2%
LT total	5,768,990	5,958,327	6,154,324	6,357,228	6,567,297	6,784,798	7,010,010	3.3%
HT Category								
HT-I Industry	3,675	3,910	4,165	4,444	4,747	5,079	5,442	6.8%
HT-I (B) Ferro-Alloys	16	16	17	17	18	18	19	3.0%
HT-II Others (Commercial)	1,837	2,008	2,200	2,414	2,654	2,923	3,225	9.8%
HT-III Public Infrastructure and Tourism	69	73	77	82	87	93	100	6.3%
HT - IV Agriculture	546	646	593	620	649	680	714	4.6%
HT-V Railway Traction	26	27	27	28	28	29	29	2.0%
HT-VI Townships and Residential Colonies	51	53	55	58	60	63	65	4.2%
HT-VII Green Power	0	0	0	0	0	0	0	0.0%
HT-VIII RESCOs	1	1	1	1	1	1	1	0.0%
HT-VIII Temporary Supply	5	5	5	5	5	6	6	2.0%
HT Total	6,226	6,739	7,141	7,669	8,250	8,892	9,601	7.5%
LT+HT Total	10,279,913	10,606,505	10,946,943	11,302,034	11,672,312	12,058,425	12,461,060	3.3%

Table 37 - Projections of number of consumers for 5th Control Period - SPDCL

Category	FY18	FY25	FY26	FY27	FY28	FY29	CAGR
LT Category							
LT-I Domestic	7,885,445	9,935,232	10,275,850	10,629,947	10,998,088	11,380,863	3.4%
LT-II Non-domestic/Commercial	773,983	904,691	928,542	953,703	980,189	1,008,016	2.4%
LT-III Industrial	73,587	87,722	90,118	92,623	95,243	97,984	2.6%
LT-IV Cottage Industries	11,858	16,946	17,993	19,148	20,423	21,833	5.7%
LT-V Agriculture	1,364,684	1,681,268	1,734,689	1,790,480	1,848,763	1,909,667	3.1%
LT-VI Street Lighting & PWS	103,861	177,538	192,188	208,187	225,671	244,787	8.1%
LT-VII General Purpose	59,759	66,444	67,464	68,500	69,554	70,625	1.5%
LT-VIII Temporary Supply	510	718	754	791	831	872	5.0%
LT total	10,273,687	12,870,559	13,307,597	13,763,379	14,238,761	14,734,648	3.3%
HT Category							
HT-I Industry	3,675	5,839	6,274	6,752	7,277	7,855	7.1%
HT-I (B) Ferro-Alloys	16	20	20	21	22	22	3.1%
HT-II Others (Commercial)	1,837	3,565	3,947	4,378	4,864	5,413	10.3%
HT-III Public Infrastructure and Tourism	69	107	114	123	133	143	6.9%
HT - IV Agriculture	546	750	790	834	881	933	5.0%
HT-V Railway Traction	26	30	30	31	32	32	2.0%
HT-VI Townships and Residential Colonies	51	68	71	75	78	82	4.4%
HT-VII Green Power	0	0	0	0	0	0	0.0%
HT-VIII RESCOs	1	1	1	1	1	1	0.0%
HT-VIII Temporary Supply	5	6	6	6	6	6	2.0%
HT Total	6,226	10,385	11,255	12,220	13,293	14,487	8.0%
LT+HT Total	10,279,913	12,880,945	13,318,852	13,775,599	14,252,054	14,749,135	3.3%

Table 38 - Projections of number of consumers for 5th Control Period – EPDCL

Category	FY18	FY25	FY26	FY27	FY28	FY29	CAGR
LT Category							
LT-I Domestic	4,928,121	6,181,177	6,385,184	6,596,100	6,814,166	7,039,630	3.3%
LT-II Non-domestic/Commercial	486,345	663,924	694,193	725,862	758,999	793,671	4.6%
LT-III Industrial	37,954	57,826	61,532	65,504	69,763	74,329	6.3%
LT-IV Cottage Industries	1,568	1,675	1,692	1,708	1,725	1,741	1.0%
LT-V Agriculture	219,214	235,905	238,392	240,905	243,446	246,013	1.1%
LT-VI Street Lighting & PWS	49,381	52,943	53,473	54,007	54,547	55,093	1.0%
LT-VII General Purpose	46,358	49,702	50,199	50,701	51,208	51,720	1.0%
LT-VIII Temporary Supply	49	70	74	78	83	88	5.5%
LT total	5,768,990	7,243,223	7,484,737	7,734,866	7,993,936	8,262,284	3.3%
HT Category							
HT-I Industry	1,846	2,881	3,079	3,291	3,521	3,719	6.6%
HT-I (B) Ferro-Alloys	21	30	32	34	36	38	5.5%
HT-II Others (Commercial)	1,341	1,959	2,071	2,189	2,316	2,447	5.6%
HT-III Public Infrastructure and Tourism	46	65	69	74	80	87	6.0%
HT - IV Agriculture	176	302	335	374	420	452	8.9%
HT-V Railway Traction	17	18	18	18	18	18	0.7%
HT-VI Townships and Residential Colonies	41	47	48	48	49	50	1.9%
HT-VII Green Power	0	0	0	0	0	0	0.0%
HT-VIII RESCOs	2.00	2.00	2.00	2.00	2.00	2.00	0.0%
HT-VIII Temporary Supply	19.0	20.6	20.9	21.1	21.4	21.6	1.2%
HT Total	3,509	5,324	5,673	6,052	6,464	6,835	6.2%
LT+HT Total	5,772,499	7,248,547	7,490,411	7,740,918	8,000,400	8,269,119	3.3%

12. Load Forecast

Licensees have used Load Factor method for determination of demand (MW) in future for computing the capital investment requirements. For meeting forecasted power procurement requirements, load forecast through time series analysis has been considered. In this method, Energy Input at State / DISCOM/Circle has been determined from projected sales including open access (IEX) sales at different voltage levels grossed up with distribution & transmission losses and load factor (calculated from the representative year FY2017-18) to arrive at the peak demand & non-coincident demand required at State/DISCOM/Circle level.

12.1 Determination of Energy Input

The methodology followed for determination of Energy Input at DISCOM / State

level is described below:

a) Based on sales forecast and open access sales projected by the Licensees, the energy input at the DISCOM periphery has been determined by undertaking following steps:

- Energy Input at LT level = LT sales + LT losses
- Energy Input at 11 kV level = Energy Input at LT level + 11 kV sales+11 kV losses
- Energy Input at 33 kV level = Energy Input at 11 kV level +33 kV Sales + 33 kV losses
- The total energy input from various schemes at 33 kV level and Energy input from Open access sales at 33 kV level has been separately calculated and added to the DISCOM level Energy input at 33 kV level.

b) Total Energy Input at DISCOM periphery = Energy Input at 33 kV level + 132 kV Sales +132 kV Open Access sales.

c) The Energy Input at State level has been determined by combining the Energy Input of both the DISCOMS and grossing up that energy with Transmission losses and PGCIL losses.

Below is the summary of voltage-wise sales forecast data projected

Table 39 - Sales forecast for APSPDCL (MU)

	FY18 (Actual)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
LT sales	21,461	22,696	24,471	26,462	28,698	31,203	34,020	37,194	40,834	45,012	49,803	55,291
OA Sales at LT level		0	7	30	73	129	205	310	509	825	1271	1864
11 kV sales	2,773	3,008	3,297	3,628	3,997	4,412	4,877	5,400	5,989	6,655	7,407	8,259
11 kV OA sales		75	78	82	87	92	98	104	110	118	126	134
33 kV sales	3,345	3,504	3,689	3,894	4,120	4,370	4,649	4,963	5,319	5,727	6,200	6,756
33 kV OA sales		857	930	1010	1099	1197	1304	1422	1551	1694	1851	2024
132 kV sales	3,779	5,231	5,490	5,769	6,071	6,398	6,753	7,139	7,559	8,015	8,513	9,055
132 kV OA sales		1109	1189	1277	1374	1480	1597	1726	1868	2024	2195	2384

Table 40 - Sales forecast for APEPDCL (MUs)

	FY18 (Actual)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
LT sales	9,779	10,515	11,437	12,461	13,598	14,858	16,258	17,816	19,521	21,513	23,769	26,318
OA Sales at LT level		0	3	13	31	55	88	133	218	353	545	799
11 kV sales	2,178	2,458	3,347	3,506	3,675	3,853	4,043	4,244	4,458	4,685	4,927	5,160
11 kV OA sales		42	44	47	50	58	62	66	70	75	80	86
33 kV sales	1,793	1,902	2,018	2,143	2,276	2,419	2,573	2,738	2,916	3,106	3,311	3,519
33 kV OA sales		349	380	414	451	526	571	620	675	735	801	873
132 kV sales	4,615	4,995	5,414	5,877	6,389	6,955	7,581	8,275	9,044	9,897	10,843	11,886
132 kV OA sales		482	504	527	554	584	616	651	689	731	777	828

12.2 Loss Trajectory

12.2.1 The licensees have taken various steps like strengthening of the network infrastructure, addition of network elements, and vigorously undertaking the Energy Audit visits to keep a close tab on the losses in order to reduce the same. The licensees have considered the losses for FY2018-19 as per the approved figures in Retail ARR Tariff Order for FY2018-19.

12.2.2 Based on the historical performance and the loss reduction measures carried out in the State, both APEPDCL and APSPDCL have projected the losses for 4th and 5th Control Periods as mentioned in the table below.

Table 41 - Loss Trajectory for APSPDCL

Voltage Level	FY 19*	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
LT	4.40%	4.36%	4.31%	4.27%	4.23%	4.18%	4.14%	4.10%	4.06%	4.02%	3.98%
11 kV	3.38%	3.35%	3.31%	3.28%	3.25%	3.21%	3.18%	3.15%	3.12%	3.09%	3.06%
33 kV	3.35%	3.32%	3.28%	3.25%	3.22%	3.19%	3.15%	3.12%	3.09%	3.06%	3.03%

**Distribution loss in % as approved by the Commission in Retail Tariff Order of FY2018-19*

Table 42 - Loss Trajectory for APEPDCL

Voltage Level	FY 19*	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
LT	4.16%	4.13%	4.11%	4.08%	4.05%	4.02%	3.99%	3.96%	3.93%	3.92%	3.90%
11 kV	3.33%	3.28%	3.25%	3.20%	3.15%	3.10%	3.05%	3.00%	2.97%	2.93%	2.90%
33 kV	2.82%	2.81%	2.80%	2.79%	2.78%	2.77%	2.76%	2.75%	2.73%	2.71%	2.70%

**Distribution loss in % as approved by the Commission in Retail Tariff Order of FY2018-19*

12.2.3 Based on the sales forecast and the loss trajectory levels, energy Input at the DISCOM periphery has been calculated and is shown below:

Table 43 - Energy input at APSPDCL for 4th Control Period

Parameters	FY18 (Actual)	FY19	FY20	FY21	FY22	FY23	FY24
Annual LT Loss %	4.50%	4.40%	4.36%	4.31%	4.27%	4.23%	4.18%
Energy Input at LT level (MU)	22,473	24,127	26,006	28,099	30,432	33,039	35,955
Annual 11 kV Loss %	3.47%	3.38%	3.35%	3.31%	3.28%	3.25%	3.21%
Energy Input at 11KV level (MU)	26,153	28,138	30,383	32,892	35,691	38,820	42,324
Annual 33 kV Loss %	3.44%	3.35%	3.32%	3.28%	3.25%	3.22%	3.19%
Energy Input at 33 kV level (MU)	30,549	33,253	35,794	38,665	41,898	45,523	49,606
Total Energy Input at 33 KV + 132 KV Sales (MU)	34,328	39,593	42,473	45,711	49,343	53,401	57,956

Table 44 - Energy input at APSPDCL for 5th Control Period

Parameters	FY25	FY26	FY27	FY28	FY29
Annual LT Loss %	4.14%	4.10%	4.06%	4.02%	3.98%
Energy Input at LT level (MU)	39,224	42,894	47,020	51,666	56,908
Annual 11 kV Loss %	3.18%	3.15%	3.12%	3.09%	3.06%
Energy Input at 11KV level (MU)	46,254	50,668	55,636	61,236	67,558
Annual 33 kV Loss %	3.15%	3.12%	3.09%	3.06%	3.03%
Energy Input at 33 kV level (MU)	54,219	59,574	65,796	73,007	81,348
Total Energy Input at 33 KV + 132 KV Sales (MU)	63,085	69,001	75,835	83,715	92,788

Table 45 - Energy input at APEPDCL for 4th Control Period

Parameters	FY18 (Actual)	FY19	FY20	FY21	FY22	FY23	FY24
Annual LT Loss %	4.27%	4.16%	4.13%	4.11%	4.08%	4.05%	4.02%
Energy Input at LT level (MU)	10,215	10,971	11,926	12,979	14,139	15,419	16,832
Annual 11 kV Loss %	3.42%	3.33%	3.28%	3.25%	3.20%	3.15%	3.10%
Energy Input at 11KV level (MU)	12,832	13,701	14,807	16,026	17,359	18,825	20,438
Annual 33 kV Loss %	2.90%	2.82%	2.81%	2.80%	2.79%	2.78%	2.77%
Energy Input at 33 kV level (MU)	15,063	16,499	18,591	20,039	21,634	23,429	25,368
Total Energy Input at 33 KV + 132 KV Sales (MU)	19,678	21,976	24,508	26,443	28,576	30,968	33,565

Table 46 - Energy input at APEPDCL for 5th Control Period

Parameters	FY25	FY26	FY27	FY28	FY29
Annual LT Loss %	3.99%	3.96%	3.93%	3.92%	3.90%
Energy Input at LT level (MU)	18,394	20,061	21,964	24,077	26,416
Annual 11 kV Loss %	3.05%	3.00%	2.97%	2.93%	2.90%
Energy Input at 11KV level (MU)	22,213	24,107	26,259	28,637	31,240
Annual 33 kV Loss %	2.76%	2.75%	2.73%	2.71%	2.70%
Energy Input at 33 kV level (MU)	27,514	29,824	32,584	35,718	39,235
Total Energy Input at 33 KV + 132 KV Sales (MU)	36,440	39,558	43,212	47,339	51,950

12.2.4 The loss trajectory considered for Transmission losses is as given below:

Table 47 – Loss trajectory for Transmission and PGCIL losses

Losses (%)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Transmission	3.14%	3.12%	3.10%	3.08%	3.05%	3.00%	2.95%	2.90%	2.85%	2.80%	2.75%

12.2.5 The Licensees have planned for 1,000 MW grid connected decentralized solar generation which would be supplying power at 33 kV substations. For such power procurement, the transmission losses shall not be applicable and hence have not been considered.

12.2.6 Licensees stated that they are not expecting any new procurement from CGS in 4th & 5th Control Periods. Therefore, the PGCIL losses have been assumed to remain same.

12.2.7 Licensees have considered the effect of the following on Transmission losses:

a) Power procurement at 33 kV level - For State level energy input, any power procurement at 33 kV level need to be deducted and hence transmission losses for the energy availability from 1000 MW Grid Connected solar plant is removed.

b) Open Access sales – Transmission losses corresponding to Open Access sales have also been considered. However, these losses have not been considered for DISCOM level power procurement.

c) Other sales – Transmission losses corresponding to other sales (non-scheduled consumers) have also been considered.

12.2.8 The total transmission losses are mentioned in the below table.

Table 48 – Projections for Transmission and PGCIL losses (MU)

Losses (MUs)	FY 19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Transmission	1,768	2,001	2,131	2,261	2,430	2,609	2,984	3,205	3,458	3,744	4,064
PGCIL	460	460	460	460	460	460	460	460	460	460	460
Less: Energy from 1000 MW Grid Connected solar	0	966	1,663	1,663	1,663	1,663	1,663	1,663	1,663	1,663	1,663

12.2.9 The Transmission and PGCIL losses are added to total Energy Input at DISCOMs level to arrive at the total Energy Input at State level.

Table 49 – Energy Input projections at State Level for 4th Control Period (MU)

Energy Input (MUs)	FY 18 (Actual)	FY 19	FY20	FY21	FY22	FY23	FY24
Energy Input @ EPDCL	19,678	21,976	24,508	26,443	28,576	30,968	33,565
Energy Input @ SPDCL	34,328	39,593	42,473	45,711	49,343	53,401	57,956
Transmission Losses	1,768	2,001	2,131	2,261	2,430	2,609	2,788
PGCIL Losses	436	460	460	460	460	460	460
Less: Procurement at 33 kV	0	0	966	1,663	1,663	1,663	1,663
Total Energy Input at State Level	56,209	64,030	68,606	73,212	79,146	85,776	93,106

Table 50 - Energy Input projections at State Level for 5th Control Period (MU)

Energy Input (MUs)	FY25	FY26	FY27	FY28	FY29
Energy Input @ EPDCL	36,440	39,558	43,212	47,339	51,950
Energy Input @ SPDCL	63,085	69,001	75,835	83,715	92,788
Transmission Losses	2,984	3,205	3,458	3,744	4,064
PGCIL Losses	460	460	460	460	460
Less: Procurement at 33 kV	1,663	1,663	1,663	1,663	1,663
Total Energy Input at State Level	101,306	110,561	121,302	133,594	147,599

12.3 Determination of Load Factors

Load Factor(s) have been determined by the following method:

- State/DISCOM/Circle level demands have been taken for each hour during FY2017-18. On the basis of this hourly demand monthly average for each hour and yearly average demand have been determined. State/DISCOM/Circle level peak demands for each month and year have also been taken for FY2017-18.
- The Load factor is determined using the formula:

  Load Factor = Yearly average demand / Yearly peak demand

12.3.1 State Level Load Factors

For FY2017-18, the average and peak demand observed at State level are 6,550 MW and 8,983 MW respectively. Thus, the State level load factor for FY2017-18 is 73%.

The load factor is expected to reduce in future with the following assumptions:

- Currently, at State level the average daily demand from agriculture is 2,000 MW that is being supplied in various phases for total duration of around 16 hours in a day for different groups at different time slots.
- With the infusion of Solar and Wind power, the peak power availability is observed during 11am to 13 pm.
- The available solar power is expected to increase in FY2018-19, FY 2019-20 and FY2020-21 as given below.

Table 51 – Solar Capacity Forecast

	FY19	FY20	FY21
Solar Capacity (MW)	2,732	4,852	5,602

- Due to high solar power infusion in the State power portfolio, the agriculture demand which is currently being catered over a period of 16 hours in the entire day, a part of it can be shifted to the time slot from 11am to 13pm (peak hours) and hence the overall peak availability is expected to be high.
- This agriculture demand shift in the mid-day time will increase the State peak demand and will reduce the State overall load factor.
- Currently, with around 2,000 MW (FY2017-18) of average agriculture demand, licensees have considered 400 MW and 500 MW of demand to be shifted in the peak hours for FY2019-20 and FY2020-21 respectively.
- Below are the projected average demands, peak demands and load factors.

Table 52 - State Load Factors

	FY18 (Actual)	FY19	FY20
Average demand	6550	7139	7782
Peak demand	8983	10,281	11,369
Load Factor	73%	69.4%	68.4%

- For future years, once agriculture demand is not flexible, State will need more Round-the-Clock power instead of solar power and in that case the peak demand arriving at mid-day will be distributed in the entire day and the peak demand will reduce resulting into increase in load factor. However, licensee assumes that the load factor will remain same for the forecasted years.

Table 53 - Forecast of the State Load Factor

	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY24	FY25	FY26
Load Factor	72.9%	69.4%	68.4%	68.4%	68.4%	68.4%	68.4%	68.4%	68.4%	68.4%	68.4%	68.4%

12.3.2 DISCOM/Circle level Load factors

For FY2017-18, Circle wise average and peak demand data is collected. DISCOMs have calculated the non-coincident and coincident peaks for FY2017-18.

Non-coincident peaks are the peaks of individual circles which are not dependent on the peak of other circles. These peaks are needed for the purpose of estimating capital expenditure in the circles to meet the projected average demand.

As per the formula for load factor, licensees have determined non-coincident load factors for all circles and DISCOM level for FY2017-18. The details for the same are shown below:

Table 54 - Non-coincident Load Factors for APSPDCL & APEPDCL

APSPDCL		APEPDCL	
Circle Name	Non-coincident load factor	Circle Name	Non-coincident load factor
Vijayawada	62%	Srikakulam	70%
Guntur	76%	Vizianagaram	66%
Ongole	58%	Visakhapatnam	70%
Nellore	68%	Rajahmundry	67%
Tirupati	51%	Eluru	67%
Kadapa	46%	EPDCL	77%
Anantapur	50%	--	--
Kurnool	59%	--	--
SPDCL	68%	--	--

It has been assumed that the load factors for at circle/DISCOM level will remain same for the 4th and 5th Control Period.

12.3.3 Load Forecast

On the basis of Energy Input at 33 kV level for DISCOM and circle and assumed load factors for FY2017-18, licensees have projected demand in MW for 4th and 5th Control Periods as per the formula mentioned below:

Peak Demand (MW) = Energy required / (24*365/1000)/ load factor

12.3.4 State Level Load Factors

The peak demand forecasted at the State level is shown below:

Table 55 - State peak demand for 4th Control Period

Parameters	FY18 (Actuals)	FY19	FY20	FY21	FY22	FY23	FY24	CAGR
Energy Requirement at State level (MUs)	56,209	64,030	68,606	73,212	79,146	85,776	93,106	8.8%
State Peak Demand (MW)	8,983	10,532	11,450	12,219	13,209	14,315	15,539	9.6%

Table 56 - State peak demand for 5th Control Period

Parameters	FY18 (Actuals)	FY25	FY26	FY27	FY28	FY29	CAGR
Energy Requirement at State level (MUs)	56,209	101,306	110,561	121,302	133,594	147,599	9.2%
State Demand (MW)	8,983	16,907	18,452	20,245	22,296	24,633	9.6%

12.3.5 Circle/DISCOM Level Demand forecast

On the basis of non-coincident load factors and energy input at 33 kV level each DISCOM & Circle level mentioned above, non-coincident peak demands at DISCOM level & at Circle level have also been estimated. Summary of the non-coincident peak demands at APSPDCL & APEPDCL is shown below:

Table 57 - Non-coincident peak demand (MW) – APSPDCL

Circle/Peaks at 33 kV level	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Vijayawada	903	994	1,104	1,228	1,370	1,530	1,711	1,917	2,155	2,430	2,748	3,114
Guntur	692	801	887	985	1,097	1,225	1,371	1,540	1,738	1,970	2,241	2,560
Ongole	595	631	675	724	778	836	900	971	1,051	1,143	1,248	1,367
Nellore	606	666	726	796	877	969	1,075	1,197	1,341	1,511	1,711	1,947
Tirupati	1,064	1,133	1,201	1,275	1,355	1,441	1,534	1,636	1,750	1,879	2,023	2,186
Kadapa	684	711	747	787	832	883	938	1,001	1,074	1,160	1,260	1,375
Anantapur	978	1,081	1,126	1,177	1,233	1,294	1,361	1,436	1,522	1,621	1,735	1,865
Kurnool	525	541	571	604	642	683	729	780	839	909	991	1,085
SPDCL	5,094	5,545	5,968	6,447	6,986	7,591	8,271	9,041	9,934	10,971	12,173	13,564

Table 58 - Non-coincident peak demand (MW) – APEPDCL

Circle/Peaks at 33 kV level	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Srikakulam	180	200	218	238	261	285	312	342	377	417	464	511
Vizianagaram	224	251	273	298	326	356	390	427	468	517	573	637
Visakhapatnam	617	696	749	807	870	938	1,013	1,095	1,184	1,288	1,404	1,535
Rajahmundry	690	739	800	868	943	1,027	1,119	1,222	1,335	1,468	1,620	1,792
Eluru	830	918	1,122	1,198	1,283	1,383	1,488	1,604	1,733	1,883	2,053	2,246
EPDCL	2,222	2,434	2,742	2,956	3,191	3,456	3,742	4,058	4,399	4,806	5,268	5,787

13. Power Procurement Plan

The licensees submitted the power procurement plan for 4th & 5th Control Periods under Clause 9 of the Regulation 4 of 2005, the details of which are as follows:

13.1 Installed Capacity from various sources

Available power plants supplying power to the DISCOMs along with key information are mentioned in subsequent sub-sections.

13.1.1 APGENCO Thermal

Table 59 – APGENCO Thermal Sources

S. No.	Source of Power	COD	AP Share	Aux Consumption	PLF	PPA Expiry Date
		MM/DD/YYYY	MW	%	%	
1	VTPS I	10/10/1980	420	8.75%	80%	3/31/2019
2	VTPS II	8/23/1990	420	8.75%	80%	3/31/2019
3	VTPS III	2/24/1995	420	8.75%	80%	3/31/2019
4	VTPS IV	6/6/2009	500	7.50%	80%	1/27/2035
5	RTPP I	2/25/1995	420	9.00%	80%	3/31/2019
6	RTPP Stage-II	11/21/2007	420	9.00%	80%	3/28/2033
7	RTPP Stage-III	12/31/2010	210	9.00%	80%	11/28/2035
8	VTPS Stage V (800MW)	4/1/2020	800	6.50%	80%	7/1/2045
9	Rayalaseema TPP Stage IV Unit- 6 (600MW)	3/19/2018	600	7.00%	80%	3/28/2043
10	Krishnapatnam TPP (JVP) Stage I (2X800MW) Unit-1	2/5/2015	800	7.50%	80%	PPA is yet to be approved
11	Krishnapatnam TPP (JVP) Stage I (2X800MW) Unit-2	8/24/2015	800	6.50%	80%	PPA is yet to be approved
12	Krishnapatnam TPP (JVP) Stage II (1X800MW) Unit-3	8/24/2020	800	6.50%	80%	PPA is yet to be approved

13.1.2 APGENCO Hydel

Table 60 – APGENCO Hydel Sources

S. No.	Source of Power	COD Date	AP Share (MW)	Aux Consumption %	PLF%	PPA Expiry Date
1	MACHKUND PH AP Share	8/8/1959	84	1.0%	45.00%	3/31/2019
2	TUNGBHADRA PH AP Share	6/19/1964	58	1.0%	15.00%	3/31/2019
3	USL	3/21/1995	240	1.0%	16.00%	3/31/2019
4	LSR	6/13/1978	460	1.0%	22.00%	3/31/2019
5	DONKARAYI	10/4/1983	25	1.0%	31.00%	3/31/2019
6	SSLM	3/19/1978	770	1.0%	9.00%	3/31/2019
7	NSRCPH	9/10/1990	90	1.0%	11.00%	3/31/2019
8	PABM	1/23/1994	20	1.0%	3.00%	3/31/2019
9	MINI HYDRO (Chettipetta)	3/1/2016	1	1.0%	30.00%	3/31/2019
10	Nagarjunasagar Tail pond (1x25 MW) Unit-1	1/23/2018	25	1.0%	23.52%	PPA is yet to be approved
11	Nagarjunasagar Tail pond (1x25 MW) Unit-2	1/23/2018	25	1.0%	23.52%	PPA is yet to be approved
12	Polavaram- (12x80MW) Unit-1	11/1/2021	80	1.0%	11.00%	4/30/2058
13	Polavaram- (12x80MW) Unit-2	11/1/2021	80	1.0%	11.00%	4/30/2058
14	Polavaram- (12x80MW) Unit-3	11/1/2021	80	1.0%	11.00%	4/30/2058
15	Polavaram- (12x80MW) Unit-4	1/22/2022	80	1.0%	11.00%	4/30/2058
16	Polavaram- (12x80MW) Unit-5	3/1/2022	80	1.0%	11.00%	4/30/2058
17	Polavaram- (12x80MW) Unit-6	5/1/2022	80	1.0%	24.60%	4/30/2058
18	Polavaram- (12x80MW) Unit-7	7/1/2022	80	1.0%	24.60%	4/30/2058
19	Polavaram- (12x80MW) Unit-8	9/1/2022	80	1.0%	24.60%	4/30/2058
20	Polavaram- (12x80MW) Unit-9	11/1/2022	80	1.0%	24.60%	4/30/2058
21	Polavaram- (12x80MW) Unit-10	1/1/2023	80	1.0%	24.60%	4/30/2058
22	Polavaram- (12x80MW) Unit-11	3/1/2023	80	1.0%	24.60%	4/30/2058
23	Polavaram- (12x80MW) Unit-12	5/1/2023	80	1.0%	26.40%	4/30/2058

13.1.3 Central Generating Stations

Table 61 – Central Generating Stations (CGS) Sources

Sr. No.	Source of Power	COD	AP Share	Aux Consumption	PLF	PPA Expiry Date
		Date	MW	%	%	
1	NTPC (SR)	3/1/1984	435	6.68%	85%	Not Applicable
2	NTPC (SR) Stage III	3/25/2005	108	5.75%	85%	Not Applicable
3	Talcher Stage 2	8/1/2003	233	5.75%	85%	Not Applicable
4	NLC Stage-I	9/29/1986	48	10.00%	85%	Not Applicable
5	NLC Stage-II	1/25/1992	87	10.00%	85%	Not Applicable
6	NPC-MAPS	1/27/1984	18	0.00%	85%	Not Applicable
7	NPC-Kaiga unit I &II	11/16/2000	56	0.00%	85%	Not Applicable
8	NPC-Kaiga unit III & IV	5/6/2007	60	0.00%	85%	Not Applicable
9	NTPC Simhadri Stage I	9/1/2002	461	5.25%	85%	Not Applicable
10	NTPC Simhadri Stage II	9/16/2011	267	5.25%	85%	Not Applicable
11	Bundled power under JVNSM (or western region)	9/16/2011	539	5.25%	85%	Not Applicable
12	Vallur Thermal Power Plant	8/31/2012	88	6.69%	85%	Not Applicable
13	Kudigi	1/31/2017	272	5.75%	85%	Not Applicable
14	Tuticorin joint venture plant	6/18/2015	123	6.25%	85%	Not Applicable
15	NNTPS	7/1/2018	52	6.50%	85%	Not Applicable

13.1.4 APGPCL, APDISCOM & IPP Gas

Table 62 – APGPCL, APDISCOM & IPP Gas Sources

Sr. No.	Source of Power	COD	AP Share	Aux Consumption	PLF	PPA Expiry Date
		Date	MW	%	%	
1	APGPCL I - Allocated capacity	3/1/2018	9	3.00%	25.0%	3/1/2030
2	APGPCL II - Allocated capacity	3/1/2018	25	3.00%	29.0%	3/1/2030
3	Godavari Gas Power Plant	6/20/1997	217	3.97%	80.0%	3/1/2030
4	Spectrum	4/19/1998	205	3.0%	68.5%	3/1/2030
5	Kondapalli (Gas)	1/1/2001	362	3.0%	80.0%	3/1/2030

13.1.5 IPP Others

Table 63 – IPPS Sources

Sr. No.	Source of Power	COD	AP Share	Aux Consumption	PLF	PPA Expiry Date
		Date	MW	%	%	
1	Srivathsa	4/1/2003	17	3.40%	74%	7/5/2021
2	Thermal Power Tech	3/1/2018	231	6%	90%	9/31/2039

13.1.6 NCE Total

Table 64 - NCE Sources

S. No.	Source of Power	AP Share (MW)	Aux Consumption (%)	PLF (%)
1	NCE Biomass	82.50	10%	As per individual Plant PLF
2	NCE Bagasse	90.50	10%	As per individual Plant PLF
3	NCE - Industrial Waste based power project	21.66	10%	As per individual Plant PLF
4	NCE - Municipal Solid Waste Projects	59.00	10%	As per individual Plant PLF
5	NCE- Wind	4774.75	0.5%	23%
6	NCE – Solar	5601.62	0.1%	20%
7	NCE- Mini Hydel	64.24	1.0%	40%
Total		10694.27		

Key Assumptions:

- APGENCO Thermal: The Power purchase agreements of the Krishnapatnam TPP (JVP) Stage-I and Krishnapatnam TPP (JVP) Stage-II plants, Nagarjunasagar Tail pond Units-1& 2 plants have not yet been approved by Commission. These plants are currently supplying power to AP State. For the future calculation purpose, licensee assumes that these plants will supply power to AP State at the same capacity as they are currently supplying.
- The Power purchase agreements of the VTPS Stage-I, Stage-II and Stage-III and RTPP Stage-I are going to expire in FY2018-19. However, licensees have assumed the trajectory for the expiry of these plants as below:
  - RTPP Stage I – FY2019-20
  - VTPS Stage I and Stage II – FY2020-21
  - VTPS Stage III – FY2021-22
- APGENCO Hydel: The Power purchase agreements of old Hydel plants which are Machkund PH, Tungbhadra PH, USL, LSR, Donkarayi, SSLM, NSRCPH, PABM,

Mini Hydro (Chettipetta) are going to expire in FY2018-19. However, licensees expect the extension of these agreements for future power supply and hence these plants are considered for future power supply projections.

- Gas plants - GMR Vemagiri, GVK Extn., GVK Gautami and Konaseema: These are stranded due to unavailability of gas and hence not considered for future calculations.
- APGPCL, APDISCOM & IPPs Gas: The MoU for APGPCL-I & II expired on 24th December, 2012 and the matter is under sub-judice. AP State is still receiving power from these plants and hence licensees have considered these plants for power projections calculations.
- IPPs: KSK Mahanadi, LVS and Hinduja Power plants are not considered for future supply projections due to pending legal issues with them.
- NCE Solar: Grid connected solar plant (1000 MW) is expected to arrive from 1st September, 2019 and hence considered in the calculations.

13.2 Future Capacities

Considering the above assumptions, the licensees expected to meet their power procurement from the above-mentioned generation sources which are available for long term. Any deficit upto 5% shall be met by short term purchases by means of bilateral purchases or through Power Exchange.

The figure below shows year-wise capacity additions in each year:

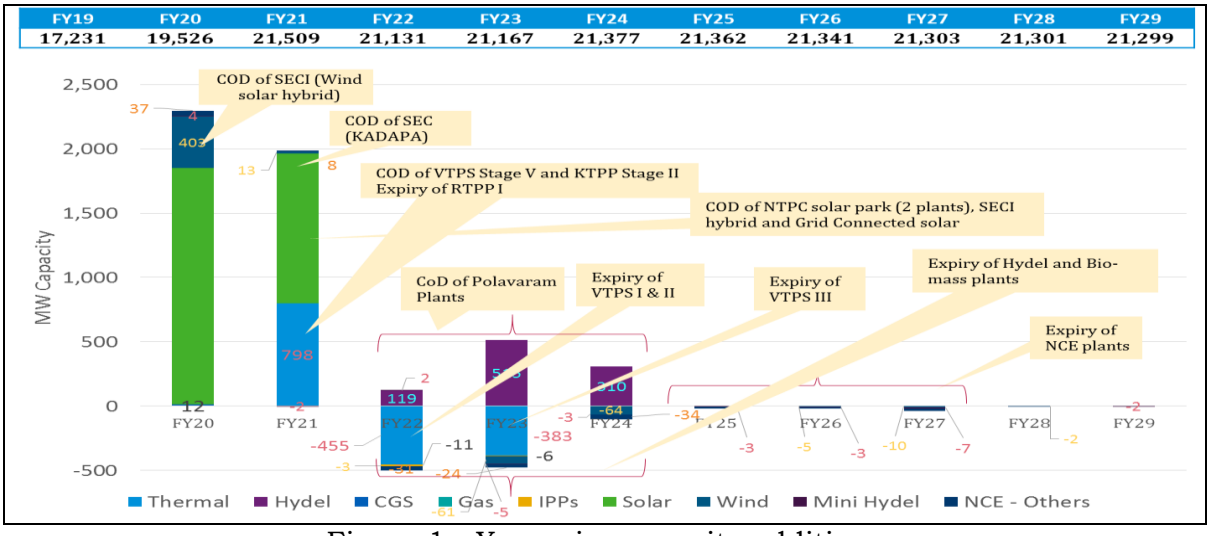


Figure 1 - Year-wise capacity additions

The summary of year-wise available plant capacities in MW has been shown below:

Table 65 - Year wise available plant capacities (MW) – 4th Control Period

Plants	FY18 (Actual)	FY19	FY20	FY21	FY22	FY23	FY24
APGENCO Thermal	4,410	4,614	4,614	5,412	4,957	4,574	4,574
APGENCO Hydel	1,798	1,780	1,780	1,780	1,898	2,413	2,723
CGS	2,795	2,674	2,686	2,686	2,686	2,686	2,686
APGPCL/DISCOM Gas	818	792	792	792	792	792	792
IPPs – Others	285	233	233	233	222	217	217
NCE – Solar	1,927	2,592	4,431	5,596	5,596	5,596	5,596
NCE - Wind Power	3,685	4,326	4,729	4,742	4,740	4,679	4,615
NCE - Mini Hydel	45	46	51	48	51	46	43
NCE -Others	201	175	212	220	189	165	131
Total	15,963	17,231	19,526	21,509	21,131	21,167	21,377

Table 66 - Year wise available plant capacities (MW) – 5th Control Period

Plants	FY18 (Actual)	FY25	FY26	FY27	FY28	FY29
APGENCO Thermal	4,410	4,574	4,574	4,574	4,574	4,574
APGENCO Hydel	1,798	2,730	2,730	2,730	2,730	2,730
CGS	2,795	2,686	2,686	2,686	2,686	2,686
APGPCL/DISCOM Gas	818	792	792	792	792	792
IPPs – Others	285	217	217	217	217	217
NCE – Solar	1,927	5,596	5,596	5,596	5,596	5,596
NCE - Wind Power	3,685	4,615	4,611	4,601	4,599	4,599
NCE - Mini Hydel	45	40	37	30	30	28
NCE -Others	201	113	100	79	78	78
Total	15,963	21,362	21,341	21,303	21,301	21,299

13.3 Renewable Power Purchase Obligations

The Licensees have been continuously exceeding the RPPO targets given by the Commission till date and expect to continue the performance in future also. As per Regulation 3 of APERC Regulation 1 of 2017, the Licensees have been given targets for RPPOs upto FY2021-22 as shown below:

Table 67 – RPPO targets as per regulation

RPPO	FY 19	FY20	FY21	FY22
Solar	4.0%	5.0%	6.0%	7.0%
Non-Solar	7.0%	8.0%	9.0%	10.0%
Total	11.0%	13.0%	15.0%	17.0%

For future years the Licensees expect a trajectory for RPPO targets as shown below:

Table 68 – Forecasted RPPO targets

RPPO	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Solar	7.5%	8.0%	8.5%	9.0%	9.5%	10.0%	10.5%
Non-Solar	10.5%	11.0%	11.5%	12.0%	12.5%	13.0%	13.5%
Total	18.0%	19.0%	20.0%	21.0%	22.0%	23.0%	24.0%

Based on renewable energy capacities planned to be added in future, below is the forecasted compliance of RPPO against targets in 4th & 5th Control Periods:

Table 69 – RPPO Compliance for 4th Control Period

State	FY 19		FY20		FY21		FY22		FY23		FY24	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Solar	4.0%	8.4%	5.0%	12.3%	6.0%	14.2%	7.0%	13.2%	7.5%	12.2%	8.0%	11.3%
Non-Solar	7.0%	15.1%	8.0%	15.3%	9.0%	14.3%	10.0%	13.2%	10.5%	11.9%	11.0%	10.7%

Table 70 - RPPO Compliance for 5th Control Period

State	FY25		FY26		FY27		FY28		FY29	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Solar	8.5%	10.4%	9.0%	9.5%	9.5%	8.7%	10.0%	8.0%	10.5%	7.3%
Non-Solar	11.5%	9.8%	12.0%	9.0%	12.5%	8.1%	13.0%	7.4%	13.5%	6.8%

With current power procurement plan the Licensees shall be able to meet the RPPO targets. However, from 5th Control Period gap in meeting the RPPO targets has been forecasted. The table below shows estimated capacity to be installed in future to meet estimated RPPO targets. However, the projected capacities shown below that need to be procured in future shall only be finalised based on trajectory approved by the Commission. Therefore, the projected capacities have not been considered as part of Procurement Plan.

Table 71 – Solar and Non-solar Capacity required for RPPO Compliance

MW Required	FY24	FY25	FY26	FY27	FY28	FY29
Solar	-	-	-	511	1,476	2,591
Non-Solar	143	1,054	2,044	3,206	4,493	5,970

14. Power Surplus/Deficit Analysis (Energy (MU) and Power (MW))

The Licensees have analysed surplus/deficit situation based on projections for both demand and supply side taking into account following avenues:

a) MU analysis – This is based on Energy Input Requirements and energy supplied by the existing and upcoming capacities.

b) MW analysis – This is based on average hourly demand in MW and hourly available capacities projected based on time series in MW for each year of the Control Periods.

The above methods are discussed in detail hereunder:

14.1 MU Analysis

14.1.1 MU Availability

Based on existing and future planned installed capacities, energy availability in MUs has been determined for each power station, based on formula shown below:

*Energy generation in MUs = Plant capacity (MW) * AP Share (%) * (1- Auxiliary power consumption in %) * Plant load factor (%) *24*365/ 1000*

The tables below summarize the projected energy generation:

Table 72 – Projected energy generation for 4th Control Period (MU)

Sources	FY 18 (Actual)	FY 19	FY 20	FY 21	FY 22	FY 23	FY 24
APGENCO Thermal	26,646	30,312	30,312	35,544	32,568	30,050	30,050
APGENCO Hydel	2,392	2,477	2,477	2,477	2,591	3,370	4,051
CGS	19,480	19,754	19,845	19,845	19,845	19,845	19,845
APGPCL/DISCOM Gas	5,195	5,195	5,195	5,195	5,195	5,195	5,195
IPPs – Others	315	1,816	1,816	1,816	1,745	1,709	1,709
NCE – Solar	2,998	5,095	8,186	10,130	10,130	10,130	10,130
NCE - Wind Power	7,282	8,429	9,223	9,245	9,237	9,115	8,987
NCE - Mini Hydel	97	103	120	127	158	147	139
NCE -Others	458	683	822	823	732	642	552
Energy Availability	64,863	73,865	77,998	85,203	82,200	80,204	80,658

Table 73 - Energy Availability at State for 5th Control Period (MU)

Sources	FY 25	FY 26	FY 27	FY 28	FY 29
APGENCO Coal	30,050	30,050	30,050	30,050	30,050
APGENCO Hydel	4,066	4,066	4,066	4,066	4,066
CGS	19,845	19,845	19,845	19,845	19,845
APGPCL/DISCOM Gas	5,195	5,195	5,195	5,195	5,195
IPPs – Others	1,709	1,709	1,709	1,709	1,709
NCE – Solar	10,130	10,130	10,130	10,130	10,130
NCE - Wind Power	8,987	8,976	8,958	8,954	8,954
NCE - Mini Hydel	133	124	96	96	93
NCE -Others	455	427	398	394	394
Energy Availability	80,570	80,521	80,446	80,439	80,436

14.1.2 MU Demand

The total MU demand is the total Energy Input at State level for power procurement determined above. For DISCOM level energy requirement, energy requirement corresponding to Open Access sales has not been considered.

14.1.3 Energy Balance (MU)

Based on the energy generation and energy input for power procurement the table below summarises Energy (MU) balance at State level:

Table 74 - Energy Surplus/Deficit Summary for 4th Control Period

	FY 19	FY20	FY21	FY22	FY23	FY24
State Energy Availability	73,865	77,998	85,203	82,200	80,204	80,658
State Energy input*	60,971	66,313	71,355	76,951	83,152	90,033
State Energy Surplus/ (Deficit)	12,894	11,685	13,847	5,248	(2,949)	(9,375)

Table 75 - Energy Surplus/Deficit Summary for 5th Control Period

	FY25	FY26	FY27	FY28	FY29	CAGR
State Energy Availability	80,570	80,521	80,446	80,439	80,436	0.9%
State Energy input*	97,707	106,247	116,046	127,141	139,665	8.6%
State Energy Surplus/ (Deficit)	(17,138)	(25,726)	(35,600)	(46,702)	(59,229)	

**This energy input doesn't include energy contribution from Open Access Sales.*

14.2 Time Series based Approach for MW analysis

14.2.1 Demand Forecast

The equation considered for time series analysis for demand forecast is

$$Y = (A + B*X) * S$$

Where,

- Y = future demand as per chosen time variable X in hour.
- A = Intercept of linear regression in MW determined from historical demand from FY2014-15 to FY2017-18.
- B = slope of the linear regression determined from historical demand from FY2014-15 to FY2017-18.
- S = seasonality index determined from historical demand of from FY2014-15 to FY2017-18.

The demand data based on the time series forecasting for all the years in the 4th Control Period for each hour of each day in the year was computed by DISCOMS.

14.2.2 Plant Supply Forecast

Forecast of hourly available capacity (MW) is determined by considering AP share in the power plants and PLFs. The assumption for plant availability shall remain the same except hourly PLFs. Hourly PLFs assumed for various sources are shown below:

Table 76 – PLFs considered for Time Series MW Balance Analysis

Category	PLFs
APGENCO Thermal	Assumed (60% to 90%)
APGENCO Hydel	As per each plant PLF
CGS	Assumed (80% to 95%)
APGPCL, APDISCOM & IPP Gas	40%
IPPs	75%
NCE Biomass	30%
NCE Bagasse	30%
NCE - Industrial Waste based power project	30%
NCE - Municipal Solid Waste Projects	30%
NCE - Wind Power	As per each plant hourly PLF
NCE - Mini Hydel	As per each plant hourly PLF
NCE – Solar	As per each plant hourly PLF

- APGENCO Thermal: Average PLF of 75% is assumed to accommodate reduction in availability of coal in future with following inputs:
  - Max. 90% for time-periods when Solar & Wind generation is lower.
  - For time-periods such as June, July, August & September, where there is high wind generation, the PLF has been considered for a minimum 60% assuming maintenance of thermal power plants is scheduled in these months.
- CGS: Average PLF of 85% is assumed to accommodate reduction in wind power generation in future with following inputs:
  - PLF of 95% for four months: February, March, April and May
  - PLF of 80% for remaining months.
- For Wind and solar plants, actual observed hourly PLF is calculated for the representative year FY2016-17 using hourly energy availability from each plant (MU) and the available plant capacity (MW) for that hour. This observed PLF is assumed for all the future years in 4th and 5th Control Periods.
- Monthly averages of hourly supply forecast for the remaining years has been provided.

14.3 Surplus/Deficit (MW Analysis)

The data for all the forecasted years based on average hourly demand and average hourly supply has been analyzed. The summary of outcome of the analysis is shown below:

Table 77 - Summary of the yearly surplus-deficit

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
FY19	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073	2,073
FY20	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779	779
FY21	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673	1,673
FY22	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251	251
FY23	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)	(526)
FY24	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)	(1,085)
FY25	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)	(1,634)
FY26	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)	(2,350)
FY27	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)	(3,173)
FY28	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)	(4,176)
FY29	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)	(5,293)

14.4 Power Procurement Plan for meeting the deficit

- On the basis of deficit scenario identified in the previous sections, Licensees have estimated yearly average of hourly maximum deficit, hourly minimum deficit and hourly average deficit. However, the Licensees have

considered yearly average of maximum deficit for determining capacity to be procured.

- The capacity procured for meeting such annual average hourly maximum deficit is stated to be sufficient to meet 90% of demand. However, Licensees have extrapolated such capacity to be procured so that it is able to meet 95% of demand. Remaining 5% has been estimated to be procured from power exchange on short-term basis.
- Licensees expect to meet the capacity to be procured through Round the Clock (RTC) power with a PLF from 60% to 80% considering following factors:
  - 70% of the requirement shall be met through plants having PLF or CUF of 70% or 80%
  - 30% of the requirement shall be met through plants having PLF or CUF of 40% or 60%.
- Licensees also expect to procure Spinning Reserve for unit with highest capacity available or 5% of installed capacity whichever is lower. Licensees have considered 800 MW to be procured in FY2019-20.

Projected capacity requirements in MW are shown below:

Table 78 - Power Procurement Plan

Power Procurement (MW)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Annual Avg Maximum Deficit (Based on hourly demand-supply situation) *	-	815	415	1,565	2,574	3,483	4,479	5,537	6,881	8,552	10,450
Annual Avg Minimum Deficit (Based on hourly demand-supply situation)	-	-	-	-	158	738	1,272	1,788	2,470	3,317	4,265
Annual Average Deficit (Based on hourly demand-supply situation)	-	-	-	381	1,310	2,075	2,906	3,767	4,858	6,187	7,682
Estimated PP Capacity to be procured for meeting 95% hourly average demand		1,500	800	2,500	4,000	5,400	6,900	8,400	10,200	12,600	15,500
Estimated PP Capacity to be procured for meeting 95% hourly average demand -YoY	-	1,500	-	1,000	1,500	1,400	1,500	1,500	1,800	2,400	2,900
Spinning Reserve for estimated PP capacity	-	879**	-	53	79	74	79	79	95	126	153
Estimated PP Capacity to be procured for meeting 95% hourly average demand -YoY	-	2,379	-	1,053	1,579	1,474	1,579	1,579	1,895	2,526	3,053

Power Procurement (MW)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
RTC Power to be procured (70% of Total PP Capacity with availability @ 80%)	-	1,665	-	737	1,105	1,032	1,105	1,105	1,326	1,768	2,137
RTC Power to be procured (30% of Total PP Capacity with availability @ 60%)	-	714	-	316	474	442	474	474	568	758	916
Short Term Purchase (Meeting 5% of hourly avg demand)	475	400	519	393	438	464	510	569	652	707	783
Estimated PP Capacity to be procured for meeting 100% hourly average demand	475	2,779	519	1,446	2,017	1,938	2,089	2,148	2,547	3,233	3,836

* - Procurement to meet this deficit will cater 90% of the hourly average demand

** - Spinning Reserve (Highest Unit Capacity or 5% of Installed Capacity whichever is lower) for 800 MW considered.

15. Capital Expenditure Summary for 4th and 5th Control Periods

In line with the network requirements based on Load forecast, compliance with the Standards of Performance (SOP) Regulation issued by the Commission, objective of continuously improving reliability and quality of services to the consumers, compliance with Ease of Doing Business (EODB) norms specified by the State Govt., adhering to future requirements for system strengthening etc., the DISCOMs have projected annual capital expenditure for the 4th & 5th Control periods.

15.1 Historical Capital Expenditure

15.1.1 Historical Capital Expenditure - DISCOMs Spent

The tables below show the historical capital expenditure which has been undertaken by the Licensees in the last 5 years i.e. FY2013-14 to FY2017-18 and met by the Licensees through own funds.

Table 79 – Historical CAPEX for New Infrastructure (Rs.Cr.) – SPDCL

S. No.	Item	FY14	FY15	FY16	FY17	FY18
1	Substations (New & Augmentation)	279	229	150	130	129
2	New Consumers Capex	259	212	197	207	257
3	Distribution Transformer Additions	136	225	327	195	150
4	Feeder Additions	0	21	11	84	56
5	Loss reduction measures	7	16	56	54	106
6	Technology Upgradation and R&M	0	33	60	108	35
7	Agri (New Consumer)	8	196	268	319	196
Total		689	932	1069	1097	929

Table 80 – Historical CAPEX for New Infrastructure (Rs.Cr.) – EPDCL

S. No.	Item	FY14	FY15	FY16	FY17	FY18
1	Substations (New & Augmentation)	40	47	77	27	26
2	Metering & Associated equipment	10	26	62	64	71
3	Distribution Transformer Additions	12	25	26	11	16
4	Lines, Cables & Network	168	169	213	221	303
5	Loss reduction measures	40	53	71	45	64
6	Technology Upgradation and R&M	0	1	1	1	0
7	Civil works and Others	8	9	49	102	97
Total		278	331	498	471	577

15.1.2 Capital Expenditure for ongoing schemes

In addition to the capital investment shown above, the Licensees have also undertaken investments under various ongoing schemes such as IPDS, DDUGJY, APDRP, HVDS project, World Bank and other grants, as shown below:

Table 81 – CAPEX under ongoing Schemes (Rs.Cr.)-SPDCL

S. No.	Item	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24
		Actuals					4th Control Period					
1	HVDS	366	465	312	367	763	590	652	337	228	-	-
2	Solar	-	-	80	149	173	-	-	-	-	-	-
3	IPDS	-	-	9	125	178	89	2	2	-	-	-
4	DDUGJY	-	-	17	219	125	76	85	-	-	-	-
5	Other Grants	38	8	4	3	1	17	11	-	-	-	-
Total (Rs.Cr.)		404	473	422	863	1240	772	750	339	228		

Table 82 – CAPEX under ongoing Schemes (Rs. Cr.)-EPDCL

S. No.	Item	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24
1	Substations (New & Augmentation)	-	-	1	28	106	149	62	-	-	-	-
2	Metering & Associated equipment	-	-	-	-	-	60	65	40	-	-	-
3	Distribution Transformer Additions	-	-	-	10	32	45	30	-	-	-	-
4	Lines, Cables & Network	8	13	56	96	107	102	29	0.75	0.75	0.75	0.75
5	Loss reduction measures	32	34	27	41	132	185	246	-	-	-	-
6	Technology Upgradation an R&M	-	-	-	32	33	69	39	-	-	-	-
Total (Rs. Cr.)		40	47	84	206	411	609	471	41	0.75	0.75	0.75

It is evident from the above table that capital investment from ongoing schemes

for network strengthening, loss reduction, improving quality and reliability such as IPDS, DDUGJY, HVDS etc. shall reduce substantially in 4th and 5th Control Periods.

15.1.3 Total Historical Capital Investment

Keeping in view the above historical capital investments, the growth in total investments made by the Licensees in the last 5 years is as shown below:

Table 83 - Total Historical Capital Investment (Rs.Cr.) - SPDCL

S. No.	Item	FY14	FY15	FY16	FY17	FY18	CAGR
1	Discom spent	689	932	1069	1097	929	7.76%
2	Funded under Schemes	404	473	422	863	1240	32.36%
Total		1,093	1,405	1,491	1,959	2,169	18.69%

Table 84 - Total Historical Capital Investment (Rs.Cr.) - EPDCL

Sr. No.	Item	FY14	FY15	FY16	FY17	FY18	CAGR
1	Discom spent	278	331	498	471	577	20.1%
2	Funded under Schemes	40	47	84	206	411	79.3%
Total		317	378	582	677	988	32.8%

The Licensees have been able to improve quality and reliability of power supply in past years on sustainable basis leveraging through the above-mentioned capital investments.

15.2 Capital Expenditure Projections for 4th and 5th Control Periods

The flagship schemes for network strengthening, load enhancement, loss reduction and sustaining quality & reliability of power supply are mostly getting expired within 4th and 5th Control Periods. Therefore, to meet capital expenditure requirements, spending in different areas such as AT&C Loss reduction measures, Renovation & Modernization, System improvement works in Distribution, Technology upgradation etc. have been projected by the Licensees for both the Control Periods.

The projections for future capital investments have been estimated by using year on year growth in forecasted non-coincident peak demand at DISCOM periphery i.e. HV side of EHT (33/11 kV) Substation. These peaks are converted into PTR capacity requirements and subsequently the PTR capacity requirements thus arrived have been used for projecting requirements for other network elements such as 33 kV lines, 11 kV lines, DTR capacity and LT lines along with metering

and other infrastructural requirements.

15.2.1 Estimation of Infrastructural requirements

Circle wise energy requirement and non-coincident load factors forecasted have been used to calculate year on year (YoY) increase in non-coincident peak demands. This YoY increase has been considered for projecting future PTR capacity requirements.

Circle wise energy input and circle wise non-coincident load factors are used to calculate the non-coincident peak demands. The non-coincident peaks observed at circle level will be used in further steps to calculate the PTR level diversity factors.

15.2.2 Existing Infrastructure Capacities

The circle-wise non-coincident peaks observed for representative year FY2017-18 have been used to calculate the diversity factor of the PTRs in all circles for FY2017-18 as per the formula given below:

PTR Diversity factor for circle = Total circle PTR Capacity/Peak demand at the circle.

Below is the summary of the DISCOM-wise circle level PTR diversity factors and DTR/PTR capacity ratio for FY2017-18.

Table 85 – PTR diversity factors and DTR to PTR capacity ratios FY2017-18

Circles	PTR capacity (MVA)	DTR Capacity (MVA)	Circle peak demand (MW)	PTR Diversity factor	DTR /PTR capacity ratio
SPDCL					
Vijayawada	1,809	2,804	903	2.0	1.55
Guntur	1,569	2,433	692	2.3	1.55
Ongole	1,539	2,374	595	2.6	1.54
Nellore	1,445	2,484	606	2.4	1.72
Tirupati	2,613	3,307	1,064	2.5	1.27
Kadapa	1,754	2,825	684	2.6	1.61
Anantapur	1,734	3,113	978	1.8	1.79
Kurnool	1,273	2,248	525	2.4	1.77
EPDCL					
Srikakulam	574	574	180	3.2	1.00
Vizianagaram	627	599	224	2.8	0.95
Visakhapatnam	1271	1767	617	2.1	1.39
Rajahmundry	1698	1863	690	2.5	1.10
Eluru	2088	2775	830	2.5	1.33

15.2.3 Forecasting circle wise total PTR capacities

The circle-wise PTR diversity factors observed as per the above section for FY2017-18 are projected for 4th and 5th Control Periods. The diversity factors are maintained at optimum level of 2. For the circles in which PTR diversity factors are higher than 2, the diversity factors are maintained at the same level.

The table below shows DISCOM-wise, circle-wise projected diversity factors of PTRs for 4th and 5th Control Periods.

Table 86 – Projected PTR diversity factors

Circles	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
SPDCL											
Vijayawada	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Guntur	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Ongole	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Nellore	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Tirupati	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Kadapa	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Anantapur	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Kurnool	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
EPDCL											
Srikakulam	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Vizianagaram	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Visakhapatnam	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Rajahmundry	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Eluru	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5

The diversity factors projected above and the non-coincident peak demands projected are used to project the circle-wise total PTR capacities as per the following formula.

Circle total PTR capacity = Projected Circle PTR diversity factor / Projected circle non-coincident demand.

Below is the summary of the DISCOM-wise, circle-wise projected PTR capacities for 4th and 5th Control Periods.

Table 87 – Projected Discom-wise circle-wise total PTR capacities - Cumulative (MVA)

PTR capacity projections (MVA)	FY 18 (Actual)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
SPDCL												
Vijayawada	1,809	1,994	2,214	2,464	2,748	3,069	3,432	3,845	4,323	4,876	5,513	6,248
Guntur	1,569	1,818	2,012	2,234	2,489	2,779	3,112	3,495	3,944	4,470	5,087	5,811
Ongole	1,539	1,637	1,752	1,878	2,017	2,169	2,336	2,520	2,729	2,969	3,242	3,551
Nellore	1,445	1,590	1,732	1,900	2,092	2,312	2,565	2,857	3,201	3,607	4,084	4,646
Tirupati	2,613	2,783	2,950	3,131	3,327	3,539	3,768	4,017	4,298	4,615	4,971	5,370
Kadapa	1,754	1,822	1,915	2,018	2,135	2,263	2,407	2,567	2,755	2,975	3,231	3,527
Anantapur	1,734	2,024	2,220	2,318	2,426	2,545	2,676	2,822	2,990	3,184	3,407	3,662
Kurnool	1,273	1,312	1,384	1,466	1,556	1,656	1,768	1,891	2,036	2,206	2,404	2,631
EPDCL												
Srikakulam	574	639	696	760	831	909	996	1,092	1,201	1,330	1,479	1,630
Vizianagaram	627	703	766	835	912	997	1,091	1,195	1,312	1,449	1,605	1,783
Visakhapatnam	1,271	1,434	1,543	1,662	1,793	1,934	2,089	2,257	2,441	2,654	2,894	3,164
Rajahmundry	1,698	1,819	1,968	2,135	2,320	2,526	2,753	3,006	3,286	3,613	3,985	4,408
Eluru	2,088	2,308	2,821	3,014	3,227	3,479	3,741	4,034	4,358	4,735	5,163	5,649

15.2.4 Forecasting circle-wise total DTR capacities

In order to ensure DTR capacities can handle the future forecasted LT sales, the ratio of forecasted LT sales to (LT +11 kV) sales has been considered and are given below:

Table 88 – Forecasted ratio for LT/ (LT+11kV) sales

LT/ (LT+11kV) sales ratio	FY 18 (Actual)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
SPDCL												
Vijayawada	0.87	0.87	0.87	0.87	0.87	0.88	0.88	0.88	0.88	0.89	0.89	0.89
Guntur	0.87	0.87	0.86	0.86	0.85	0.85	0.84	0.84	0.83	0.83	0.82	0.81
Ongole	0.89	0.88	0.88	0.87	0.87	0.86	0.86	0.85	0.85	0.84	0.84	0.84
Nellore	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.89
Tirupati	0.80	0.79	0.79	0.79	0.78	0.78	0.78	0.78	0.77	0.77	0.77	0.77
Kadapa	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Anantapur	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Kurnool	0.92	0.93	0.93	0.93	0.93	0.94	0.94	0.94	0.94	0.94	0.95	0.95
EPDCL												
Srikakulam	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.88	0.88	0.88	0.88	0.89
Vizianagaram	0.77	0.77	0.78	0.78	0.78	0.79	0.79	0.79	0.80	0.80	0.80	0.81
Visakhapatnam	0.68	0.68	0.68	0.69	0.69	0.69	0.70	0.70	0.70	0.71	0.71	0.72
Rajahmundry	0.84	0.85	0.85	0.86	0.87	0.88	0.88	0.89	0.89	0.90	0.91	0.91
Eluru	0.90	0.86	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84

In view of the above, Discom-wise, circle-wise DTR to PTR capacity ratios have been forecasted as per the following formula:

DTR to PTR capacity ratio for year t = (DTR to PTR capacity ratio for year t-1)(LT/ (LT+11kV) sales ratio for year t)/(LT/(LT+11kV) sales ratio for year t-1)*

Below are the ratios calculated for DTR to PTR capacities for all circles for forecasted years.

Table 89 – Forecasted DTR/PTR ratios

LT/ (LT+11kV) sales ratio	FY 18 (Actual)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
SPDCL												
Vijayawada	0.87	0.87	0.87	0.87	0.87	0.88	0.88	0.88	0.88	0.89	0.89	0.89
Guntur	0.87	0.87	0.86	0.86	0.85	0.85	0.84	0.84	0.83	0.83	0.82	0.81
Ongole	0.89	0.88	0.88	0.87	0.87	0.86	0.86	0.85	0.85	0.84	0.84	0.83
Nellore	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.89
Tirupati	0.80	0.79	0.79	0.79	0.78	0.78	0.78	0.78	0.77	0.77	0.77	0.77
Kadapa	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Anantapur	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Kurnool	0.92	0.93	0.93	0.93	0.93	0.94	0.94	0.94	0.94	0.94	0.95	0.95
EPDCL												
Srikakulam	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.02	1.02	1.03
Vizianagaram	0.95	1.00	1.00	1.01	1.01	1.02	1.02	1.03	1.03	1.04	1.04	1.05
Visakhapatnam	1.39	1.40	1.40	1.41	1.42	1.43	1.43	1.44	1.45	1.46	1.47	1.48
Rajahmundry	1.10	1.11	1.12	1.13	1.14	1.14	1.15	1.16	1.17	1.18	1.19	1.19
Eluru	1.33	1.28	1.11	1.12	1.14	1.15	1.17	1.18	1.20	1.21	1.23	1.24

The DTR/PTR capacity ratio calculated as above and forecasted PTR capacities calculated are used to calculate the forecasted DTR capacities as per the formula,

*DTR capacity = DTR to PTR capacity ratio * forecasted PTR capacity*

Below are the calculated circle-wise DTR capacities for forecasted years.

Table 90 – Projected circle-wise total DTR capacities (MVA)

Projection for DTR Capacity	FY 18 (Actual)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
SPDCL												
Vijayawada	2,804	3,090	3,438	3,835	4,287	4,800	5,384	6,049	6,823	7,722	8,764	9,968
Guntur	2,433	2,796	3,079	3,400	3,764	4,178	4,648	5,184	5,810	6,539	7,388	8,378
Ongole	2,374	2,493	2,653	2,830	3,023	3,232	3,461	3,711	3,998	4,324	4,696	5,117
Nellore	2,484	2,721	2,967	3,251	3,578	3,954	4,389	4,893	5,490	6,197	7,034	8,023
Tirupati	3,307	3,504	3,700	3,912	4,143	4,391	4,660	4,953	5,285	5,662	6,090	6,572
Kadapa	2,825	2,930	3,075	3,238	3,420	3,622	3,848	4,101	4,399	4,749	5,156	5,628
Anantapur	3,113	3,624	3,976	4,151	4,346	4,560	4,797	5,060	5,364	5,716	6,121	6,586
Kurnool	2,248	2,337	2,470	2,619	2,785	2,969	3,174	3,403	3,671	3,987	4,354	4,780
EPDCL												
Srikakulam	574	641	699	764	837	917	1,006	1,105	1,218	1,352	1,506	1,681
Vizianagaram	599	703	769	843	924	1,015	1,115	1,227	1,352	1,500	1,670	1,865
Visakhapatnam	1,767	2,004	2,166	2,345	2,542	2,756	2,991	3,249	3,529	3,864	4,245	4,677
Rajahmundry	1,863	2,014	2,199	2,406	2,635	2,892	3,176	3,493	3,844	4,257	4,727	5,263
Eluru	2,775	2,953	3,133	3,390	3,676	4,012	4,369	4,769	5,215	5,736	6,332	7,012

System Capacity Estimation

Based on the circle wise PTR and DTR capacities projected above, the incremental capacities required for each year have been determined. The system capacities

(MVA) thus arrived have been used to estimate number of PTRs and DTRs assuming that each 33/11 kV substation will have one PTR with a capacity of 5 MVA and each DTR will be of 100 kVA capacity.

The table below shows the number PTRs and DTRs for each circle:

Table 91 – No. of DTRs and PTRs required in 4th and 5th Control Periods

	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
SPDCL											
Vijayawada											
No. of 5 MVA 33/11 kV SS	37	44	50	57	64	73	82	95	110	127	147
No. of 100 kVA DTRs	2,860	3,480	3,970	4,520	5,130	5,840	6,650	7,740	8,990	10,420	12,050
Guntur											
No. of 5 MVA 33/11 kV SS	49	39	44	51	58	67	77	90	105	123	145
No. of 100 kVA DTRs	3,630	2,830	3,210	3,650	4,130	4,700	5,370	6,250	7,290	8,500	9,900
Ongole											
No. of 5 MVA 33/11 kV SS	19	23	25	28	30	33	37	42	48	54	61
No. of 100 kVA DTRs	1,190	1,610	1,760	1,930	2,100	2,290	2,510	2,860	3,270	3,720	4,210
Nellore											
No. of 5 MVA 33/11 kV SS	29	28	33	38	44	51	58	69	81	95	112
No. of 100 kVA DTRs	2,380	2,450	2,840	3,270	3,760	4,350	5,040	5,970	7,070	8,370	9,890
Tirupati											
No. of 5 MVA 33/11 kV SS	34	33	36	39	42	46	50	56	63	71	80
No. of 100 kVA DTRs	1,970	1,960	2,120	2,310	2,490	2,690	2,930	3,320	3,770	4,270	4,830
Kadapa											
No. of 5 MVA 33/11 kV SS	13	19	21	23	26	29	32	38	44	51	59
No. of 100 kVA DTRs	1,050	1,450	1,630	1,820	2,020	2,260	2,530	2,980	3,500	4,070	4,720
Anantapur											
No. of 5 MVA 33/11 kV SS	58	40	20	22	24	27	29	34	39	45	51
No. of 100 kVA DTRs	5,110	3,520	1,760	1,950	2,140	2,370	2,630	3,040	3,520	4,050	4,640
Kurnool											
No. of 5 MVA 33/11 kV SS	7	15	16	18	20	22	25	29	34	39	45
No. of 100 kVA DTRs	890	1,330	1,490	1,660	1,840	2,050	2,290	2,690	3,160	3,680	4,250
EPDCL											
Srikakulam											
No. of 5 MVA 33/11 kV SS	13	11	13	14	16	17	19	22	26	30	30
No. of 100 kVA DTRs	670	580	650	730	800	890	990	1,130	1,340	1,550	1,750
Vizianagaram											
No. of 5 MVA 33/11 kV SS	15	13	14	15	17	19	21	23	27	31	36
No. of 100 kVA DTRs	1,040	660	740	820	900	1,000	1,110	1,250	1,480	1,700	1,950
Visakhapatnam											
No. of 5 MVA 33/11 kV SS	33	22	24	26	28	31	34	37	43	48	54
No. of 100 kVA DTRs	2,370	1,620	1,790	1,960	2,150	2,350	2,580	2,800	3,350	3,810	4,320
Rajahmundry											
No. of 5 MVA 33/11 kV SS	24	30	33	37	41	45	50	56	65	74	85
No. of 100 kVA DTRs	1,510	1,850	2,070	2,300	2,570	2,840	3,160	3,520	4,120	4,710	5,360
Eluru											
No. of 5 MVA 33/11 kV SS	44	102	39	43	50	53	59	65	75	86	97
No. of 100 kVA DTRs	1,780	1,800	2,560	2,860	3,360	3,570	4,000	4,460	5,210	5,960	6,800

15.2.5 Line Lengths Estimation

For forecasting future additions for line lengths, the Licensees have analyzed existing infrastructure, as shown below:

Table 92 – Existing data for Line lengths norms

Average Lengths as on 31st March 2018	LT	11kV	33 kV
	Km per 100 kVA DTR	Km per 100 kVA DTR	Km per 5 MVA PTR
SPDCL			
Vijayawada	0.62	0.24	7.11
Guntur	0.38	0.28	6.81
Ongole	0.58	0.53	9.35
Nellore	0.34	0.21	7.97
Tirupati	0.25	0.21	6.00
Kadapa	0.19	0.20	5.64
Anantapur	0.36	0.26	8.07
Kurnool	0.38	0.26	9.34
EPDCL			
Srikakulam	0.89	0.43	9.07
Vizianagaram	0.65	0.35	7.51
Visakhapatnam	0.56	0.23	7.01
Rajahmundry	0.39	0.23	8.22
Eluru	0.27	0.19	6.78

The line length required at different voltage levels i.e. 33 kV, 11 kV and LT line have been estimated based on the assumption of maintaining HT: LT ratio of 1 during the Control Periods for 11 kV and LT lines whereas current standards have been assumed to be continuing in future for 33 kV lines. The assumed standards for line lengths at different voltage levels have been shown below:

Table 93 – Forecasted line lengths norms

Average Lengths as on 31st March 2018	LT	11 kV	33 kV
	Km per 100 kVA DTR	Km per 100 kVA DTR	Km per 5 MVA PTR
SPDCL			
Vijayawada	0.43	0.43	7.11
Guntur	0.33	0.33	6.81
Ongole	0.56	0.56	9.35
Nellore	0.28	0.28	7.97
Tirupati	0.23	0.23	6.00
Kadapa	0.19	0.20	5.64
Anantapur	0.31	0.31	8.07
Kurnool	0.32	0.32	9.34
EPDCL			
Srikakulam	0.66	0.66	9.07
Vizianagaram	0.50	0.50	7.51
Visakhapatnam	0.39	0.39	7.01
Rajahmundry	0.31	0.31	8.22
Eluru	0.23	0.23	6.78

Based on the above norms, licensees have estimated the line lengths required (in KMs) at different voltage levels for each circle in 4th Control Period & 5th Control Period, as shown below:

Table 94 – Forecasted Line lengths (KMs) for 4th and 5th Control Periods

	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
SPDCL											
Vijayawada											
33 kV	263	313	355	405	455	519	583	675	782	903	1,045
11kV	1,234	1,502	1,713	1,951	2,214	2,521	2,870	3,341	3,880	4,497	5,201
LT	1,234	1,502	1,713	1,951	2,214	2,521	2,870	3,341	3,880	4,497	5,201
Guntur											
33 kV	334	266	300	347	395	456	524	613	715	838	987
11kV	1,211	944	1,071	1,217	1,377	1,567	1,791	2,084	2,431	2,835	3,302
LT	1,211	944	1,071	1,217	1,377	1,567	1,791	2,084	2,431	2,835	3,302
Ongole											
33 kV	458	365	411	477	542	626	720	841	982	1,150	1,356
11kV	2,015	1,571	1,782	2,026	2,292	2,609	2,981	3,469	4,046	4,718	5,495
LT	2,015	1,571	1,782	2,026	2,292	2,609	2,981	3,469	4,046	4,718	5,495
Nellore											
33 kV	151	183	199	223	239	263	295	335	383	430	486
11kV	329	445	486	533	580	633	694	791	904	1,028	1,164
LT	329	445	486	533	580	633	694	791	904	1,028	1,164
Tirupati											
33 kV	174	168	198	228	264	306	348	414	486	570	672
11kV	543	559	648	746	857	992	1,149	1,361	1,612	1,909	2,255
LT	543	559	648	746	857	992	1,149	1,361	1,612	1,909	2,255
Kadapa											
33 kV	73	107	118	130	147	164	181	214	248	288	333
11kV	210	290	326	364	404	452	506	596	700	814	944
LT	200	276	310	346	384	429	481	566	665	773	897
Anantapur											
33 kV	468	323	161	177	194	218	234	274	315	363	411
11kV	1,590	1,095	548	607	666	737	818	946	1,095	1,260	1,444
LT	1,590	1,095	548	607	666	737	818	946	1,095	1,260	1,444
Kurnool											
33 kV	65	140	149	168	187	205	233	271	317	364	420
11kV	283	423	474	528	585	652	728	855	1,005	1,170	1,351
LT	283	423	474	528	585	652	728	855	1,005	1,170	1,351
EPDCL											
Srikakulam											
33 kV	118	100	118	127	145	154	172	200	236	272	272
11kV	441	382	428	481	527	586	652	744	882	1,021	1,152
LT	441	382	428	481	527	586	652	744	882	1,021	1,152

Vizianagaram											
33 kV	113	98	105	113	128	143	158	173	203	233	271
11kV	520	330	370	410	450	500	555	625	740	850	975
LT	520	330	370	410	450	500	555	625	740	850	975
Visakhapatnam											
33 kV	231	154	168	182	196	217	238	259	301	336	379
11kV	934	638	705	772	847	926	1,016	1,103	1,320	1,501	1,702
LT	934	638	705	772	847	926	1,016	1,103	1,320	1,501	1,702
Rajahmundry											
33 kV	197	247	271	304	337	370	411	460	534	608	698
11kV	468	573	642	713	796	880	979	1,091	1,277	1,460	1,661
LT	468	573	642	713	796	880	979	1,091	1,277	1,460	1,661
Eluru											
33 kV	298	692	265	292	339	360	400	441	509	583	658
11kV	414	419	596	665	782	831	931	1,038	1,212	1,387	1,582
LT	414	419	596	665	782	831	931	1,038	1,212	1,387	1,582

15.2.6 Projection of Capital Investment based on projected Infrastructure:

The cost for each projected network element has been taken from the existing approved rates. However, escalation in the costs has been assumed considering variation in WPI and CPI to reflect growth in GDP of the State considering a weightage of 60%:40% respectively. Licensees have adopted CERC methodology for computation of the escalation factors as shown below:

Table 95 – Cost numbers for CAPEX calculations

Cost Numbers	SPDCL	EPDCL	Units
LT Line	2.85	2.85	Rs. Lakhs/Km
DTR per Unit (100 kVA)	2.50	2.50	Rs. Lakhs/Unit
11 kV Line	3.08	3.08	Rs. Lakhs/Km
33/11kV SS per Unit (5 MVA)	130.91	130.91	Rs. Lakhs/Unit
33 kV Line	4.62	4.62	Rs. Lakhs/Km

Table 96 - Calculation for Escalation factor for SPDCL & EPDCL

Year	WPI for Electrical Conductor	WPI for Transformer	Total WPI	CPI	Composite Number	Rt= Yt/Y1	Ln (Rt)	Year -1	Product
2012	100.0	100.0	100.0	209.3	143.72				
2013	107.4	103.6	105.5	232.2	156.18	1.09	0.08	1	0.08
2014	108.7	100.2	104.45	246.9	161.43	1.12	0.12	2	0.23
2015	110.9	110.6	110.75	261.4	171.01	1.19	0.17	3	0.52
2016	103.8	104.5	104.15	274.3	172.21	1.20	0.18	4	0.72
A= Sum of Product column					1.56				
B= 6A					9.36				
C= n(n-1)(2n-1); n= number of years of data					180.00				
D=B/C					0.05				
g= exp (D)-1					0.05				
Escalation rate= g*100					5.34				

16. Keeping in view the above, the Discom-wise projected capital investments for 4th and 5th Control Periods are as shown below:

Table 97 – Total Forecasted CAPEX under DISCOM spend for 4th and 5th Control periods – SPDCL (Rs.Cr.)

Sr. No.	Item	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
1	Substations (New & Augmentation)	338	348	371	439	515	611	718	876	1,064	1,290	1,567
2	Distribution Transformer Additions	500	512	542	640	752	888	1,051	1,285	1,570	1,913	2,325
3	Lines, Cables & Network	620	570	623	746	888	1,064	1,276	1,567	1,922	2,354	2,880
Total (Rs.Cr.)*		1,458	1,431	1,536	1,826	2,155	2,563	3,046	3,727	4,556	5,557	6,773

Table 98 – Total Forecasted CAPEX under DISCOM spend for 4th and 5th Control periods – EPDCL (Rs. Cr.)

Sr. No.	Item	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
1	Substations (New & Augmentation)	231	226	283	332	390	446	517	599	727	861	1,017
2	Metering & Associated equipment	50	65	80	95	110	125	140	155	170	185	200
3	Distribution Transformer Additions	165	239	173	200	236	269	314	365	446	534	629
4	Lines, Cables & Network	253	249	275	319	375	431	502	587	725	871	1,038
5	Technology Upgradation and R&M	75	88	101	114	127	140	153	166	179	192	200
6	Civil works and Others	30	34	38	42	46	50	54	58	62	66	70
Total (Rs. Cr.)*		804	901	950	1,102	1,285	1,461	1,679	1,930	2,309	2,709	3,153

17. Further, APSPDCL plans to install smart meters for all consumers whose monthly consumption is more than 100 units (except LT Category-V Agriculture) in the 4th & 5th Control Periods. The number of LT consumers whose monthly consumption is more than 100 units is given below:

Table 99 – Consumers whose monthly consumption is more than 100 units

S. No.	Number of consumers		
	Single Phase	Three Phase	Total
1	2433985	372659	2806644

18. Further, the number of consumers whose consumption is more than 100 units is projected to increase to 3497701 Nos. single phase consumers and 549922 Nos. three phase consumers by FY2028-29. The approximate cost of single-phase smart meter is Rs.5000/- and that of three phase meter is Rs.6500/- The total expenditure over a period of 10 years is projected as Rs. 2106 Cr.

18.1 It is also proposed to install smart meters for 4,33,000 Nos. agricultural DTRs over the next 5 years at a cost of Rs.346 Cr. (The approximate cost of smart meter is Rs.8000/-)

18.2 It is planned to provide SCADA at newly erected substations in Vijayawada, Guntur & Nellore cities. The scheme cost for implementation of SCADA at these cities is Rs.318 Cr. Also, it is proposed to provide SCADA at District headquarters due to increasing urbanization with a cost of Rs. 800 Cr.

18.3 It is proposed to provide underground cable in the cities of Tirupati, Vijayawada & Guntur at a cost of Rs.1500 Cr.

18.4 It is proposed to implement the schemes that may be announced by the GoI with DISCOM contribution as indicated in the table given below:

Table 100 – Expenditure proposed to be incurred for implementing the above schemes (Rs.Cr.)

Sr. No.	Item	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
1	Providing of Smart meters to comers with consumption more than 100 units (Except Agl.)	20	100	160	200	200	220	230	240	240	245	251
2	Smart meters for Agl DTRs	10	60	90	90	96						
3	SCADA	60	98	100	100	100	100	100	100	100	130	130
4	U.G. Cable		100	100	150	150	150	150	200	200	150	150
5	DISCOM contribution towards schemes to be announced by GoI/ Infrastructure requirement due to unexpected load growth in Aqua / Industries		100	110	120	130	140	150	160	170	180	190
6	Civil infrastructure development		25	27	29	31	33	35	37	39	41	43
Total		90	483	587	689	707	643	665	737	749	746	764

Table 101 – Final Abstract for SPDCL (Rs. Cr.)

S. No.	Item	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
1	CAPEX under ongoing Schemes	772	750	339	228							
2	Capital Expenditure for infrastructure towards new loads (Base Capex)	1,458	1,431	1,536	1,826	2,155	2,563	3,046	3,727	4,556	5,557	6,773
3	Technology up gradation & Others	90	483	587	689	707	643	665	737	749	746	764
Total (Rs. Cr.)		2320	2664	2462	2743	2862	3206	3711	4464	5305	6303	7537

19. Transmission Resource Plan:

19.1 The objective of the Transmission Planning is to develop Transmission Expansion Plan based on the load forecast and generation supply scenario developed as part of the Load forecast and Resource plan for the State with the inputs of Discoms and Genco, summary of the process, assumptions, methodology, transmission network expansion plan and investment required to ensure the transmission system capable of transmitting the planned generation to meet the forecasted loads. The proposed transmission system was evaluated for the load and generation conditions. The following system conditions are studied, namely (a) Peak Load Scenario and (b)Light Load Scenario.

19.2 System studies were carried out for the above scenarios and analysed for the transmission system required for FY2018-19. The transmission investment plan is prepared based on the transmission network expansion plan developed and was based on load flow studies and short circuit studies. After conducting load flows, short circuit studies and contingency analysis under maximum thermal generation scenario as the peak demand occurs in the month of March, various generation evacuation schemes at 765 kV and 400 kV are depicted. The transmission expansion plan which includes 765 kV, 400 kV and 220 kV lines and Substations are also depicted. Sub transmission plan comprising of 132 kV network is also prepared and depicted.

19.3 AP Transco, in its filings stated that the consolidated Sales and Load forecast are prepared using Trend Method, in view of the demand expected to come up due to new capital city Amaravathi, PCPIR (Petroleum, Chemicals and Petrochemical Investment Region) corridor, Vizag Chennai Industrial Corridor (VCIC), Sri City SEZ, new airports, new sea ports. Special package to Andhra Pradesh State etc. would further stimulate the Industrial sales. New lift

irrigation schemes i.e. Purushottampatnam, Krishnavaram under Polavaram LI scheme, Chintalapudi, Kondaveeti Vaagu etc. will further contribute in increasing the sales.

19.4 Transmission Losses**:** Transmission losses will be reduced from the present (FY2017-18) level of 3.17 % to 3.0% by FY2023-24 and will further come down to 2.75% by FY 2028-2029. The details are tabulated below.

Table 102 : Details of transmission losses

Losses (%)	FY 19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Transmission	3.14%	3.12%	3.10%	3.08%	3.05%	3.00%	2.95%	2.90%	2.85%	2.80%	2.75%

19.5 Comparison of Load forecasts: Comparison of Energy (MU) forecast by Discoms with the 19th EPS projections by CEA is shown in the table below. Discoms' energy forecast (Resource plan) is slightly more than 19th EPS forecast upto FY2026-27. However, energy requirement in FY2028-29 in resource plan forecast is higher than 19th EPS forecast. Econometric forecast which takes into account GDP growth, Population growth and other demographic factors is compared with Resource plan forecast.

Table 103 - Comparision of Energy Forecast

Energy Requirement (MU)	FY 2017-18	FY 2018-19	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	FY 2024-25	FY 2025-26	FY 2026-27	FY 2027-28	FY 2028-29	CAGR FY 2018-29
19th EPS report by CEA	58846	63290	68034	73090	78540	84429	90794	97181	104072	111485	117505	123850	7.0%
Resource plan July2018	58827	64030	68606	73212	79146	85776	93106	101306	110561	121302	133594	147599	8.7%
Econometric Forecast	58828	64029	68599	73298	78597	84629	91168	97722	104958	112657	121111	129559	7.4%

19.6 The State is at present handling 58,798 MU (FY2017-18) of energy and maximum demand reached is 8983 MW. This is likely to increase to 87364 MU of energy & 15978 MW of peak demand by FY2023-24. To meet this demand, robust & reliable transmission network is required for transmission (Inter-State & Intra-State) of required energy.

19.7 For handling the above energy, PGCIL (CTU) has drawn up the following plans: Inter Regional Lines (ER-SR corridor): PGCIL commissioned Angul-Srikakulam - Vemagiri 765 kV double circuit lines. Vemagiri - Chilakaluripet line will be operationalized by June'19. These double circuit 765 kV lines will be able to transmit 3,000 MW power.

19.8 APTRANCO can import power from other Regions through this ER-SR corridor, by getting linkage through 400 kV substations at Srikakulam (Palasa).

19.9 APTRANSCO has drawn up investment plans of Rs. 4748.31 Cr. in the period FY2018-19. This investment includes 661 ckm of 400 kV, 710 ckm of 220 kV lines and 1069 ckm of 132 kV lines and 4 Nos. 400 kV Substations, 9 Nos. 220 kV Substations and 26 Nos. 132 kV Substations towards transmission expansion

19.10 Assumptions and standards adopted while conducting Load Flow studies for UHV (200KV and above) are as shown below.

(A) Standard Transformer sizes:

The utility's standard Transformer Sizes

Table 104 – Standard Transformer sizes

Voltage	ONAN Rating (MVA)	OFAF Rating (MVA)
765/400 kV	900	1500
400 / 220 kV	300	500
400 / 220 kV	190	315
220 / 132 kV	96	160
220 / 132 kV	60	100

(B) Standard Conductor types:

Table 105 – Standard Transformer sizes

Sl. No.	Line Voltage	Conductor Type	Configuration
1	765 kV	Quad Bersimis	ACSR Bersimis,4/PH, 42/4.57 mm Al + 7/2.54 mm Sel
2	400 kV	Twin Moose	ACSR Moose, 2/PH, 61/3.53mm
3	400 kV	Quad Moose	ACSR Moose, 4/PH, 61/3.53mm
4	220 kV	Single Moose	ACSR Moose, 1/PH, 61/3.53mm
5	220 kV	Twin Moose	ACSR Moose, 2/PH, 61/3.53mm
6	132 kV	Panther	ACSR Panther, 37/3.00mm

(C) Operating Limits under normal conditions: The operating limits in practice for system studies are adopted as follows:

Table 106 – Operating Limits

Sl. No.	Item	Operating Limit during normal conditions
1	765/400 KV 1500 MVA Transformer*	900MVA
2	400 / 220 kV 315 MVA Transformer	190 MVA
3	220 / 132 kV 100 MVA Transformer	60 MVA
4	765 KV Quad Bersimis Line*	2250MVA
5	400 kV Twin Moose Line	555 MVA
6	220 kV Single Moose / Zebra Line	178 MVA
7	132 kV Panther Line	67 MVA

(D) Thermal Limits of Transmission Lines at Rated Voltage:

Table 107 – Thermal Limits of Transmission Lines

Conductor	40°C ambient 75 ° Cond. Temp Amp	45°C ambient 75 ° Cond. Temp Amp	45°C ambient 85 ° Cond. Temp Amp
ACSR Bersimis	848 A	732 A	933 A
ACSR Moose	728 A	631 A	798 A
ACSR Zebra	643 A	560 A	703 A
ACSR Panther	413 A	366 A	NA

(E) Number of transformers in 765/400 kV ,400/220 kV and 220/132 kV Sub-Stations: Based on the standard transformer sizes adopted, transformer loading limits adopted and the CEA specified sub-station loading limits, the utility has adopted the maximum number of transformers in 400/220 kV, 220/132 kV and 132/33 kV Sub-Stations as four (4).

(F) The Transformer augmentation in 220/132kV substations will be carried out in the long-term planning studies considering minimum of 2 numbers PTRs to meet the N-1 contingency. The additional PTR will be provided whenever the substation load reaches 90 MVA.

(G) Capacity of Substation: As per CEA revised planning criteria, the capacity of any single substation at different voltage levels shall not normally exceed:

Table 108 – MVA Capacity of Substation

Voltage	MVA
765 kV	9000 MVA
400 kV	2000 MVA
220 kV	500 MVA
132 kV	250 MVA

(H) Voltage Limits: Permitted voltage limits, as per CEA guidelines

Table 109 – Permitted Voltage Limits

Nominal Voltage in kV	Maximum Voltage in kV	Minimum Voltage in kV
765	800	728
400	420	380
220	245	198
132	145	122

(I) Power Factor of the Loads: The Power Factor of all the loads at 220kV and 132kV voltage levels is assumed to be 0.95 lag during peak load condition and 0.98 lag during light load condition as per Transmission Planning criteria specified by CEA.

19.11 Contingency criteria: The system is planned to supply loads during normal conditions and the following contingency conditions without the need for rescheduling of generation and to maintain voltage and line loading criteria.

(i) All the equipment in the transmission system shall remain within normal thermal and voltage ratings after a disturbance involving loss of any one of the following elements (called single contingency or 'N-1' condition), but without load shedding / rescheduling of generation (a) Outage of a 132kV or 110kV single circuit, (b) Outage of a 220kV or 230kV single circuit, (c) Outage of a 400kV single circuit, (d) Outage of a 400kV single circuit with fixed series capacitor(FSC), (e) Outage of an Inter-Connecting Transformer(ICT), (f) Outage of a 765kV single circuit and (g) Outage of one pole of HVDC bi-pole.

(ii) The angular separation between adjacent buses under ('N-1') condition shall not exceed 30 degrees.

(Prior to such contingency, all elements shall be considered to be in service)

19.12 District wise load forecast: Discoms have projected their Circle wise demand forecast in Discoms Resource plan. The circle level peaks are monthly peaks and may be coincident with Discom peak in the same month.

19.13 Evacuation Schemes at 400 KV and 220 KV:

Capital Works of 400 kV and 220 KV Transmission Schemes are being taken up for (1) Evacuation of power from the Power Projects (2) System improvement i.e. to meet the additional load demand and for improvement of voltage profile, Voltage control and reduction of Transmission Losses (3) Including the associated 220 kV Lines & Substations.

Capital works are mainly funded by Japan Bank for International Cooperation (JBIC), Power Finance Corporation Limited, Rural Electrification Corporation Limited & now recently from various Commercial Banks. The new transmission schemes are proposed for the FY2018 -19 as per the Load Forecast and Power Procurement Plan.

19.14 Schemes proposed for evacuation of power (New Schemes): Comprehensive Wind Evacuation Scheme

400 KV Hindupur SS Comprehensive Wind Evacuation Scheme (1300 MW) is taken up for evacuation of power from Hindupur, Ananthapur Dist.

- The scheme consists of the following transmission lines, Power Transformers and associated bay extensions:

  a) 400/220 kV Substation with 4X315 MVA PTRs,

  b) 400 kV D/C Quad Moose Line from 400KV Hindupur SS to Uravakonda 400 kV SS – 130km.

  c) 400 kV D/C Quad Moose Line from 400KV Hindupur SS to NP Kunta 400 kV SS – 120.35km,

  d) 220 kV D/C Moose Line from 400 kV SS Hindupur to 220kV Penukonda SS – 50 km.

  e) 220 kV D/C Twin Moose Line from 400 kV SS Hindupur to 220 kV Pampanurtanda SS – 70 km.

  f) 220 kV D/C Moose Line from 400 kV SS Hindupur to 220kV Pampanurtanda SS – 70 km.

g) 220 kV D/C Twin Moose Line from 400 kV SS Hindupur to 220kV Hindupur/Gollapuram SS – 20 km,

19.15 400 KV Jammalmadugu SS Comprehensive Wind Evacuation Scheme (950 MW) is proposed for evacuation of power from the 400 kV Jammalmadugu SS in Kadapa (Dt).

- The scheme proposal is as follows:

a) 400/220/132 kV Jammalmadugu Substation with 3X315 MVA PTRs and 2x160 MVA PTRs

b) 400 kV D/C Quad Moose Line from 400kV Jammalmadugu to Kurnool 400 kV SS – 120km.

c) LILO of 400kV Quad Moose DC line from 400kV Uravakonda SS to 400kV Jammalamadugu SS at proposed 400kV Talaricheruvu SS -2km

d) 220 kV D/C Moose Line from 400 kV SS Jammalmadugu to 220kV SS Tirumalaipally – 17 km.

e) 220 kV D/C Moose Line from 400 kV SS Jammalmadugu to 220kV Betamcherla SS –68 km.

f) 220 kV D/C Moose Line from 400 kV SS Jammalmadugu to 220kV Tadipatri SS – 40 km.

g) 220 kV D/C Moose Line from 400 kV SS Jammalmadugu to 220 kV Chakrayapet SS–70 km.

h) 220 kV D/C Moose Line from 400 kV SS Jammalmadugu to 220kV Porumamilla SS – 75 km.

19.16 400 KV Uravakonda SS Comprehensive Wind Evacuation Scheme (2095 MW) is proposed for evacuation of power from the 400 kV SS Uravakonda in Anantapur (Dt).

- The scheme proposal is as follows:

i. 400/220 kV Uravakonda Substation with 2x315 MVA & 2x500 MVA PTRs.

ii. 400 kV D/C Quad Moose Line from Uravakonda (Ananthapur Dt) to Mahabubnagar 400 kV SS – 190 km.

iii. 400 kV D/C Quad Moose Line from Uravakonda to Jammalamadugu 400 kV SS – 128 km.

iv. 220 kV D/C Twin Moose Line from 400 kV SS Uravakonda to 220kV Vajra Karur – 13 km.

v. 220 kV D/C Twin Moose Line from 400 kV SS Uravakonda to 220kV Borampalli – 55 km.

vi. 220 kV D/C Single Moose Line from 400 kV SS Uravakonda to 220kV Borampalli – 55 km.

vii. 220 kV D/C Single Moose Line from 400 kV SS Uravakonda to 220kV Borampalli – 55 km, & 220KV SS Borampalli to Kalyandurg 220KV SS Twin Moose DC line – 15 km.

viii. 220 kV D/C Single Moose Line from 220 kV SS Vajrakarur to 220kV Ananthapur – 60 km.

19.17 Extension of Krishnapatnam Power Transmission Schemes Stage-2 (1X800MW).

- The scheme proposal is as follows:

  a) 400kV Quad Moose D/C Line from Krishnapatnam TPP to Chittoor 400/220 kV SS – 187 km.

19.18 Extension of Muddanur RTPP STG-IV (600MW) Power Transmission Scheme.

- The scheme proposal is as follows:

  a) 400kV D/C Twin Moose Line from Muddanur RTPP Stg IV to Chittoor 400/220 kV SS – 253 km

19.19 HNPCL Power plant Evacuation Scheme (2X520 MW) is proposed for evacuation of power from M/s HNPCL Pvt. Ltd. (Hinduja PP) of 2X520 MW power plant in Vizag Dt.

- The scheme proposal is as follows:

  a) 400/220 kV new Substation proposed at Kamavarapukota in West Godavari district with 2x315 MVA PTRs.

  b) 400kV D/C Twin Moose Line from HNPCL Power plant to proposed Kamavarapukota 400 kV SS – 244 km.

  c) 400kV D/C Twin Moose Line from 400kV Vemagiri SS to 400kV Kamavarapukota SS-60 km.

d) 400kV D/C Quad Moose Line from Kamavarapukota SS to Border point of A.P (Chinnakorukondi - Suryapet) – 90 km

19.20 Aspiri (1000MW) Wind Evacuation Scheme is proposed for evacuation of power from the 400kV SS Aspiri in Kurnool (Dt).

- The scheme proposal is as follows:

a) 400/220 kV Aspiri Substation with 2X500 MVA PTRs.

b) 400KV Quad Moose DC line from proposed Aspiri 400kV SS to 400 kV Kurnool – 80 km.

19.21 Gani (Panyam) (1000 MW) Solar Evacuation Scheme is proposed for evacuation of power from the 400kV SS Gani (Panyam) in Kurnool Dt.

- The scheme proposal is as follows:

a) 400kV Gani (Panyam) Substation with 3X500 MVA PTRs.

19.22 N. P. Kunta (1000 MW) & Galiveedu (500 MW) Solar Evacuation Scheme is proposed for evacuation of power from the 400kV SS N.P. Kunta in Ananthapur (Dt).

- The scheme proposal is as follows:

a) 400kV N.P. Kunta Substation with 3X315 MVA PTRs.

b) LILO of 400kV Quad Moose D/C line from 400kV Kadapa SS to 400kV Hindupur SS at proposed 400kV N.P. Kunta SS - 20km

c) 400KV Quad Moose DC line from 400kV Kadapa SS to 400 kV N.P. Kunta – 60km.

d) 220 kV D/C Twin Moose Line from 400kV SS N.P. Kunta to proposed 220kV Kadiri SS – 40 km.

19.23 Polavaram Hydro Electric Power Plant Evacuation Scheme (12X80MW) is proposed for evacuation of power from Polavaram Hydro Electric Plant (12X80MW) in West Godavari (Dt).

- The scheme proposal is as follows:

a) 400kV Twin Moose Line from Polavaram Hydro Electric Plant to Kamavarapukota 400 kV SS – 85 km

19.24 VTS Stg -V (800 MW) Power Transmission Evacuation Scheme.

- The scheme proposal is as follows:

  a) 400kV D/C Quad Moose Line from VTS Stg -IV to Sattenapalli 400 kV SS – 60 km.

19.25 400 KV Uravakonda-2 SS Comprehensive Wind Evacuation Scheme (1400 MW) is taken up for evacuation of power from the Uravakonda-2, Ananthapur Dt.

- The scheme proposal is as follows:

  a) 400/220 kV Substation with 3X500 MVA PTRs.

  b) 400 kV D/C Quad Moose Line from 400KV Uravakonda SS to proposed Uravakonda-2 400 kV SS – 25 km.

19.26 400 KV Talaricheruvu SS Comprehensive Solar Evacuation Scheme (500 MW) is taken up for evacuation of power from the Talaricheruvu, Ananthapur Dt.

- The scheme consists of the following transmission line, Power Transformers and associated bay extensions:

  a) 400/220 kV Substation with 3X315 MVA PTRs,

  b) LILO of 400kV Quad Moose D/C Line from 400kV Jammalamadugu SS to 400kV Uravakonda SS at proposed 400 kV Talaricheruvu SS– 2 km.

19.27 400 KV Mylavaram SS Comprehensive Solar Evacuation Scheme (1000 MW) is taken up for evacuation of power from Mylavaram, Kadapa Dt.

- The scheme consists of the following transmission lines, Power Transformers and associated bay extensions:

  a) 400/220 kV Substation with 3X315 MVA PTRs,

  b) 400 kV Quad Moose D/C line from Jammalmadugu to Proposed Mylavaram 400kV SS – 10 km.

19.28 Sub-Stations proposed for New Capital of A.P:

1) <u>400 kV Eluru Substation</u>:

   a) 400 kV Eluru Substation with 2X315 MVA PTRs.

   b) LILO of 400kV D/C Twin Moose Line from 400 kV Vemagiri SS to 400 kV Sattenapalli SS at proposed Eluru 400 kV SS – 20 km

2) <u>400 kV Gudivada Substation</u>:

a) 400 kV Gudivada Substation with 2X500 MVA PTRs

b) 400 kV D/C Quad Moose Line from 400kV Eluru SS to proposed 400 kV Gudivada SS – 40 km

c) 400 kV D/C Quad Moose Line from proposed 400kV Chilakaluripeta SS to proposed 400kV Gudivada SS – 103 km

3) 400 kV Inavolu/Thullur Substation:

a) 400 kV Inavolu/Thullur Substation with 2X500 MVA PTRs.

b) LILO of 400 kV D/C Quad Moose Line from 400 kV VTS-Stg-V SS to 400 kV Sattenapalli SS at proposed Inavolu/Thullur 400 kV SS – 28 km.

4) 400 kV Chilakaluripet Substation:

a) 400 kV Chilakaluripet Substation with 2X500 MVA PTRs.

b) 400 kV Quad Moose D/C Line from proposed 400 kV Chilakaluripeta SS to proposed 400kV Gudivada SS – 103 km

c) The 220/132kV Sub-Stations proposed for capital city are:

Amaravathi, Chilakaluripeta, Tadepalli, Malkapuram & Repalle in Guntur District and Gannavaram & Machilipatnam in Krishna district.

20. Investment Plan 220 kV and 400 kV: The investments required for 220 kV and 400 KV systems arrived based on the cost data of AP Transco are shown below:

Table 110 – Investments for 220 kV and 400 kV

FY	Sub-Stations (Nos)		Lines (CkM)		Investments in Rs. Cr.
	400kV	220kV	400kV	220kV	
2018-19	4	9	661	710	2060.30
Total	4	9	661	710	2060.30

21. 132 kV Transmission System: The total number of new and augmented 132 kV substations are as per the load requirement.

Table 111 – No. of new substations and lines

FY	2018-19	Total
No. of 132 kV Substations	26	26

FY	2018-19	Total
Addl. Length of 132 kV line in Ckm	1069	1069

22. The investments required (Rs.Cr.) for 132 kV substations and lines for the balance FY2018-19 are as under:

Table 112 – No. of new substations and lines

FY	2018-19	Total
132 kV investments (Rs. Cr.)	2688.01	2688.01

23. Transmission Investments: The total investments (Rs.Cr.) required for 132 kV, 220 kV and 400 kV systems for the balance FY2018-19 are tabulated below.

Table 113 – No. of new substations and lines

FY →	2018-19
132 kV	2688.01
220 kV	744.69
400 kV	1315.61
Total	4748.31

24. Contingencies: The transmission planning was based on a deterministic approach using the single contingency (or N-1) criterion. This is the most common approach used world-wide, and it requires the system to be able to operate satisfactorily with one element out of service (Generator, Transmission Line or Transformer), and to survive the transition from the normal state to the contingency state without any operator intervention.

25. An exception to the above criteria is that the system shall survive a 400 kV DC line outage evacuating a power plant located in the coastal area, because damage caused by cyclones are of great concern to APTRANSCO.

26. Circuit Breaker Interrupting Capacity: Circuit Breaker interrupting capabilities as per guidelines of CEA and APERC are:

765 kV breakers : 50 KA

400 kV breakers : 63 KA

220 kV breakers : 40 KA

132 kV breakers : 31.5 KA

27. Short Circuit Studies: Short Circuit studies were carried out for FY2018-19 with the machines connected for the maximum thermal Generation schedule contributing to the fault levels. Generator Sub-transient reactances were used. No contribution from the interstate tie-lines was included.

28. All calculated fault levels at 400 kV and 220 kV buses were less than 90% of the Breaker Interrupting Capabilities.

29. The 132 kV system modelled in these studies is limited to the Transformer 132 kV side load (with no 132 kV interconnections), plus a few buses connecting the Generation at the 132 kV level to the network. The 132 kV fault levels are within the breaker interrupting ratings.

30. Transmission Resource Plan from FY2019 to FY2024:

30.1 The proposed transmission system was evaluated for the load and generation conditions for FY2023-24. The transmission investment plan was prepared based on the transmission network expansion plan envisaged meeting load growth and various generation evacuation schemes at 400 kV and 220 kV are depicted. The transmission expansion plan which includes 400 kV and 220 kV Lines and Substations is also depicted. The 132 kV transmission plan comprising of 132 kV network is also prepared and depicted.

30.2 AP Transco has drawn up investment plans of Rs. 14480.12 Cr. in the period FY2019-20 to FY2023-24. This investment includes 1201 ckm of 400 kV, 3696.4 ckm of 220 kV lines and 2162 ckm of 132 kV lines, 10 Nos. of 400 kV substations, 42 Nos. of 220 kV substations and 126 Nos. of 132 kV substations towards transmission expansion.

30.3 The standards adopted while conducting Load flow studies for UHV (200 kV and above) are as detailed at para 19.10.

30.4 Investment Plan 220 kV and 400 kV: The year wise no. of substations, lines in ckm and corresponding investments (Rs.Cr.) required for 400 kV and 220 kV system arrived based on the cost data of AP Transco are shown below.

Table 114 – Substations, lines and Investments for 4th Control Period

FY →	2019-20	2020-21	2021-22	2022-23	2023-24	Total
No. of 400 kV Substations	3	2	2	2	1	10
Cost (in Lakhs)	68706	39256	37787	28022	19508	193279
No. of 220 kV Substations	14	9	7	6	6	42
Cost (in Lakhs)	69903	50487	25950	21131	21450	188921
400 kV Lines in CkM	221	230	440	270	40	1201
Cost (in Lakhs)	77813	35241	60588	37179	3672	214493
220 kV Lines in CkM	1036.4	596	898	860	306	3696.4
Cost (in Lakhs)	104242	110119	73365	70500	32811	391036.81
Total SS & Line Cost (in Rs. Cr.)	3206.64	2351.03	1976.90	1568.32	774.41	9877.30

30.5 Investment plan for Augmentation of PTRs is shown below:

Table 115 – Investments for PTR augmentation for 4th Control Period

FY →	2019-20	2020-21	2021-22	2022-23	2023-24	Total
Augmentation of PTRs @ 400kV & 220 kV Substations (Rs. Lakhs)	9035	5742	2639	3016	2639	23071.00

30.6 Transmission System (132 kV): The transmission system at 132 kV level estimation is based on the load requirement.

30.7 The year wise total number of new 132 kV substations required, length of 132 kV lines in Ckm required in respect of DC, DC/SC and 2nd circuit stringing and total investments (Rs. Cr.) required for new 132 kV substations and 132 kV lines in the 4th Control Period i.e. from FY2019-2024 is tabulated below:

Table 116 – Investments for 132kV SS and Lines for 4th Control Period

FY →	2019-20	2020-21	2021-22	2022-23	2023-24	Total
132 kV SS						
No of 132 kV Substations	32	28	23	22	21	126
Cost (Rs. Lakhs)	49534	41994	34615	33110	31605	190858
132 kV Lines						
Line length in CkM	841	500	241	115	465	2162
Cost (in Lakhs)	109182	63455	24187	11779	51396	259999
Total SS & Line Cost (in Rs.Cr.)	1587.16	1054.49	588.02	448.89	830.01	4508.57

30.8 Total Transmission Investments: The total investments (Rs.Cr.) required for 132 kV, 220 kV and 400 kV systems from FY2020 to FY 2024 are tabulated below.

Table 117 – Investments for all Voltage levels for 4th Control Period

FY →	2019-20	2020-21	2021-22	2022-23	2023-24	Total
132 kV	1587.16	1054.49	588.02	448.89	830.01	4508.57
220 kV	1831.80	1663.48	1019.54	946.47	569.00	6030.29
400 kV	1465.19	744.97	983.75	652.01	231.80	4077.72
Total	4884.15	3462.94	2591.31	2047.37	1630.81	14616.58

30.9 Tentative Transmission Network Expansion from FY2019-20 to FY2023-24: Year wise No. of Substations, Transformers and Lines in ckm (220 kV and above)

Table 118 – Tentative nerwork expansion for 4th Control Period

FY	Sub-Stations (Nos.)		Transformers (Nos.)		Lines Ckm	
	400	220	400	220	400	220
2018-19	4	9	--		661	710
2019-20	3	14	--	11	221	1036
2020-21	2	9	--	9	230	596
2021-22	2	7	--	7	440	898
2022-23	2	6	--	8	270	860
2023-24	1	6	--	7	40	306
Total	14	51	0	42	1862	4406

Table 119 – Total Investments for 4th Control Period

FY	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
132 KV	2248	1374	868	532	601	498
220 & 400 KV	1525	2422	2164	1723	1317	709
Total	3772	3796	3032	2255	1918	1207

List of 400 KV, 220 kV and 132 kV Sub-stations, lines and augmentation of PTR capacities proposed during FY2019-20 to FY2023-24 is placed at Annexure-A1.

31. Transmission Resource Plan from FY 2025 to FY2029

31.1 The proposed transmission system was evaluated for the load and generation conditions for FY2029. The transmission investment plan was prepared based on the transmission network expansion plan envisaged meeting load growth and various generation evacuation schemes of 400 kV and 220 kV are depicted. The

transmission expansion plan which includes 400 kV and 220 kV lines and Substations is also depicted. The 132 kV transmission plan comprising of 132 kV network is also prepared and depicted.

31.2 APTRANSCO has drawn up investment plans of Rs. 11241.26 Cr. in the period FY 2024-25 to FY 2028-29. This investment includes 310 ckm of 400 kV, 2822 ckm of 220 kV lines and 2348 ckm of 132 kV lines, 7 Nos. of 400 kV substations, 44 Nos. of 220 kV substations and 44 Nos. of 132kV substations towards transmission expansion.

31.3 The standards adopted while conducting Load Flow studies for UHV (200KV and above) are as at para 19.10 above.

32. Investment plan for 220 kV and 400 kV

32.1 The year wise No. of substations, lines in ckm and corresponding investments (Rs. Cr.) required for 400 kV and 220 kV system arrived at based on the cost data of AP Transco are shown below.

Table 120 – No. of Substations, Lines in Ckm (220 kV and above) for FY2024-25 to FY 2028-29

FY	2024-25	2025-26	2026-27	2027-28	2028-29	Total
No. of 400 kV Substations	1	2	2	1	1	7
Cost (in Lakhs)	34425	45900	51638	17213	17213	166389
400 kV Lines in CkM	20	40	170	40	40	310
Cost (in Lakhs)	3443	6885	18819	6885	6885	42917
No. of 220 kV Substations	10	11	8	6	9	44
Cost (in Lakhs)	59749	63749	59288	36528	42264	261578
220 kV Lines in CkM	500	1008	416	296	602	2822
Cost (in Lakhs)	110883	120636	109912	65950	66308	473689.97
No. of 132 kV Substations	11	11	10	6	6	44
Cost (in Lakhs)	16555	16555	15050	9030	9030	66220
132 kV Lines in CkM	650	554	550	284	310	2348
Cost (in Lakhs)	30638	26867	26779	13889	15159	113332
Total SS & Line Cost (in Rs. Cr.)	2556.93	2805.92	2814.86	1494.95	1568.59	11241.26

Table 121 – Total Investments(Rs.Cr.) for 5th Control Period

FY	2024-25	2025-26	2026-27	2027-28	2028-29	Total
132 kV	471.93	434.22	418.29	229.19	241.89	1795.52
220 kV	1706.32	1843.85	1692.00	1024.78	1085.72	7352.68
400 kV	378.68	527.85	704.57	240.98	240.98	2093.06
Total	2556.93	2805.92	2814.86	1494.95	1568.59	11241.26

List of 400 kV, 220 kV and 132 kV Substations and Lines proposed during FY2025-2029 is placed at Annexure-A2.

CHAPTER - II

OBJECTIONS, RESPONSES and COMMISSION'S VIEWS

Include Power Procurement from KSK Mahanadi Power plant

33. Sri A. Sreekanth, M/s KSK Mahanadi Power Company Ltd. (KMPCL), Hyderabad has stated that AP Discoms, pursuant to the competitive bidding process under Case-I, have entered into power purchase agreement (PPA) dated 31.07.2012 for off take of power from KSK Mahanadi Power Corporation Ltd. which was further extended on 19.12.2014 for off-take till 31.03.2021 and the same was approved by the Commission. The Discoms were availing power, year-on-year. In the filings AP Discoms have stated that KSK Mahanadi, LVS and Hinduja power plants are not considered for future projections due to pending legal issues. In the State Electricity Plan filed for FY19 to FY29, AP TRANSCO stated that power from KSK Mahanadi is not procured from FY2018-19 due to pending legal issues. The disputes had, in fact arisen primarily on account of non-payment of transmission charges by the DISCOMs in terms of the PPA due to which the power supply and the transmission corridor was being regulated by Power grid Corporation of India Ltd. It is also pertinent to mention that the power supply has begun and KSK Mahanadi is presently scheduling and supplying power to the Discoms, after the Discoms had undertaken to pay interim amounts to Power grid. It is requested to consider the off take of power from KSK Mahanadi in the projections for the Control Periods referred to by APDISCOMs and AP Transco, to the extent of quantum of supply under the PPA.

DISCOMs' Response: APDISCOMs disallowed the payment of PGCIL Charges for KSK Mahanadi and energy & capacity charges were also restricted to the rates approved in Retail Supply Tariff Order for FY2017-18 for want of Govt. instructions as they have not been included in the Retail Supply Tariff Order for FY2017-18. Due to non-payment of POC charges and failure in establishment of payment security mechanism to PGCIL by KMPCL, PGCIL imposed power regulation on KMPCL and regulated the power supply from KSK Mahanadi for a quantum of 67 MW from 1.03.2018 and 400 MW (entire allocation to AP) from 29.04.2018. Due to this power regulation, the power Scheduled by KSK Mahanadi to APDISCOMs has become Zero from 29.04.2018. At the time of filing petition for Resource plans for 4th & 5th Control Periods there was imposition of Power regulation on KSK by

PGCIL. Due to power regulation and connected legal issues KSK Mahanadi was not considered for future supply projections. Meanwhile the generator started efforts to restore the supply to APDISCOMs and M/s KSK Mahanadi has cleared the dues to PGCIL for FY2017-18. PGCIL has withdrawn the regulation of power to APDISCOMs. Consequently M/s KSK Mahanadi has restored power supply to APDISCOMs and commenced supply of power under the PPA from 00:00 Hrs. of 28.09.2018. APDISCOMs have long term PPA with KSK Mahanadi for supply of 400 MW power and agreement is valid upto 31.03.2021. The issues with M/s KSK have been sorted out and power scheduling is started from 28.09.2018. M/s KSK may be considered for future projections up to 31.03.2021.

Commission's View: As the issues were sorted out, M/s KSK Mahanadi is taken into account upto 31.03.2021.

Information related to Captive consumers not furnished

34. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad, has stated that according to Section 2.1(a) (iv) of Guidelines for Load Forecasts, Resource Plans and Power Procurement a detailed forecast for the Control Period under consideration for tariff review purpose shall include forecast of energy in MWh and demand in MW for each class of consumers (category-wise, voltage-wise) utilized from captive generating plants of an aggregate capacity of 1 MW and above. Information provided by APDISCOMs under load forecast is incomplete as the information provided in their filings is related to the consumers supplied by the distribution licensees only. The information did not cover captive consumers as required by Section 2.1 (a) (iv) of the Guidelines.

DISCOMs' Response: Captive consumers information is not being tracked as they do not require license to install Captive units. DISCOMs are catering to their demand at any time in the event of incidence on grid.

Commission's View: The DISCOMS shall provide the forecast of energy and demand utilized from captive generating plants of an aggregate capacity of 1 MW and above in terms of 2.1(a)(iv) of the guidelines from FY2021.

Consumption forecast is higher than CEA's EPS

35. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad, has stated that according to resource plans of APDISCOMs and APTRANSCO, State consumption is projected to grow at 8.7% whereas according to CEA's 19th Electric Power Survey (EPS), electricity consumption in the State is

expected to increase by 7% CAGR. APTRANSCO's and APDISCOMs' electricity consumption projections are higher than CEA's EPS survey. This demands re-examination of electricity consumption estimates of APTRANSCO and APDISCOMs.

Dr. S. Chandramouli, President, APSEB Engineers' Association has stated that the CAGR estimated by DISCOMs is 8.3% whereas that of Econometric Forecast and CEA 19th EPS are 7.4% and 7% respectively. Past experience has confirmed repeatedly that CAGR forecast made by the 19th EPS is on high side. The projections given by the DISCOMs are still on very high side which may not be materialized.

SPDCL Response: The forecast of electricity consumption was carried out based on various factors including historical growth rates. In fact, during H12018-19 a growth rate of 13.11% in actual sales over H12017-18 was noted. Hence, the projections of sales are estimated realistically based on the available data. DISCOM has followed adjusted Trend method based on the conditions in its service area to arrive the Load forecast, whereas CEA has followed End use approach on broad National perspective.

EPDCL Response: Historical CAGR between FY2013 to 2018 (5 Years) in EPDCL area is observed to be 10.2%. The projected Growth rate for the forecast period of 4th Control Period i.e. between FY2018 to FY2024 is 8.8% CAGR. Growth distortions and saturations levels on account of various parameters in terms HT Lift Irrigation, Ferro Alloy Industry, Aquaculture industry, LT Agriculture categories have been factored in the projections, and the Growth rates are moderated. DISCOM has followed adjusted Trend method based on the conditions in its service area to arrive the Load forecast, whereas CEA has followed End use approach on broad National perspective.

AP Transco's Response: DISCOMs have followed Trend Method to arrive the Load Forecast, whereas CEA has followed End Use approach and compared with Econometric Method.

Commission's View: An element of guess and estimate being inextricably involved in the projections made by various bodies, a reasonable margin of variance is inevitable and the DISCOMs have stated the reasons and method behind their projections which do not appear to deserve non-consideration for any strong reasons.

T&D loss levels projected are higher

36. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad, has stated that T&D losses projected for 4th and 5th Control Periods are higher than those recorded during the financial year 2017-18. T&D losses projected for 4th and 5th Control Periods are nearly 3% and 4% higher than that recorded during the financial year 2017-18 in APEPDCL and APSPDCL respectively. In the background of huge investments planned for strengthening T&D network under both the DISCOMs, T&D losses during the 4th and 5th Control Periods shall in fact be less than that recorded during FY18.

APEPDCL Energy requirement and loss levels
4th Control Period

Year	DISCOM Energy Requirement (MU)	Sales projections (MU)	T&D Losses (%)
FY 18	19,678	18,351	6.74
FY 19	21,976	19,863	9.61
FY 20	24,508	22,201	9.41
FY 21	26,443	23,963	9.38
FY 22	28,576	25,905	9.35
FY 23	30,968	28,043	9.45
FY 24	33,565	30,402	9.42

APEPDCL Energy requirement and loss levels
5th Control Period

Year	DISCOM Energy Requirement (MU)	Sales projections (MU)	T&D Losses (%)
FY 25	36,440	33,008	9.42
FY 26	39,558	35,920	9.20
FY 27	43,212	39,179	9.33
FY 28	47,339	42,823	9.54
FY 29	51,950	46,857	9.87

APSPDCL Energy requirement and loss levels
4th Control Period

Year	DISCOM Energy Requirement (MU)	Sales projections (MU)	T&D Losses (%)
FY 18	34,328	31,335	8.72
FY 19	39,593	34,439	13.02
FY 20	42,473	36,946	13.01
FY 21	45,711	39,752	13.04
FY 22	49,343	42,886	13.09
FY 23	53,401	46,384	13.14
FY 24	57,956	50,300	13.21

APSPDCL Energy requirement and loss levels
5th Control Period

Year	DISCOM Energy Requirement (MU)	Sales projections (MU)	T&D Losses (%)
FY 25	63,085	54,697	13.30
FY 26	69,001	59,701	13.48
FY 27	75,835	65,409	13.75
FY 28	83,715	71,922	14.09
FY 29	92,788	79,360	14.47

SPDCL Response: The sales projections displayed in the tables are DISCOMs sales alone without considering open access sales whereas the energy requirement is computed including open access sales. The computation of energy requirement including open access sales was carried out in order to determine capex requirement. The computation of losses by considering DISCOM sales without open access sales and energy requirement including open access sales is incorrect. If the energy requirement is computed without open access sales, the T&D losses will be as given below:

APSPDCL Energy requirement and loss levels 4th Control Period			
Year	DISCOM Energy Requirement (MU)	Sales projections (MU)	T&D Losses (%)
FY 19	37,970	34,439	9.30%
FY 20	40,730	36,946	9.29%
FY 21	43,803	39,752	9.25%
FY 22	47,220	42,886	9.18%
FY 23	51,025	46,384	9.10%
FY 24	55,272	50,300	9.00%
FY 25	60,023	54,697	8.87%
FY 26	65,350	59,701	8.64%
FY 27	71,335	65,409	8.31%
FY 28	78,077	71,922	7.88%
FY 29	85,691	79,360	7.39%

EPDCL Response: The projections are made based on reasonable assumptions, existing network conditions, maintainability of low level of losses etc. FY2018-19 is considered as the base year for the 4th Control Period. For the 4th Control Period the losses are projected to be reducing from 9.61% in FY2018-19 to 9.42% (excluding Transmission Losses) in FY2023-24. These are the losses upto 33 kV

but include EHT Sales.

Commission's View: The loss levels projected by the DISCOMs are reasonably lowered in the assessment made by the Commission with reference to the filings by DISCOMs for the 4th and 5th Control Periods for Multi Year Tariffs in juxtaposition to the filings herein.

Agriculture consumption growth

37. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad, has stated that agriculture sector consumption in the case of APSPDCL is projected to decline from 27.57% of total electricity sales in FY18 to 19.30% in FY24 and 13.56% in FY29. In the case of APEPDCL it is projected to decline from 11.92% of total electricity sales in FY18 to 8.58% in FY24 and further to 6.6% in FY29. But under APEPDCL while number of agriculture services are projected to increase by 1.1% during both the Control Periods, electricity consumption is projected to increase by 3 to 3.2%. Per pump-set electricity consumption is estimated to increase from 9,981 units in FY18 to 11,180 units in FY24 and 12,564 units in FY29. This is particularly surprising in the background of promotion of energy efficient pump sets. In the pilot project on replacement of old pump sets with energy efficient pump sets EESL claimed savings of 31% (Para 13 (vi) of APERC Order dated 17-06-2017 in O.P. No. 20 of 2017).

Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that AP has pioneered implementation of energy efficiency projects in lighting, ceiling fans and agriculture pumps. Agriculture pump project envisages very high energy savings and it is important to provide energy savings resulting from the ongoing projects. These results should be used to plan for projects and the energy savings from these should be factored in while preparing agriculture demand forecast.

Section 3.2 of the DISCOM petitions state the intention of both the Central and State governments to shift agriculture consumption to day-time supply of electricity through solar pumps and solar feeders under State and Central government schemes. Given the increasing cost competitiveness of solar PV generation, these schemes are expected to result in reduced government subsidies (especially with the solar feeder scheme) and quality day-time power for agriculture. They are likely to reduce tail-end distribution losses as well. Given all these advantages, it makes both economic and political sense to take up these

schemes at a large scale after understanding the implementation issues through pilot schemes.

In spite of this push to solarize agriculture, LT Agriculture sales have been projected with a growth rate of 2% and 3% respectively for SPDCL and EPDCL in the 4th and 5th Control Periods. On the contrary, solar electricity for agriculture, combined with the implementation of lift irrigation schemes, is expected to progressively reduce agriculture consumption that the DISCOM has to meet through additional power procurement.

DISCOMs' Response: Historically Agriculture Sales witnessed a CAGR of around 7.4% in APEPDCL and 5% in APSPDCL. GoAP is vigorously promoting the implementation of Solar Agriculture Pumpsets and Energy Efficient pumpsets in the State. Apart from this, conventional Agriculture Connections are also given to the needy farming community in accordance with the pending applications and GoAP policy in this regard. Taking all these parameters into account, a marginal growth of 3% for APEPDCL and 2% for APSPDCL is assumed in this category for sales projections.

Commission's View: The DISCOMS appear to suggest that consumption through new conventional agricultural connections to be released will overweigh the savings in consumption through use of solar power and increase of energy efficiency resulting in a marginal growth of 3% and 2% respectively. Their projections need not be doubted to be not based on real statistics or rational possibilites.

Projections of electric four wheelers' consumption is less

38. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad, has stated that Electricity consumption by electrical vehicles is expected to cross 10,000 MU by FY29, the end of 5th Control Period. DISCOM-wise use of electrical vehicles is not provided. Further, information on number of vehicles provided in the load forecast is not reliable. Electricity consumption by four wheelers by FY29 is projected to be (1,225 MU) 50% of the electricity consumption by buses (2,510 MU) and about one third of consumption of two wheelers (4,124 MU). But the present policy predilection is more towards promotion of cars and electricity consumption numbers do not seem to go with it.

DISCOMs' Response: The adoption of electric vehicles is in nascent stage and cannot be projected to grow at such high rate on account of the evolving technology.

Commission's View: Introduction of more electric buses may be a distinct possibility with bus transport being mostly a monopoly of the State which adopted the policy of promoting electric vehicles. Similarly, comparative cost and cost benefit analysis may accelerate more two wheelers coming on the road than four wheelers in the electric vehicles sector. As the expected growth rates are only hypothetical, the estimate by the DISCOMs need not be discredited.

High growth rates projected in various consumer categories

39. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad has stated that the consumer categories LT-II Commercial, LT-III Industry, HT-I (B) Ferro alloys, HT-II Commercial and HT-IV lift irrigation units under both the DISCOMs are projected to record high consumption growth throughout the 10-year period encompassing 4th and 5th Control Periods. It is doubtful whether these consumer categories will be able to sustain such a growth rate over a decade. These consumer categories account for around one third of the electricity consumption in the State.

SPDCL Response: The projected Growth rates have been arrived at after making the necessary adjustments to the historical trends. Out of the overall consumption of LT industries, the Aqua consumption alone contributes to 56%. Over a period of time, the Aqua growth has increased substantially and the projection was done appropriately considering the trend. Historically the growth rate in HT Category-II: Others is 11%. The growth rate has been projected based on the historical trends. The Growth in the lift irrigation schemes is primarily driven by the commitments of the State Government and the implementation schedule of the Schemes in association with the State Government Water Resources Department.

EPDCL Response: The projected Growth rates have been arrived at after making the necessary adjustments to the historical trends. Out of the overall consumption of LT Industrial industries, the Aqua consumption alone contributes to 70%. Over a period of time, the Aqua growth has increased substantially and the projection was done appropriately considering the trend. During the previous years, the industries under HT-1B which were sick and closed due to poor market conditions and internal financial health, have gradually come to operation after Government came to rescue by offering concessions. Thus, keeping in view the sensitivity of this category towards electricity charges and external market conditions, the actual growth rate was moderated to 15%. The Growth in the lift irrigation schemes is primarily driven by the commitments of the State Government and the

implementation schedule of the Schemes in association with the State Government Water Resources Department.

Commission's View: Ambitious projection of growth rates by DISCOMs was explained by them to be based on realistic expectations. The mere possibility of any disappointment in reaching the expectations need not deter the DISCOMs from aiming high.

Off-grid solar pumpsets potential to be realized fully

40. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad has stated that according to APDSICOMs' submission there are around 26,190 off-grid solar pumps in the State till 31st March, 2018. Further, APDISCOMs expect the Off-grid pumps to be installed in the State @ 15% per year in 4th and 5th Control Periods. Off-grid solar pump sets installed for agriculture purpose will not be used throughout the year. Given the nature of agriculture operations they may be used for 200 days in a year. They will be lying idle during the remaining days. Because of this idling their total potential will not be realized. During summer, when potential for solar power generation is high due to lower ground water availability, these solar units may not be used to full capacity. These off-grid solar pump sets are being installed with the State Government's subsidy support. As the full capacities of the Solar Pump sets are not being realized, the purpose of the subsidy support also will be realized partially.

SPDCL Response: Off-Grid Solar pump-sets are being installed in DISCOMs for new Agricultural Connections where the distribution lines are not existing and the static ground water is available at 150 to 200 Feet. Because of 7 hrs. supply restriction to Agriculture, grid connected solar pump-sets cannot be installed. Grid connected solar pump-sets can be installed only when all the pump-sets under one feeder are solar pump-sets i.e. only feeder-wise solar pump-sets can be installed.

EPDCL Response: The purpose of the off-grid Solar Agriculture Pumps is to meet the requirement of the agricultural sector where there is no grid. Hence, the percentage utilization of the capacity of Solar modules does not arise. However, to increase the Solar Power Generation through agricultural water pumping program, it is planned to use the Solar systems to the existing Grid Connected pump sets also.

Commission's View: The learned objector may suggest the specific ways and means of realizing the full potential of the Off grid Solar Pump sets.

PLF of GENCO plants considered as 75% instead of 85%

41. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad, has stated that for all APGENCO thermal plants PLF of 85% instead of 80% shall be taken into account. In the case of thermal plants of Central Generating Stations PLF of 85% is adopted.

    Dr. S. Chandramouli, President, APSEB Engineers' Association, Sri M. Venugopal Rao, Convener, Centre for Power Studies, Hyderabad, Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that there will be scope for increasing PLF of thermal plants of AP Genco, subject to availability of coal. While new thermal capacity addition by AP Genco is given up almost completely, undue importance is given to addition of new NCE, i.e., wind and solar, abnormally till the end of 2028-29. The reasons as well as justification for the same are not explained despite acknowledging the problems with NCE.

    DISCOMs' Response: Coal shortage was considered.

    AP Transco's Response: As per PPA, 80% PLF is considered for AP GENCO.

    Commission's View: The Commission adopted 80% PLF with reference to the specific conditions of PPAs and the provisions in the relevant regulations in respect of AP GENCO thermal generating units.

Inclusion of Simhapuri 400 MW plant in availability

42. Sri M. Venugopal Rao, Convener, Centre for Power Studies, Hyderabad, Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad and Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that APERC has approved procurement of 400 MW capacity power from Simhapuri Energy Private Limited for a period of 12 years through an order dated 14-08-2018. AP DISCOMs have not considered availability in their projections for the 4th Control Period. The same shall be included under power availability.

    Dr. S. Chandramouli, President, APSEB Engineers' Association has stated that APERC has already given its consent to the PPA the DISCOMs had with Simhapuri project (400 MW) and energy of 2803.20 MU per annum is available to them from this project which is not considered in the projections of the DISCOMs for the 4th Control Period.

    DISCOMs' Response: Simhapuri 400 MW will be considered under power

availability as per APERC approval accorded in its order dated 14.08.2018.

Commission's View: Availability of Power from Simhapuri is considered in tune with the earlier orders of the Commission on the subject.

Solar Power is suitable for decentralized generation

43. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad has stated that Solar power is more suitable for decentralized generation. It is best to set up at the point of consumption. This also will help to bring down T&D costs as well as T&D losses. Generation tariff for NTPC's solar plant near Kadiri in Anantapuram district nearly doubled due to T&D costs. These solar power plants need huge tracts of land. Each MW of solar power plant need 5 to 7 acres while a MW of coal based thermal power plant needs 1 to 2 acres. APDISCOMs as well as GoAP have to explore alternative modes for promotion of solar power. De-centralized distributed solar power generation taken up in Telangana and feeder based solar power plants taken up in Maharashtra are some of these alternatives. APDISCOMs' submissions on generation plan do not show new solar power capacity addition after FY21. New solar power capacity addition after FY21 shall be taken up through alternative modes that take into account the nature of solar power.

Licensees' Response: In order to promote Solar Power Projects in the State, GoAP vide G.O Ms. No.8, dated 12.02.2015, has issued a new solar policy, 2015 applicable for a period of 5 years targeted minimum solar capacity addition of 5000 MW by FY2019-2020. GoAP targeted to set up 4000 MW solar capacity through Solar Parks in Kurnool, Kadapa and Ananthapur districts with the support of GoI as dry and cheaper land is available in these districts. In order to explore alternative modes of promotion of Solar Power, APDISCOMs have finalized the proposals for procurement of 1000 MW Distributed Solar Power at the interconnection point of 33/11 kV Substations covering the entire State is included in the resource plan of 4th Control Period and submitted the same for approval to APERC to grant the permission to initiate the tender process for procurement of 1000 MW. In addition to the same Roof top solar and decentralized solar are also promoted.

Commission's View: The suggestions of the learned objector may be thought over while planning for further expansion of Solar Power in the State.

Non-promotion of rooftop Solar Plants

44. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad has stated that according to APDISCOMs' submissions for promoting solar Rooftop systems on large scale, AP State Govt. has set a target of installing 2,000 MW capacity units by year 2022 and it is doubtful whether this target can be achieved. While MNRE target for AP for rooftop systems during FY17 was 240 MW, only 28.42 MW was achieved. Similarly, during FY18 while MNRE target was 250 MW, only 50.26 MW capacity units were installed. Rooftop solar plants are not taking off due to lack of interest on the part of DISCOMs.

SPDCL Response: APSPDCL called for e-Tender for Design, Manufacture, Supply, Erection & Commissioning of Grid connected Solar Rooftops including Operation and Maintenance (O&M) for a period of 5 years after commissioning for eligible low-end LT Domestic Consumers through EPC and O&M based competitive bidding process for Tirupati Town – 2 MW and Vijayawada Town – 3 MW. Calling Tenders is under process for the Towns Guntur - 2 MW, Ongole – 1 MW, Nellore – 1 MW, Kadapa-1 MW, Ananthapuram – 1 MW and Kurnool – 1 MW.

EPDCL Response: DISCOMs are taking lot of interest for promotion of Solar Rooftop units.

a) Consumer friendly guidelines are prepared for synchronization of Solar Roof Top (SRT) and also Net and Gross billing provision is given to the consumer.

b) Exhibitions, consumer awareness programmes, meetings with bankers, agencies and owners' associations etc. were carried out frequently.

c) To promote low consumption and low-income group consumers, loans from banks were arranged duly allowing the consumers to pay their EMI through DISCOM bills.

In the year 2012 itself APEPDCL has installed 10 MW SRT on the roof of APEPDCL corporate offices.

i. Installed Solar Rooftop of capacity 1.236 MWp on all the offices of Discoms.

ii. Extended loan on par with housing loan interest for installation of 1 kWp SRT systems by entering into MOU with Andhra bank,

iii. Provided upfront subsidy i.e. 30% of MNRE and 20% of NREDCAP to the low-income group consumers in Visakhapatnam city as pilot project.

iv. MoU was entered into with M/s Andhra Bank for recovery of EMIs through CC bills. Under this programme 200 Nos. SRTs were installed.

v. APEPDCL is utilizing the technical assistance programs for promoting the Solar rooftop so as to achieve the targets fixed by MNRE.

vi. AP Discoms in coordination with NREDCAP have developed a Unified Solar Rooftop Transaction Portal (USRTP) with the technical assistance of USAID pace-D Program. Involving Discoms' consumers and NREDCAP through a single platform redressing the queries as to whom and where to approach and procedure etc. The consumer can track the application online. A Customer owned Grid-Connected Solar Rooftop (SRT) model on the Rooftops of LT Category-I, Group (B) Domestic Consumers under DFID program is going to be implemented as a pilot project in APEPDCL on Net Metering basis under Grid Connected Solar Rooftop Program with financial assistance from MNRE, GoI.

Commission's View: Every effort should be made to reach the targets in expansion of Solar roof top plants.

Grid connected Solar pumpsets may be installed

45. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad has stated that when solar power is not used for operation of pump sets, the same can be fed into the grid. As already large number of agriculture feeders are segregated, feeder based solar plants may be set up as is being done in Maharashtra. This will help to increase electricity availability in the State without additional cost.

SPDCL Response: Tenders were called during 2016-17 for Grid connected Solar pump-sets for the following two 11 kV feeders of 33/11 kV KASUMURU SS in Venkatachalam (Mandal) in Nellore (Dist.) under Pilot Project.

1. 11 kV Kuricherapadu (401 Nos. Pump-sets) &
2. 11 kV Kandalapadu (204 Nos. Pump-sets)

Very poor Response was received to the above Tender and the Tender was closed as the rate quoted by the Bidder was financially not viable.

EPDCL Response: The work on pilot basis was taken up for replacement of existing 250 Nos. inefficient AC Pumpsets with Grid connected Solar PV Brushless (BLDC) water pumping system with Remote Monitoring, Submersible BLDC Pump,

BLDC Controller with MPPT, Grid connected Inverter (unidirectional), Mounting Structure, Cables as per MNRE Specifications of 2015- 16 on the 11 kV Savaravilli rural feeder covering about 250 numbers (both 5 HP & 3 HP) of agricultural services covering 32 nos. villages of Bhogapuram section of Vizianagaram District.

Commission's View: The suggestion of the learned objector may be considered on merits.

Replace old wind units with higher PLF wind units

46. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad has stated that wind power capacity is shown to decline after FY21. This may be due to shutting down or decommissioning of old wind power units. Old wind power units which were set up first are located at places with good wind sources. Instead of foregoing these places it is better to replace old units with new units with latest technology whose PLF is higher than old units.

AP Transco & SPDCL Response: As per the terms and conditions of PPA, the Wind Power projects completing 20 years from the date of COD are not considered. M/s IL & FS limited, whose PPA is expired, proposed to setup 1040 MW Wind - Solar hybrid project in phased manner at same location (Ramagiri) with a view of re-powering and to improve the Capacity Utilization. The 160 MW Wind- Solar hybrid project is being set up by M/s SECI on pilot basis at Ramagiri, Ananthapur district for optimal utilization of wind and solar power and also to enhance the capacity utilization of the project.

Commission's View: The feasibility of the suggestion may be examined.

Assess achievement of HVDS Scheme

47. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad has stated that according to APSPDCL's submission Rs. 1,906 Cr. were spent on High Voltage Distribution System (HVDS) between FY14 and FY18. It proposes to spend another Rs.1,807 Cr. between FY19 and FY22 on it. APEPDCL did not provide details on expenditure on HVDS under its jurisdiction. HVDS is meant to provide quality power supply to agriculture and bring down T&D losses to minimum levels. The amount spent on HVDS is expected to bring down T&D losses. But T&D losses in APSPDCL are higher than APEPDCL. It is high time this scheme is assessed to find out how far it has achieved its aims, particularly reduction in line losses.

SPDCL view: The T&D losses of the DISCOM for the period FY2014 and FY2018 are 10.68% and 8.31% respectively. The T&D losses have reduced during the period under consideration i.e. from FY2014 to FY2018.

EPDCL view: The details of EPDCL expenditure of Rs.127 Cr. for the period towards HVDS is covered under the head 'Loss Reduction Measures". The proposal of spending Rs.136 Cr. towards HVDS is envisaged in World bank scheme.

Commission's View: Progressive implementation of HVDS within the available means may be considered a priority in view of the significant reduction in T&D losses wherever it was implemented.

Segregation of agricultural feeders

48. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad has stated that according to a presentation made by the APDISCOMs to the Central Ministry on progress in implementing measures envisaged under UDAY, 109 feeders are segregated under APEPDCL and 4696 feeders are segregated under APSPDCL by March, 2017. But the present submissions by both the DISCOMs on load forecast and investment plans do not throw any light either on past expenditure or future proposed expenditure on feeder segregation.

DISCOMs' Response: For the agricultural feeders only virtual segregation i.e. 1/3rd arrangements are being done so that during the period in which single phase supply is given, agricultural pump sets cannot be run. Hence, no expenditure is projected for feeder segregation.

Commission's View: The response of the DISCOMs is self-explanatory.

Non-consideration of GVK extension, GMR Vemagiri, Gautami and Konaseema plants

49. Sri M. Venugopal Rao, Convener, Center for Power Studies, Hyderabad, Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam and Dr. S. Chandramouli, President, APSEB Engineers' Association have stated that that as per the filings of DISCOMs, the gas-based power plants of GVK extension (220 MW), GMR Vemagiri (370 MW), Gautami (464 MW) and Konaseema (444.08 MW) with whom the DISCOMs have long-term power purchase agreements are stranded due to unavailability of gas and hence not considered for future calculations. They could not provide any substantiation or justification for the presumed continuance of unavailability of natural gas to these plants during the 4th Control Period. As

and when supply of natural gas to these plants re-commences, the AP Discoms will get their share of 46.11% (690 MW) and 4835.52 MU per annum from these plants at 80 per cent PLF. Therefore, presuming unavailability of natural gas to these projects, and the resultant non-generation and non-supply of power from them, it would be imprudent to enter into long-term PPAs with other power plants.

Dr. S. Chandramouli, President, APSEB Engineers' Association has stated that there is no justification for non-consideration of GVK Extension (220 MW), GMR Vemagiri (370 MW), Gautami (464 MW) and Konaseema (444.08 MW) with whom APDISCOMs have long-term power purchase agreements on the reason that they are stranded due to non-availability of gas. As and when the gas supply to these plants recommences, APDISCOMs will get their share of 46.11% (690 MW, 4835.52 MU). Once the plants get supply of natural gas, availability from these projects materializes and overall availability of surplus energy would increase with additional burdens of paying fixed charges for backing down.

Licensees' Response: Past history shows that there is no availability of Natural Gas Supplies to these projects. Considering the past history as relevant to predict the future, there is no possibility of getting gas supplies to these projects till the PPA expiry period Year i.e. 2024.

Commission's View: While the DISCOMs expect the status quo to continue, the learned objectors did not substantiate or justify their hope of availability of natural gas to these projects during the 4th Control Period to be based on any verifiable fact or circumstance. The stand of DISCOMs based on historical experience cannot be negated for no reason and as already stated at page 60 of the order on Tariff for Retail Sale of Electricity during FY2018-19, if power from the said gas plants is available at a cheaper rate as per the merit order dispatch, the DISCOMs shall take appropriate permissible steps immediately for procuring such power for the benefit of consumers through reduction of power purchase cost.

Non-consideration of Hinduja power plant

50. Sri M. Venugopal Rao, Convener, Center for Power Studies, Hyderabad, Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam and Dr. S. Chandramouli, President, APSEB Engineers' Association have stated that as per the interim order issued by APTEL, the Discoms have to purchase power from the project of HNPCL (1040 MW), if it fits into merit order, and the DISCOMs have already started purchasing power from this plant. However, the DISCOMs have not

included the plant in the resource plan.

Licensees' Response: HNPCL was not considered due to pending legal issues. Further, DISCOMs are availing power from HNPCL as per the interim directions of APTEL and may likely to stop the power from HNPCL incase APTEL pronounce in favour of DISCOMs. Since the matter is sub-judice and any decision in favour of DISCOMs or the HNPCL, either of the parties is likely to approach higher court for dispute resolution. In view of the above uncertainty, APDISCOMs have not considered power from HNPCL in the 4th Control Period.

Commission's View: Pages 19 to 24 of the order on Tariff for Retail Sale of Electricity during FY2019-20 may be looked into where the same objection was raised and the Commission, while expressing its views, gave specific directions in this regard. The said directions shall be faithfully complied with by the DISCOMs.

Surplus will be more if Hinduja and Simhapuri are considered for availability

51. Sri M. Venugopal Rao, Senior Journalist and Convener, Center for Power Studies, Hyderabad and Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that if availability of power from HNPCL and Simhapuri only is taken into account, it works out to 9091.52 MU per annum (7288.32 + 2803.20 MU). Then, total availability of energy, including from HNPCL and Simhapuri, will be as follows (in MUs):

Parameter	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Total Availability (MU)	82956	87089	94294	91291	89295	89749
State Energy Input (MU)	60971	66313	71355	76951	83152	90033
Surplus/ (deficit) (MU)	21985	20776	22939	14340	6143	(284)
Surplus/ deficit (%) on requirement	36.05	31.33	32.14	18.63	7.38	(0.31)

Dr. S. Chandramouli, President, APSEB Engineers' Association has stated that if capacities of HNPCL and Simhapuri are added, the total availability of capacities are as follows:

Description	2019	2020	2021	2022	2023	2024
Total Capacity (MW)	18671	20966	22949	22571	22607	22817
State Peak Demand	10532	11450	12219	13209	14315	15539
Surplus Capacity	8139	9516	10730	103361	8292	7278

Licensees' Response: As per hourly supply demand analysis surplus position will not arise.

Commission's View: The contingency of availability of surplus in such circumstances may not be ruled out.

Lanco and Spectrum are considered without basis

52. Sri M. Venugopal Rao, Senior Journalist and Convener, Center for Power Studies, Hyderabad and Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that even though no consent is given by the Commission for PPAs signed or to be signed with Lanco (362 MW) and Spectrum (205 MW), the Discoms have shown availability of power from these projects with PLFs of 80% and 68.5% respectively, without explaining the basis and certainty for availability of natural gas to achieve the proposed PLFs.

Licensees' Response: The tariff of Lanco and Spectrum are relatively less compared to thermal plants. In addition, ramp-up and ramp-down characteristics of Combined cycle gas turbines make attractive to balance the intermittent generation of Wind and Solar projects.

Commission's View: Consistent with the order on tariff for Retail Sale of Electricity for FY2019-20, the Commission has considered the availability of power from these two units only for FY2019-20.

Proposal to include Hydro power under Renewable Energy would increase availability under RPPO

53. Sri M. Venugopal Rao, Senior Journalist and Convener, Center for Power Studies, Hyderabad and Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that the Ministry of Power, GoI is planning to place a proposal to bring large hydro power units under the ambit of renewable energy. If such a change comes into force, then availability of NCE would increase and its availability as a percentage of requirement under RPPO would also increase.

DISCOMs' Response: The proposals for inclusion of Hydro Power units under the ambit of renewable energy is under planning stage. Further, if it is included, APDISCOMs will get revenue by selling the Renewable Energy Certificates for the energy over and above the RPPO obligations.

Commission's View: The view is true.

NCE Capacities contracted are leading to surplus

54. Sri M. Venugopal Rao, Senior Journalist and Convener, Center for Power Studies, Hyderabad and Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that the questionable actions of the Discoms in contracting NCE capacities and of approving the same by APERC, at higher tariffs vis-a-vis tariffs discovered through competitive biddings, have already caused irreparable damage to larger consumer interest on a long-term basis. As if that were not enough, the Commission has already issued its RPPO order, with an ultra simplistic and subjective approach and unrelated to demand growth and requirement of power to meet the same, determining higher percentages of NCE to be purchased by the Discoms - 11% in 2018-19, 13% in 2019-20, 15% in 2020-21 and 17% in 2021-22. The Discoms have claimed that they have been continuously exceeding the RPPO targets given by the Commission till date and expect to continue their performance in future also as projected in the subject reports.

Licensees' Response: GoAP had issued the Wind & Solar Policies in order to promote Wind & Solar Projects in the State of Andhra Pradesh in order to achieve the targets in capacity additions as envisaged by the GoI. Accordingly, APDISCOMs entered PPAs/PSAs and are submitting the same to the Commission for approval. Present trend of the Solar power tariff realized in the competitive bidding is cheaper than thermal power.

Commission's View: The perception of irreparable damage to larger consumer interest on a long term basis as conceived by the learned objectors cannot be shared by the Commission which believes that the larger interests of the power sector, the State and the consumers are safeguarded by its actions and orders and never jeopardized.

NCE capacities are leading to unwanted surplus and backing down

55. Sri M. Venugopal Rao, Senior Journalist and Convener, Center for Power Studies, Hyderabad and Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that APEPDCL in its letter dated 29.5.2018 submitted to the Commission, has explained, inter alia, that:

a) NCE generation predominated by wind, which is very seasonal and intermittent in nature and mostly available during lean demand months during the year, is causing surplus time blocks.

b) Generation from RE resources is around 23% of energy requirement. The generation from NCE is very infirm in nature and "must run". This warrants a more robust methodology of forecasting/scheduling of RE generation to suit the real time needs.

c) In the event of system emergencies, thermal generation which is supposed to operate as base load support, has to be backed down which requires critical planning in terms of technical limits of the units in terms of flame stability & ramp up/down rates.

d) During backing down of generation, technical limits of generators, PPA conditions like maximum number of instructions in a day, maximum number of backing down hours, status of generators like must run, emergency conditions like transmission constraints etc. are duly considered.

e) The quantum of backing down for each generator will be restricted up to respective generator technical limits.

f) Central Generation Stations (CGS) are operating under ABT. In ABT regime, SLDC has to inform schedule of CGS stations' generation to RLDC before six-time blocks i.e. one and a half hour. Hence, if we want to back down CGS generation, we have to inform before six-time blocks. If we want to back down immediately, we can back down only APGENCO generators and IPPs.

g) For the year 2018-19, maximum available capacity, excluding renewable energy sources, i.e. wind and solar which are very intermittent in nature, at any given point of time is around 7750 MW. Without considering solar and wind generation, the grid demand can be met 60% of the time in the year 2018-19.

h) The difference between peak demand and the demand incidental for 60% of the time is (9312-7757) 1555 MW (9213 MW is estimated to be required for 100% time duration in an year to meet demand). If the solar generation which is always incidental during most part of the day time and is coincidental with peak demand, the grid demand can be met most of the time barring a few time blocks.

From the above explanation, it is clear that, instead of contributing to a balanced energy mix, NCE, especially wind power, is creating imbalances, leading to increase in availability of unwarranted surplus and backing down. Being high-cost power which is being treated as "must run", NCE is also imposing avoidable financial

burdens on the consumers of power. In such a situation of already exceeding the targets of RPPO by more than one hundred percent in the year 2018-19 itself, it is imperative to confine to purchasing NCE only to the extent the APERC has already given its consents to the PPAs concerned so far, give up the PPAs, if entered into by the Discoms, with NCE projects, but consents of the Commission are not given, and not to enter into fresh agreements/PPAs with NCE units during the entire 4th Control Period.

Licensees' Response: Power procurement over and above committed plants of APGENCO and CGS will be made through competitive bidding process for base load. As per the Commission's directions, APDISCOMs are taking prior permissions for procurement of Wind & Solar power. Further, Commission permitted APDISCOMs for procurement of wind power through competitive bidding to avail cheaper power.

Commission's View: The suggestions will be kept in view.

1000 MW Distributed solar plant should be given up

56. Sri M. Venugopal Rao, Senior Journalist and Convener, Center for Power Studies, Hyderabad and Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that APEPDCL has pointed out in a letter that in view of the infirm and intermittency of generation from the RE sources, it is advisable in the interests of grid security and stability, to have a backup capacity in terms of pumped storage hydel, battery storage or oil-fired generation capacity which can come on to the stream in a quick time. The backup capacity in terms of the above resources shall be at least 5% of the total installed capacity of RE sources at any point of time. From the explanation it is clear that RE sources cannot serve the purpose of backup but base load capacity, which can be used as and when required, is required to serve the purpose of backup for RE. Therefore, the Discoms should give up or postpone their proposed plan for 1000 MW grid connected decentralized solar power plant.

Licensees' Response: NCE generation is environmental friendly and hence it is promoted for procurement of power under renewable energy sources. Decentralized solar power will reduce the T&D losses by utilizing power locally. APDISCOMs submitted the proposals for procurement of 1000 MW decentralized solar power to the Commission for its approval.

Commission's View: The issue is the subject of an independent proceeding under

enquiry through public consultation process and no opinion can be expressed by the Commission herein.

Decrease in State load factor and Back down of thermal generations due to Solar power

57. Sri M. Venugopal Rao, Senior Journalist and Convener, Center for Power Studies, Hyderabad and Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that Average State load factor is estimated to come down from 72.9% in 2017-18 to 68.4% in 2019-20 and remain as it is till 2028-29. Explaining the reasons for reduction of State load factor in future, the Discoms have stated that with the infusion of solar and wind power, the peak power availability is observed during 11 am to 13 pm, i.e., for two hours per day. Availability of solar power is expected to increase from 2732 MW in 2018-19 to 4852 MW in 2019-20 and to 5602 MW in 2020-21, despite its meagre utility in terms of meeting peak demand. The Discoms have maintained that by shifting the agricultural demand for power to the time slot from 11 am to 13 pm, the overall peak availability is expected to be high, but, at the same time, due to this shifting, the State overall load factor will come down. Which means due to availability of solar power for a peak period of two hours in a day, thermal plants will be asked to back down during that period. The problem of backing down thermal plants during the off-peak hours when solar and wind projects generate power will continue to persist, with its adverse consequences.

Licensees' Response: Diurnal and seasonal variation in demand will be met successfully by varying the generation dispatch.

Commission's View: A delicate balancing between different modes of power generation processes is a continuous and unavoidable necessity in managing the dynamic power sector.

Peak Demand can be met by exchange purchases

58. Sri M. Venugopal Rao, Senior Journalist and Convener, Center for Power Studies, Hyderabad and Sri Ch. Narasinga Rao, State Secretariat Member, CPI(M), Visakhapatnam have stated that for meeting peak demand, apart from continuing the normal practice of generating hydel power during peak hours, gas-based projects to whom natural gas is available much below the requirements of threshold level of PLFs can be run during peak hours. For meeting the remaining peak demand, if any, it is relatively beneficial to go in for purchases through power

exchanges etc. instead of going in for NCE or other base load plants afresh.

Licensees' Response: Some quantum of power during peak hours will be procured from power exchanges.

Commission's View: The suggestion needs to be considered.

Need for timely and effective process given past experiences

59. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that Load forecasts and resource plans are critical to provide an overall direction to sector investments and planning at a time of uncertainty. Given its importance, it is unfortunate that a resource plan has not been approved in Andhra Pradesh State for the 3rd Control period. Further, this is the second process initiated for approval of load forecasts and a resource plan for the 4th Control Period. Given the delay in processes, submissions by the DISCOMs, it is important that the current process is comprehensive and takes place with due public consultation in a timely manner to ensure continued legitimacy of the process and the decisions of the Commission in the regard.

DISCOMs' Response: Licensee will follow the guidelines given by APERC in this regard.

Commission's View: The views are unexceptionable.

Sufficient time to be provided for submission of comments

60. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that sufficient time needs to be provided for public comments so that all stakeholders have sufficient time to understand and provide constructive feedback on the petitions. For an important process like the assessment of load forecasts and resource plans where capacity addition and capital expenditure plans for the DISCOMs are submitted, time should be provided similar to the tariff determination process every year. This is because the plans have significant investment and cost implications for consumers. Thus, a minimum of 45 days needs to be provided for solicitation of comments from the public from the date of issue of the public notice.

DISCOMs' Response: Issue is in the purview of APERC.

Commission's View: The Commission always received all suggestions /views/objections from any stakeholder throughout the pendency of any proceeding before it irrespective of the time specified therefor in the public notices issued.

Stakeholder consultation and data validation processes

61. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that as per guideline 2.4.1 of the APERC guidelines on load forecasts, resource plans and power procurement notified on 28.02.2000, the Commission may ask for additional information, clarification and data as necessary and such additional information needed to be furnished within 2 months from the date of the first submission. Commission is requested to seek additional data from the DISCOMs to provide more clarity on the key assumptions and data used in the resource plans. Some examples of data needed are listed below.

- Circle-wise, consumer category-wise hourly load data for 2017-18 and previous years
- Fixed and variable cost trajectories of all existing generation sources
- Consumer category-wise load shapes assumed for projecting load in the 4th and 5th Control Periods
- Source-wise split along with capital and variable costs of estimated capacity addition as indicated in Section 5.7 (Power Procurement Plan for meeting the deficit)

Further, the resource planning process itself needs to be more inclusive and rigorous. Assumptions and input data should be publicly shared and these inputs should be vetted through an extensive consultation process. As an example of such a process, the Maharashtra Electricity Regulatory Commission (MERC) undertakes a detailed technical validation process for the business plan petitions submitted by utilities for the multi-year tariff period. The data provided by the utilities is vetted by the stakeholders and any information and methodology gaps are addressed as part of this process. APERC should undertake a similar process.

Planning for a long period of time, i.e. 10 years, involves a lot of uncertainty, especially in the current juncture where the electricity sector is undergoing a transition aided by changing resource mix, sales migration, energy efficiency measures and worsening DISCOM finances. In order to address these uncertainties before the DISCOM, it is important to understand the comprehensive picture. The Commission, as a part of the current process could publish a draft white paper on the uncertainties before the DISCOM, suggesting approaches to sales migration, tariff design and capacity addition planning. Further, the Commission, along with the DISCOMs must conduct extensive stakeholder consultations, especially with

industrial and commercial consumers. The final paper, after public consultation, including all stakeholder comments can form a roadmap for effective transition for the DISCOMs and the detailed methodology to be followed by the DISCOMs when planning for the future. This effort can feed into the resource planning process of future tariff determination processes and MYT proceedings.

DISCOMs' Response: Issues to related to setting up of extensive consultation process, requiring additional information, vetting of the data by all stakeholders, publishing of draft white paper etc. are in the purview of the APERC.

Commission's View: All possible means were adopted to collect as broad-based information as possible relevant to the present consideration as is done in any proceeding before this Commission and to arrive at the most desirable future road map based on the widest possible public consultation.

Capacity addition review

62. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that given that power procurement forms about 75-80% of the costs of the DISCOM and given the massive capacity addition plans, especially for renewable energy, the Commission must conduct a review of capacity in the pipeline given realistic demand growth and expected dates of commissioning keeping in mind important project milestones. Utilities should re-submit their resource plans based on the framework identified through this process.

The process should:

a. Review capacity in the pipeline including renewable energy. Such a review should include an evaluation of major project milestones (financial closure, BOP/BTG contracts, environment clearance, forest clearance, etc.).

b. Review if power from long term contracts can be surrendered, decommissioned, reallocated or sold using platforms such as DEEP as appropriate. This could also ensure timely and firm exit from projects which are incessantly delayed and unlikely to come up in the near future.

c. Assess the cost of grid integration for the massive renewable energy capacity addition given changes in load curve due to sales migration and energy efficiency efforts.

Such a comprehensive public review can contribute to the capacity addition planning discourse and help evaluate the need for capacity which is costly as it

comes with huge investments, resource lock-ins and contractual obligations. It would also greatly add to the legitimacy of the process.

ERCs in States such as Punjab, Uttar Pradesh and Haryana are initiating a review of existing PPAs. Maharashtra ERC is currently conducting a suo-motu process by reviewing the PPAs and capacity addition plan of the State generation company, MSPGCL1.

AP Transco and SPDCL Response: Projects with all clearances and visible commissioning dates were considered. Capacity addition is reviewed under legal framework and APERC guidelines.

EPDCL Response: Individual schemes with capital expenditure have to be approved by APERC after detailed review.

Commission's View: A comprehensive public review of the various aspects of the functioning of the Power sector by the Commission is a continuously ongoing process through various regulatory, adjudicatory, advisory and administrative proceedings undertaken by the Commission in discharge of its duties and functions from time to time.

More frequent review of resource plans

63. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that due to magnitude of uncertainties in the sector, utilities need to be agile and flexible in their decision making. These resource plans should be reviewed every two years to make sure that any changes in generation technology, costs or demand are incorporated. In case of non-submission or delay in submission of the resource plans, APERC can conduct a suo-motu process to review the plans. Such frequent reviews have also been suggested by the Ministry of Power in Section 42 (4) of the proposed amendment of the Electricity Act, 2003 (version dated 7th September 2018).

Licensees' Response: Resource plans are reviewed whenever necessity arises.

Commission's View: The review of the resource plans is undertaken as per the relevant guidelines and regulations periodically.

Capital expenditure review

64. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that increasing efficiency, reducing the cost of supply as well as improving the quality of supply are of paramount importance. The implementation and efficacy of capital

expenditure investments need to be reviewed regularly in order to address this. This is particularly important given the capital investment planned and given the efforts Andhra Pradesh is taking to meet the goal of 24x7 Power for All. Therefore, the Commission should conduct a review of the implementation of all capital expenditure projects, say once in three years to track the status of the projects as well as to assess its contribution to the intended benefits. This can improve efficiency, reduce costs, increase public accountability and increase efficiency. The review should be done for all DPR and non-DPR projects and should track implementation status, capitalization, delay in implementation and its associated reasons, accruing IDC as well as the realized benefits due to the implementation of the project. This is crucial as such a review can also inform the wheeling tariff determination process for the upcoming control period.

SPDCL Response: Under the purview of the APERC.

AP Transco and EPDCL Response: Individual schemes with capital expenditure have to be approved by APERC after detailed review.

Commission's View: As already stated, such reviews are subject to the regulations, practice directions, orders and guidelines given by the Commission from time to time.

Provide all data in spreadsheet format

65. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that all data used in the plans should be provided in spreadsheet format so that it is easy to process and analyse. Doing so will enable better quality feedback from various stakeholders, making the public consultation process more effective.

DISCOMs' Response: Licensee will follow the guidelines given by APERC in this regard.

Commission's View: The DISCOMS may take note of the suggestion.

More details needed in time series equation

66. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that the time series equation is given as Y = (A+B*X) * S, where Y is the demand in a particular hour and X is a "time" variable for that hour. No other information is provided regarding the variable X, the methodology undertaken for regression analysis, the values of the parameters A and B arrived at, or any details of the seasonality index, S. More details should be published by the utilities. In the absence of these details,

it is assumed that X refers to the hour-wise trends of change in load from year to year, and the seasonality index refers to seasonal variation. While these factors are necessary to forecast load, they are not sufficient, especially over a 10-year period. Some important factors that impact the load forecast are elaborated upon in the subsequent sections.

DISCOMs' Response: Noted.

Commission's View: Nothing further to add.

Load factor assumptions

67. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that it is not clear how the load factor was estimated and it is unclear what assumptions were made to project changes in load factor going forward. These should be clarified as these are crucial assumptions in the load forecast and will impact capacity addition requirements.

Licensees' Response: Agriculture load will be shifted from night to day hours to match with increasing solar generation thus reduces the load factor.

Commission's View: Nothing further to add.

Consumer category-wise load shapes

68. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that given that growth rates are different for different consumer categories and geographical areas, spatially disaggregated representative load shapes for different consumer categories and different types of industries are essential for any load forecasting exercise. It is not clear whether these forms the basis of the load forecast analysis presented in the submissions. If they are considered, aggregate load shapes should be shared as part of the submissions for each circle and consumer category.

Going forward, the introduction of smart meters, as indicated in the submissions, will provide the utilities access to more accurate hourly or 15-minute load shapes. These can be used to more effectively analyze how load shapes are changing over time and to estimate load shapes of the future. Equally importantly, aggregate load data with high spatial and temporal granularity should be published periodically.

DISCOMs Response: Licensee has used state level historical Load (hourly demand in MW) data (24*365) for past 4 years to forecast future demand in MW using time series regression analysis.

Commission's View: Nothing further to add.

Uncertainty in weather patterns

69. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that the seasonal component of the load, represented by the seasonality index in the load forecast equation, is influenced by weather patterns, which vary over the years with varying temperature and rainfall patterns. Hence, scenarios with different seasonality indices should be considered. Uncertainty analysis should be done on the basis of these scenarios, which is critical in ensuring that utilities are better prepared to handle different future possibilities in electricity demand patterns.

DISCOMs' Response: The seasonality index has been derived using load data for 24 hours *365 days for last 4 years. The index thus derived represents changes in the weather patterns.

AP Transco Response: The hourly demand analysis considers diurnal, seasonal variations and weather patterns.

Commission's View: The DISCOMs claim to have already done it.

Impact of captive and open access migration on load shapes

70. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that the period of ten years covered in the submissions is likely to experience significant churn and transition in the electricity sector. This ongoing transition and resultant migration of sales to captive and open access procurement could result in significant uncertainty in total energy demand as well as the load shape of such consumers. Given the rising cost of supply of the utility and the increasing viability of open access and renewable energy captive options, many consumers can reduce their dependency on the DISCOM for supply. In this context it is felt that the assumptions made for open access and rooftop solar are conservative and the assumptions for captive sales migration is non-existent. The process of preparing load forecasts and resource plans is the ideal opportunity to deal with this uncertainty. Different scenarios should be considered as part of the load forecasting exercise to account for such uncertainties. It is not clear whether this was considered when preparing the load forecast.

DISCOMs' Response: Licensees have duly projected the OA sales based on the actual OA sales in last 5 years in which uncertainties towards growth in sales due to IEX, 3rd party consumers and captive consumers etc. Based on this, licensees

have projected 10% growth rate per annum for OA sales.

Also, licensees have considered the sales from solar roof-top projects in last 3 years. The historical CAGRs are very high but it will be irrational to consider these CAGRs for 10 year's projections. Hence, licensees have moderated the CAGRs for 10 year' sales projections as explained in section 3.2.2.4 in filed resource plan.

Commission's View: The different possibilities are claimed to have already been taken into account.

Surplus-deficit analysis

71. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that from the information provided in the submissions, it appears that power generation is forecast using hourly PLFs for base load, peaking and variable intermittent generation plants. Such a simplistic analysis assumes pre-determined generation profiles, and does not take into account the intra-day and inter-temporal dynamics that occur due to diurnal and seasonal variations in both demand and variable intermittent generation. This approach has the following drawbacks:

- It does not provide any insight into the flexibility requirements imposed by varying demand and intermittent variable generation sources like wind and solar.
- There is no insight on the amount of cycling that may be required of both baseload (coal and CCGT) and peaking (hydro and open cycle gas) generation sources.
- Cost implications of such cycling are not analyzed and factored into the supply/deficit analysis. Thus, alternate sources that could provide such support more economically and efficiently are not explored.
- The resource plans are significantly supply focused and demand side measures are not considered at all.

Thus, the submissions provide very limited insight into the wide range of power procurement and demand side approaches that could be explored to meet the utility demand. The surplus-deficit analysis is much better done using more robust analytical approaches to determine the capacity addition and market procurement strategies, as well as demand-side measures and policies that are most effective in meeting demand in the future.

Licensees' Response: Hourly demand analysis which takes in to account intraday

and inter-temporal dynamics that occur due to diurnal and seasonal variations in both demand and variable intermittent generation is also considered along with surplus deficit analysis in generation planning. Hybrid systems (Wind + Solar + Storage), intermittent generation (40% to 60% PLF) are also proposed along with power purchase from short term purchases from exchanges etc. to meet system peak demand.

Commission's View: The suggestion and the response are noted.

Power procurement analysis

72. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that the analysis in the submissions leading up to the power procurement plan is too simplistic, lacks detail on the capacity addition plans and is insufficient to make robust decisions regarding how power should be procured 5-10 years down the line. Cost trajectories of different generation and storage options, if considered in the analysis, are not published. While solar, wind and battery storage prices are falling, cost of conventional sources is going up. Hence, it is economical and cleaner to procure wind and solar energy especially where there is alignment with load shapes. The role of conventional generation sources and storage, especially the new capacity to be added, is then to provide flexibility support to manage the fluctuations in demand and intermittent variable generation. Thus, the time has come to shift from base load-based power procurement planning to that based on flexibility support. Any decisions made through this process can have long-term lock-in effects, hence robust analysis is needed. This can be done through various types of models, and these models are becoming increasingly accessible to utilities in terms of ease of use, technical expertise needed and cost.

Capacity expansion models can help in identifying cost-effective options for meeting demand in the long run (5-15 years) by taking into account the characteristics of various sources including generation and storage options. Using these options, day-a-head and real-time unit commitment and dispatch models can be run to derive hourly or block-wise schedules. Based on this, periods of surplus and deficit are identified and these can then be used to analyse market interactions, seasonal and time-of-day contracts and demand-side measures such as demand response and demand shifting. Market behaviour, short term contracts and demand-side options could also be simulated as part of the dispatch modelling to help minimize system cost.

Dispatch modelling provides important insights into how much flexibility will be expected of conventional generation sources and the costs associated with it. This can be used to review the technical capabilities of generating units with long term PPAs and any R&M that could be undertaken to make them more flexible while reducing overall system cost. Likewise, regulations can be reviewed to mandate generation parameters such as technical minimum and ramp rates that help in maintaining system stability and minimizing system cost. In addition, new market instruments and ancillary services such as capacity markets can be explored and introduced if they make economic sense.

There are also mechanisms to introduce uncertainty into the above analysis. Such analysis can help identify risk mitigation strategies and thus prepare the utilities to deal a less certain future in a more effective manner, making it an integral part of the resource planning exercise.

Due to the uncertainties in generation technology, cost and demand, these models should be run at regular intervals and the decisions made should be reviewed based on the resulting analysis.

SPDCL Response: Licensee has optimized the power procurement requirement for each year of the 4th Control period considering the cost of various power sources including but not limited to thermal/ renewables.

AP Transco & EPDCL Response: Power procurement over and above committed plants of APGENCO and CGS will be made through competitive bidding process for base load. Solar power has become cheapest power hence large-scale solar parks and distributed solar generation is encouraged even though available during only day hours. Agriculture load will be shifted from night to day hours to match with solar generation. AP Genco and CGS units will be dispatched to meet intermittent solar and wind generation subjected to ramp up/down rates.

Commission's View: The Commission has considered the power procurement plan with reference to the various aspects pointed out by the learned objector.

Transmission and Distribution planning

73. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that as for transmission, considering the growth of the national grid, the State transmission plan should be done in close coordination with the regional transmission plan, which also involves transmission utilities of other states and inter-state transmission utilities. It is not clear how this coordination is ensured. As for

distribution, significant investment is planned for HVDS in both DISCOMs. It is important to provide a cost benefit study on the HVDS systems. What are the major contributors to the savings due to HVDS? Is it reduction of theft, reduction of motor burnouts or any other factors? Has any study been done by the DISCOMs in this regard? DISCOMs should also clarify on the plans to implement physical feeder separation in the State, in terms of number of feeders, investment, targets etc.

SPDCL Response: In so far as HVDS schemes are concerned, the Cost-Benefit analysis has been carried out before taking up the projects. Major savings as per the assessment are as following:

- Reduction in Theft.
- Cease up of unauthorized Connected Loads
- Improved Voltages
- Increased Water discharge.
- Reduction in DTR failures, Fuse off Calls and thereby reduced System Down time.
- Reduced Motor Burnouts
- Owning up of local DTR by the Farmers connected to it.

AP Transco and EPDCL Response: While preparing the transmission plan the network growth of national grid was also considered. However, the individual schemes will be firmed up after conducting joint studies with Power grid and CEA.

Commission's View: The licensees appear to be claiming to have taken the aspects referred to by the learned objector into account while preparing the transmission and distribution plans.

Dissonance between sales growth projections and actual experience

74. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that the sales growth assumptions made by the DISCOMs are quite substantial and are much higher than actual growth in the State (including Telangana) in the past decade. In fact, it does not compare to the growth of sales in most other states during the same time period. The past decade saw significant increase in electrification, economic growth as well as industrial development and yet, the growth rates for electricity sales were very much lesser than the assumptions made by the Andhra

Pradesh DISCOMs. It is unclear how with sales migration and recent lull in industrial production that such significant growth rates in sales can be sustained. The demand projections in the Electric Power Survey of the Central Electricity Authority have been highlighted by several commentators for its tendency to overestimate demand. Even CEA estimates for future sales assume lower sales projections than the resource plan estimates, not just for Andhra Pradesh (and Telangana) but for other States as well. In this context it is urged that the estimates and assumptions by the DISCOMs are reconsidered.

SPDCL Response: The forecast of electricity consumption was carried out based on various factors including historical growth rates. In fact, during H1 2018-19 a growth rate of 13.11% in actual sales over H1 2017-18 was noted. Hence, the projections of sales are estimated realistically based on the available data.

The Growth in the lift irrigation schemes is primarily driven by the commitments of the State Govt., and the implementation schedule of the Schemes in association with the State Govt. Water resources Dept.

EPDCL Response: Higher Sales growth is assumed compared to past trend due to new capital city Amaravathi, Petrochemical (PCPIR) corridor, Vizag Chennai industrial corridor, SEZs new air ports and sea ports etc.

Commission's View: The gap between expectations and realities in demand growth rate may by itself not suggest any unrealistic projections by the DISCOMs. Slower growth rate may be due to various circumstances beyond the comprehension or control of DISCOMs but the response of the DISCOMs shows that their estimates are based on historical data, government policies and expected growth of the State capital and other industrial and communication activities.

Inconsistency between sales (MU) projections and hourly demand (MW) projections

75. Sri N. Sreekumar, Member, Prayas Energy Group, Pune has stated that as per the hourly surplus-deficit tables in the EPDCL resource plan, the total demand for the year 2023-24 is 93,744.2 MUs, with a peak demand of 14,838 MW and a load factor of 72%. However, as per Tables 18 in both EPDCL and SPDCL resource plans, the total demand for FY24 is 80,702 MUs. Likewise, in Table 40, the load factor for FY24 is projected to 68.4% whereas it is 72% on the basis of the tables in Section 5.6.1. What is the reason for this discrepancy?

In addition, Table 87 ("Summary of the yearly surplus-deficit") of both these

documents seems to be incorrect. It shows no diurnal variation in the load, i.e., same average demand for all 24 hours of the day, within a particular year.

DISCOMs' Response: The section 5.6.1 mentions the State level energy requirement whereas table 18 mentions only about category-wise sales. The comparison between the two tables is irrational.

Commission's View: The Commission attempted to reconcile the various data in coming to its conclusions.

New and efficient gas-based plants having PPAs be given first choice

76. Sri Arunendu Saha, COO, Gas Assets, GMR Vemagiri Power Generation Limited has stated that presently domestic natural gas produced by ONGC deep water fields is available and around 3.5 MMSCMD is being supplied to GAIL and GSPC through a tendering process by ONGC. In future also abundant domestic natural gas supply of around 70 MMSCMD from deep water sources by ONGC and RIL is expected as per the projections made available. In order to utilize the Domestic Natural Gas to power the 4000 MW of stranded gas-based power generation capacity in the state of AP, GoAP have requested GoI for making available ONGC domestic gas from Deep water sources of KG Basin. AP Transco for the benefit of the Grid considering addition of Renewable Energy in large quantities should explore all possible options to utilize the gas-based capacities with efficient and improved technology within the State for balancing and peaking requirements as a prudent Resource and Electricity Plan. Pumped Storage has geographical and seasonal limitations while largely dependent on irrigation requirements. Hybrid concept will be flawed being dependent largely on the same. Battery Storage System is still under nascent stage of development and will require at least 15 years to be commercially viable. National Electricity Plan by CEA also corroborates the view as above stating the development of battery storage technology as "nascent". Also, large battery capacities require huge investments which will not be a viable solution for a developing country like India considering the cost and scale of investments. Existing gas-based capacities of approximately 4000 MW will be the best alternative solution for arriving at a practical and viable Hybrid solution for RES integration. As per National Electricity Plan, coal based thermal plants are likely to achieve lower PLFs considering the additions of RES capacity targets, thereby leaving a large capacity unutilized. The priority should be to utilize the existing gas-based power generation capacity with better efficiency levels and thereby reducing the pollution levels. The installed capacity of gas-based

generation in the State is 4000MW approximately, which is around 13% of Installed capacity of the State. Investments are very high for super critical technologies and will lead to higher tariffs. Adding further capacities will lead to under-utilization of existing capacities. Economy lies only in efficient utilization of existing generating assets at maximum PLF. Gas is a cleaner fuel emitting 50% less GHG and the particulate matter especially PM 2.5 is nil. PM 2.5 is one of the major health concerns in today's time and directly impacts human mortality rate by virtue of secondary health issues. SOx is nil and NOx levels are negligible in Gas as fuel. Considering large addition of renewables and requirement of balancing power and ancillary services, efforts towards utilizing more gas-based capacities will lead to more environmentally sustainable solution. To comply with the new environment norms there will be requirement of significant investments which will further burden the end consumers with higher tariffs. The order of investments is estimated at Rs.4,00,000 Cr. It's a financial challenge. Gas power can reduce the externalities costs as well additional investments which impacts Economy, Society and Public at large. Due to visibility of abundant domestic gas from ONGC, all four New IPPs, namely GVPGL, GVK-II, Konaseema and Goutami having long term PPAs with AP Discoms should be prioritized for generation at low cost and accordingly be captured in the Resource Plan being projected. The resource plan being projected should keep in mind the EA 2003 and the guidelines prescribed by APERC in view. As Natural gas is a rare and precious resource, its best and efficient utilization should be the key consideration under this plan. New and efficient gas-based plants having PPAs be given a first choice and receive a fair treatment under short-term/long-term power procurement by DISCOMs. Plants whose PPAs are non-existent should not be considered in the plan as ongoing basis.

Commission's View: The issues raised by GMR Vemagiri Power Generation Limited need to be specifically answered by the DISCOMs. They shall communicate their detailed response within one month from the date of communication of this order to enable the Commission to examine the further course of action it has to take on merits in accordance with law.

No need of NCE beyond RPPO targets

77. Dr. S. Chandramouli, President, APSEB Engineers' Association and Sri S. Prathap, Technical Secretary, APSEB Assistant Engineers' Association, Vijayawada have stated that as per the projected demand/supply forecast values submitted to the APERC, DISCOMs have shown large quantity of NCEs into the system though

these are more impulsive and infirm in nature. And DISCOMs are procuring more power from power exchanges in order to meet the unexpected power demand caused by the uncertainty of NCEs. As NCEs are must-run stations, SLDC has to utilize the total power generated by them. Further, SLDC has to give backing down instructions to conventional (Coal, Oil and Gas) Power Plants in order to control the grid frequency with huge generation of NCEs. SLDC can instruct GENCO thermal plants only as CGS ABT scheduling should be done before six-time blocks (one and half hour) and as such GENCO thermal plants are backing down most of the times imposing adverse effect on the life of the plants, efficiency and cost of generation. It is advisable to meet the RPPO as per the targets set by APERC but not be over enthusiastic, which will help the consumers and DISCOMs and trouble-free grid management. There is no need for the projected wind generation of 3685 MW by FY2018, 4326 MW by FY2019 and 4729 MW by FY2020 as DISCOMs have already reached their RPPO targets set by APERC and wind generation being very uncertain and unreliable, leads to backing down of conventional (Coal, Oil, Gas) Power plants.

Commission's View: The DISCOMS may examine the suggestions and take a view.

No need of Spinning Reserve and consider low cost APGENCO plants

78. Dr. S. Chandramouli, President, APSEB Engineers' Association and Sri S. Prathap, Technical Secretary, APSEB Assistant Engineers' Association, Vijayawada have stated that the proposed procurement of 800 MW in FY2019-20 for spinning reserve (for unit with higher capacity available or 5% of installed capacity whichever is lower) in not needed with rated generation of existing installed capacities. DISCOMs are not considering some of the GENCO thermal plants from FY2019-20 onwards, which are generating power at low cost and working effectively. DISCOMs can consider these power plants for the 4th and 5th Control Periods and no need to phase out which will help reduce the financial burden on both the consumers and DISCOMs.

Commission's View: The GENCO thermal plants were subsequently taken into consideration for the 4th Control Period as stated in letter no. CGM / RAC / APSPDCL/F.PPA Extn/D.No.180/19, Dt.21.03.19 from the Chief General Manager, RAC, APSPDCL to the Commission.

No plants to meet the load requirement in the medium and long term

79. Dr. S. Chandramouli, President, APSEB Engineers' Association has stated that the additional generation capacity of 5400 MW required by FY2023-24 to meet 95% of hourly average demand on year on year basis. If spinning reserve and 100% meeting of average load are considered, the capacity requirement is still higher. No plans to meet the load requirement in the medium term i.e. for the 4th Control Period and long term i.e. by FY2028-29 have been mentioned in the Resource Plan. There is no upcoming capacity in pipeline for APGENCO once the ongoing projects of SDSTPS-II (800 MW), NTTPS-V (800 MW) and Polavaram (960 MW) hydro plants are commissioned. Polavaram being a hydro plant, energy production is very less when compared to thermal plants. Power plants have long gestation periods. To get the plants materialized and pick up the load requirements, planning in advance for almost 5 to 10 years is required otherwise State will reel under heavy deficit situation in the years to come. AP GENCO being a State utility has to be given permission to explore the option of installing additional capacity.

Commission's View: The suggestion needs consideration by the State Government and the licensees.

GIS substations need not be allowed

80. Sri M. Thimma Reddy, Convener, People's Monitoring Group on Electricity, Hyderabad, has stated that APTRANSCO proposed to construct a 132 kV GIS substation at Mughalrajpuram, 220 kV GIS substations at Lingayapalem and Nelapadu, and 400 kV GIS substations at Thallayapalem, Borupalem and Nidamarru. GIS substations are located in highly built up urban areas where land is not available in sufficient measure to set up conventional substations. As the above locations meant for GIS substations are not built up areas GIS substations need not be allowed at these places.

AP Transco Response: The foremost reason to opt for GIS-SS is because of the limited availability of land in capital city of Amaravathi and per acre of land would cost around 4 to 5 cr in the area where the GIS-Substations are proposed. GIS 400KVsubstation requires 19 acres land compared to conventional substation requires 60 to 70 acres land thus making GIS an economical option. Amaravathi Capital city will be a world class city with smart, integrated infrastructure components and one among the government of India selected Smart cities.

Commission's View: Expected future growth of the State Capital is stated to be

the reason for the GIS stations at presently vacant locations.

Mutually contradictory assertions of the Discoms

81. Sri. Ch. Narsinga Rao and Sri M. Venugopala Rao submitted that, the Discoms have contended that for future years, once agriculture demand is not flexible, the State will need more round the clock power, instead of solar power, and in that case the peak demand arriving at mid-day will be distributed in the entire day and the peak demand will reduce resulting in increase in load factor. At the same time, the Discoms have assumed that the load factor will remain the same at 68.4% for the forecasted years. It is difficult to understand the intended purport of these mutually contradictory assertions of the Discoms.

AP Transco Response: Load factor will remain at 68.4% however to meet increasing demand power will be procured from power plants with 60% to 80% PLF as well as from power plants with 40% to 60% PLF and short-term purchase.

Commission's View: The Commission has taken note of the different statements in coming to its own conclusions.

CHAPTER - III

LOAD FORECASTS

82. In this chapter, the Commission has examined the load forecasts for 4th Control Period proposed by the licensees in their respective Resource Plans. The Commission, while examining the proposals, has reckoned /considered all the views/objections/suggestions expressed by the stakeholders in writing and during public hearings, which have been elaborated in Chapter-II, to the extent they are relevant to the subject matter.

Sales Forecast

83. The approach followed by the licensees for the Load Forecasts involves (i) analyzing the historical sales data to arrive at the Compounded Annual Growth Rate (CAGR), (ii) moderating the CAGR with due regard to justifiable adjustments in trends, the various policy initiatives and directions of the State Government etc., (iii) projecting the sales for the next Control Period with the moderated CAGRs, (iv) grossing up the sales with voltage-wise losses to arrive at the energy requirement at the DISCOM level and then aggregating the same together with energy expected to be handled through Open Access (OA) transactions to arrive at the energy requirement at State level, (v) deriving the system load factors at base year and projecting the same into the future years of the Control Period under consideration and (vi) arriving at the State Peak Demand by applying respective annual load factors.

84. Licensees have taken historical data of six (6) years (From FY2012-13 to FY2017-18) on Circle-wise/ Category-wise sales and adopted Trend Method (assessing historical trends and arriving at CAGRs based on which sales projections are made) / End Use Method (that takes into consideration various economic and Central / State level initiatives which effect the end use consumption and forecasted sales) for projecting the Sales for the 4th & 5th Control Periods.

85. The base year for the Sales forecast exercise is considered as FY2017-18. The licensees in their Sales forecast exercise have assessed, inter-alia, the impact on sales due to (a) Govt. Lift Irrigation Schemes, (b) Promotion of Electric Vehicles, (c) Off-grid Solar Pump sets and (d) Solar Roof top Schemes on the basis of End Use approach.

86. The impact of the above schemes has been embedded into the respective categories to arrive at overall sales forecast. The DISCOM level growth rates of historical &

projected CAGRs for the 4th Control Period are given in the following Table:

Table 122 – Historical and Projected CAGRs

Consumer Category	APSPDCL		APEPDCL	
	HISTORICAL CAGR*	PROJECTED CAGR**	HISTORICAL CAGR*	PROJECTED CAGR**
LT-I Domestic	9.6%	11.3%	9.4%	9.4%
LT-II Non-domestic/Commercial	7.6%	9.8%	9.0%	10.5%
LT-III Industrial	11.0%	14.4%	24.2%	14.5%
LT-IV Cottage Industries	6.4%	7.8%	0.0%	1.0%
LT-V Agriculture	4.2%	2.0%	7.4%	3.0%
LT-VI Street Lighting & PWS	4.3%	4.8%	0.0%	2.0%
LT-VII General Purpose	7.4%	7.1%	8.6%	7.2%
LT-VIII Temporary Supply	2.3%	3.5%	0.0%	2.0%
LT Total	**7.0%**	**8.0%**	**9.8%**	**8.9%**
HT-I Industry	4.4%	6.6%	8.5%	5.8%
HT-I (B) Ferro-Alloys	14.7%	6.9%	15.6%	11.3%
HT-II Others (Commercial)	10.3%	9.6%	5.8%	4.8%
HT-III Public Infrastructure and Tourism	112.8%	5.2%	137.5%	5.3%
HT - IV Agriculture	54.2%	20.5%	49.2%	24.9%
HT-V Railway Traction	3.9%	2.0%	3.6%	2.0%
HT-VI Townships and Residential Colonies	0.0%	3.4%	1.3%	2.6%
HT-VII Green Power	0.0%	0.0%	0.0%	0.0%
HT-VII RESCOs	9.1%	9.1%	9.3%	10.0%
HT-VIII Temporary Supply	11.4%	2.0%	0.0%	1.1%
HT Total	**7.5%**	**8.6%**	**10.6%**	**8.7%**
LT+HT Total	**7.2%**	**8.2%**	**10.2%**	**8.8%**
State Level	**8.2%**		**8.4%**	

***Historical Sales Growth during FY2012-13 to FY2017-18**

****Projected Sales Growth for 4th Control Period i.e. FY2019-20 to FY2023-24**

87. At State level, the historical Sales growth is 8.2% and the DISCOMs have projected a sales growth rate of 8.4% for the 4th Control period covering FY2019-20 to FY2023-24.

88. The difference between historical and projected category-wise CAGRs is stated to be due to (a) the expected development in the new Capital city of Amaravathi and neighbouring areas and consequent increase in residential, commercial loads and cottage industries, increase in sales to EVs, (b) promotion of Solar Roof Top projects, Off-grid Solar Pumps leading to reduction in sales, and (c) moderation of growth rates in view of saturation in the industry in respect of Ferro Alloys, HT Lift Irrigation Schemes, LT Industry and likely migration of Railway Traction loads to

Open Access and such other relevant factors. As such, the Commission is inclined to accept the CAGRs projected by the licensees.

Commission's Decision

89. The Commission, vide para 280 of the Order on the Retail Supply Tariff for FY2019-20, has determined Sales volumes for both licensees at 59162.29 MU i.e. 37166.70 MU for SPDCL and 21995.59 MU for EPDCL. The category-wise sales as approved by the Commission for FY2019-20 (as at Table 11 of the Retail Supply Tariff Order for FY2019-20) are adopted as it is for FY2019-20 being the first year of the 4th Control Period and used as base for projecting the category-wise sales for the remaining four years (FY2020-21 to FY2023-24) duly applying the category-wise CAGRs as accepted by the Commission.

90. Further, vide para 381 of its Order on Retail Supply Tariffs for FY2019-20, the Commission, keeping in view the objectives and recommendations of the committee constituted by the Ministry of Power, GoI and the amendments proposed to National Tariff Policy, 2016 with regard to simplification of tariff categories, to begin with, has decided to bringdown the number of existing eight (8) categories in LT and eight (8) categories in HT to five (5) categories altogether to provide a roadmap for the future. Accordingly, the existing 16 Categories, 51 sub-categories and 25 Slabs are reduced to 5 Categories, 30 Sub-Categories and 21 slabs, to be applicable for FY2019-20.

91. The category-wise sales derived by applying the category-wise approved CAGRs as above are recast into the simplified / modified tariff structure specified for FY2019-20, for all the years of the Control Period duly taking into account the percentage shift of the inter-se sales among categories for FY2019-20 as constant for all the remaining years of the 4th Control Period. The DISCOM wise approved Sales forecast for the 4th Control Period is worked as below:

Table 123 – Approved: Sales forecast for the 4th Control Period

Consumer Category		DISCOM	FY20	FY21	FY22	FY23	FY24	CAGR
Category-I Domestic	LT	SPDCL	9117	10162	11330	12636	14097	11.5%
		EPDCL	5671	6206	6792	7434	8136	9.4%
		Total	**14788**	**16368**	**18122**	**20070**	**22233**	**10.7%**
	HT	SPDCL	30	31	32	34	35	3.9%
		EPDCL	27	27	28	29	30	2.7%
		Total	**57**	**58**	**60**	**63**	**65**	**3.3%**
Category-II Commercial & Others	LT	SPDCL	1993	2211	2467	2757	3091	11.6%
		EPDCL	1124	1243	1383	1540	1721	11.2%
		Total	**3117**	**3454**	**3850**	**4297**	**4812**	**11.5%**
	HT	SPDCL	919	1005	1103	1216	1348	10.1%
		EPDCL	721	761	803	847	894	5.5%
		Total	**1640**	**1766**	**1906**	**2063**	**2242**	**8.1%**
Category-III Industry	LT	SPDCL	1090	1246	1428	1642	1893	14.8%
		EPDCL	423	484	554	635	727	14.5%
		Total	**1513**	**1729**	**1982**	**2276**	**2621**	**14.7%**
	HT	SPDCL	7716	8207	8747	9345	10008	6.7%
		EPDCL	7668	8288	8970	9720	10545	8.3%
		Total	**15384**	**16495**	**17717**	**19065**	**20554**	**7.5%**
Category-IV Institutional	LT	SPDCL	840	884	929	977	1029	5.2%
		EPDCL	308	317	328	339	351	3.3%
		Total	**1148**	**1201**	**1257**	**1316**	**1380**	**4.7%**
	HT	SPDCL	878	896	916	935	955	2.1%
		EPDCL	734	749	764	779	795	2.0%
		Total	**1611**	**1645**	**1681**	**1715**	**1751**	**2.1%**
Category-V Agricultural & Related	LT	SPDCL	11054	11487	11963	12486	13065	4.3%
		EPDCL	3487	3761	4069	4413	4799	8.3%
		Total	**14541**	**15249**	**16032**	**16899**	**17863**	**5.3%**
	HT	SPDCL	3113	3311	3525	3754	3999	6.5%
		EPDCL	1452	1526	1603	1685	1772	5.1%
		Total	**4565**	**4837**	**5128**	**5440**	**5771**	**6.0%**
TOTAL	**LT**	SPDCL	24094	25990	28117	30498	33175	8.3%
		EPDCL	11013	12011	13126	14361	15734	9.3%
		Total	**35107**	**38001**	**41243**	**44859**	**48909**	**8.6%**
	HT	SPDCL	13071	13904	14817	15824	16933	6.7%
		EPDCL	10983	11770	12630	13569	14594	7.4%
		Total	**24054**	**25673**	**27447**	**29393**	**31527**	**7.0%**
RESCOs		SPDCL	415	453	494	539	587	9.1%
		EPDCL	381	419	461	508	558	10.0%
		Total	**796**	**872**	**955**	**1047**	**1145**	**9.5%**
LT+HT	**Total**	SPDCL	37165	39894	42934	46322	50108	7.8%
		EPDCL	21996	23780	25755	27930	30328	8.4%
		Total	**59161**	**63674**	**68690**	**74252**	**80436**	**8.0%**

Loss Trajectory – Distribution and Transmission Loss

92. Before examining the Distribution Loss trajectory proposed by the licensees for 4th Control Period, the Commission wishes to place on record its appreciation for the

consistent reduction in losses from year to year by both the APEPDCL and APSPDCL and the maintenance by APEPDCL the record of having the lowest percentage of losses in the Country with the APSPDCL not lagging far behind. The Commission takes this opportunity to congratulate the functionaries of both the Discoms from Junior Line Men to the Chairmen and Managing Directors for their sterling performance. The Commission, while examining the loss trajectory for the 4th Control Period, has reckoned / considered all the views / objections / suggestions expressed by the stakeholders in writing and during public hearings, which have been elaborated in Chapter-II, to the extent they are relevant to the subject matter.

93. The distribution licensees have proposed voltage wise losses in percent at three voltage levels LT, 11 kV and 33 kV to be paid in kind by the users of the distribution system in their respective licensed areas. Any person who utilizes the distribution system to wheel the electricity shall pay the wheeling charges and also compensate for distribution losses in kind at the proposed loss level for each year of the Control Period.

94. The loss percentage proposed is based on estimated energy handled and losses at respective voltage levels with respect to total input for each year of the Control Period. The Loss trajectories filed by licensees are shown in the tables below:

Table 124 – Filings: Distribution Loss Trajectory - APEPDCL

Voltage Level	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24
LT	4.13%	4.11%	4.08%	4.05%	4.02%
11 kV	3.28%	3.25%	3.20%	3.15%	3.10%
33 kV	2.81%	2.80%	2.79%	2.78%	2.77%

Table 125 – Filings: Distribution Loss Trajectory - APSPDCL

Voltage Level	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24
LT	4.36%	4.31%	4.27%	4.23%	4.18%
11 kV	3.35%	3.31%	3.28%	3.25%	3.21%
33 kV	3.32%	3.28%	3.25%	3.22%	3.19%

95. Both the distribution and transmission licensees filed the loss trajectory for Transmission losses as follows.

Table 126 – Filings: Transmission Loss Trajectory

Year-->	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Losses (%)	3.14	3.12	3.10	3.08	3.05	3.0	2.95	2.90	2.85	2.80	2.75

96. The distribution licensees also stated that they do not expect any new procurement from Central Generating Stations in 4th and 5th Control Periods and therefore assumed the PGCIL losses to remain the same across the 4th and 5th Control Periods.

Determination of distribution loss trajectory

97. The Commission while fixing the loss trajectory for the 4th Control Period has examined following:

- Targets proposed for reduction of distribution losses during the Control Period duly adhering to the licensees' standards of performance regulation.
- The loss levels achieved by the licensees in 3rd Control Period up to H1 of FY2018-19 against the targets fixed by the Commission.
- The loss trajectory projected by the DISCOMS for the 4th Control Period.
- The capacity of the existing network.
- The Capital works in progress and the investments approved in this order.
- Loss reduction measures being followed and proposed by the licensees, viz. implementation of HVDS, Augmentation of Power Transformers, Procuring Star rated DTRs, Erection of line capacitor banks and intensive inspections for detection of pilferage of energy.

98. The Commission has examined the loss trajectory submitted by the licensees with reference to the above points and fixed the loss trajectory for the 4th Control Period for each licensee as shown in the tables below:

Table 127 – Approved: Distribution Loss Trajectory - APEPDCL

Voltage	**FY 2019-20**	**FY 2020-21**	**FY 2021-22**	**FY 2022-23**	**FY 2023-24**
LT	4.01%	3.99%	3.97%	3.95%	3.93%
11 kV	3.20%	3.15%	3.10%	3.05%	3.00%
33 kV	2.79%	2.78%	2.77%	2.76%	2.75%

Table 128 – Approved: Distribution Loss Trajectory - APSPDCL

Voltage	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24
LT	4.26%	4.23%	4.20%	4.17%	4.14%
11 kV	3.27%	3.22%	3.17%	3.12%	3.07%
33 Kv	3.20%	3.15%	3.10%	3.05%	3.00%

99. Further, the Commission approved the transmission loss trajectory for the 4th Control Period in its order dated 08.03.2019 on Transmission Tariffs which are given below:

Table 129 – Approved:Transmission Loss Trajectory

Financial Year	2019-20	2020-21	2021-22	2022-23	2023-24
Transmission Loss	3.10%	3.08%	3.06%	3.03%	3.00%

100. The Commission accepted the assumption of the distribution licensees with regard to the PGCIL losses remaining the same across the 4th and 5th Control Periods.

Assessment of State level Energy Requirement and Peak Demand:

101. There are two components in the State-wide energy being handled at the Grid level. They are a) Energy procurement by the DISCOMs for serving their Consumers and, b) Third party energy handled by the Grid pertaining to Inter State & Intra State Open Access transactions.

102. The Open access transactions which are being embedded into the Transmission & Distribution networks are stated to be in the range of 3187 MU to 4639 MU for each year of the 4th Control period. DISCOM wise Open Access sales as projected by the Licensees are shown in the Table below:

Table 130 – Filings: DISCOM Wise Open Access Transactions (MU)

Financial Year	FY19-20	FY20-21	FY21-22	FY22-23	FY23-24
EPDCL Area	945	1,018	1,105	1,247	1,365
SPDCL Area	2,242	2,442	2,682	2,956	3,274
Total State	3187	3460	3787	4203	4639

103. The distribution and transmission licensees have estimated the State level Energy requirement (including energy handled for Open Access Transactions) & the corresponding Grid Peak demand expected to be incident on the AP Power system

as under:

Table 131 – Filings: Energy Input (MU)

Parameter	FY20	FY21	FY22	FY23	FY24
Energy Input @ EPDCL	24,508	26,443	28,576	30,968	33,565
Energy Input @ SPDCL	42,473	45,711	49,343	53,401	57,956
Transmission Losses	2,131	2,261	2,430	2,609	2,788
PGCIL Losses	460	460	460	460	460
Total Energy Input at State Level	69,572	74,875	80,809	87,438	94,769
Less: Procurement at 33 kV	966	1,663	1,663	1,663	1,663
Total Energy Input at State Level (including Open Access)	68,606	73,212	79,146	85,776	93,106
Peak Demand (MW)	11,450	12,219	13,209	14,315	15,539

Determination of DISCOM-wise Energy Requirement and energy handled at AP Transco periphery:

104. Commission has examined the State level peak demands filed by the transmission licensee for the 4th Control Period and approved the same for determination of Transmission Tariff, vide its order on transmission tariff dated 08.03.2019. The peak demands approved are given in the table below.

Table 132 – Approved: State Peak Demand

Parameter	**FY 2019-20**	**FY 2020-21**	**FY 2021-22**	**FY 2022-23**	**FY 2023-24**
Peak Demand (MW)	11450	12219	13209	14315	15539

105. Duly applying the approved voltage wise Losses at Transmission & Distribution levels, the energy requirement by the DISCOMs for each year of the 4th Control period has been assessed and is shown in the following Table. Considering the historical System Load Factor (SLF) at Grid level, change of load mix along the time horizon of the 4th Control period and the proposals of the Licensees, the Commission has accepted the same with regard to the Open Access transactions and adopted the State Peak Demand as approved in the Transmission Tariff Order for the 4th Control Period and accordingly approved State energy requirement & Grid Peak Demand (which includes Open Access transactions) and the same are shown in the following Table.

Table 133 – Approved: Energy and Demand requirement by the DISCOMs (MU)

Financial Year	FY19-20	FY20-21	FY21-22	FY22-23	FY23-24
EPDCL-Energy requirement	24154	26246	28403	30773	33386
SPDCL-Energy requirement	41605	44822	48170	51894	56054
Total Energy Requirement (Excluding OA Transactions)	65759	71068	76573	82667	89441
Open Access Transactions	3187	3460	3787	4203	4639
Total Energy requirement at AP Transco periphery	68946	74528	80360	86870	94080
State Peak Demand (MW)	11,450	12,219	13,209	14,315	15,539
Open Access Demand (MW)	383	310	366	438	513
State Peak Demand (MW) Excluding Open Access	11,067	11,909	12,843	13,877	15,026

CHAPTER - IV

POWER PROCUREMENT PLAN

106. In this chapter, the Commission has examined the Power Procurement plan for 4th Control Period proposed by the licensees in their respective Resource Plans. The Commission, while examining the proposals, has reckoned /considered all the views/objections/suggestions expressed by the stakeholders in writing and during public hearings, which have been elaborated in Chapter-II, to the extent they are relevant to the subject matter. Before going further and at the outset, it may be noted that the licensees have reduced the energy handled through Open Access transactions from the total energy requirement at State level while drawing up the Power Procurement Plan.

Key Assumptions made by the licensees

107. The following are the key assumptions made by the licensees while drawing up the Power Procurement plan.

a) The Power purchase agreements of the Krishnapatnam TPP (JVP) Stage-I (SDSTPP-I) and Krishnapatnam TPP (JVP) Stage-II (SDSTPP-II) plants, Nagarjunasagar Tail Pond Units-1&2 have not yet been approved by the Commission. These plants are currently supplying power to AP State. For the future calculation purpose, licensees assume that these plants will supply power to AP State at the same capacity as they are currently supplying.

b) Trajectory of expiry of the following AP Genco-Thermal Plants is considered as i) RTPP Stage I – FY2019-20, ii) VTPS (NTTPS) Stage-I and Stage-II – FY2020-21, iii) VTPS (NTTPS) Stage III – FY2021-22.

c) The PPAs of all the existing AP GENCO Hydel Plants are expiring by FY2018-19. Licensees expected extension of these agreements and considered these plants for future supply projections.

d) The MOU with APGPCL – I & II expired on 24.12.2012, the matter is sub-judice and the State is still receiving power from these plants and hence licensees considered APGPCL for future supply projections.

e) GMR Vemagiri, GVK Extn., GVK Gautami and Konaseema are stranded due to unavailability of gas and hence not considered for future calculations.

f) KSK Mahanadi, LVS and Hinduja Power plants are not considered for future supply projections due to pending legal issues with them.

g) Grid connected solar plant (1000 MW) is expected to arrive from 1st September, 2019 and hence considered in the calculations.

108. Further, the Licensees have also stated that they have been continuously exceeding the Renewable Power Purchase Obligation (RPPO) targets fixed by the Commission till date and expect to continue the same performance in future also. The trajectory of RPPO fixed by the Commission and the compliance as stated by the Licensees are as follows:

Table 134 – Filings: RPPO targets and compliance

State	FY 19		FY20		FY21		FY22		FY23		FY24	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Solar	4.0%	8.4%	5.0%	12.3%	6.0%	14.2%	7.0%	13.2%	7.5%	12.2%	8.0%	11.3%
Non-Solar	7.0%	15.1%	8.0%	15.3%	9.0%	14.3%	10.0%	13.2%	10.5%	11.9%	11.0%	10.7%

Methodology Proposed by the licensees

109. The methodology proposed by the licensees for determining the additional capacity requirement is as follows:

a) The licensees have analyzed deficit/surplus situation based on projections for both demand and supply taking into account a) MU analysis – *based on energy input requirement and energy supplied by the existing and upcoming capacities*, and b) MW analysis – *based on average hourly demand in MW and hourly available capacities projected based on time series in MW,* for each year of the Control Period.

b) Based on the existing and future planned capacities, energy availability (MU) has been determined for each power station. Based on the energy generation and energy input for power procurement, annual energy balance (surplus / deficit) is prepared.

c) For the purpose of MW analysis, Demand data is projected based on Time Series Analysis and hourly supply forecast is done based on the Installed Capacity of the plants assuming hourly PLFs for various sources.

d) On the basis of deficit scenario identified from the above, Licensees have estimated yearly average of hourly maximum deficit, hourly minimum deficit and hourly average deficit. The Licensees have considered yearly average of maximum deficit for determining the capacity to be procured.

e) The capacity procured for meeting such annual average hourly maximum deficit is stated to be sufficient to meet 90% of the demand. However, Licensees have extrapolated such capacity to be procured so that they are able to meet 95% of the demand. Remaining 5% has been proposed to be procured from power exchange on short-term basis.

f) Licensees expect to meet the capacity to be procured through Round the Clock (RTC) power from the plants with PLF from 60% to 80% considering following factors:

   i. 70% of the requirement shall be met through plants having PLF or CUF of 70% or 80%

   ii. 30% of the requirement shall be met through plants having PLF or CUF of 40% or 60%.

g) Licensees have also expected to procure Spinning Reserve equal to a capacity of the unit with highest capacity available or 5% of installed capacity whichever is lower. Licensees have considered 800 MW to be procured in FY2019-20.

Additional Capacity requirement

110. Based on the above methodology, the licensees projected capacity (MW) requirements for the 4th Control Period as shown below:

Table 135 – Filings: Projected Capacity requirements for 4th Control Period

Power Procurement (MW)	FY20	FY21	FY22	FY23	FY24
Annual Avg. Maximum Deficit (Based on hourly demand-supply situation) *	815	415	1,565	2,574	3,483
Annual Avg. Minimum Deficit (Based on hourly demand-supply situation)	-	-	-	158	738
Annual Average Deficit (Based on hourly demand-supply situation)	-	-	381	1,310	2,075

Power Procurement (MW)	FY20	FY21	FY22	FY23	FY24
Estimated Capacity to be procured for meeting 95% hourly average demand	1,500	800	2,500	4,000	5,400
Estimated Capacity to be procured for meeting 95% hourly average demand -YoY	1,500	-	1,000	1,500	1,400
Spinning Reserve for estimated capacity	879**	-	53	79	74
Estimated PP Capacity to be procured for meeting 95% hourly average demand -YoY	2,379	-	1,053	1,579	1,474
RTC Power to be procured (70% of Total PP Capacity with availability @ 80%)	1,665	-	737	1,105	1,032
RTC Power to be procured (30% of Total PP Capacity with availability @ 60%)	714	-	316	474	442
Short Term Purchase (Meeting 5% of hourly average demand)	400	519	393	438	464
Estimated PP Capacity to be procured for meeting 100% hourly average demand	2,779	519	1,446	2,017	1,938

* - Procurement to meet this deficit will cater 90% of the hourly avg. demand

** - Spinning Reserve (Highest Unit Capacity or 5% of Installed Capacity whichever is lower) for 800 MW considered

111. Accordingly, the licensees have estimated an aggregate capacity addition of 8,699 MW for the 4th Control Period covering FY2019-20 to FY2023-24, for meeting 100% Demand and 5% Spinning Reserve.

Commission's decision on Sources

AP GENCO Thermal and Hydel Sources

112. The licensees have stated that the Power Purchase Agreements in respect of NTTPS-I, II, III and RTPP-I are expiring by 31.03.2019 and assumed the trajectory for the expiry of the said plants for the 4th Control Period as follows:

- RTPP Stage-I - FY2019-20; NTTPS Stage-I and II - FY2020-21; NTTPS Stage-III - FY2021-22.

113. Further, the PPAs in respect of Hydel Plants viz. Machkund Power House, Tungabhadra Power House, Upper Sileru (USL), Lower Sileru (LSR), Donkarayi, Srisailam, Nagarjunasagar Right Canal Power House (NSRCPH), Penna Ahobilam (PABM), Mini Hydro (Chettipeta) are going to expire in FY2018-19. The Licensees, expecting extension of the PPAs, considered these plants for future power supply projections.

114. Subsequently, vide letter dated 21.03.2019, the Chief General Manger, RAC, APSPDCL informed the Commission that the APDISCOMs have decided to extend the term of the composite PPA (covering the above said thermal and hydel plants) and accordingly entered into Power Purchase Agreement with APGENCO on 20.03.2019 for the old stations of APGENCO for further five (5) years i.e. from 01.04.2019 to 31.03.2024 and that the PPA will be submitted to the Commission shortly for consent.

115. There are no approved PPAs existing in respect of RTPP Stage-IV (600 MW), NTTPS-V (800 MW), SDSTPS Stage-II (800 MW) and Indirasagar Polavaram Hydro Electric Power Project (12 X 80 MW). As on date, the draft PPAs in respect of the said plants were earlier submitted to the Commission by the APDISCOMs and the same were returned on different grounds i.e. making amendments, furnishing essential information for fixation of tariff and for want of jurisdiction. As the licensees included these power plants in their information about the installed capacity from various sources, these state-owned projects are presumed to be contemplated by the licensees for resubmission of the PPAs for approval in larger public interest to preserve and utilize the valuable public assets developed at considerable public expense. Accordingly, these projects are taken into consideration.

- 800 MW Units of NTTPS Stage-V and Sri Damodaram Sanjeevaiah Thermal Power Station (SDSTPS) Stage-II are expected to come up by FY2020-21 and the Commission considered these units accordingly for future projections.
- The 12 units each of 80 MW of Indirasagar Polavaram Hydro Electric Power Project are considered from the respective expected years of COD as projected by the licensees.
- The licensees have filed a petition dt. 15.03.2019 (O.P. No. 33 of 2019) seeking approval of the Power Purchase Agreement entered with APGENCO in respect of the 600 MW RTPP-IV in which it is stated that the project has been Commissioned on 29.03.2018. The Commission, vide its Order on Retail Supply

Tariffs for FY2019-20, has considered energy availability from RTPP-IV for FY2019-20.

116. Further, the Commission in its Order dated 26.03.2016 has determined the tariff for the thermal and hydel plants of AP GENCO (NTTPS-I to IV, RTPP-I to III and Sileru Complex, Nagarjuna Sagar Right Canal Power House, Srisailam Right Bank Power House, Penna Ahobilam Power House, Nagarjunasagar Tail Pond Power House and Chettipeta Power House) for the Control Period from 01.04.2014 to 31.03.2019 in O.P. No. 3 of 2016. The petition for tariff determination for the AP GENCO projects for the subsequent Control Period (4th Control Period) is due for Commission orders.

117. Commission, vide its order dated 13.07.2018 in O.P.No.21 of 2016 granted in-principle approval to the amended and restated Power Purchase Agreement dated 24.08.2016 between AP Power Development Company Ltd. (APPDCL) and APDISCOMs in respect of 2 X 800 MW SDSTPS-I and also determined both the Capital Cost and tariff vide Order dated 02.03.2019 in O.P. No.47 of 2017.

118. Commission, vide its order dated 7.04.2018 in O.P.No.48 of 2017, approved the amended and restated Power Purchase Agreement between the APGENCO and the APDISCOMs in respect of Nagarjuna Sagar Tail Pond Hydro Electric Station (2 X 25 MW) dated 2nd August, 2017, subject to the determination of tariff.

119. Accordingly, Commission considered the thermal and hydel power plants of APGENCO and APPDCL being the state-owned utilities indicated above for power supply projections for the 4th Control Period.

Central Generating Stations (CGS) Sources

120. The licensees have considered a total capacity of 2686 MW for the 4th Control Period under this category. Upon examination of the data filed it is found that, though the capacity of 539 MW bundled power under JNNSM is shown as a separate line item, the same was also found to be embedded as part of the allocation from the plants of NTPC SR, NTPC SR Stage-III, Talcher Stage-II, NTPC Simhadri Stage-II and Kudigi approved by the Southern Regional Power Committee (SRPC) for Southern Region, as verified from their website. Besides the above correction and after adjusting for Auxiliary Consumption, the Ex-Bus capacity available from CGS works out to 2299.46 MW and the same is considered by the Commission for all the years of 4th Control Period.

APGPCL, GGPP, IPPs-Gas Sources

121. The licensees stated that Gas Plants namely, GMR Vemagiri, GVK Extn., GVK Gouthami and Konaseema are stranded due to unavailability of gas and have not considered these plants for future calculations.

In this regard, in the Order for Retail Supply Tariffs for FY2019-20, the Commission while addressing the same issue stated that the Commission's view (extracted hereunder) as stated in para 83 at page 60 of the Order on tariff for Retail Sale of Electricity during FY2018-19 holds good and is reiterated.

"If Vemagiri, Konaseema, GVK extension and Gouthami gas based power projects can supply power of a quantity of 4835.52 MU with a PLF of 80% provided natural gas is available and if there is availability / augmentation of natural gas supplies to them during FY2018-19, the distribution licensees shall take appropriate permissible steps immediately for procuring cheaper power as per merit order despatch for the benefit of the consumers by reduction of power purchase cost."

In view of the above finding, such projects which have PPAs already consented by the Commission need not be kept out during the 4th Control Period for the purpose of capacity addition planning exercise. Accordingly, the above projects are considered for the 4th Control Period for the planning exercise.

122. The licensees stated that the MoU for APGPCL-I & II expired on 24.12.2012 and the matter is sub-judice but they are still receiving power from these plants and hence considered for power projection calculations. In view of the above, the same is considered by the Commission.

123. The licensees have considered Godavari Gas Power Plant (GGPP), Spectrum and Lanco Kondapalli (Gas) for the entire 4th Control Period. The Commission considered power procurement from these three power projects for FY2019-20 in the Order for Retail Sale of Electricity for FY2019-20. The Commission, while expressing its view on the renewal of PPAs of Spectrum and Lanco, stated that a decision will be taken on merits in appropriate proceedings on any request for renewal of the PPAs with Lanco and Spectrum in accordance with the prescribed procedure. As such, the capacities of Spectrum and Lanco are factored only for FY2019-20. As regards GGPP, the same is considered for the entire 4th Control Period as being available since the power from this project should be given preeminence over others as it is owned by DISCOMs which are conferred with the universal service obligation.

124. The licensees have considered 17 MW capacity in respect of M/s Srivathsa under 'IPP-others' and have stated the PPA expiry date as 7.05.2021. However, as per APEPDCL's filings in I.A.No. 17 of 2018 in O.P. Nos. 60 & 61 of 2017, the PPA with M/s Srivathsa was stated to be expired by 31.03.2018 and 7.05.2021 is the date of expiry of Gas Supply Agreement. Commission considered power procurement from this plant for FY2019-20 vide its Order on Retail Supply Tariffs for FY2019-20. Accordingly, the capacity is considered for FY2019-20 only and the plant being a gas-based project, is included in 'IPPs-Gas' instead of 'IPP- Others'.

IPPs – Others (Thermal) Sources

125. The licensees have stated that KSK Mahanadi, LVS and Hinduja Power Plants are not considered for future supply projections due to pending legal issues with them and accordingly considered Thermal Power Tech only for the 4th Control Period.

In respect of Hinduja, the Commission, vide its order on Retail Supply Tariffs for FY2019-20 observed that, *"Though any scheduling of power from HNPCL to either DISCOM is not specifically included in this Tariff Order, it shall be deemed to have been so included to the extent of faithful compliance with the interim order of Hon'ble APTEL dated 31.05.2018 in E.P.No. 3 of 2018 in I.A.No.211 of 2018 in Appeal No. 41 of 2018 and to have been permitted by this Commission accordingly subject to any further or future Order / judgement / direction of the Hon'ble APTEL."*

126. Further, licensees have not considered the capacity of 600 MW of M/s Simhapuri (DBFOO) in their projections for the 4th Control Period. In respect of this capacity, the Commission, vide its order on Retail Supply Tariffs for FY2019-20, observed that, *"Though any scheduling of power from M/s Simhapuri to either DISCOM is not specifically included in this Tariff Order, it shall be deemed to have been so included to the extent of faithful compliance with the Orders of this Commission and to have been permitted by this Commission accordingly, as per merit order dispatch."*

127. In view of the above, the capacities of M/s Hinduja and M/s Simhapuri are considered by the Commission for the projections for the 4th Control Period.

128. Further, the licensees, while replying to the objections on non-consideration of the capacity of M/s KSK Mahanadi, have stated that the issues with M/s KSK Mahanadi have been sorted out and power scheduling started from 28.09.2018 and it may be considered for future projections up to 31.03.2021. Accordingly, Commission considered the capacity of M/s KSK Mahanadi upto FY2020-21.

Non-Conventional Energy (NCE) Sources

129. The capacity projections of licensees in respect of Biomass, Bagasse, Industrial Waste, Municipal Solid Waste and Mini-hydel plants are considered as proposed duly taking into account the expiry dates of PPAs.

130. In respect of Wind, the Commission considered a capacity projection of 3892 MW to 3757 MW across the 4th Control Period against the licensees' projections of 4729 MW to 4615 MW duly taking into account the capacities with valid PPAs duly commissioned adjusting for PPAs expiry during the 4th Control Period, other than those which are currently under public hearing process.

131. In respect of Solar, the Commission considered a capacity projection of 2728 MW across the 4th Control Period against the licensees' projections of 4431 MW to 5596 MW duly taking into account the capacities commissioned/with valid PPAs and pilot project approved by the Commission, other than those which are currently under public hearing process.

132. Accordingly, the source-wise, year-wise net (ex-bus) capacities determined by the Commission for the 4th Control Period and their classification as Base / Other Than Base (OTB) is as hereunder: (Details are enclosed as Annexure-B)

Table 136 – Approved: Year Wise net Capacities (MW)

S. No.	SOURCE	2019-20	2020-21	2021-22	2022-23	2023-24	Base/ Other than base (OTB)
1	APGENCO - Thermal	4621.75	6117.75	6117.75	6117.75	6117.75	Base
2	APGENCO - Hydel	1755.86	1755.86	1993.46	2468.66	2706.26	OTB
3	CGS	2299.46	2299.46	2299.46	2299.46	2299.46	Base
4	APGPCL, GGPP, IPPs Gas	1478.19	911.48	911.48	911.48	911.48	Base
5	IPPs - Others - Thermal	2208.15	2208.15	1808.15	1808.15	1808.15	Base
6	NCE – Solar	2728.89	2728.89	2728.89	2728.89	2728.89	OTB
7	NCE - Wind Power	3892.14	3887.17	3881.89	3881.89	3757.72	OTB
8	NCE - Mini Hydel	63.60	63.60	53.20	47.17	43.91	OTB
9	NCE – Others*	245.56	245.56	229.79	193.18	163.73	Base
TOTAL		**19293.60**	**20217.92**	**20024.09**	**20456.65**	**20537.35**	

* NCE- Others include Biomass, Bagasse, Industrial Waste and Municipal Solid Waste Plants

Table 137 – Approved: Year-wise base and Other than base Capacities (MW)

Capacities	2019-20	2020-21	2021-22	2022-23	2023-24
Base Capacity (MW)	10853.11	11782.40	11366.64	11330.03	11300.58
OTB Capacity (MW)	8440.49	8435.52	8657.45	9126.62	9236.78
Total Capacity	**19293.60**	**20217.92**	**20024.09**	**20456.65**	**20537.36**

133. **The capacities of the projects that are included for the 4th Control Period are with due regard to the existing sources of supply such as AP GENCO and CGS, the existence of PPAs consented or otherwise having been covered in any Orders of this Commission or Hon'ble APTEL or Hon'ble APEX Court, possibility of commissioning during the 4th Control Period with due regard to the circumstances surrounding them, except for those which are under enquiry before the Commission through public hearing process and not yet Commissioned. However, inclusion of any project / plant under the above sources is only for the purpose of estimating the capacity availability during the Control Period and does not in any way confer regulatory approval which has to be obtained separately based on merits in accordance with law.**

134. **However, in respect of the Generating stations included in the sources of supply shown above which either have no Power Purchase Agreements or have no approval from the Commission for their Power Purchase Agreements and/or have to still have their tariff determined by the Commission, except in the cases where there is an adhoc tariff already being paid as per the Orders of the Commission, the licensees shall not receive any supply of power without prior intimation to and prior approval of the Commission.**

Commission's analysis on Additional Capacity requirement

135. The licensees stated that PLFs are considered between 60% and 90% in respect of APGENCO and 80%-95% in respect of CGS, at 40% in respect of IPPs-Gas, at 75% in respect of IPPs-Thermal and at 30% in respect of NCE-Other than Wind, Solar and Mini hydel. The PLFs are regulated based on the anticipated reduction in availability of coal in future and the variations in wind generation, resulting in consideration of PLFs much less than the normative level. However, understating the availabilities results in artificial increase in the avoidable power procurement.

136. As per the licensees, the capacity procured for meeting the annual average hourly maximum deficit is sufficient to meet 90% of demand after duly taking into account all the supply side projections that they expect to materialize during the 4th Control Period. However, licensees have extrapolated such capacity to be procured to meet 95% of the demand. Further, the licensees expect to meet the capacity to be procured through Round the Clock (RTC) power from stations with a PLF of 60% or 80% considering factors namely, 70% of the requirement being met through plants having PLF or CUF of 70% or 80% and 30% of the requirement being met through plants having PLF or CUF of 40% or 60%.

137. As can be seen from the above, while the target of the licensees is to have 95% of the demand being met, the means of achieving the same is through Round the Clock (RTC) purchases from sources with PLF from 60% to 80%. It appears that this approach while on one hand is achieving the desired target, also results in more surplus being available in respect of the already surplus hourly time blocks. As such, this approach adopted by the licensees results in adding more capacity than required in order to meet the desired target and hence is deficient in this regard. On top of this, short-term procurement to the extent of 5% & spinning reserve to the extent of 5% have also been proposed by the licensees.

138. A procurement ratio of 70:30 is proposed to share the additional capacity requirement between plants of two classes of Load factors (70% from Plants having PLF of 70% to 80% and remaining 30% from the Plants having PLF/CUF of 40% to 60%) which tend to enhance the base generation requirement without recourse to the time duration of such requirement, since the planning is based on addressing the deficit time blocks.

139. The power procurement plan has reserved 5% of the demand requirement to be met through short-term purchases (which are usually for a period of less than one year) upfront, without any regard to the contingencies justifying such purchase. Such purchases are generally to be resorted to only in the event of emergency due to contingencies or forced outages etc., beyond the control of the licensees.

140. The proposed methodology based on hourly deficit/surplus time blocks mostly suits for short-term power procurement plan only and perhaps cannot be adopted for Long-Term / Medium-Term procurement plan (as in the case of 4th Control Period which is for a duration of five years) going by the earlier sectoral practices.

Commission's decision on methodology for Power Procurement Planning

141. The objective of the Long Term/Medium Term Power procurement planning is to meet the Demand/Load incident on the system throughout the planning period while ensuring reliability. Load is a function of time and varies from time to time duly following a pattern during a day, cycle in a month, or across seasons in a year.

142. Addressing hourly deficit & shortage is not the scope of the Medium-term or Long-term planning. Long-term or Medium-term perspective planning focuses on meeting the system demand with the existing and prospective sources including type of fuel /nature of operation. Choosing the type of sources (Thermal, Hydel, RES etc.) is of critical importance in generation planning. Planning approach is to meet the peak demand and energy requirements. In view of the increasing penetration of Renewable Energy (Solar, Wind and others about 7000 MW as on date) in the State of Andhra Pradesh, it becomes imperative to plan for more optimal mix of base, intermediate and peaking capacities as might be drawn out from the Load Duration Curves for the respective years in the planning horizon.

143. The base capacities will take care of 'bulk-power' requirement by meeting the consistent load incident on the system i.e. base load, while the other capacities will provide the required flexibility and are valuable tools to take care of intermittency of renewable generation, seasonal spikes or time-of-day variations – expected and unexpected in electricity demand. The dynamic response characteristics of such a balanced system would be far superior and would certainly contribute to higher reliability.

144. In this context, it is to state that for projecting the Generation Capacity requirements at National Level on long-term basis in the National Electricity Plan (NEP) published in January, 2018, the Central Electricity Authority (CEA), which is the highest technical authority in power sector in the Country, has adopted Load Duration Curve based approach.

145. Load duration Curve represents the distribution of quantum of Load supposed to be incident on the System over a period of time i.e. one year or one month or a day. It gives critical inputs such as percentage of time during which the load on the system is equal to or above certain quantum, or percentage of time during which the load on the system is equal to or below certain quantum specified, to the System planner.

146. The load corresponding to a certain percentage of time duration is expected to be met through the type of generation source having the availability factor equivalent to that of the same load duration percentage. The yearly additional generation sources required based on the above criteria, over and above the existing committed capacities, are to be derived with due regard to the committed capacities and the corresponding load on the Load Duration Curve.

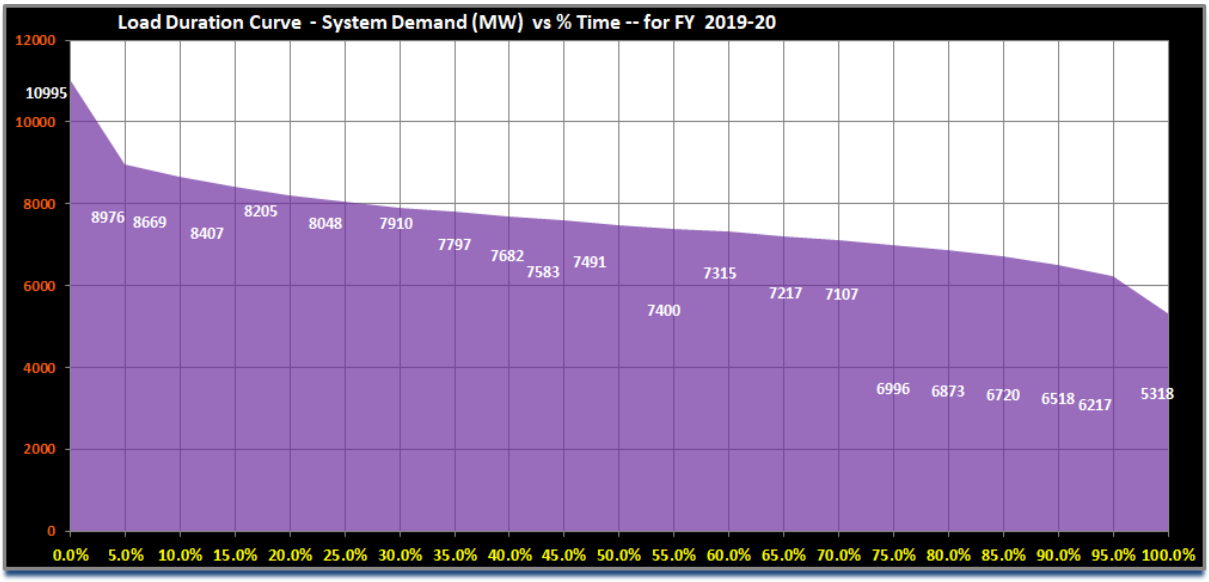
147. Commission recognized that the Load Duration Curve approach followed by the Central Electricity Authority, while developing the Generation Plan under National Electricity Plan is more suitable for long term / medium term planning compared to planning based on the deficit/surplus time blocks followed by the licensees which is more suitable for short term planning and likely to overstate the capacity requirement to be added. As such approach makes the already surplus time blocks more surplus, the Commission is inclined to adopt the Load Duration Curve method.

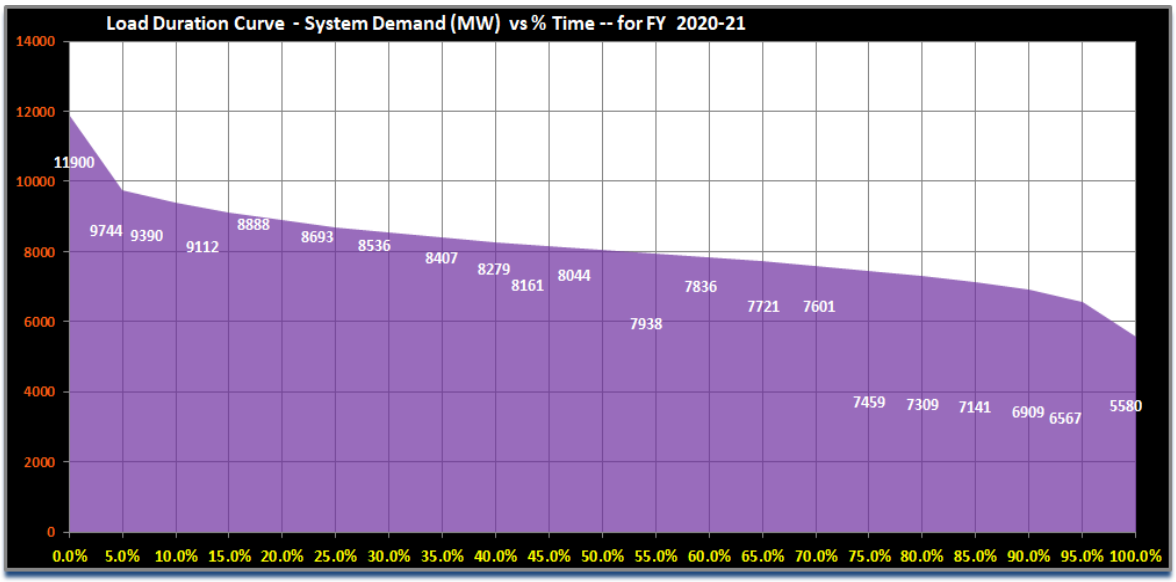
148. Based on the projected hourly demands made available during the course of proceedings and after validation with the approved sales forecast and load forecast in this order, for each year of the 4th Control Period, Annual Load Duration Curves are drawn with respect to percentage time duration with a step of 5% of time in a year (5/100 X 8760 Hours in a year = 438 Hours.) The data points thus obtained for each year of the 4th Control Period are shown below.

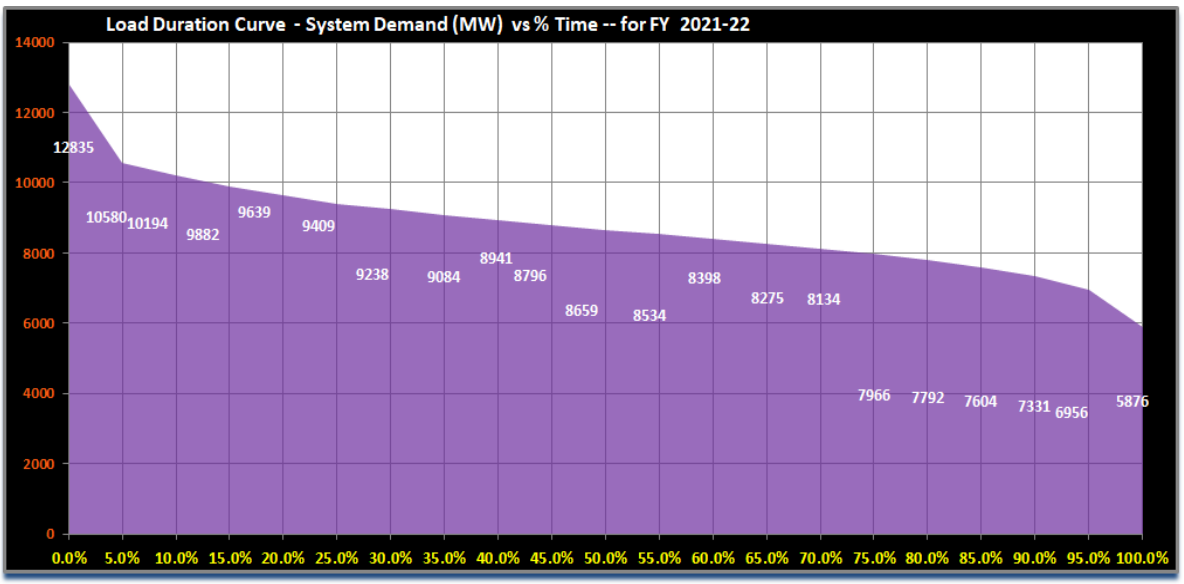
Table 138 – Data points of Annual Load Duration Curves for 4th Control Period

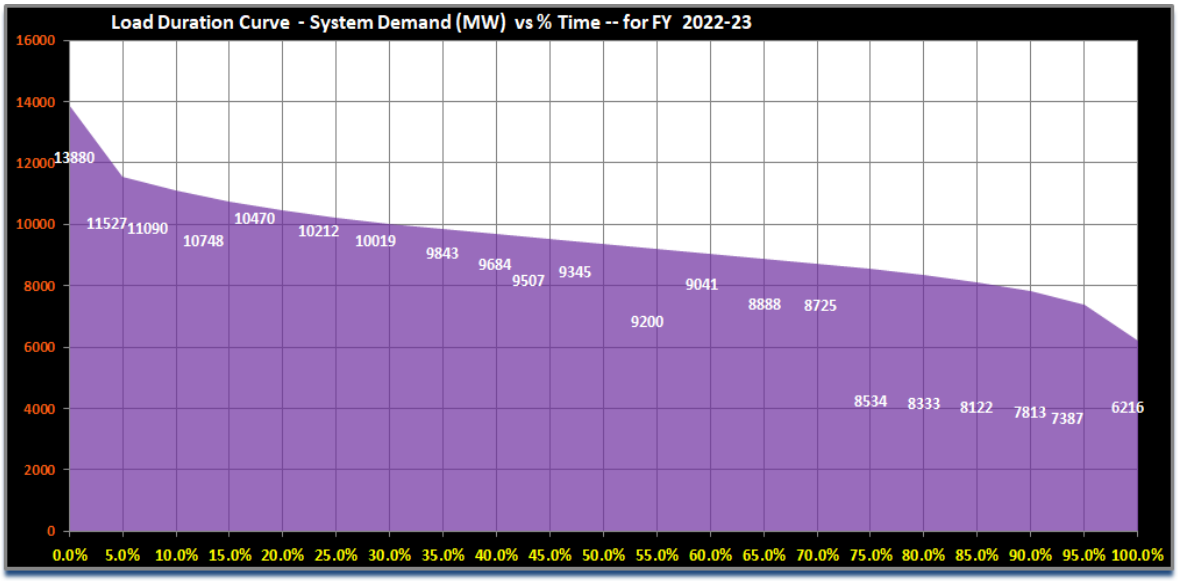
	Percentage of Time																			
FY	0.0%	5.0%	10.0%	15.0%	20.0%	25.0%	30.0%	35.0%	40.0%	45.0%	50.0%	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	85.0%	90.0%	95.0%	100.0%
2019-20 (MW)	10995	8976	8669	8407	8205	8048	7910	7797	7682	7583	7491	7400	7315	7217	7107	6996	6873	6720	6518	6217	5318
2020-21 (MW)	11900	9744	9390	9112	8888	8693	8536	8407	8279	8161	8044	7938	7836	7721	7601	7459	7309	7141	6909	6567	5580
2021-22 (MW)	12835	10580	10194	9882	9639	9409	9238	9084	8941	8796	8659	8534	8398	8275	8134	7966	7792	7604	7331	6956	5876
2022-23 (MW)	13880	11527	11090	10748	10470	10212	10019	9843	9684	9507	9345	9200	9041	8888	8725	8534	8333	8122	7813	7387	6216
2023-24 (MW)	15015	12575	12079	11710	11387	11112	10888	10698	10512	10305	10112	9941	9753	9574	9385	9173	8934	8685	8340	7873	6600

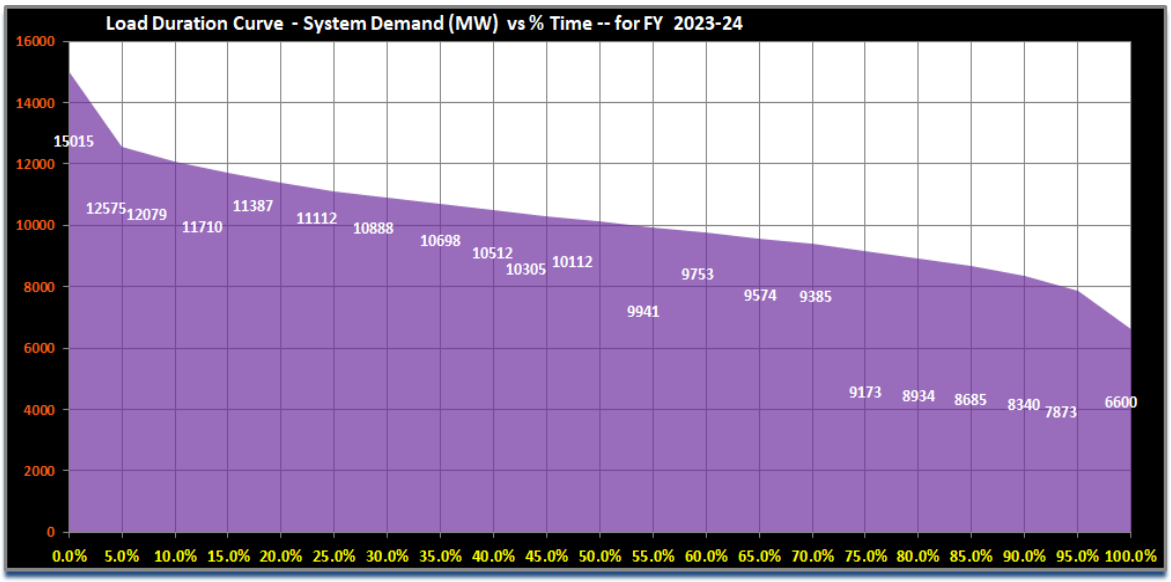
149. Load Duration Curves are plotted with the above data points for each year of the 4th Control Period, which are shown below:


Load Duration Curve - System Demand (MW) vs % Time -- for FY 2019-20
12000
10000
8000
6000
4000
2000
0
10995
8976
8669
8407
8205
8048
7910
7797
7682
7583
7491
7400
7315
7217
7107
6996
6873
6720
6518
6217
5318
0.0% 5.0% 10.0% 15.0% 20.0% 25.0% 30.0% 35.0% 40.0% 45.0% 50.0% 55.0% 60.0% 65.0% 70.0% 75.0% 80.0% 85.0% 90.0% 95.0% 100.0%


Load Duration Curve - System Demand (MW) vs % Time -- for FY 2020-21
14000
12000
10000
8000
6000
4000
2000
0
11900
9744
9390
9112
8888
8693
8536
8407
8279
8161
8044
7938
7836
7721
7601
7459
7309
7141
6909
6567
5580
0.0% 5.0% 10.0% 15.0% 20.0% 25.0% 30.0% 35.0% 40.0% 45.0% 50.0% 55.0% 60.0% 65.0% 70.0% 75.0% 80.0% 85.0% 90.0% 95.0% 100.0%


Load Duration Curve - System Demand (MW) vs % Time -- for FY 2021-22
14000
12000
10000
8000
6000
4000
2000
0
12835
10580
10194
9882
9639
9409
9238
9084
8941
8796
8659
8534
8398
8275
8134
7966
7792
7604
7331
6956
5876
0.0% 5.0% 10.0% 15.0% 20.0% 25.0% 30.0% 35.0% 40.0% 45.0% 50.0% 55.0% 60.0% 65.0% 70.0% 75.0% 80.0% 85.0% 90.0% 95.0% 100.0%





a) After duly examining the graphs as above and keeping in view the criteria laid down supra, the Commission considered the load point corresponding to 30% time duration (e.g. 10888 MW on the LDC for FY2023-24) as Base Load and the remaining as other than base (OTB) load on the annual Load Duration Curves with due regard to the PLFs of base load plants obtaining in the State keeping in view the fuel availability issues etc. on the supply side.

b) Accordingly, the corresponding base and other than base load points in the respective Load duration curves are extracted.

c) The points so extracted indicate the respective annual net (Ex-bus) capacity requirement for the base and OTB capacities.

d) Accordingly, the annual net Capacity requirement to meet the Base Load and Other than base Load as determined by the Commission to meet the System Demand duly including a spinning reserve of 5% on the corresponding demand points across the 4th Control Period is derived and is shown below:

Table 139 – Approved: Net (Ex-bus) Capacity requirement to meet the Demand (MW) including 5% spinning reserve

Capacity Required to meet the Demand as per the LDC	FY19-20	FY20-21	FY21-22	FY22-23	FY23-24
Base Capacity	8326	8986	9724	10547	11461
OTB Capacity	3247	3541	3787	4064	4344
Total Capacity	11574	12526	13511	14611	15805

150. The annual net capacity requirement is compared with the ex-bus capacities existing as on 31st March 2019 and the expected net capacities during the Control period, as determined vide Table 136.

151. Based on the annual net capacity requirement worked out with the methodology as above duly recognizing the existing & future generation capacities, the additional net capacity required (including 5% spinning reserve) during the 4th Control Period is as under.

Table 140 – Approved: Additional Net Capacity requirement to meet the Demand (MW) including 5% spinning reserve

Additional Ex-bus Capacity required (MW)	FY19-20	FY20-21	FY21-22	FY22-23	FY23-24	Total
Base Capacity	0	0	0	0	161	161
OTB Capacity	0	0	0	0	0	0
Total Capacity	0	0	0	0	161	161

152. In the above scenario, the Commission considered the four Gas based IPPs (GMR Vemagiri, GVK Extn., Konaseema, GVK Gouthami, totaling to a capacity share of 670 MW) being available as base load plants for the entire 4th Control Period. The Commission notes that these Gas based IPPs are stranded due to lack of gas for the last few years barring the period they were run on e-bid RLNG for some time. To assess the probable risk of unavailability of the above said four Gas IPPs, Commission analyzed the capacity requirements by excluding the capacity of the four Gas based IPPs from the list of Installed Capacities, as an alternate scenario which are shown in the table below.

Table 141 – Alternate Scenario: Year-wise base and Other than base Capacities (MW)

Capacities	2019-20	2020-21	2021-22	2022-23	2023-24
Base Capacity (MW)	10183.10	11112.39	10696.63	10660.02	10630.57
OTB Capacity (MW)	8440.49	8435.52	8657.45	9126.62	9236.78
Total Capacity	**18623.59**	**19547.91**	**19354.08**	**19786.64**	**19867.35**

153. The year on year additional net capacity requirement in the alternate scenario with respect to the capacity requirement as at Table 139, works out as hereunder:

Table 142 – Alternate Scenario: Additional year on year net capacity requirements

Capacity (MW)	FY19-20	FY20-21	FY21-22	FY22-23	FY23-24	Total
Base Capacity	0	0	0	0	831	831
OTB Capacity	0	0	0	0	0	0
Total	0	0	0	0	831	831

154. In this scenario, there is an additional net capacity requirement (including 5% spinning reserve) to the extent of 831 MW, over and above the existing & future generation capacities and the requirement is arising towards the end of the Control Period.

155. **The alternate scenario, in the considered opinion of the Commission, appears to be the worst-case scenario in terms of long-term capacity addition planning and as such the Commission is inclined to approve for procuring a base load capacity of 831 MW or say 1000 MW by FY2023-24. Further, since the Commission is approving only the additional capacity requirements for the 4th Control Period, even assuming that the alternate scenario does not come true, it is the firm opinion of the Commission that the base load capacity added by FY2023-24 will be at least useful for the 5th Control Period and hence licensees are authorized to procure only a base load capacity to the extent of 1000 MW to be available from FY2023-24.**

CHAPTER - V

DISTRIBUTION (CAPITAL INVESTMENT) PLAN

156. The Commission has examined the investments proposed by the licensees in the Resource Plans for 4th Control Period. The Commission, while examining the investment proposals, has reckoned / considered all the views / objections / suggestions expressed by the stakeholders in writing and during public hearings, which have been elaborated in Chapter-II, to the extent they are relevant.

157. The total investments (including ongoing Schemes) proposed for the 4th Control Period are Rs.13937 Cr. in respect of APSPDCL and Rs.6212 Cr. in respect of APEPDCL.

158. The details of investments as per the Resource Plans for the 4th Control Period is as hereunder:

Table 143 – Proposals: Investments - APSPDCL (Rs. Cr.)

S. No.	Item	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
1	Ongoing Schemes	750	339	228	-	-	1,317
2	Substations (New & Augmentation)	348	371	439	515	611	2,284
3	Metering & Associated equipment	160	250	290	296	220	1,216
4	DTR Additions	512	542	640	752	888	3,334
5	Lines, Cables & Network	570	623	746	888	1,064	3,891
6	Technology Upgradation and R&M	298	310	370	380	390	1,748
7	Civil works and Others	25	27	29	31	33	145
Total (Rs.Cr.)		**2,664**	**2,462**	**2,743**	**2,862**	**3,206**	**13,937**

Table 144 – Proposals: Investments - APEPDCL (Rs. Cr.)

S.No.	Item	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
1	Ongoing Schemes	471	41	0.75	0.75	0.75	514
2	Substations (New & Augmentation)	226	283	332	390	446	1,677
3	Metering & Associated equipment	65	80	95	110	125	475
4	Distribution Transformer Additions	239	173	200	236	269	1,117
5	Lines, Cables & Network	249	275	319	375	431	1,649
6	Technology Upgradation and R&M	88	101	114	127	140	570
7	Civil works and Others	34	38	42	46	50	210
Total (Rs.Cr.)		**1,372**	**991**	**1,103**	**1,285**	**1,462**	**6,213**

159. The following methodology has been adopted by the licensees to arrive at the network elements and accordingly investments for the next 5 years in the Control Period.

(i) Forecasting circle wise total Power Transformer (PTR) capacities and No. of PTRs:

- The licensee-wise and circle-wise non co-incident peak demands are arrived based on the year-wise estimated energy requirement with projected loss trajectory on sales for the 4th Control Period and non- coincident load factors of the FY2017-18.

  *Peak Demand (MW) = Energy Required/ (24*365/1000)/Load Factor.*

- The non co-incident peak demands observed during the FY2017-18 have been used to calculate the diversity factor of PTRs in all circles as per the formula given below:

  PTR diversity factor = Total PTR Capacity/Non co-incident peak demand

- The PTR diversity factor calculated as above, has been adopted for each year of the Control Period.

- Based on the PTR diversity factor and non-coincident demands, the circle wise cumulative PTR capacities were arrived.

- The PTR capacity so arrived is divided by 5MVA (assumed for a basic 33/11 kV SS) to arrive no. of PTRs.

(ii) Forecasting circle-wise total Distribution Transformer (DTR) capacities and No. of DTRs:

- Using the following formula, DTR to PTR ratios for each year of the Control Period has been arrived by taking FY2017-18 as a base.

  DTR to PTR capacity ratio for year t = (DTR to PTR capacity ratio for year t-1) * (LT/(LT+11kV) sales ratio for year t)/(LT/(LT+11kV) sales ratio for year t-1)

- Using the following formula, circle wise cumulative DTRs capacity were arrived.

  DTR capacity = DTR to PTR capacity ratio * forecasted PTR Capacity

- The DTR capacity so arrived is divided by 100 kVA (assumed as basic DTR capacity) to arrive at no. of DTRs.

(iii) Line Lengths estimation:

- The line length norms (a) LT km per DTR, (b)11 kV km per DTR and (c) 33kV km per 33/11 kV SS have been arrived at based on the actual data of FY2017-18.

- The line length required at different voltage levels i.e. 33 kV, 11 kV and LT line have been estimated based on the assumption of maintaining High Tension (HT) : Low Tension (LT) ratio of 1 [average of (a) LT km per DTR, (b)11 kV km per DTR] during the 4th control period for 11 kV and LT lines whereas current standards have been assumed to be continued for 33kV lines.

160. Based on the methodology described above, the total 33/11 kV SS and DTRs estimated is given in the tables below and the circle wise distribution network elements estimated by the licensees are shown in Annexures - C1 to C4:

Table 145 – Proposals: No. of 33/11 kV SS & DTRs required - APSPDCL

Component	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
33/11 kV SS	241	245	276	308	347	1,663
DTRs	18,630	18,780	21,110	23,610	26,550	127,760

Table 146 – Proposals: No. of 33/11 kV SS & DTRs required - APEPDCL

Component	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
33/11 kV SS	178	123	135	152	165	753
DTRs	6510	7810	8670	9780	10650	43420

Table 147 – Proposals: Line Lengths (km) - APSPDCL

Component	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
33 kV	1865	1891	2155	2423	2757	11091
11 kV	6829	7048	7972	8975	10163	40987
LT	6815	7032	7954	8955	10140	40896

Table 148 – Proposals: Line Lengths (km) - APEPDCL

Component	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
33 kV	1291	927	1018	1145	1244	5625
11 kV	2342	2741	3041	3402	3723	15249
LT	2342	2741	3041	3402	3723	15249

161. Further, in addition to the network elements so estimated, APSPDCL has proposed the following investments towards:

(a) Providing smart meters to the consumers whose consumption is more than 100 units - Rs. 2106 Cr. over a period of 10 years;

(b) Installation of smart meters for Agricultural DTRs - Rs.346 Cr. over a period of 5 years;

(c) Providing SCADA at newly erected substations in Vijayawada, Guntur & Nellore cities - Rs.318 Cr.;

(d) Providing SCADA at District headquarters - Rs.800 Cr.;

(e) Providing underground cable in the cities of Tirupati, Vijayawada & Guntur & capacity to meet unexpected load growth - Rs.1500 Cr.;

(f) Civil infrastructure development – Rs. 145 Cr.

162. Whereas, APEPDCL, in addition to the network elements estimated, has proposed the following investments towards:

(a) Metering & Associated equipment- Rs.475 Cr.;

(b) Technology Upgradation and R&M- Rs.570 Cr.;

(c) Civil works and others – Rs.210 Cr.

163. The following cost norms are considered by the licensees for investment estimations:

Table 149 – Proposals: Cost data for FY2017-18 - APSPDCL

Cost Item	Value	Units
LT Line	2.85	Rs. Lakhs/Km
DTR per Unit (100 kVA)	2.50	Rs. Lakhs/Unit
11 kV Line	3.08	Rs. Lakhs/Km
33/11kV SS per Unit (5 MVA)	130.91	Rs. Lakhs/Unit
33 kV Line	4.62	Rs. Lakhs/Km

Table 150 – Proposals : Cost data for FY2017-18 - APEPDCL

Cost Item	Value	Units
LT Line	3.49	Rs. Lakhs/km
DTR per Unit (100 kVA)	2.60	Rs. Lakhs/Unit
11 kV Line	3.61	Rs. Lakhs/km
33/11kV SS per Unit (5 MVA)	121.79	Rs. Lakhs/Unit
33 kV Line	4.59	Rs. Lakhs/km

164. Escalation factor of 5.16% is considered by the licensees for arriving the cost data norms for base year FY2018-19 and each year of the 4th Control Period. The escalation factor was calculated considering variation in WPI and CPI at a weightage of 60%:40% respectively.

165. It is also assumed that each sub-station capacity is 5 MVA and each DTR capacity is 100 kVA.

Commission's Decision

166. The Commission while finalizing the investments for the 4th Control Period, has kept in view the following:

(i) As per the Section 42 of the Electricity Act, 2003 read with clause 22 of Regulation 10 of 2013, it shall be the duty of the Distribution Licensee to develop and maintain an efficient, coordinated and economical distribution system in his area of supply and to supply electricity in accordance with the provisions contained in the Act.

(ii) The Commission is guided under Section 61 (c) of the Electricity Act, 2003, by the factors which would encourage competition, efficiency, economical use of the resources, good performance and optimum investments while determining the tariff.

(iii) Paragraphs 18 and 19 of Distribution and Retail Supply License stipulates that subject to the availability of adequate generating and transmission capacity, the system is capable of providing consumers within its area of supply with an adequate, safe and economical supply of electricity, having regard to quality, continuity and reliability of service.

(iv) Historic investments made by the licensees after bifurcation of State.

167. The Commission after examining the investments with reference to the above points and methodology for arriving network elements and computations of the investment, adopted the same methodology as adopted by the licensees with following changes to arrive at network elements and investments:

(i) The diversity factors considered uniformly at 2.0 for each year of the Control Period for all circles;

(ii) The cost data norms as provided by APSPDCL are considered for both the licensees.

168. With respect to the additional investments, the Commission has made the following changes:

APSPDCL:

(i) Smart Meters:

- As per the National Tariff policy, 2016, all the consumers shall be provided with smart meters whose consumption is more than 200 units. Accordingly, the Commission has limited the investments towards providing smart meters for Domestic consumers.

- Cost of the smart meter is taken as Rs. 2500 per single phase meter as per the data given in the ARR filings for Retail Supply Business for FY2018-19 as against Rs.5000 considered by the licensee.
- With respect to installation of smart meters for 4,33,000 nos. agricultural DTRs, the Commission had issued following direction in the Retail Supply Tariff Order for FY2018-19.

"The Commission directs both licensees to take up pilot projects for one selected Division each in their respective jurisdictions for progressively providing 100 percent smart meters to all AGL DTRs as per the National Tariff Policy at least within the next two years.

In this regard, comprehensive proposals shall be submitted for approval to the Commission within a period of two months from the date of this order, covering cost details for installation of meters, remote meter reading and making available the DTR wise consumption details on the licensees' websites, as a single project for a continuous duration of 5 years."

The Commission is yet to receive compliance reports from the licensees on the above direction and hence, the investments proposed by the licensees under this head are not considered in this order. However, after submission of such compliance reports, the licensees are at liberty to approach the Commission with detailed action plan and accordingly the Commission will take appropriate action based on the results achieved in the pilot projects following a prescribed procedure.

(ii) SCADA and Underground cables:

The licensee has not submitted any Detailed Project Report (DPR) or any concrete proposals / estimates / time lines for laying underground cables and installation of SCADA. Hence, the investment is not considered for the present. However, the licensee is at liberty to approach the Commission with detailed project report and necessity of taking up these works. After receipt of any such proposal from the licensee, the Commission will examine it and take appropriate action following the prescribed procedure, any financial impact of which will be considered in the true-up for the 4th Control Period. In this regard the licensees are directed to strictly comply with clause 16.2 of Regulation 4 of 2005.

(iii) Investments towards unexpected load growth

The licensee has shown Rs. 600 Cr. for 4th control period towards its contribution with respect to schemes to be announced by GoI/Infrastructure requirement due to unexpected load growth in Aqua / Industries. The same has not been considered by the Commission as it is an unsubstantiated expectation as of now and can be provided for as and when needed in exercise of powers of reconsideration and review under clauses 16, 21 and 24 of Regulation 4 of 2005, if approached by the Discoms.

(iv) Civil Infrastructure Development:

The Commission has considered 50% of the proposal, to take care of development of infrastructure as the licensee has not furnished any specific details or plans.

APEPDCL:

(i) Metering and associated equipment:

The licensee has not given any details under this head. Hence, the Commission has considered investments towards installation of smart meters as per National Tariff policy, 2016 in line with approval for APSPDCL.

(ii) Technology Upgradation and Civil Infrastructure Development:

The Commission has considered 50% of the proposals to take care of the needs of technological upgradation and development of infrastructure as the licensee has not indicated any specific details or plans.

169. With the changes as mentioned above, the Commission has estimated, the circle wise network capacity for the 4th Control Period and details are given in the Annexures - D1 to D4**.**

The Company wise network elements estimated by the licensees and estimated by the Commission are given in the tables below:

Table 151 – Proposed and Approved: No. of PTRs & DTRs required – APSPDCL

Component	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
Proposed						
33/11 kV SS	241	245	276	308	347	1,663
DTRs	18,630	18,780	21,110	23,610	26,550	127,760
Approved						
33/11 kV SS	192	216	243	271	303	1225
DTRs	14,666	16,593	18,186	21,621	23,220	94285

Table 152 – Proposed & Approved: No. of PTRs & DTRs required – APEPDCL

Component	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
Proposed						
33/11 kV SS	178	123	135	152	165	753
DTRs	6510	7810	8670	9780	10650	43420
Approved						
33/11 kV SS	143	99	110	122	133	607
DTRs	5,213	6,600	6,997	7,927	8,710	35448

Table 153 – Proposed & Approved: Line Lengths (km) – APSPDCL

Component	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
Proposed						
33 kV	1865	1891	2155	2423	2757	11091
11 kV	6829	7048	7972	8975	10163	40987
LT	6815	7032	7954	8955	10140	40896
Approved						
33 kV	1405	1582	1786	1986	2226	8986
11 kV	5003	5605	6253	7350	7932	32143
LT	5003	5605	6253	7350	7932	32143

Table 154 – Proposed & Approved: Line Lengths (km) – APEPDCL

Component	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total for CP
Proposed						
33 kV	1291	927	1018	1145	1244	5625
11 kV	2342	2741	3041	3402	3723	15249
LT	2342	2741	3041	3402	3723	15249
Approved						
33 kV	1034	740	821	915	998	4508
11 kV	1,830	2,271	2,392	2,691	2,989	12174
LT	1,830	2,271	2,392	2,691	2,989	12174

170. As detailed above, the Commission has approved the investments at Rs.9239 Cr. in respect of APSPDCL against Rs.13937 Cr. and Rs.4309 Cr. in respect of APEPDCL against Rs.6213 Cr. The company wise investments approved by the Commission are shown in the tables below:

Table 155 – Approved: Investments - APSPDCL (Rs. Cr.)

S. No.	Item	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
1	Ongoing Schemes	750	339	228	-	-	1,317
2	Substations (New & Augmentation)	264	312	370	434	511	1891
3	Metering & Associated equipment	55	55	55	55	55	275
4	Distribution Transformer Additions	405	459	529	629	710	2731
5	Lines, Cables & Network	400	472	554	679	775	2880
6	Technology Upgradation and R&M	0	0	0	0	0	0
7	Civil works and Others	25	27	29	31	33	145
Total		**1899**	**1663**	**1765**	**1827**	**2084**	**9,239**

Table 156 – Approved: Investments - APEPDCL (Rs. Cr.)

S. No.	Item	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
1	Ongoing Schemes	471	41	0.75	0.75	0.75	514
2	Substations (New & Augmentation)	197	143	167	196	224	927
3	Metering & Associated equipment	60	60	60	60	60	300
4	Distribution Transformer Additions	144	182	203	230	266	1027
5	Lines, Cables & Network	173	196	220	260	302	1151
6	Technology Up-gradation and R&M	57	57	57	57	57	285
7	Civil works and Others	21	21	21	21	21	105
Total (Rs.Cr.)		**1123**	**701**	**729**	**825**	**931**	**4309**

CHAPTER - VI

TRANSMISSION (CAPITAL INVESTMENT) PLAN

171. The Commission has examined the investments proposed by the transmission licensee in its Resource Plan for 4th Control Period. The Commission, while examining the investment proposals, has reckoned/considered all the views/objections/suggestions expressed by the stakeholders in writing and during public hearings, to the extent they are relevant to the subject matter.

172. The details of investments as per the Resource Plan for the 4th Control Period are as hereunder:

Table 157 – Filings: Transco Investments (Rs.Cr.)

Financial Year	**Evacuation and System Improvement**			**Total**
	132 kV	**220 kV**	**400 kV**	
(1)	(2)	(3)	(4)	(5)
2019-20	1587.16	1831.80	1465.19	4884.15
2020-21	1054.19	1663.48	744.97	3462.94
2021-22	588.02	1019.54	983.75	2591.31
2022-23	448.89	946.47	652.01	2047.37
2023-24	830.19	569.00	231.80	1630.81
Total	4508.57	6030.29	4077.72	14616.58

173. The licensee, according to the investments filed, has proposed the following number of Substations, voltage wise, during the 4th Control Period:

Table 158 – Filings: No. of EHV substations proposed to be commissioned

Voltage Level	2019-20	2020-21	2021-22	2022-23	2023-24	Total Substations
132 kV	32	28	23	22	21	126
220 kV	14	09	07	06	06	42
400 kV	03	02	02	02	01	10
Total	49	39	32	30	28	178

174. Further, the licensee has proposed to add 5211 circuit km of EHT Transmission lines of all voltages.

Commission's decision on Investments:

175. The Commission, while approving the investments for the 4th Control Period has examined the following points.

i. The licensee, APTRANSCO being the State Transmission Utility (STU) has to ensure development of an efficient, coordinated and economical system of intra-state transmission lines and sub-stations for smooth flow of electricity from a generating station to the load centers, as per the provisions of the Electricity Act, 2003.

ii. Investment schemes which have already been approved by the Commission presently are under various phases of implementation.

iii. Investments in telecom are required for real-time data transfer to the system operator, SLDC.

iv. The cost of investment of Lift Irrigation schemes, being contributory in nature, is borne by GoAP.

v. Evacuation of Power from Renewable Energy Sources, such as Wind sources in Kadapa, Kurnool & Anantapur Districts and Solar power sources from various locations in the State of AP.

vi. The assets not funded by APTRANSCO i.e. the assets funded by consumers and through grants.

vii. Augmentation and Renovation & Modernization requirements to maintain the present transmission system availability @ 99.98% during the 4th Control Period.

viii. System improvement and strengthening works required to meet the projected Maximum Demand growth and reliability levels as envisaged in the Indian Electricity Grid Code.

ix. System improvement and strengthening works required to meet the projected Maximum Demand growth in view of the new Capital city construction and also Vizag Chennai Industrial Corridor (VCIC), as proposed in the Andhra Pradesh Reorganization Act, 2014.

x. The investments proposed in the miscellaneous works by the licensee which

come under Renovation & Modernization works.

xi. The investment proposals made in the filings and yet to be submitted by the licensee for the approval of the Commission.

xii. The investment proposals made in the filings and submitted by the licensee for the approval and yet to be approved by the Commission.

176. While approving the investments, the Commission has taken into consideration the following:

i. The investments for all voltage levels which are already approved by the Commission have been considered in toto.

Out of the total investment of Rs.4084.74 Cr. proposed in respect of 400 kV level, investments of Rs.3512.00 Cr. are already approved by the Commission.

Out of the total investment of Rs.8169.12 Cr. proposed in respect of 132 kV and 220 kV level together, investments of Rs.4378.18 Cr. are already approved by the Commission.

ii. The investments for all voltage levels which are submitted by the licensee and yet to be approved by the Commission have been considered in toto.

Out of the total investment of Rs.4084.74 Cr. proposed in respect of 400 kV level, investments of Rs.17.74 Cr. are yet to be approved by the Commission.

Out of the total investment of Rs.8169.12 Cr. proposed in respect of 132 kV and 220 kV level together, investments of Rs.243.20 Cr. are yet to be approved by the Commission.

iii. The investments under miscellaneous head which are general in nature i.e. towards formulation of schemes, carrying out survey works, incorporation of additional features in the existing sub-stations etc. are considered at 50% of the amounts proposed.

iv. The investments towards the Schemes which are under formulation and coming up in the last two years of the Control Period and are yet to be submitted by the licensee for approval are considered at 50% of the amounts proposed.

However, the licensee is not barred from coming up before the Commission with specific proposals in respect of the above stated schemes (for which only 50% is considered is now) which will be considered based on the need and merits and any impact on account of such consideration will be considered

under true-up for the 4th Control Period.

v. The investments proposed under the augmentation and R&M head are considered at 75% of the amounts proposed keeping in view the system availability proposed to be maintained at 99.98% during each year of the Control Period.

However, the licensee is not prevented to take any augmentation and R&M work which is essential to maintain the proposed system availability at 99.98%. The impact of all such works will be considered under true-up for the 4th Control Period.

vi. The Telcom works proposed in the filings of SLDC, which facilitate real- time data transfer to SLDC from various sub-stations, are obligated to be taken by the licensee and as such they are considered as investment by the licensee in the present consideration.

vii. The cost of investment of Lift Irrigation schemes being contributory in nature and borne by GoAP and hence the same is not considered as investments.

viii. As per the information obtained by the Commission subsequently, the Wind Power evacuation projects under Phase-II which are already approved had part of their investments as grants from MNRE, and hence the grants are deducted from the investments.

177. As detailed above, the Commission has approved the investment of Rs.10,696.34 Cr. against the proposed investment of Rs. 14616.58 Cr. by the licensee for the 4th Control Period. The details of investments approved by the Commission are given in the table below:

Table 159 – Approved: Investments (Rs. Cr.)

Financial Year	Evacuation and System Improvement		Augmentation and R&M Works	Total
	440 kV	132 kV and 220 kV		
2019-20	568.35	831.95	62.25	1462.55
2020-21	809.41	1533.82	259.53	2602.76
2021-22	804.13	1758.78	227.80	2790.71
2022-23	738.47	1176.82	224.39	2139.68
2023-24	463.00	988.17	249.46	1700.63
Total	3383.36	6289.54	1023.44	10696.34

178. According to the investment approved, the Commission determined the network elements (substations) to be added during the 4th Control Period as hereunder:

Table 160 – Approved: No. of Sub-stations to be commissioned

Voltage Level	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total Substations
132 kV	32	27	21	12	18	110
220 kV	14	08	06	02	05	35
400 kV	03	02	02	02	01	10
Total	49	37	29	16	24	155

179. With reference to the investments proposed by the licensee for the 4th Control Period which are yet to be submitted to the Commission for approval, the licensee is directed to strictly comply with clause no.14(2) and 14 (3) of APERC Regulation No. 5 of 2005.

Commission's Directions

180. APERC guidelines for Load Forecasts, Resource plans and Power Procurement, 2006 at para 2.2 stipulate that for purposes of the Load Forecasts, the year shall begin on 1st April and end on the following 31st March. Each Licensee shall submit its Load Forecast to the Commission on April 1st in the year preceding the first year of the Control Period under consideration for the tariff review purpose, and/or at such other times as the Commission may require.

181. The Guidelines further state that (para 3.2.2) the Resource Plans, i.e. Distribution Plan and Power Procurement Plan for the Distribution Licensees and the transmission Plan for APTRANSCO, shall be prepared for a period of two Control Periods from the year of commencement, beginning from 1st April and ending on the following 31st March, and the plans, constituting a detailed plan for the Control Period under consideration for tariff review purpose and an indicative plan for the subsequent Control Period, shall be submitted to the Commission on April 1st of the preceding the first year of the Control Period. In any event, Licensees will notify the Commission immediately of any uncontrollable event or development which requires a significant modification to the most recently submitted Plan.

182. In this context, it is to state that the Load Forecasts, Resource plans and Power Procurement Plans are submitted to the Commission by APEPDCL on 31st July, 2018, APSPDCL on 2nd August, 2018 and Resource Plan by APTRANSCO on 1st August, 2018. The Commission has issued public notice on 04.09.2018 inviting

comments and suggestions from all the stakeholders. Subsequently, the Commission held public hearings on 06-10-2018, 27-10-2018, 17-11-2018, 24-11-2018, 01-12-2018, 15-12-2018, 22-12-2018, 29-12-2018, 19-01-2019, 25-01-2019, 02-02-2019 and the orders are reserved on 08-02-2019.

183. As can be seen from the above, the Load Forecasts and the Resource Plans, which should have been filed on 1st April, 2018 are practically filed only by 2nd August, 2018, thus delaying the process of approval also as it is today. In view of the above and also from the point of view of putting things in order at least in future APDISCOMs and APTRANSCO are directed to keep up the schedules as indicated above. The Commission, in spite of the delayed submissions still endeavoured to issue this order now notwithstanding that there have been no such orders for the last two decades only to have a semblance of discipline, planning and order in the system. Accordingly, APDISCOMs and APTRANSCO are once again directed to follow the said guidelines in their letter and spirit henceforth.

CHAPTER - VII

STATE ELECTRICITY PLAN

184. APERC guidelines for Load Forecasts, Resource plans and Power Procurement, 2006 at para 5.1 stipulate that APTRANSCO shall formulate a State Electricity Plan in co-ordination with others for the promotion of generation, transmission, distribution and supply of electricity and notify the same once in the Control Period under consideration for tariff review.

185. The Guidelines further state that APTRANSCO, in preparing the State Electricity Plan shall publish the draft State Electricity Plan and invite suggestions and objections thereon from licensees, generating companies, the Commission and the public within such time as specified by the Commission.

186. In this context, it is to state that the draft State Electricity Plan is submitted by APTRANSCO to the Commission on 1st August, 2018 and the Commission vide public notice dt. 4.09.2018 sought for the views of all the stakeholders, inter-alia, on the above said State Electricity Plan and comments/suggestions/objections have been received in the Commission and the same were sent to APTRANSCO and responses of APTRANSCO were also received in the Commission and incorporated at Chapter-II of this order and the process of public hearing stands concluded. It is also to be noted herein that the State Electricity Plan was also hosted in the official website of APTRANSCO. Hence, the requirement of APTRANSCO in publishing the draft State Electricity Plan and inviting suggestions/ objections thereon as indicated supra also can be construed to be complied with.

187. The views expressed in this order by the Commission and the orders of the Commission on the Load Forecast and Resource plans (Power Procurement Plan, Distribution plan and the Transmission Plan) may be treated as the comments of the Commission.

188. APTRANSCO shall notify the plan after considering the comments of the Commission and all stakeholders, and obtain the approval of the State Coordination Forum by revising the plan after incorporating the directions, if any, given by the State Coordination Forum while granting the approval.

This Order is signed on the 15th day of April, 2019

Sd/-	**Sd/-**	**Sd/-**
P. Rama Mohan	**Dr. P. Raghu**	**Justice G. Bhavani Prasad**
Member	**Member**	**Chairman**

Annexure – A1

List of 400 KV, 220 kV and 132 kV Sub-stations, lines and augmentation of PTR capacities proposed during FY2019-20 to FY2023-24

LIST OF 400 kV and 220 kV SUBSTATIONS PROPOSED DURING FY 2019-2024

Sl. No	District	Name of the SS	Voltage	No. of Transformers	MVA	Estimated cost Rs. Lakhs	Target year of Commissioning
	400 kV Substations						
1	Guntur	Thallayapalem GIS	400	3	1500	34884	2019-20
2	Chittoor	Rachaganneru	400	2	630	11416	2019-20
3	Kadapa	Mylavaram	400	3	945	17339	2019-20
4	Nellore & Visakhapatnam	Augmentation at Manubolu and Kalpaka	400	2	815	5067	2019-20
					3890	**68706**	
1	West Godavari	Eluru	400	2	630	17614	2020-21
2	Ananthapur	Uravakonda-2	400	3	1500	21642	2020-21
					2130	**39256**	
1	Krishna	Gudivada	400	4	1200	19416	2021-22
2	Kurnool	Aspiri	400	2	1000	18371	2021-22
					2200	**37787**	
1	Guntur	Chilakaluripeta	400	2	1000	16547	2022-23
2	East Godavari	Konaseema	400	2	1000	11475	2022-23
					2000	**28022**	
1	East Godavari	Kakinada SEZ	400	4	1320	19508	2023-24
	220 kV Substations						
1	Kurnool	Betamcherla	220	4	383	2704	2019-20
2	Anantapur	Penukonda	220	2	320	3235	2019-20
3	Visakhapatnam	Koruprolu (Chandanada/ Nakkapalli)	220	3	300	3228	2019-20
4	Nellore	Naidupeta(Menakuru)	220	5	410	5134	2019-20
5	Chittoor	Chervi	220	2	320	3458	2019-20
6	Visakhapatnam	Achutapuram	220	5	410	6762	2019-20
7	East Godavari	Kakinada SEZ	220	5	391.5	5079	2019-20
8	Guntur	220/33 kV GIS SS Lingayapalem (CRDA)	220	4	320	11731	2019-20

Sl. No	District	Name of the SS	Voltage	No. of Transformers	MVA	Estimated cost Rs. Lakhs	Target year of Commissioning
9	Guntur	Upgradation of 132 kV SS Piduguralla To 220 kV SS	220	2	200	3561	2019-20
10	Visakhapatnam	Upgradation of 132 kV SS Simhachalam to 220/132 kV SS	220	2	200	3256	2019-20
11	East Godavari	132 kV & 33 kV Features at 220/11 kV LIS SS Ramavaram	220	4	263	4498	2019-20
12	East Godavari	220/33 kV SS Chinturu	220	2	100	3025	2019-20
13	Guntur	220/33 kV GIS SS Nelapadu (CRDA)	220	3	240	11008	2019-20
14	Anantapur	Pampanur Thanda	220	2	320	3224	2019-20
					4177.5	**69903**	
1	East Godavari	Korukonda	220	2	100	2816	2020-21
2	West Godavari	220/33 kV SS Akiveedu	220	2	100	3025	2020-21
3	Vizianagaram	Vizianagaram	220	2	200	3256	2020-21
4	Anantapur	Dharmavaram	220	2	200	2110	2020-21
5	East Godavari	Amalapuram (Siripalli)	220	3	300	3000	2020-21
6	Guntur	Upgradation of 132 kV SS Tadepalli to 220 kV SS	220	2	200	3256	2020-21
7	Guntur	Thulluru	220	3	240	11008	2020-21
8	Guntur	Rayapudi	220	3	240	11008	2020-21
9	Guntur	Velagapudi	220	3	240	11008	2020-21
					1820	**50487**	
1	Nellore	Kothapalem	220	4	263	4500	2021-22
2	East Godavari	Ramachandrapuram	220	2	200	3575	2021-22
3	Guntur	Repalle	220	2	200	3575	2021-22
4	Kurnool	Adoni	220	4	272	3575	2021-22
5	Krishna	Gannavaram	220	2	200	3575	2021-22
6	East Godavari	Machilipatnam	220	2	200	3575	2021-22
7	Prakasam	Kanigiri	220	2	200	3575	2021-22
					1535	**25950**	
1	Nellore	Kavali	220	2	200	3575	2022-23
2	Anantapur	Kadiri	220	2	200	3575	2022-23

Sl. No	District	Name of the SS	Voltage	No. of Transformers	MVA	Estimated cost Rs. Lakhs	Target year of Commissioning
3	East Godavari	Prattipadu	220	2	200	3575	2022-23
4	Kurnool	Dhone 132 kV Features	220	2	200	3256	2022-23
5	East Godavari	Editha	220	2	200	3575	2022-23
6	West Godavari	Tanuku	220	2	200	3575	2022-23
					1200	**21131**	
1	Kadapa	Rayachoti	220	2	200	3575	2023-24
2	West Godavari	Penugonda	220	2	200	3575	2023-24
3	Prakasam	Podalakuru	220	2	200	3575	2023-24
4	Nellore	Sarvepalli	220	2	200	3575	2023-24
5	Visakhapatnam	Anandapuram	220	2	200	3575	2023-24
6	Visakhapatnam	Commom Point	220	2	200	3575	2023-24
					1200	**21450**	

LIST OF 132 kV SUBSTATIONS PROPOSED DURING FY 2019-2024

Sl. No	District	Name of the SS	No. of Transformers	MVA	Estimated cost in Rs. Lakhs	Target year of Commissioning
1	Prakasam	Anumalapalle	2	47	1406	2019-20
2	Nellore	Kallurpalli	2	63	1132	2019-20
3	Nellore	Vinjamur	2	47	1300	2019-20
4	Nellore	Koruturu	2	47	1346	2019-20
5	East Godavari	Mummidivaram	2	63	1658	2019-20
6	East Godavari	Gollapalem	2	63	1658	2019-20
7	Chittoor	Kothapalli (Gudipala)	2	63	1658	2019-20
8	Chittoor	Penumur	2	63	1658	2019-20
9	Nellore	Kadivedu	2	63	1658	2019-20
10	Anantapur	Palasamudram	2	81.5	1713	2019-20
11	Krishna	Bantumilli	2	63	1658	2019-20
12	Chittoor	Mangalam	2	63	1658	2019-20
13	Nellore	Gottiprolu	2	63	1658	2019-20
14	East Godavari	Vepakayaladibba	2	47.5	1505	2019-20
15	Visakhapatnam	APMTZ, Nadupuru	2	47.5	1505	2019-20
16	Vizianagaram	Alamanda	2	47.5	1505	2019-20

Sl. No	District	Name of the SS	No. of Transformers	MVA	Estimated cost in Rs. Lakhs	Target year of Commissioning
17	West Godavari	Vatluru/ Hanuman Junction	2	47.5	1505	2019-20
18	West Godavari	TR Palem/ Gunnampalli	2	47.5	1505	2019-20
19	West Godavari	AttiliI (Pippara)	2	47.5	1505	2019-20
20	West Godavari	Palakollu	2	47.5	1505	2019-20
21	West Godavari	Dharmajigudem	2	47.5	1505	2019-20
22	Srikakulam	Veeraghattam	2	47.5	1505	2019-20
23	Srikakulam	Sarubujjili (Amadalavalasa)	2	47.5	1505	2019-20
24	Kurnool	33kV features at Nansuralla LIS SS	2	47.5	1432	2019-20
25	Visakhapatnam	Jamathulapalem	2	63	1658	2019-20
26	Visakhapatnam	Tida	2	63	1658	2019-20
27	Visakhapatnam	Bhudevi Tank	2	63	1658	2019-20
28	Vizianagaram	Veeranarayanapuram	2	63	1658	2019-20
29	Vizianagaram	Tatipudi	2	63	1658	2019-20
30	Vizianagaram	Kondagandredu	2	63	1658	2019-20
31	Vizianagaram	GM Valasa	2	63	1658	2019-20
32	Vizianagaram	Burjavalasa	2	32	1285	2019-20
					49534	
1	East Godavari	Annavaram	2	47.5	1505	2020-21
2	Prakasam	Chinnaganjam	2	47.5	1505	2020-21
3	Krishna	Gunadala	2	47.5	1505	2020-21
4	Krishna	Mukthyala	2	47.5	1505	2020-21
5	Krishna	Gampalagudem	2	47.5	1505	2020-21
6	Krishna	Vuyyuru	2	47.5	1505	2020-21
7	Prakasam	Kothapatnam	2	47.5	1505	2020-21
8	Prakasam	Pallamalli	2	47.5	1505	2020-21
9	Prakasam	Singarayakonda	2	47.5	1505	2020-21
10	Prakasam	Mekalavaripalli	2	47.5	1505	2020-21
11	Prakasam	Ulavapadu	2	63	1725	2020-21

Sl. No	District	Name of the SS	No. of Transformers	MVA	Estimated cost in Rs. Lakhs	Target year of Commissioning
12	Prakasam	Pullalacheruvu	2	47.5	1432	2020-21
13	Prakasam	Komarole	2	47.5	1432	2020-21
14	Prakasam	Elchuru (V), Santhamaguluru (M)	2	32	1285	2020-21
15	Prakasam	Siddannapalem (V), Pullalacheruvu (M)	2	47.5	1505	2020-21
16	Kurnool	Near Ayyaluri Metta (Nandyal)	2	47.5	1505	2020-21
17	Chittoor	Kakalamitta	2	47.5	1505	2020-21
18	Chittoor	Gudipadu	2	47.5	1505	2020-21
19	Chittoor	Vijalapuram	2	47.5	1505	2020-21
20	Kurnool	Gondiparla (E.Thandrapadu)	2	47.5	1505	2020-21
21	Srikakulam	Sompeta	2	47.5	1505	2020-21
22	Srikakulam	Hiramandalam	2	47.5	1505	2020-21
23	Krishna	Kabela	2	47.5	1505	2020-21
24	Vizianagaram	Chipurupalli	2	47.5	1505	2020-21
25	Vizianagaram	Nellimarla	2	47.5	1505	2020-21
26	Vizianagaram	GajapathiNagaram	2	47.5	1505	2020-21
27	Guntur	Nekarikallu	2	47.5	1505	2020-21
28	Kurnool	Kosgi	2	47.5	1505	2020-21
					41994	
1	Nellore	Chintavaram	2	47.5	1505	2021-22
2	Krishna	Jakkampudi	2	47.5	1505	2021-22
3	Krishna	Mallavalli	2	47.5	1505	2021-22
4	Krishna	Devanakonda	2	47.5	1505	2021-22
5	Krishna	Kalluru	2	47.5	1505	2021-22
6	Chittoor	Gandhipuram	2	47.5	1505	2021-22
7	Kurnool	Gajulapalli	2	47.5	1505	2021-22
8	Anantapur	Kuderu	2	47.5	1505	2021-22
9	Guntur	Bhattiprolu	2	47.5	1505	2021-22
10	Guntur	Bellamkonda	2	47.5	1505	2021-22

Sl. No	District	Name of the SS	No. of Transformers	MVA	Estimated cost in Rs. Lakhs	Target year of Commissioning
11	Kurnool	33kV features at Krishnagiri LIS SS	2	47.5	1505	2021-22
12	Chittoor	Satyavedu	2	47.5	1505	2021-22
13	Chittoor	Poothalapattu	2	47.5	1505	2021-22
14	Chittoor	BN Kandriga	2	47.5	1505	2021-22
15	Prakasam	Kaligiri	2	47.5	1505	2021-22
16	Prakasam	Veligandla	2	47.5	1505	2021-22
17	Prakasam	Ponnaluru	2	47.5	1505	2021-22
18	Krishna	Penamaluru	2	47.5	1505	2021-22
19	Krishna	Kankipadu	2	47.5	1505	2021-22
20	Krishna	Challapalle	2	47.5	1505	2021-22
21	Srikakulam	Gara	2	47.5	1505	2021-22
22	Srikakulam	Polaki	2	47.5	1505	2021-22
23	Srikakulam	Vajrapukothuru	2	47.5	1505	2021-22
					34615	
1	Vizianagaram	Pusapathirega	2	47.5	1505	2022-23
2	Vizianagaram	Kurupam	2	47.5	1505	2022-23
3	Vizianagaram	Mentada	2	47.5	1505	2022-23
4	Nellore	Duttalur	2	47.5	1505	2022-23
5	Nellore	Buchireddypalem	2	47.5	1505	2022-23
6	Nellore	Somasila	2	47.5	1505	2022-23
7	Nellore	Dakkili	2	47.5	1505	2022-23
8	Nellore	Jonnawada	2	47.5	1505	2022-23
9	Nellore	Vidavaluru	2	47.5	1505	2022-23
10	Visakhapatnam	Madugula	2	47.5	1505	2022-23
11	Visakhapatnam	Sabbavaram	2	47.5	1505	2022-23
12	Visakhapatnam	Nathavaram	2	47.5	1505	2022-23
13	West Godavari	Unguturu	2	47.5	1505	2022-23
14	West Godavari	Undrajavaram	2	47.5	1505	2022-23
15	West Godavari	Veeravasarevu	2	47.5	1505	2022-23
16	Guntur	Peddakakani	2	47.5	1505	2022-23

Sl. No	District	Name of the SS	No. of Transformers	MVA	Estimated cost in Rs. Lakhs	Target year of Commissioning
17	Guntur	Gurazala	2	47.5	1505	2022-23
18	Guntur	Edlapadu	2	47.5	1505	2022-23
19	YSR Kadapa	Galiveedu	2	47.5	1505	2022-23
20	YSR Kadapa	Nandaluru	2	47.5	1505	2022-23
21	YSR Kadapa	Pullampeta	2	47.5	1505	2022-23
22	YSR Kadapa	Lakkireddipalle	2	47.5	1505	2022-23
					33110	
1	Kurnool	Jupadu	2	47.5	1505	2023-24
2	Kurnool	Miduthur	2	47.5	1505	2023-24
3	Kurnool	Chagalamarri	2	47.5	1505	2023-24
4	Nellore	Mallam	2	47.5	1505	2023-24
5	Nellore	Varagali	2	47.5	1505	2023-24
6	Vizianagaram	Govada	2	47.5	1505	2023-24
7	Visakhapatnam	K.Kotapadu	2	47.5	1505	2023-24
8	Visakhapatnam	Vaddadhi	2	47.5	1505	2023-24
9	Visakhapatnam	Bhimili	2	47.5	1505	2023-24
10	Visakhapatnam	Rambili (Lalam Koduru)	2	47.5	1505	2023-24
11	Visakhapatnam	Auto Nagar	2	47.5	1505	2023-24
12	Visakhapatnam	East Point Colony	2	47.5	1505	2023-24
13	East Godavari	Hamsavaram	2	47.5	1505	2023-24
14	East Godavari	Panasapadu, Kakinada Rural	2	47.5	1505	2023-24
15	East Godavari	Teki	2	47.5	1505	2023-24
16	East Godavari	Uppalaguptam	2	47.5	1505	2023-24
17	East Godavari	Mamidikuduru	2	47.5	1505	2023-24
18	East Godavari	Gokavaram	2	47.5	1505	2023-24
19	East Godavari	Dwarapudi or Mukkinada	2	47.5	1505	2023-24
20	East Godavari	Atreyapuram	2	47.5	1505	2023-24
21	East Godavari	Addathigala	2	47.5	1505	2023-24
					31605	

LIST OF 400 kV and 220kV LINES PROPOSED DURING FY2019-2024

Sl. No.	Name of the Transmission Line	IC	Conductor Type	Ckt.	Length in Ckt. KM	Estimated Cost Rs. Lakhs	Target year of Commissioning	Present status of implementation / Criticalities if any
	400 kV Lines							
1	400 kV LILO of 400 kV Chittoor SS – 400 kV APGENCO Krishnapatnam to proposed 400/220/132kV Rachagunneri SS	L	Quad Moose	LILO	180	31304	2019-20	---
2	Diversion of 400 kV Lines in CRDA	S			37	45671	2019-20	---
3	400kV LILO of existing - 400kV VTS – Sattenapalli DC line at proposed 400/220kV Thallayapalem GIS	L	Twin Moose	LILO	2	287	2019-20	---
4	400 kV Jammalamdugu SS to 400 kV Mylavaram	G	Quad Moose	D/C	2	551	2019-20	---
					221	**77813**		
1	LILO of 400 kV Vemagiri - Sattenpalli DC twin lines at Eluru 400 kV substation	L	Twin Moose	LILO	40	3672	2020-21	---
2	400 kV Existing Urvakonda SS to proposed 400 kV Uravkonda 2 SS	G	Quad Moose	D/C	50	6885	2020-21	---
3	400 kV Kamavarapukota SS to Polavaram Generating Station	G	Quad Moose	D/C	140	24684	2020-21	---
					230	**35241**		
1	400 kV Eluru SS to 400 kV Gudivada SS	L	Quad Moose	D/C	80	11016	2021-22	---
2	400 kV Jammalamdugu SS to 400 kV Gani SS	G	Quad Moose	D/C	180	24786	2021-22	---
3	400 kV Narnoor to 400 kV Aspiri SS	G	Quad Moose	D/C	180	24786	2021-22	---
					440	**60588**		
1	765 kV PGCIL Chilakaluripeta SS to 400 kV APTRANSCO Chilakaluripeta SS	L	Quad Moose	D/C	64	8836	2022-23	---
2	400 kV Chilakaluripeata SS to 400 kV Gudivada SS	L	Quad Moose	D/C	206	28343	2022-23	---
					270	**37179**		
1	400kV LILO of existing 400 kV HNPCL – Kamavarapukota at proposed 400/220 kV Kakinada SEZ SS	L	QuadMoose	LILO	40	3672	2023-24	---

Sl. No.	Name of the Transmission Line	IC	Conductor Type	Ckt.	Length in Ckt. KM	Estimated Cost Rs. Lakhs	Target year of Commissioning	Present status of implementation / Criticalities if any
	220 kV Lines							
1	Jammalmadugu 400 kV SS To proposed Betamcherla SS	G	SM	DC	136	4749	2019-20	Work under progress
2	220 kV DC line with Moose ACSR on Galvanised towers for LILO of 220 kV Parwada - Samalkota SC line at the proposed 220 kV SS, Koruprolu	L	SM	LILO	32	3552.3	2019-20	Work under progress
3	220kV DC line for LILO of 220 kV VSS - Kakinada SC Line at the proposed 220 kV SS, Koruprolu	L	SM	LILO	32			
4	Hindupur 400 kV SS to proposed Penukonda SS	G	SM	DC	70	4993	2019-20	Work under progress
5	220kV DC Line from proposed 400/220/132kV SS Rachagunneri to the proposed 220 kV Menakuru/ Naidupeta SS	L	SM	DC	80	5706	2019-20	Work under progress
6	Rachagunneri 400 kV SS To proposed Chervi 220 kV SS	L	SM	DC	100	9453	2019-20	Site to be finalized
7	Sullurpet 220 kV SS To proposed Chervi 220 kV SS	L	SM	DC	60			
8	220kV DC Line from 220kV SS Brandix to the proposed 220kV GIS Atchutapuram SS on Multi-circuit Towers	L	SM	DC	16	2384	2019-20	PO to be issued
9	220kV DC Line from 220kV SS Samarlakota Switching Station to the proposed 220 kV Kakinada SEZ Sub-Station (10.00Km MC +50.00 Km OH Line)	L	SM	DC	120	10643.02	2019-20	Covered under 400kV GAIL
10	220kV DC Line for making LILO of existing VTS - Podili line at proposed 220 kV GIS SS Lingayapalem (One circuit) 2 (OH) + 1.8 (Cable)	L	SM	LILO	7.6	17806.6	2019-20	Tender called

Sl. No.	Name of the Transmission Line	IC	Conductor Type	Ckt.	Length in Ckt. KM	Estimated Cost Rs. Lakhs	Target year of Commissioning	Present status of implementation / Criticalities if any
11	220kV DC Line for making LILO of existing VTS - Narasaraopet line at proposed 220/33 kV GIS SS Lingayapalem 2 (OH) + 1.8 (Cable)	L	SM	LILO	7.6			
12	Erection of 220kV DC line for making LILO of existing 220kV VTS-Thallapalli 3rd circuit to proposed 220/132/33kV SS Piduguralla on Narrow based towers	L	SM	LILO	4	1774.1	2019-20	Tender to be called
13	Erection of 220kV DC line for making LILO of existing 220kV VTS-Thallapalli 4th circuit to proposed 220/132/33kV SS Piduguralla on Narrow based towers	L	SM	LILO	4			
14	220kV DC line for making LILO of 220kV Kalapaka - Dairyfarm to proposed 220/132/33kV SS Simhachalam on MC Towers	L	SM	LILO	8	2839	2019-20	Tender to be called
15	LILO of 220kV Tadikonda - Ongole SC line to 220kV SS Guntur (Prathipadu) under construction on NMD towers	L	SM	LILO	4.2	1605.83	2019-20	Tender to be called
16	220 kV LILO of Kalpaka - Brandix to 220 kV Simhachalam SS	L	SM	LILO	105	1500	2019-20	System Studies to be furnished
17	LILO of 220kV Lower Sileru - KTS-II (Old stage) to proposed 220kV SS Chinturu	L	SM	LILO	6	700	2019-20	TOO to be issued
18	220kV DC XLPE 1000 Sq.mm UG Cable from proposed 400/220kV GIS SS Tallayapalem to proposed 220/33 kV GIS SS Nelapadu	L	XLPE CABLE	DC	20	20994.33	2019-20	Estimates to be received
19	Hindupur 400 kV SS to proposed Pampanur Thanda SS	G	SM	DC	180	10900	2019-20	PO to be issued
20	220kV DC line from 400/220kV SS Kamavarapukota to 220kV SS Bhimadole in West Godavari district	L	SM	DC	44	4641.63	2019-20	Tender Called

Sl. No.	Name of the Transmission Line	IC	Conductor Type	Ckt.	Length in Ckt. KM	Estimated Cost Rs. Lakhs	Target year of Commissioning	Present status of implementation / Criticalities if any
					1036.4	**104241.81**		
1	220kV DC line for making LILO of 2nd circuit from proposed 220kV Korukonda Switching Station - Rampachodavaram to 220kV SS Lower Sileru	G	SM	LILO	164	16400.41	2020-21	Tender to be called
2	Erection of 2nd circuit from proposed 220kV Korukonda Switching Station to 220kV SS Rampachodavaram	G	SM		78			
3	220kV LILO of one circuit of 220kV Bhimavaram-Eluru line to proposed 220kV SS Akiveedu	L	SM	LILO	2	680.19	2020-21	TOO to be issued
4	220kV DC line for making LILO of 220 kV Garividi-Pendurthy line to proposed 220/132kV SS Vizianagaram	L	SM	LILO	20	3734.08	2020-21	Tender to be called
5	Tirumalayapalli To proposed Dharmavaram SS	L	SM	DC	168	6122	2020-21	Revised TOO to be issued with revised connectivity
6	220kV DC Line for LILO of existing one circuit of 220kV Vemagiri – Undi DC Line at proposed 220kV SS Siripalli (Amalapuram)	L	SM	LILO	48	4829.5	2020-21	Revised TOO to be issued for Siripalli with revised connectivity
7	LILO of VTS-Tallapalli Ckt2 to proposed Tadepalli 220 kV SS	L	SM	LILO	40	4000	2020-21	TOO to be issued
8	Lingayapalem 220 kV SS To proposed Tadepalli 220 kV SS (Cable)	L	XLPE CABLE	DC	24	19000	2020-21	
9	Inavolu / Thullur 400 kV SS to Proposed Tadepalli 220 kV SS (Cable)	L	XLPE CABLE	DC	22	18500	2020-21	
10	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Borupalem to proposed 220/33 kV GIS SS Thulluru	L	XLPECABLE	DC	12	14026.33	2020-21	System Studies to be furnished

Sl. No.	Name of the Transmission Line	IC	Conductor Type	Ckt.	Length in Ckt. KM	Estimated Cost Rs. Lakhs	Target year of Commissioning	Present status of implementation / Criticalities if any
11	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Borupalem to proposed 220/33 kV GIS SS Rayapudi	L	XLPE CABLE	DC	6	8800.33	2020-21	System Studies to be furnished
12	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV SS Tallayapalem to proposed 220/33 kV GIS SS Velagapudi	L	XLPE CABLE	DC	12	14026.33	2020-21	System Studies to be furnished
					596	**110119**		
1	220kV DC line from 400kV Manubolu to proposed 220kV SS Kothapalem	L	SM	DC	50	4054	2021-22	System Studies to be furnished
2	220kV DC line from 220kV Amalapuram to proposed 220kV SS Ramachandrapuram	L	SM	DC	80	6177	2021-22	System Studies to be furnished
3	Parchuru To proposed Repalle 220 kV SS	L	SM	DC	200	20000	2021-22	System Studies to be furnished
4	Guntur To proposed Repalle 220 kV SS	L	SM	DC	120	7985	2021-22	System Studies to be furnished
5	Gooty 400 kV SS To proposed Adoni SS	L	SM	DC	128	9500	2021-22	System Studies to be furnished
6	Gudiwada 400 kV SS To proposed Gannavaram 220 kV SS	L	SM	DC	70	6000	2021-22	System Studies to be furnished
2	220kV DC line from 220kV SS Nunna to Proposed 220kV SS Gannavaram in Krishna District	L	SM	DC	50	4648.50	2021-22	System Studies to be furnished
7	Gudivada 400 kV SS To proposed Machilipatnam 220 kV SS	L	SM	DC	80	7000	2021-22	System Studies to be furnished
8	Proposed Podili 400 kV SS To proposed Kanigiri(Prksm) 220 kV SS	L	SM	DC	120	8000	2021-22	System Studies to be furnished
					898	**73365**		

Sl. No.	Name of the Transmission Line	IC	Conductor Type	Ckt.	Length in Ckt. KM	Estimated Cost Rs. Lakhs	Target year of Commissioning	Present status of implementation / Criticalities if any
1	Manubolu 400 kV SS To proposed Kavali 220 kV SS	L	SM	DC	360	35000	2022-23	System Studies to be furnished
2	N P Kunta To proposed Kadiri 220 kV SS	L	SM	DC	160	11000	2022-23	System Studies to be furnished
3	Koruprolu 220 kV SS To proposed Prattipadu 220 kV SS	L	SM	DC	140	9500	2022-23	System Studies to be furnished
4	Vemagiri 400 kV SS To proposed Editha 220 kV SS	L	SM	DC	80	7000	2022-23	System Studies to be furnished
5	Nidadavolu 220 kV SS To proposed Tanuku 220 kV SS	L	SM	DC	120	8000	2022-23	System Studies to be furnished
					860	**70500**		
1	220kV DC line from 400kV SS Kalikiri to Proposed 220kV SS Rayachoti in Y.S.R Kadapa District	L	SM	DC	100	8811.00	2023-24	System Studies to be furnished
2	220 kV SS Tanuku to proposed 220 kV SS Penugonda in West Godavary District	L	SM	DC	26	7000	2023-24	System Studies to be furnished
3	220 kV SS Nellore To 220 kV SS Podalakuru	L	SM	DC	80	7000	2023-24	System Studies to be furnished
4	400 kV Manubolu To 220 kV SS Sarvepalli	L	SM	DC	50	4500	2023-24	System Studies to be furnished
5	220 kV Diary Farm To proposed 220 kV Anandapuram	L	SM	DC	30	3000	2023-24	System Studies to be furnished
6	220 kV Gajuwaka To Common Point	L	SM	DC	20	2500	2023-24	System Studies to be furnished
					306	**32811**		

LIST OF 132 KV LINES PROPOSED DURING FY 2019-2024

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
1	Stringing of 2nd circuit on 132 kV Cumbum – Giddalur DC/SC Line	37.5	2601.28	2019-20	Work under progress
2	132 kV DC Line for LILO of 2nd circuit of 132 kV Cumbum – Giddalur line to proposed 132/33 kV Substation at Anumalapalle	17			
3	132 kV DC/SC radial line from 220/132 kV Nellore Substation to the proposed 132/33 kV Kallurpalli substation	5	298	2019-20	Work under progress
4	132 kV DC/SC line from proposed 220/132 kV SS Atmakur to the proposed 132 kV SS Vinjamur	25	2515.64	2019-20	Work under progress
5	132 kV DC radial line from proposed 132/33 kV Kallurpalli Substation to the proposed 132/33 kV Koruturu substation	25	1952	2019-20	Work under progress
6	132 kV DC radial line from proposed 220/132 kV Amalapuram SS to the proposed 132/33 kV Mummidivaram SS	15	2927.89	2019-20	Work under progress
7	132 kV DC Line for making LILO of 132 kV Ramachandrapuram – Amalapuram radial line to proposed 132/33 kV Mummidivaram SS	8			
8	Stringing of 2nd circuit on existing 132 kV Kakinada – Yanam DC/SC Line	42	1938.52	2019-20	Work under progress
9	Erection of 132 kV DC line for making LILO of 2nd circuit of 132 kV Kakinada – Yanam line to the proposed 132/33 kV Gollapalem SS	6			
10	132 kV DC radial line from 132 kV Noonegundlapalli switching station to the proposed 132/33 kV Kothapalli substation	25	2738.26	2019-20	Work under progress

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
11	132 kV DC radial line from proposed 132/33 kV Pachikapallam to the proposed 132/33 kV Penumur substation	20	3373.55	2019-20	Tender opened
12	2nd circuit stringing on 132 kV DC/SC Line from 220/132 kV SS Nagari to 132 kV SS Pachikapallam	40			
13	132 kV DC radial line from 400/220/132 kV SS Manubolu to the proposed 132/33 kV Kadivedu substation	25	2735.08	2019-20	Tenders to be called
14	Stringing of 2nd circuit on existing 132 kV DC/SC Line from 220/132 kV SS Gudivada to 132 kV SS Chigurukota	23	2344.42	2019-20	Tenders to be called
15	132 kV DC line from 132 kV SS Chigurukota to the proposed 132/33 kV SS Bantumilli	18			
16	132 kV DC line from 220/132 kV SS Rachagunneri to the proposed 132/33 kV SS Mangalam	30	2905.6	2019-20	Tenders to be called
17	132 kV DC line from proposed 220/132 kV SS Naidupet to the proposed 132/33 kV SS Gottiprolu	30	2905.6	2019-20	Tenders to be called
18	132 kV LILO of existing 132 kV Kanumolu - Pamarru at proposed 400/220/132 kV SS Gudiwada	4	500	2019-20	TOO issued
19	132 kV LILO of existing 132 kV Chilakaluripet - Nallapadu at proposed 220/132 kV SS Chilakaluripet	10.5	1200	2019-20	TOO issued
20	132 kV LILO of existing 132 kV Chilakaluripet - Marripalem at proposed 220/132 kV SS Chilakaluripet	10.5	1200	2019-20	TOO issued
21	132 kV DC/SC Line with XLPE UG Cable from proposed 220/132/33 kV SS Amaravati to the proposed 132/33 kV SS Peddaparimi	19	15516	2019-20	TOO to be issued

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
22	132 kV DC/SC Line with XLPE UG Cable from proposed 220/132/33 kV SS Malkapuram to the proposed 132/33 kV SS Navuluru	12	9900	2019-20	TOO to be issued
23	132 kV DC/SC Line with XLPE UG Cable from proposed 132/33 kV SS Peddaparimi to the proposed 132/33 kV SS Navuluru	16	13070	2019-20	TOO to be issued
24	132 kV DC/SC Line from 220/132 kV SS Brandix to the proposed 132/33 kV Substation APMTZ	30	3018.7	2019-20	TOO to be issued
25	132 kV DC Line by making LILO of 132 kV Gajuwaka – Parawada line at proposed 132 kV SS APMTZ	3			
26	220 kV SS Bommur to 132 kV SS Vepakayaladibba	7	1000	2019-20	Proposal deemed to be dropped
27	220 kV SS Undi to 132 kV SS Akiveedu	15	1600	2019-20	System studies to be furnished
28	220 kV SS Kamavarapukota to 132 kV SS Dharmajigudem	25	2469	2019-20	System studies to be furnished
29	220 kV SS Undi to 132 kV SS Attili	25	2469	2019-20	System studies to be furnished
30	220/132/33 kV SS Duvva to the proposed 132/33 kV SS Palakollu	20	2028	2019-20	Tenders to be called
31	132 kV SS Rajam to 132 kV SS Veeraghattam	35	3300	2019-20	System studies to be furnished
32	132 kV SS Palakonda to 132 kV SS Sarubujjili	20	2028	2019-20	Revised System studies to be furnished
33	132 kV DC line 220/132 kV Anrak Sw.Station to Jamathulapalem	40	3360	2019-20	Scheme formulation under process
34	132 kV DC line 220/132 kV Anrak Sw.Station to Teeda	20	1680	2019-20	Scheme formulation under process
35	132 kV TB vara to VN Puram DC/SC line	8	584	2019-20	Scheme formulation under process

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
36	132 kV TB vara to Thatipudi DC/SC line	8	584	2019-20	Scheme formulation under process
37	132 kV Garividi to Kondaganredu DC/SC line	9	657	2019-20	Scheme formulation under process
38	132 kV Parvathipuram to GM vasa DC/SC line	18	1314	2019-20	Scheme formulation under process
39	132 kV BGC to Burjavalasa	5	365	2019-20	Scheme formulation under process
40	132 kV DC line from 220/132 kV SS Penukonda to 132 kV SS Penukonda	20	3624.8	2019-20	Work under progress
41	132 kV DC Line for making LILO of existing 132 kV Naidupeta-Gudur line to proposed 220 kV SS Menakuru/ Naidupeta	30.00	2146	2019-20	Work under progress
42	132 kV DC Line from proposed 220 kV SS Menakuru/ Naidupeta to 132 kV SS Menakuru	16.00		2019-20	Work under progress
43	132 kV 630sqmm XLPE Cable with terminal blocks (for 2 LVs) for 220 kV Atchutapuram SS	3.00	3660	2019-20	Work under progress
44	33 kV 400sqmm 1 core copper XLPE Cable with terminal blocks (for 2 LVs) for 220 kV Atchutapuram SS	2.00		2019-20	Work under progress
45	132 kV DC line at the existing 132 kV Simhachalam – Nakkavanipalem & 132 kV Simhachalam – Commonpoint corridor with 132 kV XLPE UG Cable	2.00	1250	2019-20	Tender to be called
46	132 kV DC line for making LILO of both the lines from existing 132 kV Peddapuram - Prathipadu line to 220/11 kV LIS SS Ramavaram	16.00	1422.5	2019-20	Tender to be called
		841	**109181.8**		

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
1	132 kV DC/SC Line with XLPE UG Cable from proposed 220/132/33 kV SS Malkapuram to the proposed 132/33 kV SS Uddandrayanipalem	3	2687	2020-21	TOO to be issued
2	132 kV DC/SC Line with XLPE UG Cable from proposed 132/33 kV SS Dondapadu to the proposed 132/33 kV SS Uddandrayanipalem	7	5860	2020-21	TOO to be issued
3	132 kV DC/SC Line with XLPE UG Cable from proposed 220/132/33 kV SS Malkapuram to the proposed 132/33 kV SS Krishnayanipalem	6	5075	2020-21	TOO to be issued
4	132 kV DC/SC Line with XLPE UG Cable from proposed 132/33 kV SS Navuluru to the proposed 132/33 kV SS Krishnayanipalem	3	2650	2020-21	TOO to be issued
5	132 kV SS Pithapuram to 132 kV SS Annavaram	30	2905	2020-21	System studies to be furnished
6	220 kV SS Garividi to 132 kV SS Nelimarla	30	2905	2020-21	System studies to be furnished
7	220 kV SS Kondapalli to 132 kV SS Kabela	25	2469	2020-21	System studies to be furnished
8	132 kV SS Palasa to 132 kV SS Sompeta	35	3300	2020-21	Revised System studies to be furnished
9	220 kV SS Garividi to 132 kV SS Chipurupalli	10	1200	2020-21	System studies to be furnished
10	132 kV TB Vara - 220 kV Garividi LILO to Gajapathinagaram	36	3422	2020-21	System studies to be furnished
11	220 kV SS Kandukur to 132 kV SS Singarayakonda	30	2905	2020-21	System studies to be furnished
12	Proposed 132 kV SS Chinnarikatla to 132 kV SS Mekalavaripalli	25	2469	2020-21	System studies to be furnished
13	220 kV SS Ongole to 132 kV SS Kothapatnam	30	2905	2020-21	Tenders to be called
14	220 kV SS Kandukuru to proposed 132 kV SS Ulavapadu	10.5	1064	2020-21	Tenders to be called

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
15	220/132 kV SS Gudivada to the proposed 132/33 kV SS Vuyyuru	20	2239	2020-21	Tenders to be called
16	220/132 kV Narasaraopeta to the proposed 132/33 kV SS Elchuru	25	2288	2020-21	Tenders to be called
17	Proposed 132 kV SS Kalasapadu to 132 kV SS Komarole	30	2905	2020-21	System studies to be furnished
18	220 kV SS Gunadala to 132 kV SS Gunadala	25	2469	2020-21	System studies to be furnished
19	220 kV SS Chillakallu to 132 kV SS Mukthyala	30	2905	2020-21	System studies to be furnished
20	LILO of 132 kV Kondapalli-Nuzividu line to 132 kV SS Gampalagudem	40	3500	2020-21	System studies to be furnished
21	132 kV SS Irala to 132 kV SS Kakalamitta	20	2028	2020-21	System studies to be furnished
22	132 kV SS Shanthipuram to 132 kV SS Vijalapuram	25	2469	2020-21	System studies to be furnished
23	132 kV DC Line for LILO of existing one circuit of 132 kV R.C Puram – Amalapuram DC line at proposed 220/132 kV SS Siripalli (Amalapuram)	2.00	836	2020-21	Revised TOO to be issued for Siripalli with revised connectivity
24	132 kV LILO of 132 kV Amalapuram-Kothapeta to proposed 220/132 kV Siripalli (Amalapuram)	2.00		2020-21	Revised TOO to be issued for Siripalli with revised connectivity
		500	**63455**		
1	132 kV Renigunta-Chandragiri line LILO to 132 kV SS Gandhipuram	5	700	2021-22	System studies to be furnished
2	132 kV SS Kesinenipalli to 132 kV SS Pullalacheruvu	35	3300	2021-22	System studies to be furnished
3	132 kV Nandyala-Allagadda LILO to 132 kV SS Gajulapalli	20	2028	2021-22	System studies to be furnished
4	220 kV SS Cherivi to 132 kV SS Satyavedu	24	2460	2021-22	System studies to be furnished
5	132 kV SS Penumur to 132 kV SS Poothalapattu	20	2028	2021-22	System studies to be furnished
6	220 kV SS Atmakuru to 132 kV SS Kaligiri	30	2905	2021-22	System studies to be furnished

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
7	132 kV SS Repalle to Bhattiprolu	17	1800	2021-22	System studies to be furnished
8	132 kV SS Piduguralla to Bellamkonda	19	2000	2021-22	System studies to be furnished
9	132 kV SS Kanigiri to Veligandla	26	2469	2021-22	System studies to be furnished
10	220 kV SS Kandukuru to Ponnaluru	20	2028	2021-22	System studies to be furnished
11	220 kV SS Rachagunneri to BN Kandriga	25	2469	2021-22	System studies to be furnished
		241	**24187**		
1	132 kV SS Vinjamuru to 132 kV SS Duttaluru	30	2905	2022-23	System studies to be furnished
2	132 kV SS NTS to 132 kV SS Buchireddypalem	10	1200	2022-23	System studies to be furnished
3	132 kV SS Rapur to 132 kV SS Somasila	25	2469	2022-23	System studies to be furnished
4	132 kV SS Rapur to 132 kV SS Dakkili	30	2905	2022-23	System studies to be furnished
5	132 kV Nellore - Atmakuru LILO to 132 kV SS Jonnawada	5	700	2022-23	System studies to be furnished
6	220 kV SS Racharlapadu to 132 kV SS Vidavalur	15	1600	2022-23	System studies to be furnished
		115	**11779**		
1	220 kV SS Meenakuru to 132 kV SS Mallam	40	3500	2023-24	System studies to be furnished
2	220 kV SS Manubolu to 132 kV SS Varagali	20	2028	2023-24	System studies to be furnished
3	132 kV SS Chodavaram to 132 kV SS K.Kotapadu	10	1200	2023-24	System studies to be furnished
4	Kasimkota - Pendurthy LILO to Govada	15	1600	2023-24	System studies to be furnished
5	Anrak SS to 132 kV SS Vaddadhi	20	2028	2023-24	System studies to be furnished
6	132 kV SS Kapuluppada to 132 kV SS Bhimili	15	1600	2023-24	System studies to be furnished
7	Brandix to 132 kV SS Rambili	15	1600	2023-24	System studies to be furnished

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
8	Dairy Farm to 132 kV SS NSTL	10	1200	2023-24	System studies to be furnished
9	Gajuwaka to 132 kV SS Auto nagar	10	1200	2023-24	System studies to be furnished
10	Peddawaltair to East Point colony	5	700	2023-24	System studies to be furnished
11	Proposed 220 kV SEZ SS to Hamsavaram	25	2469	2023-24	System studies to be furnished
12	Proposed 220 kV SS Gollaprolu to Hamsavaram	30	2905	2023-24	System studies to be furnished
13	Proposed 220 kV SS Prathipadu to Hamsavaram	40	3500	2023-24	System studies to be furnished
14	LILO of 132 kV Kakinada - Peddapuram line to Panasapadu	2	2500	2023-24	System studies to be furnished
15	Proposed 220 kV Ramachandrapuram to Teki	15	1600	2023-24	System studies to be furnished
16	Proposed 132 kV SS Mummidivaram to Uppalaguptam	15	1600	2023-24	System studies to be furnished
17	LILO of 132 kV Amalapuram-Razolu line to Mamidikuduru	3	2650	2023-24	System studies to be furnished
18	Proposed 220 kV SS Korukonda to Gokavaram	10	1200	2023-24	System studies to be furnished
19	132 kV SS Biccavolu to Dwarapudi or Mukkinada	12	1400	2023-24	System studies to be furnished
20	Proposed 220 kV Ramachandrapuram to Dwarapudi or Mukkinada	20	2028	2023-24	System studies to be furnished
21	220 kV SS Nidadavolu to Atreyapuram	20	2028	2023-24	System studies to be furnished
22	132 kV LILO of Bommuru-Nidadavolu to Atreyapuram	15	1600	2023-24	System studies to be furnished
23	Proposed 132 kV SS Gokavaram to Addathigala	35	3300	2023-24	System studies to be furnished
24	Proposed 132 kV SS Jaggampeta to Addathigala	40	3500	2023-24	System studies to be furnished
25	132 kV SS Palakonda to Hiramandalam	23	2460	2023-24	System studies to be furnished
		465	**51396**		

Augmentation of PTR Capacities at 400kV & 220 kV Substations during FY2019-20 to FY2023-24

Sl.No	Substation	Existing PTR Capacity in MVA	Proposed PTR Capacity in MVA	Estimated Cost Rs. Lakhs	Target year of Commissioning
1	Tekkali	2X100	2X160+1X100	754	2019-20
2	Garividi	2X100+1X160	3X160	754	2019-20
3	Bhimadole	1 x 160 + 2 x 100	2 x 160 + 1 x 100	377	2019-20
4	Gunadala	1 x 160 + 2 x 100	2 x 160 + 1 x 100	377	2019-20
5	Narasaraopeta	3 X 100	1X160+2 X 100	377	2019-20
6	Nunna	2X100	2X100 + 1X160	377	2019-20
7	Bommuru	1X160+2X100	2X160+1X100	377	2019-20
8	Maradam	3X315	2X315+1X500	2916	2019-20
9	Vemagiri	3X315	4X315	2726	2019-20
				9035	
1	Nidadavole	3 X 100	2 x 160 + 1 x 100	754	2020-21
2	Bobbili	2x100	2 x 160 + 1 x 100	754	2020-21
3	Renigunta	1 x 160 + 2 x 100	2 x 160 + 1 x 100	377	2020-21
4	A P Carbides	1X160 +2X100	2 x 160 + 1 x 100	377	2020-21
5	Kuppam	2X100	1 x 160 + 2 x 100	377	2020-21
6	Gudivada	1X160+2X100	2X160+1X100	377	2020-21
7	Narnoor	2X315	3X315	2726	2020-21
				5742	
1	Rentachintala	2X100	1X160+2 X 100	377	2021-22
2	Kamavarapukota	3X100	3 x 160	1131	2021-22
3	Kondapally	1X160+2 X 100	2 x 160 + 1 x 100	377	2021-22
4	Brandix	2X100	2X100+1X160	377	2021-22
5	Dairy Farm	2X100	2X100 + 1X160	377	2021-22
				2639	
1	Parwada	3X100	2X100+1X160	**377**	2022-23
2	Samalkota	3X100	1X100 + 2X160	754	2022-23
3	Nagari	3 x 100	2 x 160 + 1 x 100	754	2022-23
4	Rachaganneru	2X100	1 x 160 + 2 x 100	377	2022-23
5	Undi	3 X 100	2 x 160 + 1 x 100	754	2022-23
				3016	
1	Chillakallu	3 X 100	2 x 160 + 1 x 100	754	2023-24
2	Kalikiri	3 X100	2X160+1X 100	754	2023-24
3	Palamaneru	1X160+1 X 100	2 x 160 + 1 x 100	377	2023-24
4	Thimmapuram	2X100	1 x 160 + 1 x 100	377	2023-24
5	Parchur	3X100	2X100 + 1X160	377	2023-24
				2639	

Annexure – A2

Tentative Transmission Network Expansion from FY2024-25 to FY2028-29

Yearwise No. of Substations, Lines in Ckm (220 kV and above)

FY →	2024-25	2025-26	2026-27	2027-28	2028-29	Total
No of 400 kV Substations	1	2	2	1	1	7
Cost (in Lakhs)	34425	45900	51638	17213	17213	166389
400 kV Lines in CkM	20	40	170	40	40	310
Cost (in Lakhs)	3443	6885	18819	6885	6885	42917
No of 220 kV Substations	10	11	8	6	9	44
Cost (in Lakhs)	59749	63749	59288	36528	42264	261578
220 kV Lines in CkM	500	1008	416	296	602	2822
Cost (in Lakhs)	110883	120636	109912	65950	66308	473689.97
No of 132 kV Substations	11	11	10	6	6	44
Cost (in Lakhs)	16555	16555	15050	9030	9030	66220
132 kV Lines in CkM	650	554	550	284	310	2348
Cost (in Lakhs)	30638	26867	26779	13889	15159	113332
Total SS & Line Cost (in Rs. Crs)	**2556.93**	**2805.92**	**2814.86**	**1494.95**	**1568.59**	**11241.26**

Total Investment in Rs. Crores

FY →	2024-25	2025-26	2026-27	2027-28	2028-29	Total
132 kV	471.93	434.22	418.29	229.19	241.89	1795.52
220 kV	1706.32	1843.85	1692.00	1024.78	1085.72	7352.68
400 kV	378.68	527.85	704.57	240.98	240.98	2093.06
Total	**2556.93**	**2805.92**	**2814.86**	**1494.95**	**1568.59**	**11241.26**

LIST OF 400 kV and 220 kV SUBSTATIONS PROPOSED DURING FY2025-2029

Sl. No.	District	Name of the SS	Voltage	No. of Transformers	MVA	Estimated cost Rs. Lakhs	Target year of Commissioning
400 kV Substations							
1	Guntur	Borupalem GIS	400	3	1500	34425	2024-25
1	Visakhapatnam	Vizag - 2 SS	400	2	1000	34425	2025-26
2	Eest Godavari	GVK Bus extension for 400/220 KV SS	400	2	1000	11475	2025-26
						45900	
1	Guntur	Nidamarru GIS	400	3	1500	34425	2026-27
2	Krishna	Nandigama	400	2	1000	17213	2026-27
						51638	
1	Nellore	Nellore – 2	400	2	1000	17213	2027-28
1	Srikakulam	Srikakulam	400	2	1000	17213	2028-29

	220 kV Substations						
1	Vizianagaram	T B Vara	220	3	300	4000	2024-25
2	Kurnool	Nandikotkur	220	3	300	4000	2024-25
3	Srikakulam	Srikakulam	220	3	300	4000	2024-25
4	YSR Kadapa	Proddatur	220	3	300	4000	2024-25
5	Guntur	Uddandrayunipalem	220	3	240	11008	2024-25
6	Guntur	Inavolu	220	3	240	11008	2024-25
7	Guntur	Nagarjuna University	220	2	200	3575	2024-25
8	Kurnool	Banaganapalli	220	2	200	3575	2024-25
9	Krishna	Gunadala Extn	220	2	200	3575	2024-25
10	Guntur	Sakhamuru	220	3	240	11008	2024-25
					2520	**59749**	
1	Kurnool	Atmakur(KNL)	220	3	300	4000	2025-26
2	Ananthapur	Guntakal	220	3	300	4000	2025-26
3	Visakhapatnam	Autonagar/NSTL	220	3	300	4000	2025-26
4	Visakhapatnam	JNPC Pharma city	220	3	300	4000	2025-26
5	Chittor	Gurramkonda	220	2	200	3575	2025-26
6	Kadapa	Sambepalli	220	2	200	3575	2025-26
7	Guntur	Dondapadu	220	3	240	11008	2025-26
8	Guntur	Nidamarru	220	3	240	11008	2025-26
9	Guntur	Mandadam	220	3	240	11008	2025-26

	220 kV Substations						
10	Srikakulam	Palakonda	220	3	300	4000	2025-26
11	Guntur	Bapatla	220	2	200	3575	2025-26
					2820	**63749**	
1	Chittoor	Srikalahasti	220	3	300	4000	2026-27
2	Guntur	Nowluru	220	3	240	11008	2026-27
3	Guntur	Kuragallu	220	3	240	11008	2026-27
4	Guntur	Krishnayapalem	220	3	240	11008	2026-27
5	Visakhapatnam	Upgradation of 220 kV Anrak Switching Station to Substation	220	2	200	3256	2026-27
6	Nellore	Kavali	220	3	300	4000	2026-27
7	Prakasam	Giddalur	220	3	300	4000	2026-27
8	Guntur	Venkatapalem	220	3	240	11008	2026-27
					2060	**59288**	
1	West Godavari	P T Palli	220	3	300	4000	2027-28
2	Krishna	Kanumolu	220	3	300	4000	2027-28
3	East Godavari	Upgradation of 132 kV Kothapet to 220 kV	220	2	200	3256	2027-28
4	Guntur	Thallayapalem	220	3	240	11008	2027-28
5	Visakhapatnam	Papayyapalem	220	2	200	3256	2027-28
6	Guntur	Anathavaram	220	3	240	11008	2027-28
					1480	**36528**	
1	Krishna	Jakkampudi	220	3	300	4000	2028-29
2	Chittoor	Panjani	220	3	300	4000	2028-29
3	Chittoor	Penumur	220	3	300	4000	2028-29
4	Nellore	Adurupalli	220	3	300	4000	2028-29
5	Kurnool	Gopavaram Upgradation of 132 kV SS Rudravaram	220	2	200	3256	2028-29
6	Krishna	Machilipatnam	220	3	300	4000	2028-29
7	Visakhapatnam	VSEZ	220	3	300	4000	2028-29
8	Nellore	Krishnapatnam Port	220	3	300	4000	2028-29
9	Guntur	Neerukonda	220	3	240	11008	2028-29
					2540	**42264**	

LIST OF 132 kV SUBSTATIONS PROPOSED DURING FY 2025-2029

Sl. No	District	Name of the SS	No. of Transformers	MVA	Estimated cost in Rs. Lakhs	Target year of Commissioning
1	Anantapur	Yadiki	2	63.0	1505.00	2024-25
2	Chittoor	Ramakuppam	2	63.0	1505.00	2024-25
3	East Godavari	Eleswaram	2	63.0	1505.00	2024-25
4	Guntur	Durgi	2	63.0	1505.00	2024-25
5	Krishna	Kollipara	2	63.0	1505.00	2024-25
6	Kurnool	Nandipadu	2	63.0	1505.00	2024-25
7	Nellore	Pellakuru	2	63.0	1505.00	2024-25
8	Prakasam	Ardaveedu	2	63.0	1505.00	2024-25
9	Srikakulam	Kasibugga	2	63.0	1505.00	2024-25
10	Visakhapatnam	Rayavaram	2	63.0	1505.00	2024-25
11	Vizianagaram	Duggeru	2	63.0	1505.00	2024-25
					16555.00	
1	Anantapur	Singanamala	2	63.0	1505.00	2025-26
2	Chittoor	Putala Pattu	2	63.0	1505.00	2025-26
3	East Godavari	Rajavommangi	2	63.0	1505.00	2025-26
4	Guntur	Ipuru	2	63.0	1505.00	2025-26
5	Krishna	Kanchikacherla	2	63.0	1505.00	2025-26
6	Kurnool	Uyyalavada	2	63.0	1505.00	2025-26
7	Nellore	Chintaladevi	2	63.0	1505.00	2025-26
8	Prakasam	Chundi	2	63.0	1505.00	2025-26
9	Srikakulam	Srikurmam	2	63.0	1505.00	2025-26
10	Visakhapatnam	Tallapalem	2	63.0	1505.00	2025-26
11	Vizianagaram	Naguru	2	63.0	1505.00	2025-26
					16555.00	
1	Anantapur	Garladinne	2	63.0	1505.00	2026-27
2	Chittoor	Vadamala	2	63.0	1505.00	2026-27
3	East Godavari	Gokavaram	2	63.0	1505.00	2026-27
4	Guntur	Achampeta	2	63.0	1505.00	2026-27
5	Krishna	Janardanavaram	2	63.0	1505.00	2026-27
6	Kurnool	Devanakonda	2	63.0	1505.00	2026-27

Sl. No	District	Name of the SS	No. of Transformers	MVA	Estimated cost in Rs. Lakhs	Target year of Commissioning
7	Nellore	Dugarajapatnam	2	63.0	1505.00	2026-27
8	Prakasam	Pedda alvalapadu	2	63.0	1505.00	2026-27
9	Srikakulam	Chatram	2	63.0	1505.00	2026-27
10	Visakhapatnam	Kottakota	2	63.0	1505.00	2026-27
					15050.00	
1	West Godavari	Guntupalli	2	63.0	1505.00	2027-28
2	West Godavari	Dwaraka Tirumala	2	63.0	1505.00	2027-28
3	West Godavari	Koyyalagudem	2	63.0	1505.00	2027-28
4	Vizianagaram	Bhogapuram	2	63.0	1505.00	2027-28
5	Guntur	Nagulavaram	2	63.0	1505.00	2027-28
6	Krishna	Challapalle	2	63.0	1505.00	2027-28
					9030.00	
1	YSR Kadapa	Payalakunta	2	63.0	1505.00	2028-29
2	YSR Kadapa	Mogilipenta	2	63.0	1505.00	2028-29
3	YSR Kadapa	Obalam	2	63.0	1505.00	2028-29
4	Nellore	Bitragunta	2	63.0	1505.00	2028-29
5	Prakasam	Kommalapadu	2	63.0	1505.00	2028-29
6	West Godavari	Gopalapuram	2	63.0	1505.00	2028-29
					9030.00	

LIST OF 400 kV and 220kV LINES PROPOSED DURING FY2025-2029

Sl. No.	Name of the Transmission Line	IC	Conductor Type	Ckt	Length in Ckt KM	Estimated Cost Rs Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
400 kV Lines								
1	400kV LILO of 400kV VTS – Sattenapalli QM DC line at proposed 400/220kV Borupalem in CRDA	L	Quad Moose	LILO	20.00	3443.00	2024-25	---
2	LILO of 400kV Maradam - Kalpaka QMDC Line to Vizag - 2 SS	L	Quad Moose	LILO	40.00	6885.00	2025-26	---
3	400kV LILO of 400kV Chilakaluripeta – Sattenapalli QM DC line at proposed	L	Quad Moose	LILO	40.00	6885.00	2026-27	---

Sl. No.	Name of the Transmission Line	IC	Conductor Type	Ckt	Length in Ckt KM	Estimated Cost Rs Lakhs	Target year of Commissioning	Present status of implementation/ Criticalities if any
	400/220kV Nidamarru in CRDA							
4	400kV LILO of 400kV VTPS - Suryapet TM DC line at proposed 400/220kV Nandigama SS.	L	Quad Moose	LILO	30.00	2754.00	2026-27	---
5	400kV LILO of 400kV Vemagiri - Sattenapalli TM DC line at proposed 400/220kV Nandigama SS.	L	Quad Moose	LILO	100.00	9180.00	2026-27	---
6	400kV LILO of 400kV Krishnapatnam – Nellore QM DC line at proposed 400/220kV Nellore - 2 SS.	L	Quad Moose	LILO	40.00	6885.00	2027-28	---
7	400kV Maradam - Srikakulam QMDC Line	L	Quad Moose	DC	40.00	6885.00	2028-29	---

220 kV Lines								
1	220kV DC line from 220kV SS Vizianagaram to Proposed 220kV SS T.B Vara in Vizianagaram District	L	SM	DC	80	7146.00	2024-25	System Studies to be furnished
2	220kV DC line from 400kV SS Nannur to Proposed 220kV SS Nandukotkur in Kurnool District	L	SM	DC	70	6313.50	2024-25	System Studies to be furnished
3	220kV DC line from 220kV SS Paydibhimavarm to Proposed 220kV SS Srikakulam in Srikakulam District	L	SM	DC	70	6313.50	2024-25	System Studies to be furnished
4	220kV DC line from 400kV SS Talamanchipatnam to Proposed 220kV SS Proddatur in Y.S.R Kadapa District	L	SM	DC	90	7978.50	2024-25	System Studies to be furnished
5	220kV DC 1000Sq mm XLPE UG Cable from proposed 220/33 GIS kV SS Velagapudi to proposed 220/33 kV GIS SS Uddandarayunipalem	L	XLPE CABLE	DC	6	8800.33	2024-25	System Studies to be furnished
6	220kV DC 1000Sq mm XLPE UG Cable from proposed 220 kV SS Lingayapalem to proposed 220/33 kV GIS SS Uddandarayunipalem	L	XLPE CABLE	DC	6	8800.33	2024-25	System Studies to be furnished

220 kV Lines								
7	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV SS Tallayapalem to proposed 220/33 kV GIS SS Inavolu	L	XLPE CABLE	DC	26	26220.3	2024-25	System Studies to be furnished
8	220kV DC line from 220 kV SS Guntur to proposed 220 kV SS Nagarjuna University in Guntur District	L	SM	DC	28	3500	2024-25	System Studies to be furnished
9	Panyam (Gani) 400 kV SS To proposed Banaganapalli 220 kV SS	L	SM	DC	80	7000	2024-25	System Studies to be furnished
10	Gunadala 220 kV SS To proposed Gunadala Extn 220 kV	L	SM	DC	20	2500	2024-25	System Studies to be furnished
11	220kV DC 1000Sq mm XLPE UG Cable from proposed 220 kV GIS SS Anathavaram to proposed 220/33 kV GIS SS Sakhamuru	L	XLPE CABLE	DC	16	17510.33	2024-25	System Studies to be furnished
12	220kV DC 1000Sq mm XLPE UG Cable from proposed 220 kV GIS SS Ainavolu to proposed 220/33 kV GIS SS Sakhamuru	L	XLPE CABLE	DC	8	8800.33	2024-25	System Studies to be furnished
					500.00	**110883.12**		
1	220kV DC line from 220kV SS Nandyala to Proposed 220kV SS Atmakur in Kurnool District	L	SM	DC	100	8811.00	2025-26	System Studies to be furnished
2	220kV DC line from 400kV SS Uravakonda to Proposed 220kV SS Guntakal in Anantapur District	L	SM	DC	70	6313.50	2025-26	System Studies to be furnished
3	220kV DC line from 400kV SS Kalpaka to Proposed 220kV SS Autonagar (NSTL) in Visakhapatnam District	L	SM	DC	50	4648.50	2025-26	System Studies to be furnished
4	220kV DC line from 220kV SS Parwada to Proposed 220kV SS JNPC Pharma city in Visakhapatnam District	L	SM	DC	20	2076.00	2025-26	System Studies to be furnished
5	220kV DC line from 400kV SS Kalikiri to Proposed 220kV SS Gurramkonda Chittoor District	L	SM	DC	90	7978.50	2025-26	System Studies to be furnished
6	220kV DC line from 400kV SS Maradam to Proposed 220kV SS Pappayapalem in Visakhapatnam District	L	SM	DC	100	8811.00	2025-26	System Studies to be furnished
7	220kV DC line from 400kV Kalikiri to proposed 220kV SS Sambepalli	L	SM	DC	80	6177	2025-26	System Studies to be furnished
8	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Borupalem to proposed	L	XLPE CABLE	DC	16	17510.33	2025-26	System Studies to be furnished

220 kV Lines								
	220/33 kV GIS SS Dondapadu							
9	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Nidamarru to proposed 220/33 kV GIS SS Nidamarru	L	XLPE CABLE	DC	10	12284.33	2025-26	System Studies to be furnished
10	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Tallayapalem to proposed 220/33kV GIS SS Mandadam	L	XLPE CABLE	DC	12	14026.33	2025-26	System Studies to be furnished
11	Chilakaluripeta 400 kV SS To proposed Bapatla SS	L	SM	DC	160	11000	2025-26	System Studies to be furnished
12	Bobbili To proposed Palakonda SS	L	SM	DC	150	10500	2025-26	System Studies to be furnished
13	Tekkali 400 kV SS To proposed Palakonda SS	L	SM	DC	150	10500	2025-26	System Studies to be furnished
					1008.00	**120636.49**		
1	220kV DC line from 400kV SS Rachagunneru to Proposed 220kV SS Srikalahasti in Chittoor District	L	SM	DC	30	2921.00	2026-27	System Studies to be furnished
2	220kV DC 1000Sq mm XLPE UG Cable from proposed 220 kV GIS SS Mandadam to proposed 220/33 kV GIS SS Nowluru	L	XLPE CABLE	DC	14	17510.33	2026-27	System Studies to be furnished
3	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Nidamarru to proposed 220/33 kV GIS SS Nowluru	L	XLPE CABLE	DC	16	17510.33	2026-27	System Studies to be furnished
4	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Nidamarru to proposed 220/33 kV GIS SS Kuragallu	L	XLPE CABLE	DC	14	17510.33	2026-27	System Studies to be furnished
5	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Tallayapalem to proposed 220/33 kV GIS SS Krishnayapalem	L	XLPE CABLE	DC	16	17510.33	2026-27	System Studies to be furnished
6	220kV DC line from 400kV SS Maradam to Proposed 220kV SS Palakonda in Srikakulam District	L	SM	DC	90	7978.50	2026-27	System Studies to be furnished
7	220kV DC line from 220kV SS Kandukur to Proposed 220kV SS Kavali in Nellore District	L	SM	DC	110	9643.50	2026-27	System Studies to be furnished

220 kV Lines								
8	220kV DC line from 220kV SS Porumamilla to Proposed 220kV SS Giddalur in Prakasam District	L	SM	DC	120	10527.58	2026-27	System Studies to be furnished
9	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Tallayapalem to proposed 220/33 kV GIS SS Venkatapalem	L	XLPE CABLE	DC	6	8800.33	2026-27	System Studies to be furnished
					416.00	**109912.23**		
1	220kV DC line from 220kV SS Undi to Proposed 220kV SS P.T Palli in West Godavari District	L	SM	DC	50	4648.50	2027-28	System Studies to be furnished
2	220kV DC line from 220kV SS Nunna to Proposed 220kV SS Kanumolu in Krishna District	L	SM	DC	26	2583.00	2027-28	System Studies to be furnished
3	220kV DC line from 220kV SS Amalapuram to Proposed 220kV SS Kothapeta in East Godavari District	L	SM	DC	80	6177	2027-28	System Studies to be furnished
4	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Tallayapalem to proposed 220/33 kV GIS SS Tallayapalem	L	XLPE CABLE	DC	16	17510.33	2027-28	System Studies to be furnished
5	220kV DC line from 400kV SS Maradam to Proposed 220kV SS Pappayapalem in Visakhapatnam District	L	SM	DC	100	8811.00	2027-28	System Studies to be furnished
6	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Borupalem to proposed 220/33 kV GIS SS Anathavaram	L	XLPE CABLE	DC	24	26220.3	2027-28	System Studies to be furnished
					296	**65950.13**		
1	220kV DC line from 220kV SS Nunna to Proposed 220kV SS Jakkampudi in Krishna District	L	SM	DC	26	2583.00	2028-29	System Studies to be furnished
2	220kV DC line from 220kV SS Palamaneru to Proposed 220kV SS Panjani in Chittor District	L	SM	DC	90	7978.50	2028-29	System Studies to be furnished
3	220kV DC line from 220kV SS Nagiri to Proposed 220kV SS Penmur in Chittor District	L	SM	DC	90	7978.50	2028-29	System Studies to be furnished
4	220kV DC line from 220kV SS Atmakur to Proposed 220kV SS Adurueupalli in Nellore District	L	SM	DC	100	8811.00	2028-29	System Studies to be furnished

220 kV Lines								
5	220kV DC line from 220kV Nandyala to proposed Upgradation of 132kV SS Rudravaram (Gopavaram)	L	SM	DC	60	4780	2028-29	System Studies to be furnished
6	220kV DC line from 400kV SS Gudivada to Proposed 220kV SS Machilipatnam in Krishna District	L	SM	DC	82	7312.50	2028-29	System Studies to be furnished
7	220kV DC line from 220kV SS Gajuwaka to Proposed 220kV SS VSEZ in Visakhapatnam District	L	SM	DC	62	5692.50	2028-29	System Studies to be furnished
8	220kV DC line from 220kV SS Manubolu to Proposed 220kV SS Krishnapatnam Port in Nellore District	L	SM	DC	80	7146.00	2028-29	System Studies to be furnished
9	220kV DC 1000Sq mm XLPE UG Cable from proposed 400/220 kV GIS SS Nidamarru to proposed 220/33 kV GIS SS Neerukonda	L	XLPE CABLE	DC	12	14026.33	2028-29	System Studies to be furnished
					602	**66308.33**		

LIST OF 132 kV LINES PROPOSED DURING FY 2024-2029

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning
1	132kV DC line from 220kV SS Tadipatri to Proposed 132kV SS Yadiki in Anantapur dist.	60	2905.00	2024-25
2	132kV DC line from 220kV SS Kuppam to Proposed 132kV SS Ramakuppam in Chittoor dist.	50	2469.00	2024-25
3	132kV DC line from 132kV SS Pitapuram to Proposed 132kV SS Eleswaram in East Godavari dist.	60	2905.00	2024-25
4	132kV DC line from 132kV SS Veldurthi to Proposed 132kV SS Durgi Guntur dist.	40	2030.00	2024-25
5	132kV DC line from 132kV SS Vuyyuru to Proposed 132kV SS Kollipara Krishna dist.	40	2030.00	2024-25
6	132kV DC line from 132kV SS Koilakuntla to Proposed 132kV SS Nandipadu Kurnool dist.	80	3500.00	2024-25

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning
7	132kV DC line from 220kV SS Naidupeta to Proposed 132kV SS Pellakuru Nellore dist.	50	2469.00	2024-25
8	132kV DC line from 132kV SS Cumbum to Proposed 132kV SS Ardaveedu Prakasam dist.	40	2030.00	2024-25
9	132kV DC line from 220kV SS Tekkali to Proposed 132kV SS Kasibugga Srikakulam dist.	80	3500.00	2024-25
10	132kV DC line from 132kV SS Kasimkota to Proposed 132kV SS Rayavaram in Visakhapatnam dist.	80	3500.00	2024-25
11	132kV DC line from 132kV SS Saluruto Proposed 132kV SS Duggeru in Vizianagaram dist.	70	3300.00	2024-25
		650	**30638.00**	
1	132kV DC line from 220kV SS Anantapur to Proposed 132kV SS Singanamala in Anantapur dist.	50	2469.00	2025-26
2	132kV DC line from 220kV SS Chittoor to Proposed 132kV SS Putalapattu in Chittoor dist.	40	2030.00	2025-26
3	132kV DC line from 220kV SS Ramavaram to Proposed 132kV SS Rajavommangi East Godavari dist.	60	2905.00	2025-26
4	132kV DC line from 132kV SS Vinukonda to Proposed 132kV SS Ipuru Guntur dist.	44	2030.00	2025-26
5	132kV DC line from 132kV SS Nandigama to Proposed 132kV SS Kanchikacherla Krishna dist.	36	2030.00	2025-26
6	132kV DC line from 220kV SS Betamcharla to Proposed 132kV SS Uyyalavada Kurnool dist.	50	2469.00	2025-26
7	132kV DC line from 132kV SS Vinjamur to Proposed 132kV SS Chintaladevi Nellore dist.	60	2905.00	2025-26
8	132kV DC line from 220kV SS Kandukur to Proposed 132kV SS	44	2030.00	2025-26

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning
	Chundi Prakasam dist.			
9	132kV DC line from 132kV SS Srikakulam to Proposed 132kV SS Srikurmam in Srikakulam dist.	40	2030.00	2025-26
10	132kV DC line from 220kV SS Parawada to Proposed 132kV SS Tallapalem in Visakhapatnam dist.	50	2469.00	2025-26
11	132kV DC line from 220kV SS Bobbili to Proposed 132kV SS Naguru in Vizianagaram dist.	80	3500.00	2025-26
		554	**26867.00**	
1	132kV DC line from 220kV SS Anantapur to Proposed 132kV SS Garladinne in Anantapur dist.	60	2905.00	2026-27
2	132kV DC line from 220kV SS Renigunta to Proposed 132kV SS Vadamala in Chittoor dist.	40	2030.00	2026-27
3	132kV DC line from 220kV SS Bommuru to Proposed 132kV SS Gokavaram East Godavari dist.	60	2905.00	2026-27
4	132kV DC line from 132kV SS Piduguralla to Proposed 132kV SS Achampeta Guntur dist.	60	2905.00	2026-27
5	132kV DC line from 220kV SS Nujiveedu to Proposed 132kV SS Janardhanavaram Krishna dist.	60	2905.00	2026-27
6	132kV DC line from 132kV SS Pattikonda to Proposed 132kV SS Devanakonda Kurnool dist.	40	2030.00	2026-27
7	132kV DC line from 132kV SS Chendodu to Proposed 132kV SS Dugarajapatnam Nellore dist.	50	2469.00	2026-27
8	132kV DC line from 220kV SS Kandukur to Proposed 132kV SS Pedda Alvalapadu Prakasam dist.	70	3300.00	2026-27

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning
9	132kV DC line from 132kV SS Srikakulam to Proposed 132kV SS Chatram in Srikakulam dist.	70	3300.00	2026-27
10	132kV DC line from 132kV SS Narsipatnam to Proposed 132kV SS Kottakota in Visakhapatnam dist.	40	2030.00	2026-27
		550	**26779.00**	
1	132kV DC line from 132kV SS Chitalapudi to Proposed 132kV SS Guntupalli in West Godavari dist.	40	2030.00	2027-28
2	132kV DC line from 220kV SS Bhimadole to Proposed 132kV SS Dwaraka Tirumala in West Godavari dist.	44	2030.00	2027-28
3	132kV DC line from 132kV SS Tadepalli Gudem to Proposed 132kV SS Koyyalagudem in West Godavari dist.	70	3300.00	2027-28
4	132kV DC line from 220kV SS Vizianagaram to Proposed 132kV SS Bhogapuram in Vizianagaram dist.	40	2030.00	2027-28
5	132kV DC line from 220kV SS Vinukonda to Proposed 132kV SS Nagulavarm Guntur dist.	50	2469.00	2027-28
6	132kV DC line from 132kV SS Avanigadda to Proposed 132kV SS Challapalle Krishna dist.	40	2030.00	2027-28
		284	**13889.00**	
1	132kV DC line from 220kV SS Porumamilla to Proposed 132kV SS Payalakunta in Y.S.R Kadapa dist.	40	2030.00	2028-29
2	132kV DC line from 132kV SS T. Sundupalli to Proposed 132kV SS Mogilipenta in Y.S.R Kadapa dist.	70	3300.00	2028-29
3	132kV DC line from 132kV SS Badvel to Proposed 132kV SS Obalam in Y.S.R Kadapa dist.	50	2469.00	2028-29
4	132kV DC line from 132kV SS Alluru to Proposed 132kV SS Bitragunta Nellore dist.	40	2030.00	2028-29

Sl. No.	Name of Transmission line	Length in Ckt. kM	Estimated cost Rs. Lakhs	Target year of Commissioning
5	132kV DC line from 132kV SS Martur to Proposed 132kV SS Kommalapadu Prakasam dist.	40	2030.00	2028-29
6	132kV DC line from 220kV SS Nidadavolu to Proposed 132kV SS Gopalapuram in West Godavari dist.	70	3300.00	2028-29
		310	**15159.00**	

ANNEXURE - B

APPROVED: SOURCE-WISE YEAR-WISE NET CAPCITIES (MW) for 4th Control Period

S. No.	Source	Capacity (MW)	AP Share (%)	AP Share (MW)	Aux (%)	Ex-Bus Capacity considered (MW)				
						FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24
APGENCO - Thermal										
1	NTTPS I	420	100%	420	8.75%	383.25	383.25	383.25	383.25	383.25
2	NTTPS II	420	100%	420	8.75%	383.25	383.25	383.25	383.25	383.25
3	NTTPS III	420	100%	420	8.75%	383.25	383.25	383.25	383.25	383.25
4	NTTPS IV	500	100%	500	7.50%	462.50	462.50	462.50	462.50	462.50
5	RTPP I	420	100%	420	9.00%	382.20	382.20	382.20	382.20	382.20
6	RTPP Stage-II	420	100%	420	9.00%	382.20	382.20	382.20	382.20	382.20
7	RTPP Stage-III	210	100%	210	9.00%	191.10	191.10	191.10	191.10	191.10
8	NTTPS Stage V (800MW)	800	100%	800	6.50%	0.00	748.00	748.00	748.00	748.00
9	Rayalaseema TPP Stage IV Unit- 6 (600MW)	600	100%	600	7.00%	558.00	558.00	558.00	558.00	558.00
10	Krishnapatnam TPP (JVP) Stage I (2X800MW) Unit-1 (SDSTPP-I)	800	100%	800	6.50%	748.00	748.00	748.00	748.00	748.00
11	Krishnapatnam TPP (JVP) Stage I (2X800MW) Unit-2 (SDSTPP-II)	800	100%	800	6.50%	748.00	748.00	748.00	748.00	748.00
12	Krishnapatnam TPP (JVP) Stage II (1X800MW) Unit-3 (SDSTPP- III)	800	100%	800	6.50%	0.00	748.00	748.00	748.00	748.00
Total AP GENCO Thermal		**6,610**		**6,610**		**4621.75**	**6117.75**	**6117.75**	**6117.75**	**6117.75**
APGENCO – Hydel										
13	MACHKUND PH AP Share	120	50%	60.00	1.00%	59.40	59.40	59.40	59.40	59.40
14	TUNGBHADRA PH AP Share	72	80%	57.60	1.00%	57.02	57.02	57.02	57.02	57.02
15	USL	240	100%	240	1.00%	237.60	237.60	237.60	237.60	237.60
16	LSR	460	100%	460	1.00%	455.40	455.40	455.40	455.40	455.40

S. No.	Source	Capacity (MW)	AP Share (%)	AP Share (MW)	Aux (%)	Ex-Bus Capacity considered (MW)				
						FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24
17	DONKARAYI	25	100%	25	1.00%	24.75	24.75	24.75	24.75	24.75
18	SSLM	770	100%	770	1.00%	762.30	762.30	762.30	762.30	762.30
19	NSRCPH	90	100%	90	1.00%	89.10	89.10	89.10	89.10	89.10
20	PABM	20	100%	20	1.00%	19.80	19.80	19.80	19.80	19.80
21	MINI HYDRO (Chettipetta)	1	100%	1	1.00%	0.99	0.99	0.99	0.99	0.99
22	Nagarjunasagar Tail pond (1x25 MW) Unit-1	25	100%	25	1.00%	24.75	24.75	24.75	24.75	24.75
23	Nagarjunasagar Tail pond (1x25 MW) Unit-2	25	100%	25	1.00%	24.75	24.75	24.75	24.75	24.75
24	Polavaram- (12x80MW) Unit-1	80	100%	80	1.00%	0.00	0.00	79.20	79.20	79.20
25	Polavaram- (12x80MW) Unit-2	80	100%	80	1.00%	0.00	0.00	79.20	79.20	79.20
26	Polavaram- (12x80MW) Unit-3	80	100%	80	1.00%	0.00	0.00	79.20	79.20	79.20
27	Polavaram- (12x80MW) Unit-4	80	100%	80	1.00%	0.00	0.00	0.00	79.20	79.20
28	Polavaram- (12x80MW) Unit-5	80	100%	80	1.00%	0.00	0.00	0.00	79.20	79.20
29	Polavaram- (12x80MW) Unit-6	80	100%	80	1.00%	0.00	0.00	0.00	79.20	79.20
30	Polavaram- (12x80MW) Unit-7	80	100%	80	1.00%	0.00	0.00	0.00	79.20	79.20
31	Polavaram- (12x80MW) Unit-8	80	100%	80	1.00%	0.00	0.00	0.00	79.20	79.20
32	Polavaram- (12x80MW) Unit-9	80	100%	80	1.00%	0.00	0.00	0.00	79.20	79.20
33	Polavaram- (12x80MW) Unit-10	80	100%	80	1.00%	0.00	0.00	0.00	0.00	79.20
34	Polavaram- (12x80MW) Unit-11	80	100%	80	1.00%	0.00	0.00	0.00	0.00	79.20
35	Polavaram- (12x80MW) Unit-12	80	100%	80	1.00%	0.00	0.00	0.00	0.00	79.20
Total AP GENCO Hydel		**2,808**		**2,733.60**		**1755.86**	**1755.86**	**1993.46**	**2468.66**	**2706.26**
Central Generating Stations										
36	NTPC (SR)	2,100	20.70%	273.11	6.68%	254.86	254.86	254.86	254.86	254.86
37	NTPC (SR) Stage III	500	21.61%	68.77	5.75%	64.82	64.82	64.82	64.82	64.82
38	Talcher Stage 2	2,000	11.64%	175.20	5.75%	165.13	165.13	165.13	165.13	165.13
39	NLC Stage-I	630	7.56%	47.64	10.00%	42.87	42.87	42.87	42.87	42.87

S. No.	Source	Capacity (MW)	AP Share (%)	AP Share (MW)	Aux (%)	Ex-Bus Capacity considered (MW)				
						FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24
40	NLC Stage-II	840	10.34%	86.81	10.00%	78.13	78.13	78.13	78.13	78.13
41	NPC-MAPS	440	4.19%	16.47	0.00%	16.47	16.47	16.47	16.47	16.47
42	NPC-Kaiga unit I &II	440	12.78%	50.35	0.00%	50.35	50.35	50.35	50.35	50.35
43	NPC-Kaiga unit III & IV	440	13.64%	53.66	0.00%	53.66	53.66	53.66	53.66	53.66
44	NTPC Simhadri Stage I	1,000	46.11%	461.10	5.25%	436.89	436.89	436.89	436.89	436.89
45	NTPC Simhadri Stage II	1,000	26.69%	190.50	5.25%	180.49	180.49	180.49	180.49	180.49
46	Bundled power under JVNSM (or western region)	539.12	100%	506.93	0.00%	506.93	506.93	506.93	506.93	506.93
47	Vallur Thermal Power Plant	1,500	5.86%	87.93	6.69%	82.04	82.04	82.04	82.04	82.04
48	Kudigi	1,600	16.99%	215.04	5.75%	202.68	202.68	202.68	202.68	202.68
49	Tuticorin joint venture plant	1,000	12.32%	123.22	6.25%	115.52	115.52	115.52	115.52	115.52
50	NNTPS	1,000	5.25%	52	6.50%	48.62	48.62	48.62	48.62	48.62
Total CGS		**15,029.12**		**2,408.73**		**2299.46**	**2299.46**	**2299.46**	**2299.46**	**2299.46**
APGPCL, APDISCOM & IPPs-Gas										
51	APGPCL I - Allocated capacity	100	9.33%	9.33	3.00%	9.05	9.05	9.05	9.05	9.05
52	APGPCL II - Allocated capacity	172	14.51%	24.96	3.00%	24.21	24.21	24.21	24.21	24.21
53	Godavari Gas Power Plant	216.82	100%	216.82	3.97%	208.22	208.22	208.22	208.22	208.22
54	Spectrum	205.19	100%	205.19	3.00%	199.03	0.00	0.00	0.00	0.00
55	Kondapalli (Gas)	361.92	100%	361.92	3.00%	351.06	0.00	0.00	0.00	0.00
56	GMR Vemagiri	370	46.11%	170.61	3.00%	165.49	165.49	165.49	165.49	165.49
57	GVK Extns	220	46.11%	101.44	3.00%	98.40	98.40	98.40	98.40	98.40
58	GVK Gautami	464	46.11%	213.95	3.00%	207.53	207.53	207.53	207.53	207.53
59	Konaseema	444	46.11%	204.73	3.00%	198.59	198.59	198.59	198.59	198.59
60	Srivathsa	17.20	100%	17.20	3.40%	16.62	0.00	0.00	0.00	0.00
Total APGPCL, APDISCOM & IPPs-Gas		**2,571.13**		**1,526**		**1478.19**	**911.48**	**911.48**	**911.48**	**911.48**

S. No.	Source	Capacity (MW)	AP Share (%)	AP Share (MW)	Aux (%)	Ex-Bus Capacity considered (MW)				
						FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24
IPPs - Others - Thermal										
61	Hinduja	1,040	100%	1,040	6.00%	977.60	977.60	977.60	977.60	977.60
62	DBFOO	600	100%	600	0.00%	600.00	600.00	600.00	600.00	600.00
63	LVS	37	100%	37	3.40%	0.00	0.00	0.00	0.00	0.00
64	KSK Mahanadi (MT)	400	100%	400	0.00%	400.00	400.00	0.00	0.00	0.00
65	Thermal Power Tech	500	46.11%	230.55	0.00%	230.55	230.55	230.55	230.55	230.55
66	**Total IPPs - Thermal**	**2,540**		**2,270**		**2208.15**	**2208.15**	**1808.15**	**1808.15**	**1808.15**
67	**Total NCE - Solar**	**2777.43**		**2777.43**	**0.10%**	**2728.89**	**2728.89**	**2728.89**	**2728.89**	**2728.89**
68	**Total NCE - Wind Power**	**3,944.70**		**3,944.70**	**0.50%**	**3892.14**	**3887.17**	**3881.89**	**3881.89**	**3757.72**
69	**Total NCE - Mini Hydel**	**65.89**		**64.24**	**1.00%**	**63.60**	**63.60**	**53.20**	**47.17**	**43.91**
70	Total NCE - Bio Mass	84.50		84.50	10%	76.05	76.05	61.65	39.60	28.35
71	Total NCE - Bagasse	108.50		108.50	10%	96.92	96.92	95.55	80.99	62.79
72	Total NCE - Industrial Waste based power project	21.66		21.66	10%	19.49	19.49	19.49	19.49	19.49
73	Total NCE - Municipal Solid Waste Projects	59.00		59.00	10%	53.10	53.10	53.10	53.10	53.10
Total NCE Others		**273.66**				**245.56**	**245.56**	**229.79**	**193.18**	**163.73**
Total						**19,293.60**	**20,217.92**	**20,024.09**	**20,456.65**	**20,537.35**

ANNEXURE - C1

Filings: Total No. PTRs & DTRs-APEPDCL

FY⟶	2019-20	2020-21	2021-22	2022-23	2023-24	Filed for CP
Srikakulam						
No of 5 MVA 33/11 kV SS	11	13	14	16	17	**71**
No of 100 kVA DTRs	580	650	730	800	890	**3,650**
Vizianagaram						
No of 5 MVA 33/11 kV SS	13	14	15	17	19	**78**
No of 100 kVA DTRs	660	740	820	900	1,000	**4,120**
Visakhapatnam						
No of 5 MVA 33/11 kV SS	22	24	26	28	31	**131**
No of 100 kVA DTRs	1,620	1,790	1,960	2,150	2,350	**9,870**
Rajahmundry						
No of 5 MVA 33/11 kV SS	30	33	37	41	45	**186**
No of 100 kVA DTRs	1,850	2,070	2,300	2,570	2,840	**11,630**
Eluru						
No of 5 MVA 33/11 kV SS	102	39	43	50	53	**287**
No of 100 kVA DTRs	1,800	2,560	2,860	3,360	3,570	**14,150**

ANNEXURE - C2

Filings: No. of PTRS & DTRS-APSPDCL

FY→	2019-20	2020-21	2021-22	2022-23	2023-24	Filed for CP
Vijayawada						
No of 5 MVA 33/11 kV SS	44	50	57	64	73	**287**
No of 100 kVA DTRs	3,480	3,970	4,520	5,130	5,840	**22,940**
Guntur						
No of 5 MVA 33/11 kV SS	39	44	51	58	66	**258**
No of 100 kVA DTRs	2,830	3,210	3,650	4,130	4,700	**18,520**
Ongole						
No of 5 MVA 33/11 kV SS	23	25	28	30	33	**139**
No of 100 kVA DTRs	1,610	1,760	1,930	2,100	2,290	**9,690**
Nellore						
No of 5 MVA 33/11 kV SS	28	33	38	44	51	**194**
No of 100 kVA DTRs	2,450	2,840	3,270	3,760	4,350	**16,670**
Tirupati						
No of 5 MVA 33/11 kV SS	33	36	39	42	46	**196**
No of 100 kVA DTRs	1,960	2,120	2,310	2,490	2,690	**11,570**
Kadapa						
No of 5 MVA 33/11 kV SS	19	21	23	26	29	**118**
No of 100 kVA DTRs	1,450	1,630	1,820	2,020	2,260	**9,180**
Anantapur						
No of 5 MVA 33/11 kV SS	40	20	22	24	27	**133**
No of 100 kVA DTRs	3,520	1,760	1,950	2,140	2,370	**11,740**
Kurnool						
No of 5 MVA 33/11 kV SS	15	16	18	20	22	**91**
No of 100 kVA DTRs	1,330	1,490	1,660	1,840	2,050	**8,370**

ANNEXURE - C3

Filings: Line Lengths (km)-APEPDCL

FY⟶	2019-20	2020-21	2021-22	2022-23	2023-24	Filed for CP
Srikakulam						
33 kV	100	118	127	145	154	644
11kV	382	428	481	527	586	2404
LT	382	428	481	527	586	2404
Vizianagaram						
33 kV	98	105	113	128	143	587
11kV	330	370	410	450	500	2060
LT	330	370	410	450	500	2060
Visakhapatnam						
33 kV	154	168	182	196	217	917
11kV	638	705	772	847	926	3888
LT	638	705	772	847	926	3888
Rajahmundry						
33 kV	247	271	304	337	370	1529
11kV	573	642	713	796	880	3604
LT	573	642	713	796	880	3604
Eluru						
33 kV	692	265	292	339	360	1948
11kV	419	596	665	782	831	3293
LT	419	596	665	782	831	3293

ANNEXURE - C4

Filings: Line Lengths (km)-APSPDCL

FY⟶	2019-20	2020-21	2021-22	2022-23	2023-24	Filed for CP
Vijayawada						
33 kV	313	355	405	455	519	2047
11kV	1,502	1,713	1,951	2,214	2,521	9901
LT	1,502	1,713	1,951	2,214	2,521	9901
Guntur						
33 kV	266	300	347	395	456	1764
11kV	944	1,071	1,217	1,377	1,567	6176
LT	944	1,071	1,217	1,377	1,567	6176
Ongole						
33 kV	365	411	477	542	626	2421
11kV	1,571	1,782	2,026	2,292	2,609	10280
LT	1,571	1,782	2,026	2,292	2,609	10280
Nellore						
33 kV	183	199	223	239	263	1107
11kV	445	486	533	580	633	2677
LT	445	486	533	580	633	2677
Tirupati						
33 kV	168	198	228	264	306	1164
11kV	559	648	746	857	992	3802
LT	559	648	746	857	992	3802
Kadapa						
33 kV	107	118	130	147	164	666
11kV	290	326	364	404	452	1836
LT	276	310	346	384	429	1745
Anantapur						
33 kV	323	161	177	194	218	1073
11kV	1,095	548	607	666	737	3653
LT	1,095	548	607	666	737	3653
Kurnool						
33 kV	140	149	168	187	205	849
11kV	423	474	528	585	652	2662
LT	423	474	528	585	652	2662

ANNEXURE - D1

Approved: Total No. PTRs & DTRs-APEPDCL

FY⟶	2019-20	2020-21	2021-22	2022-23	2023-24	Filed for CP
Srikakulam						
No of 5 MVA 33/11 kV SS	7	8	9	10	11	**45**
No of 100 kVA DTRs	360	400	460	480	540	**2,240**
Vizianagaram						
No of 5 MVA 33/11 kV SS	9	10	11	12	14	**56**
No of 100 kVA DTRs	488	484	542	669	667	**2,849**
Visakhapatnam						
No of 5 MVA 33/11 kV SS	21	23	25	27	30	**127**
No of 100 kVA DTRs	1,474	1,943	1,777	1,919	2,530	**9,643**
Rajahmundry						
No of 5 MVA 33/11 kV SS	24	27	30	34	37	**152**
No of 100 kVA DTRs	1,354	1,737	1,931	2,177	2,115	**9,315**
Eluru						
No of 5 MVA 33/11 kV SS	82	30	34	40	42	**228**
No of 100 kVA DTRs	1,536	2,037	2,287	2,683	2,858	**11,401**

ANNEXURE - D2

Approved: No. of PTRS & DTRS-APSPDCL

FY→	2019-20	2020-21	2021-22	2022-23	2023-24	Filed for CP
Vijayawada						
No of 5 MVA 33/11 kV SS	44	50	57	64	73	**287**
No of 100 kVA DTRs	3,416	3,850	4,409	5,514	5,685	**22,875**
Guntur						
No of 5 MVA 33/11 kV SS	34	39	45	51	58	**228**
No of 100 kVA DTRs	2,351	3,004	3,043	3,878	3,935	**16,211**
Ongole						
No of 5 MVA 33/11 kV SS	18	20	22	23	26	**108**
No of 100 kVA DTRs	1,342	1,244	1,629	1,459	1,908	**7,582**
Nellore						
No of 5 MVA 33/11 kV SS	24	28	32	37	42	**164**
No of 100 kVA DTRs	2,040	2,380	2,754	3,127	3,603	**13,904**
Tirupati						
No of 5 MVA 33/11 kV SS	27	30	32	34	37	**160**
No of 100 kVA DTRs	1,700	1,850	1,571	2,122	2,295	**9,538**
Kadapa						
No of 5 MVA 33/11 kV SS	14	16	18	20	22	**91**
No of 100 kVA DTRs	1,148	1,275	1,434	1,626	1,753	**7,236**
Anantapur						
No of 5 MVA 33/11 kV SS	18	20	22	24	27	**112**
No of 100 kVA DTRs	1,599	1,812	1,990	2,167	2,380	**9,948**
Kurnool						
No of 5 MVA 33/11 kV SS	12	13	15	16	18	**75**
No of 100 kVA DTRs	1,071	1,178	1,357	1,726	1,660	**6,992**

ANNEXURE - D3

Approved: Line Lengths (km) – APEPDCL

FY→	2019-20	2020-21	2021-22	2022-23	2023-24	Filed for CP
Srikakulam						
33 kV	65	73	83	87	98	**406**
11kV	238	264	304	317	356	**1478**
LT	238	264	304	317	356	**1478**
Vizianagaram						
33 kV	66	75	84	90	102	**418**
11kV	244	242	271	334	333	**1425**
LT	244	242	271	334	333	**1425**
Visakhapatnam						
33 kV	149	163	177	191	210	**889**
11kV	575	758	693	748	987	**3761**
LT	575	758	693	748	987	**3761**
Rajahmundry						
33 kV	201	224	247	276	302	**1249**
11Kv	420	538	599	675	656	**2888**
LT	420	538	599	675	656	**2888**
Eluru						
33 Kv	553	206	231	271	285	**1546**
11Kv	353	469	526	617	657	**2622**
LT	353	469	526	617	657	**2622**

ANNEXURE - D4

Approved: Line Lengths (km) - APSPDCL

FY→	2019-20	2020-21	2021-22	2022-23	2023-24	Filed for CP
Vijayawada						
33 kV	313	353	405	456	516	2043
11kV	1469	1656	1896	2371	2445	9836
LT	1469	1656	1896	2371	2445	9836
Guntur						
33 kV	234	267	305	349	398	1553
11kV	776	991	1004	1280	1299	5350
LT	776	991	1004	1280	1299	5350
Ongole						
33 kV	165	183	202	217	239	1006
11kV	745	690	904	810	1059	4208
LT	745	690	904	810	1059	4208
Nellore						
33 kV	191	223	258	293	338	1304
11kV	561	654	757	860	991	3824
LT	561	654	757	860	991	3824
Tirupati						
33 kV	163	178	192	206	223	962
11kV	391	425	361	488	528	2194
LT	391	425	361	488	528	2194
Kadapa						
33 kV	81	90	102	115	124	512
11kV	224	249	280	317	342	1411
LT	224	249	280	317	342	1411
Anantapur						
33 kV	145	165	181	197	216	904
11kV	496	562	617	672	738	3084
LT	496	562	617	672	738	3084
Kurnool						
33 kV	112	123	142	153	172	702
11kV	343	377	434	552	531	2237
LT	343	377	434	552	531	2237

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