
24X7 POWER FOR ALL

A JOINT INITIATIVE OF GOVERNMENT OF
INDIA AND GOVERNMENT OF KERALA



FEBRUARY 2016



Government of India



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Foreword

Electricity consumption is one of the most important indicator that decides the development level of a nation. The Government of India is committed to improving the quality of life of its citizens through higher electricity consumption. Our aim is to provide each household access to electricity, round the clock. The 'Power for All' programme is a major step in this direction.

Kerala's per capita electricity consumption is lower than national average, however the state ensures 24 hours supply to all segments of consumers. The state should make endeavours to bring the remaining unconnected households under electrification and should step up initiatives for wider and deeper implementation of DSM and renewable energy initiatives in the state.

This joint initiative of Government of India and Government of Kerala aims to further enhance the satisfaction levels of the consumers and improve the quality of life of people through 24x7 power supply. This would lead to rapid economic development of the state in primary, secondary & tertiary sectors resulting in inclusive development.

I compliment the Government of Kerala and wish them all the best for implementation of this programme. The Government of India will complement the efforts of Government of Kerala in bringing uninterrupted quality power to each household, industries, commercial business, public needs, small & medium enterprises & any other public needs and adequate power to agriculture as per the state policy.



Government of Kerala



Oommen Chandy

Chief Minister of Kerala

Foreword

An efficient, resilient and financially sustainable power sector is essential to stimulate growth and prosperity. Moreover electricity has become an essential commodity that mankind cannot live without. It shall be a priority of a welfare state to make available reliable, good quality and affordable electricity to every citizen of the country. However the fact remains that a large number of households in the country still remain unelectrified. Besides that houses in the rural areas, though connected to grid, are not guaranteed with electricity for 24 hours of a day.

When compared with other states, Kerala stands better on equitable electricity service delivery across the urban-rural divide and on deeper penetration of the network to the rural interiors. These achievements stand proof to our policy to provide electricity to all, followed through the past years.

It is not claimed here that the entire population of the state is gifted with quality electricity. The state is committed to bring the presently unconnected households, though small in number, under electrification and to ensure uninterrupted power to all segments of consumers. AT&C loss reduction and application of DSM measures are essential in achieving these objectives.

It is at this juncture that '**24x7 Power for all**' programme play a pivotal role. Conceived with the objective of providing 24x7 quality, reliable and affordable power for all, this programme takes a holistic approach for addressing the concerns across the value chain in Power sector.

On behalf of Government of Kerala, I would like to thank Government of India, Hon'ble Prime Minister and Hon'ble Minister of Power for implementation of this programme.



सत्यमेव जयते

Government of India



Government of Kerala

Joint Statement

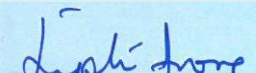
The State of Kerala is committed to provide quality life to people of state. Electricity supply serves as an important means to achieve this. The programme of "24x7 power for all" is an important step in this direction and this programme will be implemented by Government of Kerala (GoK) with the objective to connect the unconnected in phased manner by FY 2018-19 to ensure supply of quality, reliable and affordable power to all category of consumers on 24x7x365 basis.

Government of Kerala would ensure that all the necessary steps outlined in the PFA document are taken up in terms of capacity addition, power procurement, strengthening the required transmission and distribution network, encouraging renewable, Demand side management & energy efficiency measures, undertaking customer centric initiatives, reduction of AT & C losses, bridging the gap between ACS & ARR, and following good governance practices in implementation of all central and state government schemes.

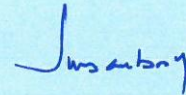
Government of India (GoI) would supplement the efforts of Government of Kerala by fast tracking resolution of key issues pertaining to generation, expediting the additional interstate connectivity and ensuring optimum allocations in various distribution schemes, as per the provisions of applicable policies.

Government of Kerala would endeavour to implement the programme within the targeted time frame of FY 2018-19 or even earlier than the targeted date.

The central and state governments would meet regularly to review the progress of the programme over the next four (4) years and would strive to achieve the objectives of the programme by taking the necessary steps as envisaged in the PFA document.


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POWER MAP OF 400 kV & 220 kV GRID NETWORK



24x7 Power for All (24x7 PFA) is a Joint Initiative of Government of India (GoI) and State Governments with the objective to make 24x7 power available to all households, industries, commercial businesses, public needs, any other electricity consuming entity and adequate power to agriculture consumers by FY 2018-19 as per State policy.

This roadmap document aims to meet the above objectives for the state of Kerala. With respect to installed capacity Kerala stands at 16th position with approximately 1.66% of the total in the country. The per capita consumption of power in Kerala has been 549 units which is much lower than the National Average of 1010 units as observed during FY 2014-15.

Compared with most other States, the power sector of Kerala has been on a 24x7 footing at least since the past decade as the peculiar socio-economic conditions of the State demanded it. Deep and wide reach of the Grid, cent percent village electrification and the comparable service in urban and rural areas stand proof to the said approach.

CONNECTING THE UNCONNECTED

According to a recent survey undertaken by the state, about 3,55,578 households in rural areas and about 1,25,444 households in urban areas are un-electrified and the state has planned to electrify them completely by FY 2016-17 under the DDUGJY/ IPDS scheme of GoI and through off-grid solutions.

GROWTH IN DEMAND

As per the present power supply position in the state, Kerala has about 3.35% peak power shortage & 0.52% energy shortage during FY 2014-15.

In order to achieve the objective of 24x7 power supply to all, the state would see an increase in peak demand from 3,727 MW at present (FY 2014-15) to 4,821 MW in FY 2018-19 with corresponding increase in energy requirement from 22,040 MU in FY 2014-15 to 29,620 MU in FY 2018-19.

The future demand for domestic consumers has been derived by estimating the urban and rural household consumption taking into account the growth in number of electrified households on the one hand and the growth in average consumption per household on the other. As discussed with the state, the growth for other than domestic category has been considered at an average CAGR of 6% per year.

SUPPLY ADEQUACY

The available capacity (installed as well as allocated share) for the State as on 31st March 2015 was 4412.87 MW. In order to meet the estimated increased demand for providing 24x7 power supply in the state, the state has already planned additional capacity availability of 2332.75 MW by FY 2018-19 through own generating stations, renewable energy sources, central generating stations and long term/ medium term PPAs in a phased manner. Out of this, 822.40 MW shall be added through non-conventional energy sources and balance 1510.35 MW through conventional sources.

It is to be noted that even after consideration of 24x7 PFA requirement, the state will have a surplus of about 10.4% to 2.43% in terms of peak demand during the period FY 2015-16 to FY 2018-19. During the same period, the state will also have availability of surplus energy in the range of 1.37% to 3.39% except during FY 2015-16 in which the state will have energy deficit of about 4.91%. Therefore, the Kerala state will remain as power surplus state during the entire study period (i.e. from FY 2016-17 to FY 2018-19) having surplus in both peak power and energy availability. As the state generation is heavily dependent on hydro & RES sources (about 38.51% to 47.25% during the study period), the above surplus scenario may change slightly on year to year basis depending upon monsoon scenario in the state.

In poor monsoon years, the availability of energy from Hydro Power Plants shall also be poor. In order to mitigate the above situation Government of Kerala (GoK) would have to effectively plan through comprehensive power procurement initiatives on short term basis and look for procurement of power either through



competitive bidding or through other sources. On the other hand, in the years of above-average / good monsoon scenario, the availability of surplus energy from Hydro Power Sources shall increase especially in view of low agricultural load in State of Kerala (less than 2%). Under such situation, the state is required to firm up plan for export of surplus energy to those states which face power deficit during that period and in turn, the state of Kerala may earn revenue. Further, the peak power & energy requirement of the State can also be effectively reduced through proper implementation of DSM & energy efficiency measures in the state.

Kerala is bestowed with huge hydro power potential by way of plentiful of rain and many rivers. However, out of the estimated hydel potential of about 6000 MW, only about 2040 MW have been harnessed so far in the state due to denial of environmental and forest clearances. MOE&F should consider the need to explore the possibilities of granting various clearances / approvals etc. to the hydro projects in the State.

State's experiment with liquid fuel /naphtha based stations have not yielded desired results as the installed capacity of these stations remained underutilized due to the prohibitive fuel costs. Around 750 MW of power is not being scheduled to meet the power requirement of the state. There is an urgent need for converting these liquid fuel / naphtha based stations into natural gas based station. Govt. of Kerala (GoK) expects that domestic gas at administered price shall be provided by GoI to meet minimum 60% of the natural gas requirement for the projects.

ADEQUACY OF TRANSMISSION NETWORK

The state is well served by a network of Inter-state transmission lines at 400 kV, 220 kV levels and the existing ISTS transmission system capacity is adequate for meeting the present power requirement.

In ISTS system, Power Grid Corporation of India Limited (PGCIL) & Kerala State Electricity Board (KSEBL) have already undertaken/ planned a

number of transmission works for further strengthening & augmenting the capacity and to ensure better connectivity of Kerala Grid with National Grid for meeting the projected power demand of Kerala by FY 2018-19 for 24x7 PFA in the state. The existing combined Transformation capacity of PGCIL & KSEBL at 400/220 kV level is 3150 MVA and the same shall be increased to 6355 MVA by FY 2018-19. Keeping in view the power evacuation of about 3200 MW by FY 2018-19 at 220 kV and below level within the state, the capacity addition plan as envisaged is adequate to meet the projected power demand of 4821 MW by FY 2018-19.

The total existing Intra state transmission capacity at 220 kV level is 5732 MVA which can comfortably cater to the maximum demand of 3760 MW of the state during FY 2014-15. The same shall be increased to 11632 MVA which would be adequate to take care of maximum power demand of 4821 MW of the state by FY 2018-19 to cater 24x7 PFA requirements.

The capacity addition in Intra-state transmission system has been planned with an investment of 2517.15 Crores from FY 2015-16 to FY 2018-19 to meet the requirement of 24x7 PFA.

ADEQUACY OF DISTRIBUTION NETWORK

Power distribution in the State is handled by KSEBL along with nine other distribution licensees (detail given in distribution chapter). For operational conveniences, distribution wing is divided into three zones namely South, Central and North. It served about 111.92 Lakhs of electricity consumers in the state, out of which there is about 4.63 Lakhs consumers are under agriculture category in FY 2013-14. As per the survey undertaken by the state, still there are about 4,81,022 un-electrified households in the state which are proposed to be electrified during next two (2) financial years. There is no separate agriculture feeder hence all feeders emanating from power substation are being given supply with 24 hrs electricity.



Distribution sector in the state is being augmented through RAPDRP/ RGGVY schemes of GOI and other state schemes. R-APDRP, Part-A is under implementation in 43 Towns with total outlay of Rs. 214.38 Crores. R-APDRP, Part-B, with total estimated cost of Rs. 1078.30 Crores is under implementation in 43 towns.

The state has proposed a requirement of capital expenditure of Rs 1720.90 Crores in DDUGJY against which DPR cost approved by Monitoring Committee is Rs. 485.37 Crores for connecting the unconnected households, metering, System Strengthening & Sansad Adarsh Gram Yojana and under IPDS scheme Rs. 597.46 Crores for metering, 24x7 power supply, Reduction of AT & losses, roof top solar & miscellaneous items. The DPR sanctioned cost of project for IPDS is Rs. 597.46 Crores.

Keeping in view the existing & proposed capacities at sub-transmission and distribution level, the system would be adequate to meet the projected load of the state by FY 2018-19.

AT&C losses in the state are targeted to be decreased to 10% in FY 2018-19 from 10.80% in FY 2014-15 as per loss trajectory committed to MoP by the state.

FINANCIAL POSITION

KSEBL is a combined entity for generation and distribution in whole Kerala. After unbundling

of the erstwhile Kerala State Electricity Board (KSEBL) in October 2013, Govt. of Kerala revested all the assets & liabilities of the Board in new Company i.e KSEBL. The Govt of Kerala issued the final transfer scheme by issuing a new balance sheet for KSEBL as on 01.11.2013. The last reported profit as per provisional financial statements of the Board (from 01.04.2013 to 31.10.2013) was Rs 140.41 Crores with accumulated profit of Rs 2348.74 Crores. However after taking over the assets & liabilities of the board by KSEBL with a revised value, KSEBL reported loss of Rs 29.46 Crores for the period 01.11.2013 to 31.03.2014 making its accumulated loss of Rs 32.73 Crores as on 31.03.2014 (as per provisional accounts of 2013-14).

Various scenarios have been worked out in order to assess the viability of the scheme considering the new investments from FY 2015-16 to FY 2018-19 and parameters like AT&C loss reduction trajectory, purchase price of power & other expenses and average billing revenue as per the Annual Accounts. The viability in all the scenarios is possible only through tariff hikes in the range of 4% to 6%.



Providing access to electricity on 24x7 basis to all its citizens and other consumers means much more than merely an act of providing connectivity. It can bring in radical changes in socio-economic profile of the state and thus this issue has acquired significant dominance on the national as well as state agenda. Endeavour to perk-up the growth in electricity consumption to stay in pace with national/global benchmark, therefore, are to be taken up with top most priority.

Under the Indian Constitution, electricity is a concurrent subject and distribution of electricity falls under the purview of the respective State Government/State Power Utility. As per Electricity Act 2003, it is the duty of a distribution licensee to develop and maintain an efficient, co-ordinated and economical distribution system in his area of supply and to supply electricity in accordance with the provisions contained in the Act. The State Electricity Regulatory Commission (SERC) have to specify and enforce standards with respect to quality, continuity and reliability of service by licensees. Accordingly, State Electricity Regulatory Commissions (SERCs) have notified the Standards of Performance specifying maximum allowable time for restoration of supply due to forced breakdowns and Supply Code specifying the supply voltages & frequency etc, to be followed by Discoms. SERCs also monitor the performance of distribution companies on the basis of notified Performance of Standards.

OBJECTIVES OF THE 24X7 POWER FOR ALL – JOINT INITIATIVE

To supplement the efforts of State Government, Government of India and Government of Kerala have taken a joint initiative to provide 24x7 power in the state to all consumers. The hours of adequate supply to agriculture consumers will be decided by the state Government. This initiatives aims at ensuring uninterrupted supply of quality power to existing consumers and providing access to electricity to all unconnected/upcoming consumers by FY 2018-

19. The initiative of 24x7 Power supply to all encompasses mainly the following:

- i. To provide reliable & quality 24x7 power supply to the existing consumers in a phased manner within a period of three years from the date of commencement of the programme.
- ii. All unconnected households to be provided access to electricity in a time bound manner ultimately by FY 2018-19. States have the liberty to hasten the process by taking speedy steps, if required.
- iii. To ensure adequate capacity addition planning & tie ups for power from various sources at affordable price to meet the projected increase in power demand for future in a cost effective manner.
- iv. To strengthen the Transmission and Distribution network to cater to the expected growth in demand of existing as well as forthcoming consumers.
- v. Monitoring the timely commissioning of various generating plants, transmission and distribution infrastructure projects to meet the expected growth in demand.
- vi. To put in place a strategy to ensure reduction of AT&C losses as per the agreed loss reduction trajectory and methodology & steps required to be taken at every level of distribution.
- vii. Overall Power Supply Improvement – To be achieved by undertaking measures such as energy mix optimization, reduction in power operational in-efficiency of state generation plant(s) and optimal fuel procurement policy.
- viii. To take financial measures including investment rollout plans and undertaking necessary balance sheet analysis to assess the financial strength/weaknesses in the utility finances.



- ix. To introduce modern technologies to monitor reliable supply like sub-station automation, providing adequate communication infrastructure, GIS, reliability, centralized network analysis and planning tools, SAP driven ERP systems, DMS (Distribution Management Systems), OMS (Outage Management System), etc.
- x. To take essential measures for meeting the performance standards as laid down by SERC.

An Action plan would be drawn to achieve the above aims and objectives. The plan will be executed by the State Government with the support of Government of India, wherever necessary, as per their approved plans, schemes and policies. This joint initiative of Government of India and Government of Kerala aims to enhance the satisfaction levels of consumers, improve the quality of life of people, and increase the economic activities resulting into inclusive development of the state.

METHODOLOGY FOR PREPARATION OF THE ACTION PLAN FOR 24X7 POWER FOR ALL

Accordingly the methodology adopted to prepare the 'Action Plan' for 24x7 PFA includes inter-alia:

- 1) Projection of average per day consumption of rural and urban households based on respective historical compounded annual growth rates (CAGR) during the past years and also considering the aspirational growth perspectives as decided in consultation with state.
- 2) Projection of demand of consumers encompassing commercial, industrial, agricultural and remaining consumers has

been carried out under others category based on past data and historical CAGR of these categories recorded for the state during the past years after discussing the same with state and factoring in the growth perspectives in these sectors of state economy.

- 3) Assess the power requirement of un-electrified households and draw up a time bound plan for electrification of all households.
- 4) Project the annual energy requirement and maximum demand by aggregating the requirement of all consumer categories and applying an appropriate load factor.
- 5) Prepare a broad plan to meet power demand in future through additional generation capacity proposed in the state and quantum for additional procurement required.
- 6) Assess the financial implications on utilities for procuring additional energy to meet the energy requirement of all segments of consumers. Assess the adequacy of the network - both inter-state and intra state transmission as well as distribution so as to meet the projected power requirement of all consumer categories of the state.
- 7) Conduct sensitivity analysis on various parameters namely average selling price of energy, AT&C loss reduction, etc to their impact on viability.
- 8) Set monitorable targets to achieve the goal of providing 24x7 PFA in a cost effective manner to the consumers of the State.



CHAPTER – 2: FACTS ABOUT KERALA



Kerala is the 22nd largest state with an area of 38,863 km² and the 13th largest by population (as per census 2011) with total population of 33,406,061 (16,027,412 male and 17,378,649 female). Kerala boasts to have highest Human Development Index (HDI) in the country being 0.79 according to the Human Development Report (2011). It is also known for its highest literacy rate; 93.91%, highest life expectancy; 77 years and the highest sex ratio; 1,084 women per 1000 men. It is bordered by Karnataka to the north and north east, Tamil Nadu to the east and south, and the sea to the west with Thiruvananthapuram as its capital. Kerala has coastline of 595 kilometres and forest area of 9,400 km², which is 24% of its geographical area.

The brief profile of the Kerala state is as follows:

Table-2.1

Brief Profile of Kerala

Sl. No.	Particular	Unit	Value
1.	Area	Sq. Km	38863
2.	Population (Persons as per 2011 census)	Nos.	3,34,06,061
	- Rural	Nos.	1,74,71,135
	- Urban	Nos.	1,59,34,926
3.	Per Capita income	Rs.	103820*
4.	No. of Districts	Nos.	14
5.	State GDP growth rate (2013-14)	%	13.14%
6	Total electrified rural household- FY 2014-15(State data)	Nos.	4005554

Sl. No.	Particular	Unit	Value
7	Total electrified urban household- FY 2014-15 (State data)	Nos.	3729925

* Ministry of Informatics & Programme Implementation

** Other source is Wikipedia

On state wise installed capacity Kerala stands at 16th position with approx. 1.66% of total installed capacity in the country. Kerala State Electricity Board Limited (KSEBL) is the single power entity looking after generation, transmission & distribution in the state. KSEBL has pioneered modern concepts in developing an adequate transmission network for transferring power from power stations to the local load centers. The major power consuming sector being the domestic sector puts KSEBL in a critical situation while planning their expenses for augmentation and providing subsidies to the consumers.

The state power scenario portrays satisfactory situation as it has reduced its peak shortage and energy shortage during the last year.

On the connectivity front, as per state data, the state still has around 4.81 lakhs un-electrified households which are proposed to be electrified by FY 2016-17. The connectivity data of state are at a variance with Census 2011 data and projections thereof. Nevertheless, state has re-confirmed the validity of its current data and therefore, the same has been considered for the report purpose.

Though state has reported unconnected households in rural areas, however it has also reported supplying 24 hours power supply to all the electrified households - Rural as well as Urban without any discrimination.

CHAPTER – 3: CONSUMPTION PATTERN AND ELECTRIFICATION STATUS

As per Census 2011 data, there were about 77.16 lakhs households in the state, out of which 40.95 lakhs were in rural areas and balance 36.21 lakhs were in urban areas. Out of 40.95 lakhs rural households, 37.72 lakhs (92.1%) were electrified and balance 3.23 lakhs (7.9 %) were un-electrified. In urban areas, out of total of 36.21 lakhs households, 35.13 lakhs (97.01%) were electrified and balance 1.08 lakhs (2.99 %) were un-electrified. Kerala registers commendable track record in terms of electrification with around 94.41% households as electrified. The details are at Annexure-II.

While planning for future electrification, certain projections have been made. The projection of

total number of households to FY 2014-15 has been carried out based on census figures of 2011 and considering CAGR of the past 10 years. However, the arrived figures have also been compared with state data. The comparison leads to certain anomalies in the data pertaining to no. of rural and urban households, electrified households etc. as compared to state furnished data. The issue has been thoroughly discussed with the state authorities who endorsed the state data as correct stating that state data is collected by their civil supply establishment and therefore the latest data of the state has been finally considered for projecting the future household consumption and other purposes for this report.

The details of households in the State of Kerala based on Census figures and as per GoK are shown hereunder :

Table-3.1

No. of Households in Kerala in FY 2014-15

Particulars	Census 2001	Census 2011	CAGR	As projected from Census figures	As per State	Finally Adopted
Total Households	6595206	7716370	1.58%	8753962	8216501	8216501
Rural Households	4942550	4095674	-1.86%	3799051	4361132	4361132
Urban Households	1652656	3620696	8.16%	4954911	3855369	3855369
Total Electrified Households	4632722	7284706	4.63%	9093092	7735479	7735479
Rural Electrified H/H	3238898	3772137	1.54%	4009254	4005554	4005554
Urban Electrified H/H	1393823	3512569	9.68%	5083839	3729925	3729925
Total Un-electrified H/H	1962484	431664			481022	481022

Based on the above, there are about 77.4 lakhs electrified households in the state (Rural 40.1 lakhs and Urban 37.3 lakhs). The state still has total 4.81 lakhs un-electrified households. In FY 2013-14, out of the total consumption in the state, domestic category of consumers consume about 50.07%, commercial 12.77%, industrial 29.40% and agricultural around 1.78%. The category wise growth in consumers from FY

2009-10 to FY 2014-15 is furnished in Annexure-I.

Load Projection

Based on the total household consumption data provided by state, present per household per day consumption has been assessed as 3.32 units/ day as shown in Table-3.2.

Table-3.2**ESTIMATION OF EXISTING PER HOUSEHOLD CONSUMPTION**

Sl. No.	Particulars	Unit	As per State data (FY 2014-2015)
1	Total Households in State	Nos.	8216501
2	Total Urban Households	Nos.	3855369
3	Total Rural Households	Nos.	4361132
4	Total Electrified Households	Nos.	7735479
5	Total Electrified Households - Urban	Nos	3729925
6	Total Electrified Households - Rural	Nos	4005554
7	Balance Un-electrified Households	Nos.	481022
8	Balance Un-electrified Households - Urban	Nos.	125444
9	Balance Un-electrified Households - Rural	Nos.	355578
10	Annual energy sold in the State during FY 2014-15	MU	18426
11	Annual Domestic energy sold in the state during FY 2014-15	%	50.87
12	Annual Domestic energy sold in the State during FY 2014-15	MU	9373
13	Average Annual Energy Consumption per household during FY 2014-15	kWh	1212
14	Average Daily Energy Consumption per household during FY2014-15	kWh	3.32

The daily per household consumption as worked out above has been considered for projection of Annual energy requirement in the state from FY 2015-16 to FY 2018-19.

CHAPTER – 4: DEMAND AND SUPPLY SCENARIO

Kerala has well managed the power situation in the State resulting into holding its peaking shortage in the range of -0.84% to -3.60% during the period from FY 2011-12 to FY 2014-15.

The Power Supply Scenario in Kerala (as per state data) from the FY 2009-10 to FY 2014-15 is as under:

Table-4.1

Power Supply Scenario

Period/Items	Unit	FY 2009-10	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Peak Demand at state periphery	MW	2998	3119	3473	3298	3588	3727
Peak Met	MW	2998	3119	3348	3268	3558	3602
Peak Deficit (-)/ Surplus (+)	MW	0	0	-125	-30	-30	-125
Peak Deficit (-)/ Surplus (+)	%	0	0	-3.60	-0.91	-0.84	-3.35
Energy Requirement at state periphery	MU	17350	17808	19521	20736	21264	22040
Energy Availability at state periphery	MU	17036	17470	19140	19876	21940	21925
Energy Deficit (-)/ Surplus (+)	MU	-314	-338	-381	-860	676	-115
Energy Deficit (-)/ Surplus (+)	%	-1.81	-1.90	-1.95	-4.15	3.18	-0.52

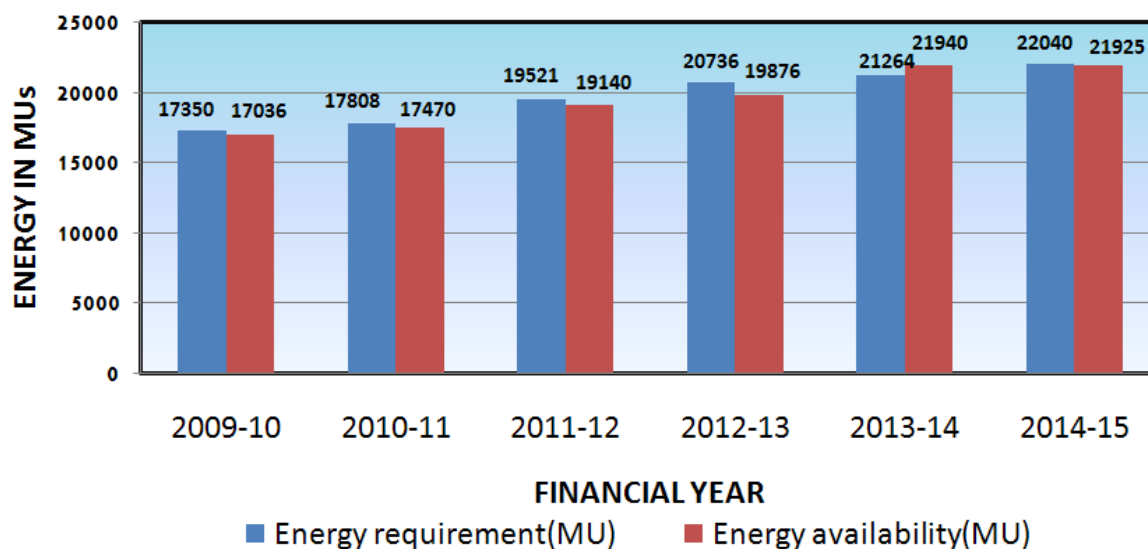
Source: State Power Utilities.

The Kerala's power situation is largely dependent on Monsoon owing to sizeable Hydel capacity which explains the variations in demand supply scenario.

of consumers as well as energy availability in the state have grown at almost same Compound Annual Growth Rate (CAGR) of 4.9% and 5.2% respectively based on data from year FY 2009-10 to FY 2014-15 furnished by state.

The energy requirement including all categories

Energy requirement and availability



The base year for the purpose of beginning the future assessment has been considered as FY 2014-15 which has an aggregated demand of 22.0 Billion Unit (BU).

Demand Estimation Methodology

For the purpose of estimation, power consumers have been broadly classified into the domestic consumers and others (commercial, industrial, agriculture etc.). The demand projection has been done taking into account the demand for 24x7 power supply under following heads:

- a) Demand growth to a targeted value for already electrified households (both Urban and Rural).
- b) Demand growth expected from electrification of un-electrified households (both Urban and Rural).
- c) Demand arising from electrification of newly constructed Household (both Urban and Rural).
- d) Demand on account of consumers “other than domestic” including agricultural consumers.

Considering the expected growth of electrification in the state in the coming years, all the un-electrified households have been considered to be brought under electrification by the year FY 2016-17.

The assumptions for projection of demand under different categories are enumerated below:

- Based on the total energy consumption data provided by GoK, present (FY 2014-15) per household consumption has been assessed as 3.32 units/day.
- Energy requirement for all households have been computed based on the latent demand growth observed in past. The daily per household consumption is estimated to increase from the current levels of 3.32 units/day to 4.35 units/day by FY 2018-19.
- Demand projections for consumers “other than domestic” category have been done

based on average combined CAGR of these categories as observed in the past (FY 2008-19 to FY 2014-15) and also discussing the growth perspectives of these segments with state authorities. Accordingly, 6% constant growth in energy requirement per annum has been taken keeping in view the growth in industrial & commercial activities due to assured power availability.

PROJECTIONS OF ANNUAL ENERGY REQUIREMENT OF THE STATE

The annual energy requirement at the state periphery works out to be around 23.8 BU in FY 2015-16 which is scaling up to around 29.6 BU in FY 2018-19 after considering the following :

a) Demand of already electrified households

The annual energy consumption for existing household works out to be 12.29 BU in FY 2018-19.

b) Demand from electrification of un-electrified households

According to the state data, the state has 4.81 lakhs un-electrified households. These households are envisaged to be completely electrified by FY 2016-17. The annual energy consumption for un-electrified households after electrification works out to 0.764 BU in FY 2018-19.

c) Demand from electrification of newly constructed households

To account for energy requirement of new houses which are likely to come up in the coming years, projection has been done considering CAGR of 1.58% (census of 2001 & 2011) on total number of households in the state. The total projected energy consumption of this category works out to 0.846 BU in FY 2018-19.

d) Demand on account of users other than domestic consumers.

The annual energy requirement for other than domestic consumers has been



calculated from past data and after discussion with State officials assuming that such segment of consumers are expected to grow at a constant CAGR of 6% per annum. The energy consumption of

“other than domestic” consumers works out to be 11.43 BU in FY 2018-19.

The summary of energy calculation during the next four years is given in the table hereunder.

Table-4.2

SUMMARY OF ANNUAL ENERGY REQUIREMENT PROJECTIONS (in MU)

Sl. No.	PARTICULARS→ ↓	YEARS			
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
1	Annual Energy Requirement including additional energy requirement for existing electrified households	10029	10731	11483	12286
2	Annual Energy Requirement for Electrification of un-electrified Household	312	667	714	764
3	Annual Energy Requirement for newly constructed Household	169	364	588	846
	TOTAL DOMESTIC	10510	11762	12785	13896
4	Annual Energy Requirement including additional energy requirement - Other than Domestic Consumers (with 6% growth P.A.)	9596	10172	10782	11429
	GRAND TOTAL	20106	21934	23567	25325

Annual energy requirement at state periphery

The table below showcases values of projected energy requirement at the state periphery

considering distribution losses and intra-state transmission loss trajectory as informed by state for the FY 2015-16 to FY 2018-19.

Table-4.3

ANNUAL ENERGY & PEAK DEMAND REQUIREMENT AT STATE PERIPHERY

Year	Unit	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Energy requirement as per demand projections	MU	20106	21934	23567	25325
Distribution losses*	%	10.50%	10.25%	10.00%	10.00%
Intrastate transmission losses**	%	5.70%	5.60%	5.50%	5.00%
Energy requirement at state periphery	MU	23822	25889	27709	29620
Peak Demand at 70.13%# Load Factor (LF)	MW	3878	4214	4510	4821

*As per AT&C loss trajectory decided by MOP

**Derived from T&D loss trajectory informed by state.

#As per State.



The load factor of 70.13% has been considered based on the data provided by state.

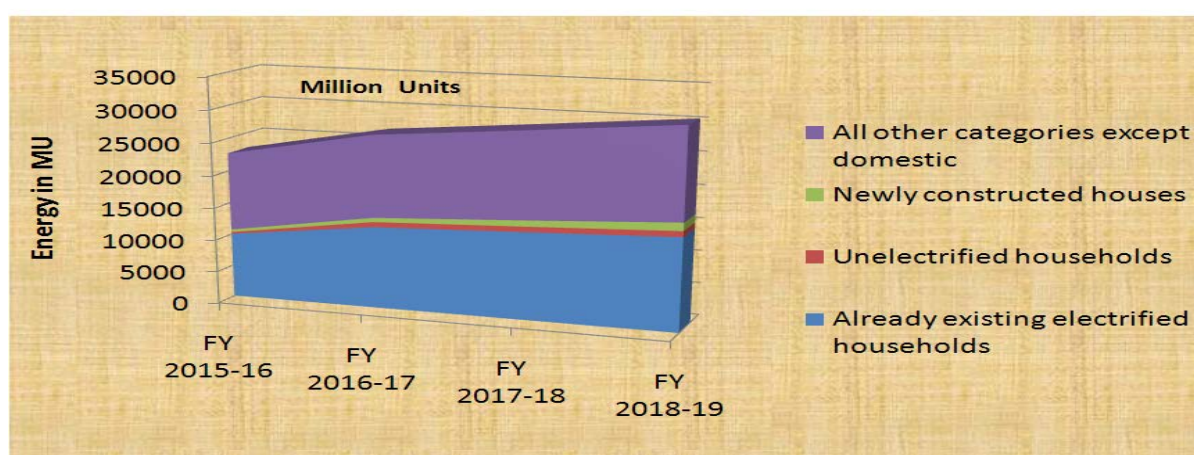
The detailed calculation of energy demand under different categories is given at Annexure-III.

In accordance with the steps followed above, the total energy requirement at consumers end is estimated as 25.3 BU which corresponds to 29.6 BU at state periphery (considering the T&D loss trajectory as indicated by state) for all

categories of consumers by FY 2018-19. Accordingly, the maximum demand requirement of the state is projected to increase to around 4821 MW by FY 2018-19.

As per projections made in 18th EPS of CEA, the projected energy demand and peak load for the state of Kerala would be 29.6 BU and 5198 MW respectively in FY 2018-19 as against the now calculated energy demand of 29.6 BU (0%) and peak load of 4821 MW (-7.25%) in FY 2018- 19.

Projected annual energy requirement at state periphery



As against energy demand of 29.6 BU in FY 2018-19 at the state periphery, the energy availability projections from all possible sources as per State Plan by FY 2018-19 works out to 30.7 BU (shown in next chapter) indicating a surplus of 1.1 BU.

The adoption of various energy efficiency measures like energy efficient lighting (use of LEDs), adopting demand side management initiatives like introduction of Time of Day

(TOD) tariff etc., or by adopting accelerated AT &C loss reduction targets would help in further reducing the peak demand and energy requirement of the state.

However, an assessment of the adequacy of Generation, Transmission and Distribution infrastructure vis-a-vis the projected demand by FY 2018-19 has been made in the subsequent chapters.

The generation plan will ensure adequate capacity addition planning & tie ups for power from various sources at affordable price to meet the projected increase in power demand for future. The generation plan includes:

- Existing Generation
- Future Generation Plans (Projects under construction and future projects)
- Year-wise capacity addition plan from renewable source (separately for Solar, Wind, Small Hydro Power (SHP) & Biomass, etc.)
- Generation capacity required to meet Peak Demand
- Power procurement costs
- Fuel Requirement
 - Domestic Gas allocation requested
- Action plan of the state
- Fund Requirements
- GoI/ State Govt. Interventions

Existing Generation Capacity / Availability of Power (As on 31.03.15)

Total generation capacity / availability of power as on 31.03.2015 for the state of Kerala is 4413 MW. Out of total 4413MW, 43.37 % is from Hydro, 31.71 % is from Coal based Thermal, 12.20% is from Gas Based Thermal , 3.62% is Diesel Based Thermal, 5.21% from Nuclear and balance 3.89 % is from Renewable Energy Sources.

In terms of ownership, the State Sector has the largest share of 49.56 %, followed by share of Central Sector Allocation which is 44.84 %. The share of Private Sector / IPPs is 5.60%. The details of existing generating capacity available for the state of Kerala are shown in Table 5.1 below:

Table-5.1

Existing Generation Capacity / Availability of Power (As on 31.03.15)

Ownership/ Sector	Mode-wise Break up (MW)							Grand Total (MW)
	Thermal				Nuclear	Hydro	RES & NRSE (MNRE)	
	Coal	Gas	Diesel	Total				
State	0.00	0.00	159.96	159.96	0.00	1913.75	113.43	2187.14
Private/ IPPs	10.00	178.90	0.00	188.90	0.00	0.00	58.01	246.91
Central	1389.39	359.58	0.00	1748.97	229.85	0.00	0.00	1978.82
Total :	1399.39	538.48	159.96	2097.83	229.85	1913.75	171.44	4412.87

Future plan for augmentation of generation capacity / availability of power:

As per generation plan of State of Kerala, capacity of around 2332.75 MW is expected to be added by FY 2018-19 (from new projects as well as from allocation from Central Sector and IPP Projects). Out of this, 822.40 MW shall be added through non-conventional energy sources

and balance 1510.35 MW through conventional sources. As such the total available capacity by FY 2018-19 is expected to be 6745.62 MW (5751.78 MW– conventional and 993.84 MW – Renewable).

Year wise Summary of Generation Capacity / Availability of Power, upto FY 2018-19 is indicated in Table-5.2 below:

Table -5.2

Particulars	Year wise Existing & Likely Capacity to be added (MW)-Cumulative				
	As on March 2015	As Planned			
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
State Sector					
• Thermal	159.96	159.96	199.96	199.96	199.96
• Hydro (Renewable)	1,913.75	1,908.75	1,908.75	1,908.75	2,008.75
• RES (MNRE)	113.43	139.13	233.63	406.83	543.83
Private/IPPs					
• Thermal	188.90	836.00	1,260.25	1,481.75	1,481.75
• Hydro (Renewable)	0.00	0.00	0.00	0.00	0.00
• RES (MNRE)	58.01	58.01	63.01	301.61	348.01
Central Generating Station					
• Thermal	1,748.97	1,942.07	1,655.47	1,655.47	1,655.47
• Hydro (Renewable)	0.00	0.00	0.00	0.00	0.00
• RES (MNRE)	0.00	0.00	0.00	50.00	102.00
• Nuclear	229.85	362.85	405.85	405.85	405.85
Total :	4,412.87	5,406.77	5,726.92	6,410.22	6,745.62

Break up & details of capacities likely to be added year wise is indicated in Annexure- IV.

Peaking & Energy Availability to Meet Peak & Energy Demand

Year wise peaking power availability has been worked out based on the peaking availability & auxiliary power consumption norms of each plants as per National Electricity Plan (Vol-I) for 12th five year Plan as well as the data provided by the state. However for wind power plant, 8% peaking availability has been considered for estimation of Peak demand. As per the state, solar does not contribute in the peak which is

occurring at night. Hence 0% peaking availability has been considered for solar. Further, as per state data only 20% of the small hydro capacity of the state contributes in the peak. Similarly the energy availability in each year has also been worked out based on the PLF & auxiliary power consumption norms of each plant as per National Electricity Plan and as per the information made available by the State. The availability of peaking capacity and energy availability have been worked out up to FY 2018-19 and shown in Table 5.3 below:

Table-5.3

Sl. No.	Particulars	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
1	Total Capacity (MW)	5,407	5,727	6,410	6,746
2	Estimated Peak Availability at State Periphery (MW)	4,328	4,585	4,833	4,941
3	Estimated Energy Availability at State Periphery				
	Energy from all sources (MU)	22,708	26,597	28,093	30,658
	Energy from Renewable sources(MU)	537	627	1336	1769

Based on the deliberation in the previous text, the scenario in the state emerges as shown in the Table-5.4a below.

It could be seen from Table 5.4a that the peak demand of Kerala would be about 4821 MW by FY 2018-19 considering the additional power requirement for providing 24x7 power supply

to the state. The expected energy requirement at state periphery for FY 2015-16 is about 23822 MU which is likely to increase to 29620 MU by FY 2018-19. It is also observed from Table 5.4a that the state will have a surplus of about 2.43% to 10.40% in terms of peak demand during the period FY 2015-16 to FY 2018-19. During the same period, the state will also have availability

of surplus energy in the range of 1.37% to 3.39% except during FY 2015-16 in which the state will have energy deficit of about 4.91%. Therefore, the Kerala state will remain as power

surplus state during the period from FY 2016-17 to FY 2018-19 having surplus in both peak power and energy availability.

Table-5.4a

S. No	Power Supply Position	Unit	Year wise Figures			
			FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
1	Estimated Peak Requirement at state Periphery (MW)	MW	3878.00	4214.00	4510.00	4821.00
2	Estimated Availability of Peak/ Maximum Demand as per State Generation Plant	MW	4328.25	4585.00	4832.56	4940.85
3	Peak Surplus (+)/Deficit(-)	MW	450.25	371.00	322.56	119.85
4	Surplus(+)/Deficit(-)	%	10.40	8.09	6.67	2.43
5	Estimated Energy Requirement at State Periphery	MU	23822.00	25889.00	27709.00	29620.00
6	Estimated Energy Availability at State Periphery as per State Generation Plan	MU	22708.14	26596.99	28092.88	30658.18
7	Energy Surplus (+)/ Deficit(-)	MU	-1113.86	707.99	383.88	1038.18
8	Energy Surplus (+)/ Deficit(-)	%	-4.91	2.66	1.37	3.39

As the state generation is heavily dependent on hydro & RES sources (about 38.51% to 47.25% during the study period), the above surplus scenario may change slightly on year to year basis depending upon monsoon scenario in the state.

In poor monsoon years the availability of energy from Hydro Power Plants shall also be poor. In order to mitigate the above situation GoK would have to effectively plan through comprehensive power procurement initiatives on short term basis and look for procurement of power either through competitive bidding or through other sources. On the other hand, in the years of above-average / good monsoon scenario, the availability of surplus energy from Hydro Power

Sources shall increase especially in view of low agricultural load in State of Kerala (less than 2%). Under such situation, the state is required to firm up plan for export of surplus energy to those states which face power deficit during that period and in turn, the state of Kerala may earn revenue. Further, the peak power & energy requirement of the State can also be effectively reduced through proper implementation of DSM & energy efficiency measures in the state.

The generation mix as per the proposed generation plan of the state is shown in Table-5.4b.

Table -5.4b

Generation Mix

Sl. No.	Description	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
a.	Thermal	47.54%	54.34%	54.40%	52.06%	49.47%
b.	Hydro (Renewable)	43.37%	35.30%	33.33%	29.78%	29.78%
c.	RES (MNRE)	3.89%	3.65%	5.18%	11.83%	14.73%
d.	Nuclear	5.21%	6.71%	7.09%	6.33%	6.02%

Issues Regarding Generation & Fuel availability Plan:

• MOE&F Clearance for hydroelectric projects:

Kerala is bestowed with huge hydro power potential by way of plentiful of rain and many rivers. As if acted upon by nature's balancing mechanism, the State is devoid of any fossil fuel reserves. It is estimated that the vast hydro power potential can take care of the power needs of the state for many decades to come. However, out of the estimated hydel potential of about 6000 MW, Kerala could harness only about 2040 MW so far. Only two major projects with substantial storage capacity viz. Idukki (780 MW) and Sabarigiri (300 MW) could be accomplished so far.

Even though many other large capacity hydroelectric power projects were being formulated, these could not be developed due to denial of environmental and forest clearances. With the enactment of the Forest Conservation Act in 1980, the situation had become worse and even the medium capacity projects had to be shelved. Some of the major hydroelectric power projects, which were denied environmental clearance, are 240MW plant each at Silent Valley & Pooyamkutty, 100MW Pathrakkadavu and 163 MW Athirappally. All the proposed hydro power projects in Kerala can come up only in the Western Ghats, which is declared as a biodiversity hotspot by IUCN (International Union for Conservation of Nature).

Early clearance to the above projects by the Ministry of Environment & Forests is needed to implement the project without further delay.

• Under utilization of LSHS/naphtha based power stations:

Facing difficulty in developing more hydro power projects, the state was forced to experiment with liquid fuel/naphtha based stations to meet the soaring demand for power, as there were no other alternatives before the government. But this also ended up in disaster as the installed capacity of these stations are remaining underutilized due to the prohibitive fuel costs. The per-unit cost of power from these projects is to the tune of Rs.13/- and thus around 750 MW of power is not being scheduled to meet the power requirement of the state.

Thus, there is an urgent need for converting these liquid fuel/naphtha stations into natural gas based station. However, economic operation of these plants is not possible without ensuring adequate amount of domestic gas at controlled price. Government of India may provide domestic gas at administered price to Kerala to meet minimum 60% of the natural gas requirement for the projects (namely 360MW RGCCPP of NTPC at Kayamkulam, 157 MW BKPL plant of BSES at Kochi, state owned 128MW KDPP at Kozhikode & 107MW BDPP and 400MW new proposed plant at Brahmapuram under the ownership of the state utility) proposed to be converted from liquid fuel/naphtha. The natural gas requirement for the above power stations is as given in table 5.5 below:

Table 5.5

Gas Requirement for Conversion of LSHS/Naphtha Based Power Stations into Gas Based Stations

Project	Present fuel	Capacity (MW)	Gas requirement @ 85 PLF
Brahmapuram Diesel Power Plant (BDPP)	LSHS	107	3.4 MMSCMD
Kozhikode Diesel Power Plant(KDPP)	LSHS	128	
RGCCPP, Kayamkulam (NTPC)	Naphtha	360	
BSES, Kochi	Naphtha	157	
Total :		752	3.4 MMSCMD (0.95 MTPA)

Note: For proposed New 400 MW gas based power station at Brahmapuram (to be commissioned after FY 2018-19) about 1.8 MMSCMD (0.5 MTPA) natural gas will be required.



- **Underutilization of the plant assets of 360 MW RGCCPP of NTPC at Kayamkulam:**

Rajiv Gandhi Combined Cycle Power Project (RGCCPP) of NTPC at Kayamkulam shall be a cause of worry for the whole nation. The infrastructure including land available at this station is sufficient to generate a minimum of 2500MW of power. First unit of 360 MW naphtha based power plant at this site was commissioned on 02.06.1998. The cost of naphtha has increased ever since in leaps and bounds and the plant has been grossly underutilized due to the exorbitant cost of generation. As per the original agreement, fuel of the plant is to be changed to gas and the installed capacity shall be increased as and when natural gas is made available. But soon after the commissioning of re-gasification terminal at Kochi, NTPC approached participants in the southern grid to share power based on natural gas from the proposed expansion project of RGCCPP. However, the same was turned down later citing uneconomic

cost of generation due to high and uncertain RLNG prices. The conversion of naphtha based unit to natural gas and expansion of the plant being at stake, GoK proposed pooling of energy cost of existing RGCCPP unit with that of other thermal stations of NTPC as an immediate solution to avoid wastage of invaluable assets. There is sound reasoning behind the request to pool the cost of generation of RGCCPP with other thermal stations of NTPC, at least in the Southern grid, so that 360 MW shall be continuously available in the energy deficient region at the cost of an insignificant increase in the unit price of energy from other stations in the pool.

ACTION PLAN – STATE

To complete the generating capacities of State and to monitor the Central Sector & Private Sector Projects as per following Roll out Plan given in Table- 5.6:

Table -5.6

Sl. No	Power For All (Roll Out Plan)	Year wise Addition (MW)				Total (MW)
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
A.	State Sector					
a.	Thermal	0.00	40.00	0.00	0.00	40.00
b.	Hydro (Renewable)	-5.00	0.00	0.00	100.00	95.00
c.	RES (MNRE)	25.70	94.50	173.20	137.00	430.40
B.	Private Sector					
a.	Thermal	647.10	424.25	221.50	0.00	1,292.85
b.	Hydro (Renewable)	0.00	0.00	0.00	0.00	0.00
c.	RES (MNRE)	0.00	5.00	238.60	46.40	290.00
C.	Central Generating Station					
a.	Thermal	193.10	-286.60	0.00	0.00	-93.50
b.	Hydro (Renewable)	0.00	0.00	0.00	0.00	0.00
c.	RES (MNRE)	0.00	0.00	50.00	52.00	102.00
d.	Nuclear	133.00	43.00	0.00	0.00	176.00
	Total	993.90	320.15	683.30	335.40	2,332.75

The state is required:

- To firm up plan to reduce the peak demand and energy demand through demand side management and by adopting energy efficiency measures.
- To firm up plan for export of surplus energy (whenever available with the State) to states facing power deficit and earn revenue. Alternatively, the surplus energy can be banked with other states having large demand during monsoon season due to heavy agricultural load. This banked energy can be used by the State of Kerala to mitigate the deficit scenario encountered due to poor availability of energy from hydro power during years having below average / poor monsoon in the state and/or non availability from liquid fuel /naphtha/gas based Thermal Power Station.
- To firm up plan to address gas availability issues with MoP, GoI (as discussed above) so that no capacity within Kerala state remains unutilized.

POWER PURCHASE PLANNING

The state will work towards institutionalizing and strengthening the Power Purchase Planning and Procurement Cell, which will dedicatedly work on the short / medium / long term power purchase planning and work on the procurement of power on cost effective basis. This cell will also work on the monthly power availability from already tied up sources (on the basis of annual schedules provided by these sources) and accordingly work out the

requirement for tying up power through competitive bidding route keeping into consideration variation in availability & requirement of energy from various sources across the year.

Government of India (GOI) Intervention Required:

- Ministry of Environment & Forest needs (MOE&F) to be requested to explore the possibilities of granting various clearances /approvals etc. in regard to development of large/medium capacity hydro projects as discussed earlier. Some of the major hydroelectric power projects, which were denied environmental clearance, are 240MW plant each at Silent Valley & Pooyamkutty, 100MW Pathrakkadavu and 163 MW Athirappally.
- Ministry of Oil & Gas needs to be requested for allocation of domestic gas at administered price to Kerala to meet minimum 60% of the natural gas requirement for the projects (namely 360MW RGCCPP of NTPC at Kayamkulam, BKPL plant of BSES at Kochi (157 MW), KDPP (128 MW), BDPP (106 MW) and the proposed 400 MW new plant at Brahmapuram) proposed to be converted from LSHS/naphtha.
- Ministry of Power (MoP) needs to be requested for pooling of cost of generation of 360MW RGCCPP of NTPC at Kayamkulam with other thermal stations of NTPC in the southern grid as an immediate solution to avoid underutilization of the plant assets.



Fund Requirement:

The details of estimated fund requirement of the state sector projects and JV projects (where state is a partner) are given in the Table 5.7 below:

Table -5.7

For State Sector/JV Projects

(Rs. in Crores)

Sl. No.	TYPE	Total Cost of Project	Expenditure up to March 2015	Year wise Fund Requirement				Details of Fund arrangement
				FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
A.	Projects under construction / execution							
a.	Thermal	110.00	0.00	20.00	50.00	40.00	0	
b.	Hydel	568.12	250.00	20.00	70.00	110.00	115.00	70% loan
c.	RES (SHP)	644.20	186.00	142.00	177.00	115.00	25.00	70% loan
	Sub Total	1322.32	436.00	182.00	297.00	265.00	140.00	
B.	Projects under R&M							
a.	Hydel	80.00	0.00	10.00	10.00	30.00	30.00	70% loan
	Sub Total	80.00	0.00	10.00	10.00	30.00	30.00	
C.	Future Projects (COD within FY 2018-19)							
a.	RES(SHP, Solar, Wind)	8972.17	0.00	24.00	281.00	110.00	97.00	70% loan
	Sub Total	8972.17	0.00	24.00	281.00	110.00	97.00	
D.	Future Projects (COD after FY 2018-19)*							
a.	Thermal	15000.00	0.00	0.00	0.00	20.00	150.00	70% loan
b.	Hydel	1561.86	0.00	0.00	5.00	50.00	150.00	70% loan
c.	RES	897.62	0.00	0.00	0.00	20.00	145.00	70% loan
	Sub Total	17459.48	0.00	0.00	5.00	90.00	445.00	
	Grand Total	27833.97	436.00	216.00	593.00	495.00	712.00	

- Projects to be commissioned after FY 2018-19, have not been considered for financial analysis.

The peak power demand and energy requirement of Kerala at state periphery during FY 2014-15 is 3760 MW and 22411 MU respectively. The above requirement in the coming years is expected to increase significantly due to various factors i.e. increased uses of various electrical appliances in domestic sector, increase in commercial activities and industrialization in the state. Taking into account all the above factors and with an objective to provide 24x7 power supply to all, the expected power demand of Kerala by FY 2018-19 would be 4821 MW with annual energy requirement of 29620 MU. To meet this growing demand, existing transmission system would be strengthened both at Inter-state

level as well as Intra state level with proper planning to cater to the future demand in a reliable manner. The connectivity with central grid has been shown in the Power Map of the 400 kV & 220 kV Grid Network which is attached in the report after Annexure.

Existing Inter State Transmission System (ISTS)

Presently about 572 ckt. Km of 400 kV EHV transmission line and four (4) numbers of Grid sub-stations at 400/220 kV level with total transformation capacity of 3150 MVA are existing in Kerala under Inter-state Transmission system of PGCIL & KSEBL.

The details of existing ISTS Grid sub-stations are as mentioned below:

Table-6.1

Details of existing Grid sub-station (ISTS)

Sl. No.	Name of GSS	Voltage Ratio	No. of Transformers	MVA capacity	Total Transformer capacity(MVA)
400 kV GRID SUBSTATION (PGCIL)					
1	400 kV Pallippuram (Tiruvanthapuram North)	400/220 kV	3	3X315	945
2	400 kV Elapully (Palakkad)	400/220 kV	2	2X315	630
3	400 kV Kochin-East (Muvattupuzha)	400/220 kV	2	2X315	630
				Total :	2205
400 kV GRID SUBSTATION (KSEBL)					
1	400 kV Madakatara	400/220 kV	3	3X315	945
				Total (PGCIL+KSEBL)	3150

In order to facilitate the drawl of power by Kerala and to meet the projected peak load of 4821 MW by FY 2018-19, a robust inter-state transmission system (ISTS) would be required. The present ISTS system capacity of PGCIL at 400/220 kV level is 2205 MVA and it would be increased to 3150 MVA by FY 2018-19 after implementation of ongoing schemes. In addition to this the existing transformation capacity at 400/220 kV level of KSEBL system is 945 MVA and it would be increased to 3205 MVA by FY 2018-19 after new addition & augmentation of substations. (For KSEBL detail refer Intra state transmission system indicated in the subsequent para of this chapter). The combined Transformation capacity of PGCIL & KSEBL

system at 400/220 kV level would be 6355 MVA by FY 2018-19, which shall take care the increased power demand of Kerala up to FY 2018-19.

The various ongoing ISTS projects are outlined below:

On-going /planned ISTS projects:

New GSS & Transmission lines

- One number of new grid substation at Kozhikode (Areekode) with capacity 2 x 315 MVA at 400/220 kV level by PGCIL.
- 320 kV HVDC system (grid) with 2000 MW at Madakatara (Trichur) has been planned.

Table-6.2 a**NEW GSS**

Project	Voltage Level	Unit	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Inter-State Transmission Network	400/220 kV	No./ MVA	2x315 MVA	-	-	-
	320 kV HVDC	No./ MVA	-	-	-	2000 MW*

Table-6.2 b**UPCOMING ISTS LINES**

Sl. No.	Line	Voltage Level	Circuits	Expected Commissioning Schedule
1	Mysore-Areekode	400 kV	DC	FY 2015-16
2	Uduppi-Mylatty/Neeleeswaram -Areakode	400 kV	DC	-
3	Thirunelveli-Cochin East 400 kV DC line	400 kV	DC	-
4	HVDC 2000 MW Pugulur-Madakathara line	400 kV	HVDC	FY 2018-19

Augmentation/Capacity addition on existing sub-stations

To meet the growing power demand of Kerala, augmentation of transmission capacity in following substation has been undertaken by PGCIL. This would enable Kerala to draw its share of power from the Grid:

- Capacity addition at Areekode (Kozhikode) with 1X315 MVA 400/220kV Transformer. The above GSS is expected to be commissioned during FY 2017-18.

On-going Tariff Based Competitive Bidding (TBCB) Schemes:

- Presently no scheme is under implementation in this head.

Inter and Intra state Transmission plan for evacuation of power from existing and upcoming Renewable Energy sources and balancing Infrastructure envisaged for integration of large scale renewable energy.

The existing renewable energy generation including state's Hydro projects, Wind Projects, Solar Power Projects is 171.44 MW which would be increased up to 1162.81 MW by FY 2018-19. The power evacuation from renewable generation shall be done at distribution level of 11 kV from existing 110/11 kV & 66/11 kV PSS for small scale scattered generating stations. The power evacuation from bulk renewable energy generation units would be done at 220

kV & 110 kV level. Major renewable power evacuation details are as follows:

- 80 MW power of Kottathara Wind Farm by NHPC would be evacuated to 220 kV Substation, Vettathur (New substation has been planned by LILO of one circuit of 220 kV Madakkathara-Areekode DC feeder)
- Power from 50 MW Grid connected Solar Power project at West Kallada in Kollam District shall be evacuated at 110 kV level.
- 1 MW Grid connected Solar Project power shall be evacuated at 22 kV of 220 kV Palakad Substation.

In future 220 kV, 110 kV GSS spread throughout the state, will take care of the power evacuation from these renewable generations.

Renewable Energy Management centers proposed for Real time monitoring of Generation from RE sources:

Presently Renewable Energy Management center is not in existence but ANER-Kerala is working on Green Energy promotion in the state.

Adequacy to meet Power Transfer requirement of the state till FY 2018-19

The present ISTS system capacity of PGCIL at 400/220 kV CTU level is 2205 MVA and after augmentation the transformation capacity would be increased to 3150 MVA. At KSEBL



system existing capacity at 400/220 kV level is 945 MVA & it would be increased to 3205 MVA by FY 2018-19 after new addition & augmentation. Hence the combined transformation capacity at 400/220 kV level would be 6355 MVA by FY 2018-19 in the state.

The projected power demand of Kerala by FY 2018-19 would be 4821 MW (5357 MVA). Considering drawl of power of about 2794 MW (3104 MVA) by FY 2014-15, 2439 MW (2709 MVA) by FY 2015-16, 2558 MW (2842 MVA) by

FY 2016-17, 2679 MW (2977 MVA) by FY2017-18 and 3200 MW (3556 MVA) by FY 2018-19 from the state generating units at 220kV level and below, the balance power drawl at 400kV level would be 1621 MW (1801 MVA) by FY 2018-19. Considering 80% loading on transformers and overall diversity of 1.2, minimum transformation capacity required is 1.5 times the projected peak demand (MVA) i.e 2702 MVA (1.5 x 1801 MVA).

The year wise generation, total available capacity, peak power demand vis-a-vis transmission system available at 400 kV & 220 kV and below level is tabulated as under:

Table 6.3

Year	Generation Within Kerala – Intra state (MW)		Inter state (ISGS) – Generation for Kerala (MW)		Total Available capacity (in MW)	Peak Power Demand of Kerala at 400/220 kV level (Peak Power Demand- Power Evacuated at 220 kV level and below) MW	Minimum Transformation capacity required at 400 kV level(MVA)*	Transmission System existing/Planned at 400 kV level including PGCIL & KSEBL (Interstate & Intrastate) 400 kV GRID S/S MVA
	Addition	Total	Addition	Total				
FY 2014-15		2794		1619	4413	3760-2794=966	1610	3150
FY 2015-16	668	3462	326	1945	5407	3878-2439=1439	2398	3780
FY 2016-17	564	4026	-244	1701	5727	4214-2558=1656	2760	3780
FY 2017-18	683	4709	0	1701	6410	4510-2679=1831	3052	5095
FY 2018-19	335	5044	0	1701	6745	4821-3200=1621	2702	6355

* Minimum Transformer capacity in MVA=Peak Power Demand at distribution level((in MW/0.9) x1.5))

(For 400 kV proposed Grid Substation of PGCIL & KSEBL from FY 2015-16 to FY 2018-19 refer Annexure-V)

As such the planned ISTS system would be adequate to meet the projected peak demand of 5193 MW up to FY 2018-19. The ISTS system adequacy has sufficient from FY 2014-15 to FY 2017-18 also.

The transmission system of Kerala up to FY 2018-19 is adequate.

Action Plan – CTU (Central Transmission Utility, PGCIL)

- Ongoing schemes (New Substation & Transmission line) to be implemented as per schedule by PGCIL for ensuring robust transmission system.
- Adequate planning & implementation to be ensured to make the system more reliable for FY 2018-19.

- The Transmission line work of 400kV Uduppi –Mylatty/ Neeleswaram –Areekode (Kozhikode) DC to be started on urgent basis by PGCIL for receiving power supply from central grid.
- 2000 MW HVDC Pugulur-Madakathara link line to be established by PGCIL urgently for meeting future requirement.

Intra state Transmission System:

Existing System:

The existing Intra state transmission capacity at 400kV GSS level (400/220 kV) is 945 MVA, at 220 kV GSS level (220/110 kV, 220/66, 220/33kV) is 5732 MVA at 110 kV GSS level (110/66 kV,110/33 kV) is 4115 MVA and 66 kV GSS level(66/33 kV) is 72 MVA.



The ongoing strengthening program of existing Intra-state transmission system is under implementation. After implementation of this plan the existing transformation capacity of 5732 MVA (at 220 kV level) shall be increased to 11632 MVA by FY 2018-19 and 945 MVA at 400 kV GSS level shall be increased to 3205 MVA by FY 2018-19 after new addition & augmentation.

Note: List of existing 220 kV, 110 kV, 66 kV substations is enclosed as Annexure-VI.

Ongoing / Planned Intra-State Transmission system:

New sub-stations, Augmentation / Transmission lines

- At 400 kV level the 3 nos. New Grid Substations i.e. Neeleswaram (Mylaty)

(2x500 MVA), Kottayam (Ettumanoor) (2x315 MVA), Kollam (Kundara) (2x315 MVA) have been planned which would increase the existing transformation capacity from 945 MVA to 3205 MVA, (for details of upcoming GSS refer Annexure-V).

- 16 New Substations with 3640 MVA capacity addition at 220 kV & 110kV GSS level would be installed by FY 2018-19.

Augmentation on existing sub-stations

- The augmentation work planned at 220/110 kV Sub-station level is 2300 MVA by FY 2018-19 as shown below in table no 6.4.

(The details of year wise ongoing/ planned Intra-state transmission system are enclosed as Annexure -VII.).

The year wise proposed physical plan of New Grid sub-station, augmentation & Transmission lines is as follows:

Table-6.4

Project	Voltage Level	Unit/ Substation	Existing as on March 2015 *	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Intra-State Transmission Network (New)	400 kV	No./MVA	1/945			1/1000	2/1260
		Ckt km	572	-	---	108	----
	220kV	No./MVA	19/5732	1/200	5/1200	4/800	5/1400
		Ckt km	2765	24	71	213.5	32
	110 kV	No./MVA	92/4115	-	----	1/40	----
		Ckt km	4260	313	239	196	149
	66 kV	No./MVA	3/72	-	-	-	-
		Ckt km	2203	18	35	19.5	-
Intra-State Transmission Network (Augmentation)	220/110 kV	MVA	-	-	1420	200	680

* The Line data has been considered for 31.3.2014.

Adequacy to meet Power Transfer requirement of the state by FY 2018-19

The year wise peak power demand of state, vis-a-vis transmission system available at 220 kV & 110 kV level for Kerala is tabulated as below:

Table- 6.5

Year	Peak Power Demand(MW)		Minimum Transformation capacity required(MVA)*	Transmission System existing/Planned at 220/110 kV, 220/66 kV (MVA)**	
	Addition	Total		Addition	Total
FY 2014-15	0	3760	6267	0	5732
FY 2015-16	118	3878	6463	200	5932
FY 2016-17	336	4214	7023	2620	8552
FY 2017-18	296	4510	7517	1000	9552
FY 2018-19	311	4821	8035	2080	11632

* Minimum Transformer capacity in MVA=Peak Power Demand at distribution level (in MW/0.9x1.5)

** Projected transmission capacity based on planning

As such, the existing and plan Intra-state transmission system of Kerala would be adequate to meet the projected peak demand of Kerala of 4821 MW by FY 2018-19 at, 220kV level as well as downstream level.

Year wise fund requirement for development of Planned Transmission system:

Total estimated investment of about Rs. 2517.15 Crores from FY 2015-16 to FY 2018-19 has been envisaged for the intra state system. Details of year wise investment plan for transmission infrastructure from FY 2015-16 to FY 2018-19 are indicated in Table 6.6 below.

Year wise details of Physical targets and proposed investments plan are detailed in Annexure-VIII A & VIII B.

Table- 6.6

Intra State Transmission System Investment

Sl. No	Financial Year	Investment Rs. (Crores)
1	2015-16	294.24
2	2016-17	359.48
3	2017-18	1682.27
4	2018-19	181.16
Total Investment in Intra state only		2517.15

Trans Grid 2.0

Considering the inability to set up large capacity power plants within the state, Kerala is highly dependent on import of power from outside the

state comprising of central sector sources and long term and medium/short term tie-ups for the purchase of power from various other sources. Based on the above and the generation additions expected within the State, it is estimated that an additional import capability of around 2000MW by year 2018 and 4000MW by year 2022 will become essential.

Against this backdrop, additional ISTS corridors including a 2000MW HVDC corridor has been sanctioned to the State. However the intra-state transmission system will not be sufficient for catering to the additional transmission capacity required for dispersing the ISTS power received as above from the upcoming ISTS nodes.

In consideration to the planning philosophy adopted to embrace the latest technological innovations including innovative business models and alternative construction methods available in the sector with a mission to enhance system reliability and security with minimum disturbance to environment and a green vision for better energy management through reduction in system losses, KSEBL has prepared a Long Term Transmission Plan titled **Trans Grid 2.0**, the future grid of the State.

Even though the proposed network enhancements are planned to satisfy the planning criteria of CEA, which may not be singularly aligned to generate financial gains from the project, implementation of these



projects by 2022 is expected to provide a reduction in peak load system loss of about 107.8 MW. The corresponding annual energy savings of 521.73 Mu due to this loss reduction works out to a financial savings of about Rs.255 Crore per annum at an average realisation of Rs. 4.90 per unit of energy.

The projects proposed under TransGrid 2.0 are planned for execution in two phases. The elements which are critical to the system for relieving congestion and constraint free power evacuation from the HVDC and other ISTS/Generation nodes are listed as TransGrid 2.0 Phase-1 works and needs to be expedited to ensure their availability by 2019-20 time frame.

The works pertaining to evacuation of power from Renewable resources are proposed to be carried out under the Green Corridor project funding. These projects will be taken up with CEA for including in the Green corridor project funding mechanism. The works under this scheme is also planned to be executed so to be available by 2019-20 time frame.

Phase-2 works will be taken up in coordination with the completion of Phase-1 works so that a seamless integration of the planned elements is achieved for strengthening the network.

The approximate investment required for the works proposed under TransGrid 2.0 is as follows:

- 1) Phase-1 works – Rs.4745 Crore
- 2) Green Corridor works – Rs.2500 Crore
- 3) Phase-2 works – Rs.1630 Crore
- 4) Local system strengthening works associated with Phase-1 & Phase-2 works – Rs.550 Crore
- 5) Network addition works – Rs.5750 Crore

Action Plan – KSEBL (State Transmission Utility, STU)

The ongoing scheme needs to be implemented as per proposed plan for ensuring 24x7 power supply in State. Financial approval shall be expedited timely for completion of the project in time.

State Government intervention

The state government shall expedite all necessary help (i.e Right of Way clearance, Forest clearance if any, land acquisition problems etc) to KSEBL (STU) for installation of new substation and associated transmission lines to support the objective of providing 24x7 Power for all in Kerala.

The proposed transmission lines may be executed through PPP mode by adopting either the MTA document with VGF provisions or SBD of tariff based competitive bidding route of MoP. This may bring shown the Capex need of state.

Government of India intervention

- Mitigation of Right of way constraints and availability of land: GoI, MoP has issued guidelines at 15th October 2015 on providing compensation for acquiring ROW (Right of Way) for transmission lines.
- Up gradation of existing transmission lines with high capacity conductor to meet reliability criteria.
- Intervention required by GOI for facilitating the job on urgent basis to be executed by PGCIL for planned 400kV Uduppi-Mylatty-Areekode (Kozhikode) D/C line for getting power supply from central grid.
- Intervention required for completion of 2000 MW HVDC Pugalur-Madakathara link under “Urgency Clause’ by PGCIL considering the import power requirements of Kerala in coming future.

Initiatives Taken by the State on SCADA & SUBSTATION AUTOMATION

- Substation automation for 400 kV, 220kV & selected 110kV Grid Substation has been established.
- Provision of Remote Terminal Units (RTU) at 400 kV, 220 kV, 110 kV Grid Substations and Generating Stations for reliable communication and protection are already there.



- At all major Grid Substations GIS Mapping work has been completed.
- The State Load Despatch Centre (SLDC) has been located at Kochi which has been already acquiring major Electrical parameters centrally up to 220kV & selected 110 kV Grid Substation.
- Replacement of conventional ground wire with Optical Fibre Ground Wire (OPGW) to serve the purpose of earth wire as well as data transfer in the system.
- Real Time system energy accounting through ABT compliance Boundary Metering Scheme implemented to calculate real time energy loss.
- Procurement of Polymer insulators for EHT lines to have higher reliability during foggy weather.
- KSEBL is conducting various load flow studies for future Grid sub-station and selection of its equipment, also to maintained the voltage profile and optimum power flow. The load flow studies document may be submitted to CEA for information.
- The transmission system of Kerala up to FY 2018-19 would be adequate. However, transmission system of Kerala from FY 2020-21 onwards would be reviewed in future so that increased requirement could be fulfilled.

Any other issues/ Achievements

- Introduction of HTLS (High Temperature Low Sag) conductor (being used in few areas) for increasing power transmission capacity.



KSEBL distributes electricity in the state of Kerala except in the Thrissur Municipal Corporation and Munnar (Kannan Devan Hills). For operational conveniences the distribution wing is divided into three zones namely South, Central and North. The south zone with headquarters at Thiruvananthapuram has 6 Electrical Circles, 19 Division, 58 Subdivisions, 177 Electrical sections and a Regional Store Division at Kundara. The Central has 7 Electrical Circles, 25 Division, 75 Subdivisions, 230 Electrical section and a Regional Store Division at Aluva and its headquarters at Ernakulum. The North zone with headquarters at Kozhikode and has 10 Electrical Circles, 25 Division, 78 Subdivisions, 287 Electrical sections and a Regional Store Division at Kallai.

There are other nine distribution licensees i.e. Cochin Port Trust, Kannan Devan Hills Plantations Company (P) Ltd, Technopark, Thrissur Corporation, Cochin Special Economic Zone (CSEZ), KINESCO, Rubber Park India (P) Ltd, Military Engineering Service and Infopark. The per capita consumption of power in Kerala has been 549 units which is much lower than

the National Average of 1010 units as observed during FY 2014-15.

As per State there are 4,81,022 un-electrified households in the state. Electrification of these un-electrified households has been planned by the state under DDUGJY. There is no separate agriculture feeders in the state, hence all feeders emanating from power substation are being given supply with 24 hrs electricity.

The power demand of the state is expected to increase from 3727 MW in FY 2014-15 to 4821 MW by FY 2018-19 due to natural increase in demand from the present consumer base, addition of new households, commercial activities in & around urban area and due to boost in tourism industry. The objectives of this Roadmap for supplying 24x7 Power For All (PFA) to all the consumers can be achieved through capacity augmentations, building redundancies in the upstream network, adopting appropriate technologies and efficient system for reliable & quality power for end consumers.

The details of existing distribution system in FY 2013-14 are tabulated below in Table-7.1.

Table 7.1

Sl. No.	DESCRIPTION	Unit	STATUS
1	No. of 66kV Lines/feeders	Nos	181
2	Total length of 66kV lines	ckt kms	2202.81
3	No. of 33kV Lines/feeders	Nos	166
4	Total length of 33kV lines	ckt kms	1719.28
5	Total No. of 66/11KV & 33/11kV PSS	Nos	215
6	Total capacity of PSS at 11 kV level	MVA	6985.2
a	Total capacity of step down Power Transformer at 11 kV level at 400/110/11kV,220/110/66/11 & 110/11kV PSS	MVA	4172.3
b	Total capacity of step down Power Transformer at 11 kV level at of 66/11KV & 33/11kV PSS	MVA	2812.9
7	Total No. of Distribution transformers	Nos	68,172
8	Total Capacity of Distribution transformers	MVA	8,329.11
9	Total length of 11kV lines	ckt kms	54,791
10	Total length of LT Lines	ckt kms	2,67,355

HT: LT ratio:

Various initiatives by KSEBL like HVDS, Bifurcation of 11 kV feeders etc have been taken by GoK to increase the **HT to LT** ratio from 0.159 to 0.203. There is scope to further increase the HT to LT ratio after implementation of the ongoing and proposed scheme in distribution area.



Category Wise Consumer

At present, there are about Rs. 111.92 Lakhs of electricity consumers in the state, out of which

there are about Rs. 4.63 Lakhs consumers which are under agriculture category. The category wise number of consumers at the end of FY 2013-14 is enlisted in Table-7.2 below:

Table 7.2

Sl. No	CATEGORY OF CONSUMER	NUMBER	CONNECTED LOAD(MW)	CONSUMPTION IN MU
1.	Domestic	87,88,916	12428.24	8739.52
2.	LT commercial	17,95,160	2905.34	2229.34
3.	LT Industrial	1,37,744	1620.52	1096.56
4.	HT & EHT Industrial	4256	1316.68	4035.49
5.	PUBLIC Lighting	3789	110.99	319.06
6.	Agricultural	4,63,006	952.77	310.24
7.	Railway traction	8	66.25	200.69
8.	Miscellaneous	11	204.23	523.15
	TOTAL NO OF CONSUMERS	1,11,92,890	19684.15	17454.05

Source: State power Utility

SCHEMES UNDER IMPLEMENTATION

R-APDRP

Ministry of Power, Govt. of India, has launched the Restructured Accelerated Power Development and Reforms Program (R-APDRP) in the XIth Five Year Plan as a Central Sector Scheme to cover urban areas - towns and cities with population of more than 30,000 as per Census of 2001. Power Finance Corporation Limited (PFC) has been designated by GoI as the Nodal Agency for the program. The continuation of RAPDRP for 12th & 13th plan has been subsumed in the newly launched IPDS scheme in Dec 2014. The focus of the R-APDRP programme was on actual, demonstrable performance in terms of sustained loss reduction. Establishment of reliable and automated systems for sustained collection of accurate base line data, and the adoption of Information Technology in the areas of energy accounting will be essential before taking up the regular distribution strengthening projects.

The program was divided into two (2) parts Part-A and Part - B. Part - A included projects for establishment of baseline data and IT applications like Meter Data Acquisition, Meter Reading, Billing, Collections, GIS, MIS, Energy Audit, New Connection, Disconnection, Customer Care Services, Web self-service etc. &

verification of baseline AT&C losses as well as SCADA/ DMS (Supervisory Control And Data Acquisition/Distribution Management System) Implementation.

Part-B of RAPDRP included regular distribution strengthening projects i.e. renovation, modernization and strengthening of 11kV lines and substations, Re-conductoring of lines at 11kV level and below, Load Bifurcation, Feeder Separation, Load Balancing, HVDS (11kV), Aerial Bunched Conductor in dense areas, replacement of electromagnetic energy meters with tamper proof electronic meters, installation of capacitor banks and mobile service centers etc.

100% grant is provided under R-APDRP Part-A projects while a maximum of 50% grant is being provided for Part B projects after fulfilling certain conditions.

Status of R-APDRP Part-A

This scheme is for implementation of IT in Power Sector and being implemented in 43 Towns each having population more than 30,000. The total outlay of the scheme is Rs. 214.38 Crores.



Status of R-APDRP- SCADA

This scheme is a part of R-APDRP Part-A scheme for 3 big towns namely Thiruvanthapuram, Ernakulum (Cochin) & Kozhikode. As part of implementation of Part-A of RAPDRP, SCADA/Distribution Management System will be implemented in the urban areas which are towns and cities with population of more than 4,00,000 and annual input energy of 350 MUs. In KSEBL, the SCADA/DMS project for automation of distribution systems up to 33 kV is being implemented. The cost of the project scheme is to the tune of Rs. 83.15 Crores. After implementation of SCADA, AMR is introduced so billing problem is solved. Revenue collection & cash realization becomes easier.

Status of R-APDRP Part-B

MoP (GoI) launched centrally sponsored R-APDRP (Part-B) scheme for strengthening of sub-transmission and distribution system of urban India. The total cost of this scheme is Rs. 1078.30 Crores. This scheme is for improvement of Distribution system by replacement of existing worn out 11 KV and LT lines, Cables and augmentation of Distribution Transformers and providing new Distribution System with the objective to reduce T&D losses below 15% in the major towns having population of more than 30,000. This scheme is being implemented in 43 towns. 40 towns work is under departmental execution and 3 towns namely Ernakulum, Kozhikode and Thiruvanthapuram work is under Turnkey Execution.

Financial & infrastructural achievement till date of these schemes is given in **Annexure-IX & Annexure-X**.

The main scope of work is for erection of new as well as augmentation of HT & LT lines, Distribution Transformers, replacement of Electro Mechanical Meters with Electronic Meters, shifting of meters outside consumer premises, erection of new sub stations & associated transmission lines.

Following benefits to the consumers are created (or in the process of completion) and made available in R-APDRP, Part-A :

- **Data Center** – A full fledged Data Centre in 3200 Sq. feet area as per tier-III standards has been setup in Vydyuthi bhavanam, Thiruvananthapuram for hosting the software Applications of KSEBL. The complete IT infrastructure including Servers, Storage, Networking and Security systems is accommodated in 38 racks in the Server Farm. The Data Centre has future scalability for hosting 10 more racks.
- **Wide Area Network-** As part of establishment of Wide Area Network, around 250 Electrical Sections were connected to the Data Centre through MPLS VPN network. Steps are being taken to connect the remaining Electrical Sections along with Electrical Circles and Divisions to the Data Centre
- **Centralized Customer Care Services (CCC)** - A Call Centre cum Customer Care Centre has been setup in Vydyuthi bhavanam, Thiruvananthapuram and it has started functioning at the end of 2013-14. Around 50 Call Centre executives can work in the above facility to attend complaints/queries from the consumers under various Electrical Sections all over Kerala. Around 64 Electrical Sections (from May 2015, it will be increased to 168 Stns) have been migrated to CCC for reporting/rectification of complaints. A toll free number with 32 lines has been provided to the public for reporting of calls. Steps are being taken to add more Sections to the CCC. Center will also provide the facility for customer walk-in in order to rectify the complaints related to bills, tariff, new connection etc.
- **Web Self Services-** This online portal provides facilities like e-Payment, bill view, consumption pattern, meter reading history etc. Around 205 Electrical Sections were attached to the above website for providing consumer services. More Sections will be



added to the above Portal when Ornament deployment is completed in those Sections.

- **Geographical Information System, Meter Data Management System, Energy Audit, Network Analysis-** After completing the software development and testing, the above Applications have been rolled out in 25 Electrical Sections.
- **Asset Management, Maintenance Management, Project Management System and Management Information System-** The software development for these Applications is completed and testing is in progress.
- **Disaster Recovery Centre-** A Disaster Recovery Centre is being setup at Info Park, Cherthala in order to provide redundancy for the Data Centre IT infrastructure.
- **SCADA/DMS Project:** As part of implementation of Part-A of RAPDRP, SCADA/Distribution Management System will be implemented in the urban areas which are towns and cities with population of more than 4,00,000 and annual input energy of 350MUs. In KSEBL, the SCADA/DMS project for automation of distribution systems up to 33KV is being implemented in Thiruvananthapuram, Ernakulum and Kozhikode towns.
- **Handheld devices for meter reading:** The roll out of handheld devices (Spot billing

machine) in Electrical Sections for meter reading of LT consumers is in progress. This has been already implemented in 10 Electrical Sections.

- **Centralized automation:** It has already been implemented for the Core functional areas of the Organization like LT Billing, HT/EHT Billing, Supply Chain Management System, ARU & Corporate Accounting and HR Information System.
- **Implementation of e-Office:** Steps are being taken to implement e-Office package in KSEBL offices.
- **Video Conferencing System:** The Video Conferencing System connecting three locations viz. Thiruvananthapuram, Kochi and Kozhikode has been implemented.

RGGVY

Government of India launched RGGVY scheme during 10th plan period for providing access to electricity to all rural households in the country. The scheme was continued during 11th Plan and the continuation of 12th & 13th plan RGGVY has been subsumed in the newly launched DDUGJY scheme of GOI in Dec 2014.

RGGVY X, XI plan (1st phase) is completed & RGGVY XI plan (2nd phase) is expected to be completed shortly. Detail status of these schemes is attached as **Annexure XI**.

REDUCTION IN AT&C LOSSES

AT&C losses in the state are targeted to be decreased to 10.00% in FY 2018- 19 from 10.80% in FY 2014- 15 as per loss trajectory committed to MoP by the state. The projected AT & C losses of KSEBL are summarized below:

Table 7.3

AT & C Losses Trajectory

Year	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
AT & C losses*	10.80%	10.50%	10.25%	10.00%	10.00%

*As per AT&C loss trajectory decided by MOP



KSEBL have envisaged following measures for bringing down AT&C losses;

- Revamping of Distribution system of 43 towns.
- Replacements of Old Conductor/Cables. Adopting aerial bundle conductor (ABC).
- Feeder Renovation / Improvement Program: Reducing the length of LT lines by relocation of distribution sub stations or installations of additional new distribution transformers.
- Installation of lower capacity distribution transformers at each consumer premises instead of cluster formation and substitution of distribution transformers with those which have lesser no load losses such as amorphous core transformers.
- HT & LT Capacitors / Star rating DT (No load losses).
- HVDS: Line losses in LT line is completely avoided and it also helps in avoiding tapping of LT line and theft.
- Meter replacement: EM/Faulty meters to Static meters.
- Strictly Follow Preventive Maintenance Program: Adopting Preventive Maintenance Program of Line to reduce Losses due to Faulty / Leakage Line Parts. Required to tighten joints of wire to reduce leakage current.
- GIS mapping / Data of Distribution Line: Mapping of complete primary and secondary distribution system with all parameters such as conductor size, line lengths etc. Compilation of data regarding existing loads, operating conditions,

forecast of expected loads etc. Preparation of long-term plans for phased strengthening and improvement of the distribution systems along with transmission system.

- Implementation of energy audits schemes Initiating studies for realistic assessment of the total T&D Losses into technical and non-technical losses.

PILOT PROJECT

A Pilot Project for implementation of HVDS in KSEBL was implemented at Peyad Electrical Section in Thiruvananthapuram district. As a part of this project one 160 kVA transformer area was selected, of which three numbers of LT feeders were dismantled and 22 no's 15 kVA oil filled 11/0.433 kV copper wound oil filled transformers were installed. Accordingly 2 KM LT line was removed enroute and about 260 consumers were given supply from these transformers. The total cost of the pilot project is assessed as Rs 30 Lakh including cost of Transformers, network modification, rearranging of service connections etc.

The main advantage expected due to implementation of HVDS is improved voltage, reduced rate of interruption and avoidance of accidents due to LT lines. In addition, line losses in LT lines can be completely avoided .HVDS will also help in avoiding tapping line and theft. Validation of the project is being done and based on the results KSEBL proposes to roll out the project to other suitable areas.

State Govt. Scheme:

KSEBL has made a detailed plan for up gradation of existing 110/11kV PSS & Construction of New 110/11kV PSS . Year wise detailed capex plan and capacity of PSS is given in Annexure-XIV.

Table 7.4

THE FUND REQUIREMENT FOR 110/11 kV PSS UNDER STATE SCHEME

Sl. No.	Name of Scheme/Project	Fund Requirement
1	110/11 kV-New & Upgradation of PSS	Rs 365.20 Crores



Major constraint faced by KSEBL (Distribution) for providing quality & reliable power

- Restriction is imposed in some area due to system constraint (tree falling etc) during monsoon season.
- Weather dependence of hydel generation often leads to restrictions during poor monsoon years.
- Owing to thick vegetation cover, hilly regions are more susceptible to supply interruption due to falling trees during rainy seasons, which also adds to accident risk on O/H distribution system. In this region KSEBL is replacing O/H conductor with ABC & U/G Cables with their Capex fund.
- Disaster management team is available in 25 circles during monsoon season for system restoration. KSEBL managing this situation with their own resources, State Govt help is expected.
- Right of Way (ROW) issue is main bottleneck for expediting the work or completing the work in time.
- 25 circles of KSEBL is in the hilly terrain so in the monsoon season faults occurs frequently.
- Day time Transformer loading is less due to full family is out (for job etc) but night time transformer loading increases significantly.

Improving Consumer Convenience & Revamping Maintenance Philosophy

- A Call Centre cum Customer Care Centre has been setup in Vidyuthibhvanam, Thiruvananthapuram and started functioning at the end of 2013-14. The consumers can register complaints and can access other information by calling 1912/0471-2555544 or through web self services under KSEBL official website- www.ksebl.in.
- Around 50 Call Centre executives can work in the above facility to attend complaints/queries from the consumers under various

Electrical Sections all over Kerala.

- Around 64 Electrical Sections (by May 2015 will be increased to 168 Sections) have been migrated to CCC for reporting/rectification of complaints.
- A toll free number with 32 lines has been provided to the public for reporting of calls. Steps are being taken to add more Sections to the CCC.
- The Center will also provide the facility for customer walk-in in order to rectify the complaints related to bills, tariff, new connection etc.
- Implemented online payment facility using debit cards, credit cards and Internet banking for all consumers
- Provided Web enabled services like viewing bills, meter reading history, consumption pattern etc.
- Greater interface with the power utility with the availability of SMS alerts for power shut downs.
- IVRS based complaint handling portal for redressal of supply related complaints besides the status updates on the service requests.
- Availability of GIS based network maps to help the line maintenance activities thereby ensuring better supply quality to the consumer by reducing breakdown period.
- MIS reports helping in operational efficiency and better decision making.
- Better asset management resulting in lower cost of maintenance and longer asset life.
- Reduced human interface ensuring efficient and error free working.
- Video Conferencing System: The Video Conferencing System connecting three locations viz. Thiruvananthapuram, Kochi and Kozhikode is implemented.



- Installation of SCADA/DMS System in 3 towns of Kerala namely Ernakulum, Kozhikode and Thiruvanthapuram.
- Accurate & transparent billing & collection resulting in increased revenue.
- Updated Monthly assessment report
- Transformer over load report
- Transformer phase unbalance report

Performance Monitoring Mechanism

Project Monitoring is being done by Govt. of Kerala using the online portal “Plan Space”. Circle, Division and Sub-division performance is

being monitored based on T&D losses along with Billing Efficiency and collection efficiency and reviewed on monthly basis.

In order to implement appropriate reform measures and meet the objective, baseline parameters needs to be verified and established, and hence it is proposed that a Third Party Audit should be carried out for establishing the baseline parameters for the KPI indicated below and thereafter following performance parameters needs to be monitored at KSEBL Corporate level.

Table-7.5

Corporate Strategic Objectives	KPI	UOM
Maximize Rate of Return	PAT	Rs Crs
	No of households to be electrified	Nos in Lakhs
	CAPEX	Rs. Crs
Sustain AT&C loss level & achieve further reduction	AT&C Losses	%
	Collection Efficiency	%
	Billing Efficiency	%
Monitoring Distribution Cost	Establishment Cost	Rs. Crs
	R&M Cost	Rs. Crs
	A&G Cost	Rs. Crs
	Power Purchase Cost	Rs./unit
Enhancing Customer Satisfaction	CSI Overall	Index
	Total Consumer Complaints/ '000 consumers	Nos.
	New initiatives to enhance customer convenience	Nos.
	Addition in regards to Payment Avenues	Nos.
	PA Compliance Index	Index
Operational Efficiency	No. of customers served /employee	Ratio
System Reliability	SAIDI	Hrs
	SAIFI	nos.
	DTR Failure Rate	%
	PADCI (Project Av. Duration Closure Index)	Months
	No of Accidents (Fatal/ Non Fatal)	Nos.

The fund requirement of the ongoing distribution schemes are furnished in table no. 7.6.

Table 7.6**Fund Requirement for Schemes Already Sanctioned and Under Implementation****(In Rs Crores)**

Sl. No.	Name of Scheme/ Project	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	Total
1	RAPDRP- Part- A for IT enablement under RAPDRP – Part A (For towns with population more than 30,000)	84.1	65.9			150.00
2	RAPDRP Part A – SCADA projects for big towns	58.2				58.2
3	RAPDRP Part B – 40 towns Departmental execution	225.59	225.59			451.18
4	RAPDRP Part B – 3 towns Turnkey execution	232.69	232.69			465.38

Source – State power Utility & website of PFC: apdrp.gov.in

PROPOSED SCHEMES FOR RURAL & URBAN AREAS

To provide 24x7 quality & reliable power to the consumers in the state, KSEBL have formulated a plan for augmentation of distribution system in rural areas and urban areas. The Estimated cost is 1720.90 Crores in DDUGJY against which DPR cost approved by Monitoring Committee is Rs. 485.37 Crores. The tentative project cost for urban areas is about 597.45 Crores under IPDS Scheme. The works of feeder separation, establishment of new PSS, augmentation of existing PSS, new 66 & 11 kV lines, LT lines & metering are proposed to be implemented in the state by FY 2018-19.

Table 7.7**The Fund Requirement for the Urban & Rural Areas**

Sl. No.	Name of Scheme/Project	Fund Requirement (Rs in Crores)
1	Urban Areas	597.45
2	Rural Areas	1720.90
	TOTAL COST	2318.35

Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY)

Government of India launched Deendayal Upadhyaya Gram Jyoti Yojna” (DDUGJY) on 3rd December, 2014 for;

- Separation of agriculture and non-agriculture feeders facilitating judicious restoration of supply to agricultural & non-agriculture consumers in the rural areas.

- Strengthening and augmentation of sub-transmission & distribution infrastructure in rural areas, including metering of distribution transformers/ feeders/ consumers.
- Rural electrification for completion of the targets laid down under RGGVY for 12th and 13th Plans by carrying forward the approved outlay for RGGVY to DDUGJY.

The components at (i) and (ii) of the above scheme will have an estimated outlay of Rs. 43033 Crores including a budgetary support of Rs. 33453 Crores from Government of India during the entire implementation period.

As already mentioned, the scheme of RGGVY as approved by CCEA for continuation in 12th and 13th Plans has been subsumed in this scheme as a separate rural electrification component for which CCEA has already approved the scheme cost of Rs. 39275 Crores including a budgetary support of Rs. 35447 Crores. This outlay will be carried forward to the new scheme of DDUGJY in addition to the outlay of Rs. 43033 Crores. REC is the nodal agency for the operationalization of DDUGJY in the Country.

KSEBL has prepared DPR for all 14 Districts indicating the basic works to be covered along with tentative cost amounting to Rs 1720.90 Crores as per format provided by Nodal Agency (REC) and submitted to REC, New Delhi. Monitoring Committee headed by Secretary



(Power) approved the DDUGJY projects on 14.08.2015 for Rs. 485.37 Crores for kerala which include projects worth

- Rs. 81.58 Crores for connecting the unconnected households
- Rs. 259.16 Crores for metering
- Rs. 83.06 Crores for system strengthening.
- Rs. 57.87 Crores for SAGY (Sansad Adarsh Gram Yojna) scheme.

The approved cost also includes Rs. 2.41 crores as PMA charges. The remaining fund as per the requirement would have to be arranged by the State. The detailed requirement is given in Annexure-XII.

Integrated Power Development Scheme” (IPDS)

The Central Government has sanctioned “Integrated Power Development Scheme” (IPDS) on 3rd December, 2014 for urban area for:

- i. Strengthening of sub-transmission and distribution networks in the urban areas.
- ii. Metering of distribution transformer/ feeders/ consumers in the urban areas.
- iii. IT enablement of distribution sector and strengthening of distribution network, for completion of the targets laid down under R-APDRP for 12th and 13th Plans by carrying forward the approved outlay for R-APDRP to IPDS.

The components at (i) and (ii) above will have an estimated outlay of Rs. 32,612 Crores

including a budgetary support of Rs. 25,354 Crores from Government of India during the entire implementation period.

The scheme of R-APDRP as approved by CCEA for continuation in 12th and 13th Plans has been subsumed in this scheme as a separate component relating to IT enablement of distribution sector and strengthening of distribution network [component (iii) above] for which CCEA has already approved the scheme cost of Rs. 44,011 Crores including a budgetary support of Rs. 22,727 Crores. This outlay will be carried forward to the new scheme of IPDS in addition to the outlay indicated above. PFC is the nodal agency for the operationalization of IPDS in the country.

It is related to the work of renovation & up gradation of transmission & distribution infrastructure of urban area in KERALA. As per requirement of MoP (GoI), Need Assessment Document (NAD) was submitted to the Nodal Agency i.e. PFC New Delhi. Detailed DPRs of 63 towns & Cochin port trust areas covered in the scheme have been prepared. The DPR sanctioned cost of project is Rs. 597.46 Crores. The state has proposed following works

- Rs. 68.72 Crores for metering,
- Rs. 142.38 Crores for 24x7 Power supply,
- Rs. 287.76 Crores for Reduction of AT & C losses
- Rs. 72.78 Crores for roof top solar & miscellaneous items

For detailed requirement please refer **Annexure-XIII.**



ASSESSMENT OF ADEQUACY OF DISTRIBUTION SYSTEM

The distribution network growth as planned by KSEBL under various ongoing and forthcoming schemes is as follows:

Table-7.8

The Network Growth As Planned By KSEBL under Various Ongoing and Forthcoming Schemes

Sl. No.	PARTICULARS	Unit	STATUS OF 31.03.14	DURING FY 2014-15	DURING FY 2015-16	DURING FY 2016-17	DURING FY 2017-18	DURING FY 2018-19	CUMULATIVE UP TO FY 2018-19
1	No. of 33/66 KV Lines /feeders	No	347						
2	Total length of 33/66 KV lines	Ckt kms	3922.09						
3	Total No. of 66/11kV & 33/11kV PSS	No	215	3 ⁽¹⁾	10 ⁽¹⁾	10 ⁽¹⁾	10 ⁽¹⁾		248
4	Total capacity of 66/11 kV & 33/11kV PSS	MVA	2812.9	30 ⁽²⁾	100 ⁽²⁾	100 ⁽²⁾	100 ⁽²⁾		3142
5	Total capacity of step down Power Transformer at 11 kV level at 400/110/11kV,220/110/66/11 & 110/11kV PSS	MVA	4172.3	425 ⁽³⁾	547.5 ⁽³⁾	225 ⁽³⁾	125 ⁽³⁾	225 ⁽³⁾	5720
6	Total capacity of Power Transformer at 11 kV level in PSS	MVA	6985.2	455	647.5	325	225	225	8862
7	Total No. of Distribution transformers	No	68,172	3788	3200	3100	3000	3000	84,260
8	Total Capacity of Distribution transformers in MVA at 11/0.415 kV	MVA	8,329.11	378.8 ⁽⁴⁾	320.2 ⁽⁴⁾	310 ⁽⁴⁾	300 ⁽⁴⁾	300 ⁽⁴⁾	9938.11
10	Total length of 11kV lines in Ckt. Kms	ckt kms	54,791	2665	2800	2750	2700	2600	2665
11	Total length of LT Lines in Ckt. Kms	ckt kms	2,67,355	4322	4000	4100	4000	4000	4322

Source: state power utilities

Note:

(1) 66/11 kV & 33/11 kV PSS added 13 no under RAPDRP-B, 17 no under DDUGJY & 3 no under IPDS scheme as per state data.

(2) Derived PSS capacity (MVA) considering 2X5 MVA Power Transformer.

(3) PSS Capacity addition under State government scheme refer Annexure-XIV.

(4) DTR capacity (MVA) derived considering 100 KVA DTR.



From the above table, it is evident that the transformation capacity at 110/11kV, 66/11kV & 33/11kV is projected to grow from 6985.2 MVA in FY 2013-14 to 8862 MVA in FY 2018-19 and distribution transformation capacity at 11/415 kV level is projected to grow from 8329.11 MVA in FY 2013-14 to 9938.11 MVA in FY 2018-19.

The Projected peak demand of the state, including demand of large industrial consumers has been projected at 4821 MW in FY 2018-19. Considering a power factor of 0.9 this corresponds to 5356 MVA in FY 2018-19.

Against this peak requirement at 110/11 kV, 66/11 kV & 33/11 kV level in FY 2018-19 the installed capacity is projected at 8862 MVA. This shows that the sub transmission system would be adequate for meeting the projected load and average loading of the system would be around 60% on 110/11kV, 66/11kV and 33/11 kV transformers under peak demand conditions.

Based on the present conditions, the projected load of 11 kV consumers in FY 2018-19 would be about 1000 MW and the corresponding demand at 11 kV and below would be around 3821 MW (4821 MW-1000 MW) which corresponds to 4245 MVA considering a power factor of 0.9. Against this peak requirement, the installed capacity 11/0.415 kV level would be around 9938.11 MVA by FY 2018-19 which shows that the Distribution transformation capacity planned at DT level for FY 2018-19 would be adequate for meeting the projected demand by FY 2018-19 and Average loading of DTs would be around 42.7%.

ACTION POINT-FOR STATE GOVERNMENT

- To complete all the distribution works necessary for providing 24x7 quality supply to all the connected consumers & newly constructed household.
- To meet the agreed trajectory for reduction of AT&C losses through initiatives as described earlier under sub heading **“Reduction in AT&C losses”**.
- To introduce modern technologies to monitor reliable supply like sub-station automation, providing adequate communication infrastructure, GIS, Reliability, Centralized Network Analysis and Planning tools, SAP driven ERP systems, DMS (Distribution Management Systems), OMS (Outage Management System), etc.
- State would take necessary steps to meet the Performance Standards specified by Kerala State Electricity regulatory commission (KSERC). Proper mechanism of monitoring Key parameters.
- Performance Index (KPI) as described under sub heading “Performance Monitoring Mechanism”.
- There are some key issues in Distribution as mentioned. Immediate state govt Intervention required.
- To make arrangement of balance funds after approval of Proposed schemes of GOI like DDUGJY and IPDS.

GOI Intervention

To approve the whole amount of the projects under DDUGJY & IPDS.



Renewable energy is increasingly becoming an important source of the energy mix- meeting the twin objectives of energy security and clean energy considerations. Kerala has good potential for promotion and development of renewable and non conventional energy projects, particularly Solar, Wind, Small Hydro Projects (SHP) and Biomass. Good explorable options and potential exists for power generation from water falls & streams, solar including solar PV on canal top & solar (floatovoltaic) on reservoirs, biomass cogeneration etc. State has already issued liberal policies for promotion of renewable energy generation in the state.

Government of Kerala is keen to tap renewable power potential of the state to meet the growing demand of power in an environmental friendly and sustainable manner. Kochi has already been selected as a Solar city under the MNRE program of Solar/ Green Cities. Union Ministry of New and Renewable Energy (MNRE) has approved nearly Rs. 696-crore master plan for

the Kochi solar city project. The master plan has envisaged that the city will need 975 million units (MU) of power per year by 2021. It is estimated that the city can achieve an “aggregate reduction of 155.42 MU” in five years. The areas of studies are:

- Renewable energy generation plans especially for Solar, Wind, Small Hydro and biomass based power projects
- Renewable Energy Potential of Kerala
- Renewable Energy policy framework in Kerala
- Government of Kerala Initiatives & RPO targets
- Action plan of the state
- Fund Requirements
- GoI/ State Govt Interventions

Grid Connected Renewable Energy:

The total grid connected Renewable Energy (RE) installed capacity (consisting of solar, wind, SHP etc.) as on 31.03.15 is given in Table 8.1 below:

Table-8.1

Sl. No.	Ownership/ Sector	Mode wise Breakup (MW)				Grand Total (MW)
		Solar	Wind	SHP	Biomass	
1	State	0.00	2.03	111.40	0.00	113.43
2	Private/ IPPs	0.00	32.85	25.16	0.00	58.01
3	Central	0.00	0.00	0.00	0.00	0.00
	Total	0.00	34.88	136.56	0.00	171.44

The potential of generation of power through Renewable Energy Sources in Kerala state is estimated to be about 8731 MW as indicated in Table 8.2 below:

Table-8.2

Sl. No.	Type	Estimated Potential in MW (as per MNRE)
1	Solar Power	6110
2	Biomass Power	1044
3	Wind Power	837
4	Small Hydro Power (SHP)	704
5	Waste to energy	36
	TOTAL	8731

Policy and notifications in place

Several “New & Renewable Energy Policies” are already in place in Kerala. The policies notified by Government of Kerala (GoK), Kerala State Electricity Regulatory Commission (KSERC) and Agency for Non-Conventional Energy and Rural Technology (ANERT) are as described below:

- a) “Kerala Renewable Energy Policy 2002” vide Govt. of Kerala Notification no. G.O. (MS)No.16/2002/STED) dated 03.04.2002.
- b) “Development of wind power in Kerala through private developers modified” vide Govt. of Kerala Notification no. G.O.(Rt.) No.295/08/PD) dated 22.11.2008.
- c) “Kerala Solar Energy Policy 2013” vide Govt. of Kerala Notification no. G.O. (P)No.49/2013/PD) dated 25.11.2013.
- d) “Kerala Small Hydro Power Policy 2012” vide Govt. of Kerala Notification no. G.O. (P)No. 25/2012/PD dated 03.10.2012.
- e) “Allocation of Government land for setting up Solar / Wind power plants” vide Govt. of Kerala order no. G.O(MS) 12/2015/PD) dated 07.04.2015.
- f) “Kerala State Electricity Regulatory Commission (Renewable Purchase Obligation and its compliance) Regulations, 2010” vide KSERC notification no. 1429/CT/2010/KSERC dated 09.02.2015.

For further promoting generation through New and Renewable Sources of Energy (NRSE), GoK has also come out with many notifications with respect to exemptions of taxes & duties, with respect to land use, etc.

Government of Kerala Initiatives and Plan

Agency for Non-Conventional Energy and Rural Technology (ANERT) is the State Nodal Agency for promotion and development of Renewable Energy projects. ANERT is also the State agency for Renewable Energy Certificates (REC) accreditation under the notification by KSERC in accordance with the REC Regulation of CERC.

Following strategic initiatives have been taken by the state based on renewable energy policies:



(i) For Small Hydro Power Plants:

- a) SHP projects identified by private agencies on private land will be permitted. Period of allotment will be 30- years.
- b) SHP projects identified by Govt. agencies will be put on bidding route for allotment to private agencies.
- c) Local Self Government's (LSGs) will be given preference for Micro Hydro projects up to 500kW without bidding.
- d) For Public Private Partnership (PPP), private partners to be selected through competitive bidding.
- e) Banking Facilities: KSEBL will permit banking facility during a financial year subject to availability of Grid and the rights for banking the energy with the KSEBL and charges applicable for the same shall be determined by the regulation in force from time to time.
- f) KSEBL will provide a relief in demand charges to HT/EHT captive consumers for continuously operating their captive power plant for a minimum of 15 days during a month.

(ii) For Solar Energy Power Projects

- a) KSEBL shall create necessary evacuation facility beyond the pooling station for the projects with capacity less than or equal to 10MW.
- b) There shall be no open access charges for solar projects for wheeling the power within the state.
- c) Wheeling charges and T&D losses will not be applicable for the Captive Solar generators within the state.
- d) The energy generated from the plants under this policy shall be fully exempted from the Electricity duty.
- e) Conditional Banking facility shall be available to captive generators after considering system constraints.
- f) Financing mechanisms including subsidy, demonstration projects, net-metering, REC, feed-in tariff shall be applicable for solar power projects.

(iii) For Wind Energy Power Projects

- a) Captive Power Producer and Independent Power Producers (IPP) mode are permitted under this policy
- b) Any Individual / Company / Body Corporate / Partnership firm / Joint Venture are eligible under IPP.
- c) All HT/EHT industrial consumers of Kerala State Electricity Board (KSEBL) with contract demand 500 KVA and above or group of such consumers forming a consortium are eligible to apply for the development of wind projects under CPP category.
- d) The Developer at their own cost and responsibility shall carry out development of necessary infrastructure facilities such as approach roads, improvements to existing roads etc.
- e) Government land will be licensed to IPPs on payment of licensing fee for the development of wind power for a period of 20 (twenty) years from the date of allotment. After this period the land with Wind Energy Generators (WEGs), evacuation arrangements and all other facilities shall be returned back to the Government.
- f) KSEBL/ STU will provide its surplus transmission capacity available with it for wheeling power from the wind generating station on payment of wheeling charges and other levies as determined by SERC.

Being the integrated utility on transmission and distribution in the state, KSEBL shall have the following responsibility under renewable policies:

- (i) To create awareness through work shop / seminars, energy audits and demo projects in order to promote energy efficiency in different sectors of the economy in the state.

- (ii) To mainstream solar applications by pioneering installations in canals, reservoirs (floatovoltaic), public spaces, etc;
- (iii) To evolve and update standards of grid-connectivity for the Solar Power Systems at LT and HT level and notify to promote decentralized solar power generation which would also enable the State to gain maximum benefit from the 13 FC allocations and other.
- (iv) Financial allocation to assess the feasibility and provide connectivity to grid connected solar projects in a timely manner;
- (v) Resort to tariff based bidding for solar energy in meeting RPO, if required;
- (vi) To develop necessary transmission infrastructure based on a renewable master plan;
- (vii) To provide banking facility for solar energy, incentives in the form of exclusion from open access charges, wheeling charges and T&D loss for solar power;
- (viii) To act as single window service provider to all grid connected solar plants in association with other state agencies.

Kerala facilitates setting up of RE projects on Build, Own and Operate basis under the NRSE Policy 2012. Valuable incentives are provided to the interested developers to invest and set up RE projects in the state.

RENEWABLE PURCHASE OBLIGATION (RPO):

Every obligated entity (distribution licensee(s), captive users, open access customers etc.) shall purchase electricity from RE sources including solar, not less than a percentage specified by ANERT from time to time. As per notification dated 09.02.15, the specified minimum percentage are given in Table below:



Table -8.3

Year	FY 2015 -16	FY 2016 -17	FY 2017 - 18	FY 2018 - 19
Non Solar RPO (%)	4.43	4.87	5.36	5.89
Solar RPO (%)	0.40	0.44	0.49	0.54
Total RPO (%)	4.83	5.31	5.85	6.43

Year Wise Availability (Cumulative) through proposed capacity addition plan – through renewable (grid interactive) is as follows:

Table-8.4

Sl. NO	Particulars	Year wise Existing & Likely Capacity to be added (MW)-Cumulative				
		As on March 2015	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
a.	Solar	0.00	1.10	79.60	398.80	513.80
b.	Wind	34.88	34.88	42.88	114.88	166.88
c.	SHP	136.56	161.16	174.16	244.76	313.16
d.	Biomass	0.00	0.00	0.00	0.00	0.00
	Total	171.44	197.14	296.64	758.44	993.84

Action Plan of the State for Grid Interactive NCE/RNES Plants:

The state has to ensure completion and addition of renewable generating capacities in the State of Kerala as per the following roll out plan:

Table -8.5

Sl. No	Power For All (Roll Out Plan)	Year wise Addition (MW)				Total (MW)
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
a.	Solar	1.10	78.50	319.20	115.00	513.80
b.	Wind	0.00	8.00	72.00	52.00	132.00
c.	Small Hydro Power	24.60	13.00	70.60	68.40	176.60
d.	Biomass	0.00	0.00	0.00	0.00	0.00
	Total	25.70	99.50	461.80	235.40	822.40

Total fund requirement (Year wise) for various projects is given here under:

Table-8.6

Fund Requirement

Sl. No	RES Projects	Year wise Fund Requirement (Rs. In Crores)				Total (Rs in Cr.)
		FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
a.	Solar	7.67	549.50	2,234.40	805.00	3,596.57
b.	Wind	0.00	40.00	360.00	260.00	660.00
c.	Small Hydro Power	147.60	78.00	423.60	410.40	1,059.60
d.	Biomass	0.00	0.00	0.00	0.00	0.00
	Total	155.27	667.50	3,018.00	1,475.40	5,316.17

Intervention by Govt. of Kerala:

- a) GoK may submit their proposal to MNRE for VGF funding as per norms of the scheme.
- b) Set up single window clearances mechanism to expedite clearances of NCE / RNES projects.
- c) To provide solar energy generation based rebate in electricity bills for motivating consumers to install solar power plants.

Intervention by GOI :

- a) Viability Gap Funding (VGF) as applicable for various Solar Projects in the State.
- b) Target shall be allotted in programme mode instead of project mode at the start of the financial year.
- c) Subsidy for development of Green Corridor from NCEF.

Renewable Energy Initiatives of Govt. of Kerala at Consumer Level:

For promoting generation through renewable at consumer level various programs has been launched.

➤ **Solar Connect 2014-15 – program**

Under this scheme, grid connected Roof-top Solar PV power plants of 2 kW to 50 kW capacity to be installed in the state of Kerala. The scheme is open to all types of beneficiaries limiting the total installed capacity to 50 kW in a single location. Central and State Govt. subsidy as applicable under this scheme shall be made available to the beneficiary.

➤ **Solar Water Pump 2014-15 – program**

Under this programme, it is planned for installation of 1380 nos. of Solar Water Pumps each of 1 HP to 5 HP (AC/DC) capacities, for Irrigation/community drinking water Purpose; only one system is allowable to an individual beneficiary.

➤ **Solar Thermal Program 2014-15 - Solar water heating system**

The Government of Kerala has accorded Administrative Sanction for the Proposal to install 2400 nos. of FPC Type SWHS and 7200 Nos. of ETC based SWHS included in the Annual Plan of ANERT for the year 2014-15.

➤ **Bio Energy Program 2014-15 - Family Type Biogas Plants**

Bio Energy is not converted into the electricity and this is restricted up to family type Biogas Plants in the state.

➤ **10,000 Solar Rooftop Power Plant Program**

It is a pioneering programme for decentralized stand alone rooftop solar power generation as part of the Jawaharlal Nehru National Solar National Mission being implemented by ANERT during the year 2012-13. 1kW solar power plants on 10,000 rooftops totaling a capacity of 10MW are going to be installed. This initiative is the first of its kind in India. This initiative was awarded on 27 Aug 2015 for its Outstanding Performance by Association of Renewable Energy Agencies of States (AREAS).

Further, as per MNRE rooftop solar programme, the state has to develop a total of 320 MW (4 MW in FY 2015-16, 96 MW in FY 2016-17, 100MW in FY 2017-18 and 120 MW in FY 2018-19) by FY 2018-19 at an estimated cost of Rs. 6400 Crores.

➤ **Micro-grid**

Micro grid is a small scale power supply network to provide power for a small community. It is used for local power generation for local loads. It uses highly flexible and efficient small power generating sources. For developing the idea of micro grid and to explore the possibility, KSEBL selected eight (8) locations for implementing as Pilot project. Details of the same are given in table 8.7 below:



➤ **Solar Off-Grid Systems**

It is an ongoing scheme of MNRE in which domestic lighting system (DLS) / home lighting system (HLS- Model-II) are being provided to the beneficiaries in rural and urban areas having one solar module of 24 W, 2 LEDs each of 9 W and one battery of 12V, 12Ah capacity. This scheme is having a provision of 30% subsidy from MNRE and

balance 70% to be borne by the state & beneficiary as per the state policy.

The Government buildings, hospitals, Public Health Centres (PHCs), Block offices in rural and semi-urban areas may be proposed to be provided with Solar Off-Grid Systems with battery support. Proposal for above schemes would be prepared on annual basis and submitted to MNRE for approval.

Table-8.7

Estimated Cost														
Sl. No.	Project	District	Connected Load (MW)	SPV Plant		Vanadium flow Battery Storage			Micro Hydel		Wind		Biomass	
				Capacity (MWp)	Cost (in Lacs)	Capacity (MWh)	Backup Required (hrs)	Cost (in Lacs)	Capacity (kW)	Cost (in Lacs)	Capacity (kW)	Cost (in Lacs)	Capacity (kW)	Cost (in Lacs)
1	Ponmudi	Tvpm	0.85	-	-	8.00	8.00	2546.00	SHEP Integration with 3MW Peppara Project		50 X 10	754		
2	Nilakkal	Pathanamthitta	4.00	4.00	4370.00	3.50	4.00	3000.00	10 x 2	100.00			10	75
3	Irumbayam	Kottayam	0.25	0.25	291.17	1.72	8.00	619.20					250	252.5
4	Pazhukkakanam	Kottayam	0.25	0.20	140.72	0.64	8.00	230.40	250.00	273.14				
5	Marayoor	Idukki	1.00	3.00	2175.00	4.00	4.00	1000.00	700	1055.00				
6	Chathuranagppara	Idukki	0.18	0.18	192.50	1.00	4.00	250.00			20 x 3	45		
7	Mamalakadam	Ernakulam	0.25	0.35	390.00	1.40	12.00	504.00	3000	2000.00				
8	Balanthode	Kasargode	0.80			8.00	8.00	2546.00	1350	1084.00				
	Total		7.58	7.98	7559.39	28.26		10695.60	275.05	4512.14	560.00	799	260	327.5



Funding for implementation of above scheme will be met from:

- (i) Central Financial Assistance (CFA) provided from Ministry of New and Renewable Energy, GoI under its various scheme.
- (ii) Central Financial Assistance from Ministry of Power, GoI under DDG scheme.
- (iii) Grant provided from State Government.
- (iv) State Green Energy Fund, if any.
- (v) Various private developers.

Electrification of household through Decentralized Distributed Generation (DDG) under RGGVY

No such proposal is there as Kerala State is fully electrified.

Action PLAN - state –renewable energy

DPRs for above schemes would be prepared and submitted to MNRE for approval on yearly basis

GOI INTERVENTION

- (a) Capital subsidy under Rashtriya Krishi Vikash Yojana for solar Pump system
- (b) The target shall be given on programme mode instead of project mode.
- (c) Central Financial Assistance shall be provided in the beginning of financial year.



With increasing importance being given to low carbon growth these days, the cheapest and more affordable option to overcome the energy deficit is Demand Side Management (DSM) and implementation of energy efficiency measures in various sectors such as agriculture, municipalities, buildings, domestic, industries etc. The DSM has been traditionally seen as a means of reducing peak electricity demand. In fact, by reducing the overall load on an electricity network, DSM has various beneficial effects, including mitigating electrical system emergencies, reducing the number of blackouts and increasing system reliability. Possible benefits can also include reducing dependency on expensive imports of fuel, reducing energy cost, and reducing harmful emissions to the environment.

Finally, DSM has a major role to play in deferring high investments in generation, transmission and distribution networks. Thus DSM applied to electricity systems provides significant economic, reliability and environmental benefits. Opportunities for reducing energy demand are numerous in all sectors and many are low-cost, or even no cost, items that most enterprises or individuals could adopt in the short term, if good energy management is practised.

In view of absence of any data, an exercise has been undertaken using data from other states such as Rajasthan and Andhra Pradesh. Going by the experience of these states, one finds the most common measures of DSM and the average normative approximate savings for each measure are as furnished below:

Table-9.1

Sector	DSM Technique	Energy saving Potential as % of total consumption	Investment/ MU of savings (INR Crores)
Agriculture	Replacement with Energy efficient pump Sets	27%	1.5
Domestic	Replacement of ICLs with LED bulbs	23%	0.8
Commercial building	Retrofitting of Energy efficient equipments	15%	1.5
Public water Works (PWW)	Replacement with energy efficient Pumps	26%	0.6
Municipal Street lighting (MSL)	Replacement of existing street light with LEDs	51%	2.0

Application of the above provides substantial energy savings per year. In Street lighting, the saving potential is maximum, because in this sector DSM can be planned and implemented by municipal authority. Public water works is a government organization and hence penetration rate is quite high. In other sectors, serious awareness campaign through stakeholders' consultation is required to achieve and enhances the desired energy savings.

Enlisted below are some of the DSM measures and energy efficiency initiatives to be taken up by the state of Kerala.

- Mandatory use of LED / CFL in Govt. buildings / Govt. aided institutions / Boards / Corporations.

- Promotion of Solar water heating system in domestic sector
- Solar Water Heating System to be made mandatory in industries where hot water is required for processing, hospitals and nursing homes, Govt. hospitals, hotels, motels and banquet halls, jail barracks, canteens, housing complexes set up by Group Housing Societies/Housing Boards, Residential buildings built on a plot of size 500 sq.yds. and above falling within the limits of Municipal Committees/Corporations and all Govt. buildings, Residential Schools, Educational Colleges, Hostels, Technical/Educational Institutes, District Institute of Education and Training, Tourism Complexes and Universities etc.

- Use of star rated pumps to be mandated for agriculture sector.

Government of Kerala (GoK) Initiatives:

To encourage Energy Efficiency (EE) and DSM, GoK has taken up many initiatives as given below. It is worth mentioning that during the year 2009 – 10, EMC with the support of the State Utility KSEBL, distributed 1.27 Crores CFLs to all domestic consumers in the State which was one of the biggest DSM programme in India at that point of time.

a) Empowering Consumers on Energy Efficiency:

State is conducting energy survey among all domestic consumers by utilizing the NSS student force in technical institutions for empowering consumers on energy efficiency. A Master Training of Trainers (TOT) programme was conducted to NSS student's force, recently. The other steps are in progress.

b) Agricultural DSM:

The existing inefficient Petty-Para dewatering pumping system used in coal/puncha paddy field was replaced with energy efficient submersible pumps at various locations all over Kerala. It led to energy savings of about 40%.

c) DSM in Ice plants:

State is enforcing implementation of various energy conservation measures in Ice plants all over Kerala. It was found that, there is a saving potential of **0.2MU/day**, if all the 525 nos. of Ice plants in Kerala implement the energy conservation measures.

d) DSM on Drinking water scheme:

Studies for saving potential of "Jaladhara", "Jalanidhi" drinking water systems at various locations in Kerala are in progress. Based on the studies, inefficient pumps will

be replaced with energy efficient pumps. This project is about to start.

e) Energy Audit:

KSEBL is the accredited auditing firm and conducting Energy Audits among various consumer segments and providing recommendations/suggestions on Energy Efficiency and Energy Conservation.

f) Assessment of Energy Conservation Potential

EMC has conducted a study on "Assessment of Energy Conservation Potential in Kerala". Based on the study, EMC carried out energy audit in following sectors.

- Rice mill
- Crumb rubber
- Coir manufacturing Unit

g) DSM activities:

EMC / KSEBL is consistently conducting awareness programs on DSM & energy efficiency, among all types of consumers through distribution of leaflets, arranging exhibition etc.

Energy Conservation Awareness Programmes: EMC is also conducting Energy Conservation Awareness Programmes in Domestic, Industrial and Educational Sector as per the detail given below:

➤ Domestic Sector

- Energy Conservation awareness among house wives (Energy Clinic)
- Certificate course for Home Energy Auditors
- Energy conservation awareness programmes for general public in association with NGO's, residential association etc.
- Energy conservation awareness through Media



➤ **Industrial Sector**

- Capacity Building training program for Industrial/ Commercial Energy consumers
- Capacity building training program for registered energy auditors.
- Capacity building training program for Certified Energy auditors and Managers.
- Capacity building program for Designated Consumers.

➤ **Educational Sector**

- Kerala State Students Energy Congress
- Smart Energy program in Schools
- Orja Vijan Pariksha for students
- State Level energy camp
- Energy conservation awareness program for schools, colleges and Technical institutions
- Financial assistance for projects on Energy conservation and energy efficiency
- Strengthening support infrastructure for energy studies & research in the State.
- Cartoon and Animation Film Making Competition Programme for High School and Higher Secondary School Students

h) Domestic Efficient Lighting Programme (DELP).

Energy saving potential of 241MU is expected through implementation of DELP (For details refer Table 9.2).

i) Implementation of Mandatory energy audits in HT/Extra High Tension (EHT).

Government Vide G.O (Rt) No .2/2011/PD/ dated 01.1.2011 made energy Audit Mandatory for all High Tension /Extra High Tension installations and High Rise buildings and shall be done periodically once in three years from the date of publication of G.O (Rt) No .2/2011/PD/ in the Gazette. In order to carry out above,

EMC has empanelled 30 energy auditing firms and have received around 114 audits reports.

j) High Voltage Distribution system (HVDS)

State is giving service connection to consumers directly from high voltage lines by installing small capacity distribution transformer in the line.

k) Improvement of Distribution transformer (DT) Stations

EMC initiated study to identify the losses in distribution transformers including the study of distributions system. 100 numbers DT stations have been taken up by the state for Improvement. Till date EMC has conducted study in 9 distribution transformers and the reports were forwarded to KSEBL for implementation.

l) Implementation of EMC's recommendation on Energy loss in Earthing

State is implementing the recommendation given by EMC in the study report on Energy loss in Earthing.

m) LED Village projects:

EMC with the support of BEE had implemented LED village programme in 3 Gramma panchayath and in one Municipality. This project include Supply and installation of 50 nos of 25 watts LED based Street lights and 1500 numbers of 9 watts LED bulbs to all domestic consumers (2 each).

n) Implementation of Energy efficient street lights in various locations

State is implementing new energy efficient street lighting scheme in various locations in Kerala. EMC has taken up demonstration projects on energy efficient street lighting system based on LED in all the Municipalities and Corporations of the State.



EMC successfully completed installation of 6500 numbers of 45 Watts LED street lights (100 each in 60 municipalities and 5 Corporations) in Kerala. EMC provided “Almanac fed Automatic Streetlight Switching System (Astrolite)” suitable for automatic ON/OFF.

o) Retrofitting in Hospitals

State has taken up retrofitting of lights and fans with energy efficient lights & fans in Government hospitals. The project is under progress in five (5) Government hospitals at an investment of 18.61 lakhs. From this project about 0.16 MU per annum will be saved.

p) Energy Conservation Fund:

Every year Government of Kerala provides grants to Kerala State Energy Conservation Fund. The following activities are carried out with the funds:

- ***Walk-through energy audit / Subsidy Scheme***

A walk-through energy audit is performed before conducting Energy Audit in an industry / commercial establishment. The output of this study is useful in creating a database on energy utilization pattern in industrial & commercial establishments. EMC is providing subsidy for conducting energy audit in Government /Public building.

- **Energy audit of Government /Public building and its implementation.**

As part of BEE's Investment Grade Energy Audit programme, 29 Government buildings in Kerala were audited for assessing energy conservation potential and also to make these Government buildings as model energy efficient buildings. Out of these 29 buildings, EMC has already completed the implementation of

energy audit recommendation in 6 Government buildings and taking up the implementation in 2 more building this year using energy conservation fund.

- ***Model Energy Efficient Panchayat***

In order to propagate the need and importance of energy efficiency on a large scale, EMC is making one Grama Panchayats in the State a energy efficient Panchchayath by distributing Energy efficient products like LED Bulb, LED Streetlights, LED tube lights.

- **Energy efficient Schools**

Every year EMC plans to take certain number of schools from each district to make them energy efficient by installing Energy efficient LED Tubes, LED Bulbs and five stars rated Fan.

q) Kerala State Energy Conservation Awards:

In order to identify & recognize industries, institutions and individuals who have put in serious efforts for achieving energy efficiency in their respective areas of activity, EMC has devised Kerala State Energy Conservation Award Scheme which is conducted every year and Awards are given on 14th December, National Energy Conservation Day. The following activities also envisaged under Kerala state Energy Conservation award Scheme every year

- Visit to facilities of National energy conservation Award Winners
- Publication of best practices
- Workshop on best practices case sharing

r) Other Initiatives

- Intensive training program for Energy Managers/ Engineers in Public Sector Undertakings (PSUs)



- Walk through Energy Audit in LT Consumers in Industry and Public Buildings
- Hand on Training and Certification for Boiler and Furnace Operators
- Electrical safety & Energy Conservation awareness programme for Electrical wiremen and licensed electrical supervisors
- Accreditation of energy auditors for conducting energy audit as per mandatory energy audit programme of the State
- Interaction and documentation with departments such as Department of Environment and Climate Change (DoECC)
- Hands on Capacity Building Programme on Energy Conservation Building Code (ECBC) for practising Architects and Engineers in the State
- Selected High Impact Demo Projects in Energy Efficiency
- Revision of Energy Audit Manual
- Categorisation of Medium to Large Energy Consumers in Industrial and Commercial Category
- Performance Assessment of EMC registered Energy Audit Firms
- Focussed training Programmes

Awards received by EMC, Government of Kerala (GoK) :

As recognition of the excellent performance in the field of energy efficiency and energy conservation, EMC was honoured with 7 National Awards. In the years 2008, 2010, 2012 & 2013, EMC was adjudged as the second best and in 2014 as the best State Designated Agency (Energy Conservation) in India by MoP, GoI and Power Award for the best Demand Side Management Programmes for the year 2010 and 2014.

Policy and notification in Place

Govt. of Kerala (GoK) Vide G.O. (Rt). No. 2/2011/P.D. dated 01-01-2011, made energy

audit mandatory for all HT/EHT consumers in the state.

Govt. of Kerala (GoK) Vide G.O(P) No 21/2015/PD dated 11th June 2015 (Kerala Gazette Vol4; No. 1506 dated 11.06.15) issued directive for regulation of the energy consumption standards for equipments and appliances to be used in different sectors.

Govt. of Kerala (GoK) Vide G.O(P) No 10/2014/PD dated 11.04.2014 issued directive for replacement of existing agricultural pumps with 4 or 5 star BEE star labelled pump sets in a phased manner within three years of notifications.

Govt. of Kerala has issued notifications for mandatory use of CFL/LED, Roof Top Solar PV and solar Water Heating Systems, BIS approved & minimum BEE 4 Star Labeled pump sets and promotion of energy efficient buildings. Demo projects have been initiated for development of energy efficiency in municipal street lighting, water pumping & existing Govt. buildings. Use of BEE Star Labeled electrical appliances in all government organizations has also been mandated.

Energy Conservation Building Code (ECBC) has been launched by Bureau of Energy Efficiency, MOP, GOI on 27th May, 2007 to be implemented on voluntarily basis. The code is applicable to buildings/ building complexes that have a connected load/ contract demand of 100 kW/ 120 KVA and more or having conditioned area of 500 sq meters or more and is being amended as the Kerala State Energy Conservation Building Code (KECBC) to be applicable in the state of Kerala.

Govt of Kerala (GoK) also notified following through various circular:

- Kerala State Energy Conservation fund rule
- Draft lighting policy
- Soft loan incentive scheme (through KFC)
- Annual Energy Saving Plan for Municipal and Industrial sectors



Agency responsible for DSM

Energy Management Centre (EMC) was established in February 1996 as an autonomous organization under the Department of Power, Government of Kerala (GoK). GoK vide notification number, 2450 (S R O No.1212 /2003) designated EMC as State Designated Agency (SDA) to coordinate, enforce and implement the Energy Conservation Measures in the state in accordance with the provisions contained in the Energy Conservation Act-2001 (Central Act 52 of 2002), in consultation with Bureau of Energy Efficiency (BEE), Ministry of Power, GoI.

Objectives and suggested Interventions

The domestic sector accounted for about 50% of the state's energy consumption during 2013-14, there is substantial saving potential exists in this sector through replacement programmes by energy efficient lighting and other energy efficient electrical appliances. In order to stimulate investments in energy efficient lighting projects, high quality LED lamps are proposed to be given to households at the cost of incandescent lamps (ICLs) to encourage them to invest in energy efficiency under the Domestic Efficient Lighting Program (DELP).

DELP KEY FEATURES

- LED at cost of Rs. 95-105 as against a market price of Rs 350-450
- Consumer take LED bulb at Rs. 10/-, Balance paid by DISCOM from energy savings or by consumer in 8-12 months installment.
- 3 years free replacement warrantee
- No impact on tariff
- Total upfront investments by EESL
- Benefits sharing approach

The Domestic Efficient Lighting Programme (DELP) seeks to promote high quality LED lighting in the domestic sector by overcoming the high first cost barrier. DELP will enable sale of LED bulbs from designated places at a cost that is much less than the market price of Rs. 350-450 as replacements of Incandescent Lamps (ICLs). The programme will reduce installed load approximately by 226 MW as shown in Table-9.2 and will lead to approximate annual energy consumption reduction of the state by more than 241millionKWh. The saved energy can be sold to better paying consumers like Industry and Commercial, which will provide additional revenue stream to the state utility.

ICLs are extremely energy inefficient form of lighting. In contrast, LEDs consume a fraction of energy used by ICLs to provide better light output. A single LED outlasts about 30 ICLs, and hence on life cycle cost effectiveness it fares better than ICL and CFL. However, the penetration of LEDs is very low because of their high first cost. To overcome this barrier, Energy Efficiency Services Limited (EESL), has been implementing programmes in several states to provide high quality LEDs as replacements to ICLs and CFLs at a cost of Rs. 95-105 each to residential consumers.

EESL procures the LEDs bulbs and provides to consumers at an initial rate of Rs. 10 each (balance by DISCOM from energy savings or by consumer in installment) as against their market price of Rs. 350-450.

Table-9.2

	RURAL	URBAN	TOTAL	REMARKS
No. of House Hold Consumers targeted, (Lakhs)	32.47	22.30	54.77	Total urban electrified H/Hs and about 60% of rural electrified households of Kerala as on FY 2014-15 has been considered
No. of inefficient ICLs & CFLs to be replaced, (Lakhs)	64.94	44.60	109.54	Rural – 1 no. ICL (60 W each) and 1 no. CFL (14 W each) to be replaced with LEDs (7 W each) Urban -2 nos. CFL (14 W each) to be replaced with LEDs (7 W each)
Total reduction of connected load in the state, (MW)	195	31	226	
Total energy consumption reduction in the state, (MUs)	207.63	33.27	241	
Energy bill reduction for each household per annum (Rs.)	190 to 210	45 to 50	---	Average domestic tariff considered Rs. 3.0 to Rs.3.25 per kWh
Cost reduction for DISCOMS per annum of peak power (Rs. Crores)	249	40	289	
Upfront investment by State/ DISCOM	Nil	Nil	Nil	Cost of peak power considered Rs. 1.28 Crores / MW / Annum
Total Program Investment by EESL/ Lighting companies* (Rs. Crores)	71	49	119	Cost of LED bulb considered as Rs. 109 per bulb inclusive of transportation and bulb distribution charges.
Recovery of cost	1. DISCOM Repayment 2. Consumer Repayment			

Note: * Taxes such as service tax, sales tax, or any other taxes as applicable will be charged on actual basis which is not included in these amounts.

EESL will make / arrange the upfront investment estimated at Rs. 119 Crores for procurement, transportation, distribution of 100.10 Lakhs LED to domestic households in the state.

Approach / Strategy

All the above interventions involve replacement of inefficient equipment / appliances with energy efficient ones for the agriculture, domestic, commercial buildings and municipalities. **These can be undertaken by the State Government at no upfront cost by using the Energy Service Company (ESCO) model.** The model is based on the concept of promoting Performance Contract mode where the company invests in any project by entering into a contract agreement with the facility

owner which is recovered through the savings accrued due to reduced electricity bills.

Actions Points

The sector-wise Central Government and State Government actions envisaged to facilitate implementation of energy efficiency measures as mentioned above are detailed below:

Central Government

- BEE may consider formulation of specification for LED bulbs and introducing star label scheme for LED bulbs.
- Energy Efficiency Services Limited (EESL) to take up project design and project development.

State Government

- Distribution Companies / Utilities may file DSM petition with Kerala Electricity Regulatory Commission for getting sanction of the proposed DSM plan.



- Ensure formulation of a detailed time line in consultation with concerned departments like Distribution Companies for implementation of energy efficiency measures in municipalities.
- Ensure establishment of a payment security mechanism so that the company making investments under the ESCO mode recovers the same through the savings accrued due to reduced electricity bills.

Central Government

- BEE may provide technical support for effective enforcement of ECBC and promotion of ESCO based retrofitting works in Government buildings. BEE can provide support for capacity building of state department through establishment of ECBC cells for compliance of ECBC and retrofitting in Government buildings.
- Energy Efficiency Services Limited (EESL) to take up project design and project development for retrofitting in commercial buildings.

State Government

- Government of Kerala has to adopt ECBC Directives for new commercial building design and mandated energy audit of existing commercial building once in a three-year period. Effective enforcement of ECBC compliance and mandating

retrofitting in energy-audited buildings may result in reduction of electrical consumption from commercial sector. Government of Kerala may consider mandatory retrofitting in Government buildings with an objective of reduction of electricity bills, which state government is paying against electricity bill of these buildings. This would also demonstrate impact of ESCO based retrofitting projects to private building owners to adopt the same.

- As per the Planning Commission's projection; residential building are becoming one of the larger consumers of electricity in the country by 2030. BEE is introducing design guidelines for energy efficient multi storey residential apartments including in the composite and hot & dry climatic zone. State Government may mandate compliance of these guidelines through institutional framework in the state.
- For residential buildings, the state could adopt the star labeling scheme for multi-storey residential apartment buildings, being prepared by BEE.

In addition to the above, Kerala Electricity Regulatory Commission (RERC) may be requested to issue directives for creation of DSM funds by DISCOMs / Utilities of the State so that DSM activities can get extra emphasis. Such funds can be utilized for meeting incremental cost of efficiency improvement.



Financial Position

KSEBL is a combined entity for generation, transmission and distribution of power in whole of Kerala. Financial statement (provisional) was made available for FY 2012-13 and FY 2013-14. Based on this, the present financial position for KSEBL is as follows:-

After corporatization of the erstwhile Kerala State Electricity Board (KSEBL) in October 2013, Government of Kerala revested all the assets & liabilities of the Board in new Company i.e KSEBL. The Government of Kerala issued the Final transfer scheme by issuing a new balance sheet for KSEBL as on 01.11.2013. The last reported profit as per provisional financial statements of the board (from 01.04.2013 to 31.10.2013) was Rs 140.41 Crores with accumulated profit of Rs 2348.74 Crores. However after taking over the assets & liabilities of the board by KSEBL with a revised value, KSEBL reported loss of Rs 29.46 Crores for the period 01.11.2013 to 31.03.2014 making its accumulated loss of Rs 32.73 Crores as on 31.03.2014 (as per provisional accounts of 2013-14). Revenue from sale of power of KSEBL for five months (01.11.2013 to 31.03.2014) was reported at Rs 5253.58 Crores in FY 2013-14.

Financial Viability

Based on the road map discussed in the previous chapters, various scenarios have been

prepared to visualize the profitability from operating the business as per the roadmap laid down and sensitivity thereof with changes in important input parameters like tariff and AT&C losses. However, the analysis has been restricted up to FY 2018-19 being the analysis framework for 24x7 PFA initiatives.

The following scenarios have been detailed in subsequent sections:

- At targeted growth rate and other parameters as per “24x7 Power for All” Road Map (Base case).
- Same as (a) and tariff hikes for viability, if required.
- Non-Adherence to AT & C Loss Reduction Trajectory and subsequent dependence on higher tariff hike for viability.
- At targeted growth and loss reductions as per roadmap and all funding including those under GOI schemes as per Debt equity ratio of 70:30.
- Scenario considering provisions under newly constituted UDAY Scheme for power sector.

Common Assumptions

- Average cost of power purchase for each year has been considered as per state furnished data. The details are given as hereunder:

Table-10.1

Sl. No.	Description	Unit	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
1.	Power Purchased at state periphery	MU	15613	19386	20449	22593
2.	Power Purchase Cost	Rs Crores	6329.5	7458.0	7872.8	8815.8
3.	Average Power Purchase Cost	Rs/kWh	4.05	3.84	3.85	3.90

Source: State Data

- The major share of internal generation being from hydro sources, the total cost of generation was only Rs 240 Crores for FY 2013-14 which is adopted without any change for the future years also.
- The rate of power purchase for future years is worked out by averaging the total

cost of purchase from various sources including CGS, traders and IPPs at the respective tariffs (as per PPAs and latest power purchase statements) against the quantum of power proposed to be purchased from each source. The inter-state losses and inter-state transmission charges are considered to be included.



4. The average rate of power purchase thus calculated for the future years works out as shown in table no- 10.1.
5. Escalation towards O&M cost (excl employees cost) and administrative and General expenses has been considered @ 6% p.a. in line with average changes in WPI;

Table-10.2

Month/ Year	WPI Indices	CPI Indices
Average 2012-13	168	215
Average 2013-14	178	236
Increase	5.95%	9.8%
Say	6.0%	10%

Source: eaindustry.gov.in

6. Escalation towards Employee Cost considered @ 10% p.a. based on CPI Indices.
7. Purchase Demand considered as forecasted in previous chapters.
8. Grant, Loan and Equity ratio has been considered as 60%:30%:10% (DDUGJY/IPDS). All other investments have been considered for funding as per Debt equity ratio 70:30. Additional grant of 15% of IPDS & DDUGJY has been taken from 3rd year onwards. Financing of other schemes have been done as per their guidelines.
9. Interest computation has been done as per the existing loan profiles of KSEBL. Interest on future long term loan has been calculated @ 12% p.a. Interest on Working Capital loan has been calculated @13% p.a.

10. The existing average billing rate was Rs 5.03/kWh in FY 2014-15 based on state data. Subsequently, from FY 2015-16 to FY 2018-19, the average billing rate has been considered based on the emerging consumer mix. Thus, the weighted average ABR, is as shown hereunder:

Table-10.3

Year	Rs./kWh
FY 2015-16	4.98
FY 2016-17	4.93
FY 2017-18	4.91
FY 2018-19	4.89

The details of weighted average billing rate is given in Annexure-XV.

11. The interstate sale of surplus energy has been considered at the rate of 3.00 Rs/kWh. Average rate for sale of power through power trading exchange is in the range of Rs 2-4/kWh, hence an average of Rs 3/kWh has been adopted.
12. Depreciation has been computed @ average 2.03% for existing assets and 5.28% for new incoming assets.
13. Escalation towards Meter Rent & Other Receipts has been considered@ 4.63% p.a. as per CAGR of no. of electrified households and other income considered growing @ 10.0% p.a.
14. Receivable against supply of power has been projected @ 1 month level.
15. Liabilities for purchase of power has been considered as 2 month of power purchase.
16. Collection efficiency has been assumed as 100%.



Scenario A: Targeted Growth Rate as per 24x7 Road Map (Base Case)

Assumptions

- ✓ No tariff hike and change in power purchase cost.
- ✓ AT&C losses as per MoP targeted trajectory.

Table-10.4A

Financial Position of the Utilities (Scenario A)

Assumptions	SCN-A				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required		20106	21934	23567	25325
Requirement at state periphery	MU	23822	25889	27709	29620
AT & C Losses (As per Trajectory)	%	10.50%	10.25%	10.00%	10.00%
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		15.6%	15.3%	15.0%	14.5%
Power purchase cost	Rs/Unit	4.050	3.840	3.850	3.900
Energy available at state periphery	MU	22708	26597	28093	30658
Shortage/Surplus of Power	MU	-1114	708	384	1038
State's Own Generation	MU	7352	7445	7877	8298
Purchased Power	MU	16470	19152	20216	22360
Revenue Parameters					
Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Tariff increase	%	0.0%	0.0%	0.0%	0.0%
Effective Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Energy sold within state	MU	20106	21934	23567	25325
Energy sold to other states	MU	0	708	384	1038
Expense					
Employee cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
SCN-A					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	10013	11026	11686	12695
Other income like meter rent, theft recov etc	Rs Crores	302	316	330	346
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	330	359	390	425
Total Income		10645	11701	12407	13466
Expenditure					
Power Purchase	Rs Crores	6670	7354	7783	8720
Generation of Power	Rs Crores	240	240	240	240
Employee cost	Rs Crores	3039	3343	3677	4045
R & M Cost	Rs Crores	255	270	287	304
Admn. & General expenses	Rs Crores	280	297	314	333
Others	Rs Crores	0	0	0	0
Total expenses		10484	11505	12302	13643
Gross Profit	Rs Crores	160	196	106	-177
Interest	Rs Crores	743	855	1006	1114
Depreciation	Rs Crores	597	717	848	937
Profit before tax	Rs Crores	-1180	-1376	-1748	-2228
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-1180	-1376	-1748	-2228

Table-10.4B**(Rs. in Crores)**

Description	2015-16	2016-17	2017-18	2018-19
Cash Inflows				
-Grants	127	431	248	144
-Equity	499	594	764	264
-Long term loans	1178	1196	1775	573
-Profit before Tax	-1180	-1376	-1748	-2228
-Depreciation	597	717	848	937
-Interest	743	855	1006	1114
-Bank borrowings for working capital	245	269	296	323
-Security deposit from consumers	0	0	0	0
-Long term Provisions	1738	1912	2103	2313
-Short term borrowings	0	0	0	0
Total Cash Inflow	3947	4597	5292	3440
Cash outflow				
-capital expenditure	1804	2220	2787	981
-Loan repayments	414	414	414	512
-Repayment of short term borrowings	0	0	0	0
-Interest payouts	743	855	1006	1114
-Increase in working capital	-1441	-280	-281	-352
-Interest on short term borrowings@13% p.a.	0	0	0	0
-Tax	0	0	0	0
Total cash outflow	1519	3210	3926	2255
Net cash inflow	2428	1388	1366	1185
Opening cash balance from previous year	9283	11710	13098	14464
Closing cash balance	11710	13098	14464	15650

The projected scenario exhibits the continuation of loss making situation in the forthcoming period and tariff hikes would be required if turnaround is to be achieved.

Scenario B : Targeted Growth Rate as per 24x7 Road Map and Turnaround with Tariff Hikes.

Assumptions

- ✓ All other assumptions as per Base-case (Scenario-A)
- ✓ Turnaround considering tariff hike.

Table-10.5A

Financial Position of the Utility (Scenario B)

Assumptions	SCN-B				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required		20106	21934	23567	25325
Requirement at state periphery	MU	23822	25889	27709	29620
AT & C Losses (As per Trajectory)	%	10.50%	10.25%	10.00%	10.00%
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		15.6%	15.3%	15.0%	14.5%
Power purchase cost	Rs/Unit	4.050	3.840	3.850	3.900
Energy available at state periphery	MU	22708	26597	28093	30658
Shortage/Surplus of Power	MU	-1114	708	384	1038
State's Own Generation	MU	7352	7445	7877	8298
Purchased Power	MU	16470	19152	20216	22360
Revenue Parameters					
Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Tariff increase	%	0.0%	5.7%	5.7%	5.7%
Effective Average billing rate	Rs/Unit	4.98	5.21	5.49	5.77
Energy sold within state	MU	20106	21934	23567	25325
Energy sold to other states	MU	0	708	384	1038
Expense					
Employee cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
SCN-B					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	10013	11642	13043	14936
Other income like meter rent, theft recov etc	Rs Crores	302	316	330	346
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	330	359	390	425
Total Income		10645	12317	13764	15706
Expenditure					
Power Purchase	Rs Crores	6670	7354	7783	8720
Generation of Power	Rs Crores	240	240	240	240
Employee cost	Rs Crores	3039	3343	3677	4045
R & M Cost	Rs Crores	255	270	287	304
Admn. & General expenses	Rs Crores	280	297	314	333
Others	Rs Crores	0	0	0	0
Total expenses		10484	11505	12302	13643
Gross Profit	Rs Crores	160	812	1463	2064
Interest	Rs Crores	743	857	1012	1123
Depreciation	Rs Crores	597	717	848	937
Profit before tax	Rs Crores	-1180	-762	-397	3
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-1180	-762	-397	3

Table-10.5B**(Rs. in Crores)**

Description	2015-16	2016-17	2017-18	2018-19
Cash Inflows				
-Grants	127	431	248	144
-Equity	499	594	764	264
-Long term loans	1178	1196	1775	573
-Profit before Tax	-1180	-762	-397	3
-Depreciation	597	717	848	937
-Interest	743	857	1012	1123
-Bank borrowings for working capital	245	269	296	323
-Security deposit from consumers	0	0	0	0
-Long term Provisions	1738	1912	2103	2313
-Short term borrowings	0	0	0	0
Total Cash Inflow	3947	5214	6649	5681
Cash outflow				
-capital expenditure	1804	2220	2787	981
-Loan repayments	414	414	414	512
-Repayment of short term borrowings	0	0	0	0
-Interest payouts	743	857	1012	1123
-Increase in working capital	-1441	-228	-219	-279
-Interest on short term borrowings@13% p.a.	0	0	0	0
-Tax	0	0	0	0
Total cash outflow	1519	3263	3993	2338
Net cash inflow	2428	1950	2655	3343
Opening cash balance from previous year	9283	11710	13661	16316
Closing cash balance	11710	13661	16316	19659

The scenario exhibits the extent of tariff hikes required to make turnaround of situation as shown under scenario -A. The tariff hikes to the tune of 5.7% in each year from FY 2016-17 to FY 2018-19 would be able to make turnaround by FY 2018-19.

Scenario C: Non-Adherence to Performance Parameters (Loss Reduction Trajectory) and subsequent dependence on Higher Tariff Hike.

Assumptions

- ✓ AT&C losses higher by 1% than the targeted trajectory.
- ✓ All other assumptions as per Base-case (Scenario-A)

Table-10.6A

Financial Position of the Utility (Scenario C)

Assumptions	SCN-C				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required		20106	21934	23567	25325
Requirement at state periphery	MU	24079	26180	28021	29953
AT & C Losses (As per Trajectory)	%	11.50%	11.25%	11.00%	11.00%
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		16.5%	16.2%	15.9%	15.5%
Power purchase cost	Rs/Unit	4.050	3.840	3.850	3.900
Energy available at state periphery	MU	22708	26597	28093	30658
Shortage/Surplus of Power	MU	-1371	417	72	705
State's Own Generation	MU	7352	7445	7877	8298
Purchased Power	MU	16727	19152	20216	22360
Revenue Parameters					
Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Tariff increase	%	0.0%	0.0%	0.0%	0.0%
Effective Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Energy sold within state	MU	20106	21934	23567	25325
Energy sold to other states	MU	0	417	72	705
Expense					
Employee cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
SCN-C					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	10013	10938	11593	12596
Other income like meter rent,theft recov etc	Rs Crores	302	316	330	346
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	330	359	390	425
Total Income		10645	11613	12314	13366
Expenditure					
Power Purchase	Rs Crores	6774	7354	7783	8720
Generation of Power	Rs Crores	240	240	240	240
Employee cost	Rs Crores	3039	3343	3677	4045
R & M Cost	Rs Crores	255	270	287	304
Admn. & General expenses	Rs Crores	280	297	314	333
Others	Rs Crores	0	0	0	0
Total expenses		10588	11505	12302	13643
Gross Profit	Rs Crores	56	109	12	-277
Interest	Rs Crores	742	854	1008	1121
Depreciation	Rs Crores	597	717	849	940
Profit before tax	Rs Crores	-1283	-1463	-1844	-2338
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-1283	-1463	-1844	-2338

Table-10.6B**(Rs. in Crores)**

Description	2015-16	2016-17	2017-18	2018-19
Cash Inflows				
-Grants	127	431	217	89
-Equity	499	594	764	264
-Long term loans	1178	1196	1807	627
-Profit before Tax	-1283	-1463	-1844	-2338
-Depreciation	597	717	849	940
-Interest	742	854	1008	1121
-Bank borrowings for working capital	245	269	296	323
-Security deposit from consumers	0	0	0	0
-Long term Provisions	1738	1912	2103	2313
-Short term borrowings	0	0	0	0
Total Cash Inflow	3843	4510	5199	3340
Cash outflow				
-capital expenditure	1804	2220	2787	981
-Loan repayments	414	414	414	512
-Repayment of short term borrowings	0	0	0	0
-Interest payouts	742	854	1008	1121
-Increase in working capital	-1459	-270	-282	-353
-Interest on short term borrowings@13% p.a.	0	0	0	0
-Tax	0	0	0	0
Total cash outflow	1501	3219	3927	2261
Net cash inflow	2342	1291	1271	1079
Opening cash balance from previous year	9283	11625	12915	14187
Closing cash balance	11625	12915	14187	15266

The scenario exhibits that non adherence to AT & C Loss reduction trajectory would compound the losses further and higher tariff hikes to the tune of 6% in FY 2016-17 & FY 2017-18 and 6% in FY 2018-19 may be required to observe a turn around by FY 2018-19.

Scenario D: Targeted Growth Rate as per 24x7 Road Map and Considering all funding including GoI Schemes in the Debt Equity Ratio of 70:30.

Assumptions

- ✓ At targeted growth rates and loss reduction as per road map.
- ✓ Considering all funding including GoI Schemes in the Debt Equity Ratio of 70:30.

Table-10.7A

Financial Position of the Utility (Scenario D)

Assumptions	SCN-D				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required		20106	21934	23567	25325
Requirement at state periphery	MU	23822	25889	27709	29620
AT & C Losses (As per Trajectory)	%	10.50%	10.25%	10.00%	10.00%
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		15.6%	15.3%	15.0%	14.5%
Power purchase cost	Rs/Unit	4.050	3.840	3.850	3.900
Energy available at state periphery	MU	22708	26597	28093	30658
Shortage/Surplus of Power	MU	-1114	708	384	1038
State's Own Generation	MU	7352	7445	7877	8298
Purchased Power	MU	16470	19152	20216	22360
Revenue Parameters					
Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Tariff increase	%	0.0%	0.0%	0.0%	0.0%
Effective Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Energy sold within state	MU	20106	21934	23567	25325
Energy sold to other states	MU	0	708	384	1038
Expense					
Employee cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	10013	11026	11686	12695
Other income like meter rent,theft recov etc	Rs Crores	302	316	330	346
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	330	359	390	425
Total Income		10645	11701	12407	13466
Expenditure					
Power Purchase	Rs Crores	6670	7354	7783	8720
Generation of Power	Rs Crores	240	240	240	240
Employee cost	Rs Crores	3039	3343	3677	4045
R & M Cost	Rs Crores	255	270	287	304
Admn. & General expenses	Rs Crores	280	297	314	333
Others	Rs Crores	0	0	0	0
Total expenses		10484	11505	12302	13643
Gross Profit	Rs Crores	160	196	106	-177
Interest	Rs Crores	748	886	1070	1195
Depreciation	Rs Crores	601	735	884	983
Profit before tax	Rs Crores	-1188	-1426	-1848	-2355
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-1188	-1426	-1848	-2355

Table-10.7B**(Rs. in Crores)**

Description	2015-16	2016-17	2017-18	2018-19
Cash Inflows				
-Grants	0	0	0	0
-Equity	541	666	836	294
-Long term loans	1263	1554	1951	687
-Profit before Tax	-1188	-1426	-1848	-2355
-Depreciation	601	735	884	983
-Interest	748	886	1070	1195
-Bank borrowings for working capital	245	269	296	323
-Security deposit from consumers	0	0	0	0
-Long term Provisions	1738	1912	2103	2313
-Short term borrowings	0	0	0	0
Total Cash Inflow	3947	4597	5292	3440
Cash outflow				
-capital expenditure	1804	2220	2787	981
-Loan repayments	414	414	414	519
-Repayment of short term borrowings	0	0	0	0
-Interest payouts	748	886	1070	1195
-Increase in working capital	-1441	-280	-281	-352
-Interest on short term borrowings@13% p.a.	0	0	0	0
-Tax	0	0	0	0
Total cash outflow	1524	3241	3990	2343
Net cash inflow	2423	1356	1302	1097
Opening cash balance from previous year	9283	11705	13062	14364
Closing cash balance	11705	13062	14364	15461

This scenario exhibits that absence of grant funds would make considerable dent on overall profitability and tariff hikes to the tune of 6% in each year from FY 2016-17 to FY 2018-19 would have to be resorted to in order to see turnaround by FY 2018-19.

Scenario under UDAY Scheme:

Assumptions:

- ✓ State to take over 75.0% of DISCOMs debt as on 30th Sept' 2015 over two years as 50.0% in FY 2015-16 and 25.0% in FY 2016-17.
- ✓ Interest rate on balance 25.0% to be charged at 9.0%

Table-10.8A

Financial Position of the Utility (UDAY)

Assumptions	UDAY				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required		20106	21934	23567	25325
Requirement at state periphery	MU	23822	25889	27709	29620
AT & C Losses (As per Trajectory)	%	10.50%	10.25%	10.00%	10.00%
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		15.6%	15.3%	15.0%	14.5%
Power purchase cost	Rs/Unit	4.050	3.840	3.850	3.900
Energy available at state periphery	MU	22708	26597	28093	30658
Shortage/Surplus of Power	MU	-1114	708	384	1038
State's Own Generation	MU	7352	7445	7877	8298
Purchased Power	MU	16470	19152	20216	22360
Revenue Parameters					
Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Tariff increase	%	0.0%	0.0%	0.0%	0.0%
Effective Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Energy sold within state	MU	20106	21934	23567	25325
Energy sold to other states	MU	0	708	384	1038
Expense					
Employee cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	10013	11026	11686	12695
Other income like meter rent,theft recov etc	Rs Crores	302	316	330	346
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	330	359	390	425
Total Income		10645	11701	12407	13466
Expenditure					
Power Purchase	Rs Crores	6670	7354	7783	8720
Generation of Power	Rs Crores	240	240	240	240
Employee cost	Rs Crores	3039	3343	3677	4045
R & M Cost	Rs Crores	255	270	287	304
Admn. & General expenses	Rs Crores	280	297	314	333
Others	Rs Crores	0	0	0	0
Total expenses		10484	11505	12302	13643
Gross Profit	Rs Crores	160	196	106	-177
Interest	Rs Crores	373	382	504	639
Depreciation	Rs Crores	597	717	848	937
Profit before tax	Rs Crores	-810	-903	-1246	-1753
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-810	-903	-1246	-1753

Table-10.8B**(Rs. in Crores)**

Description	2015-16	2016-17	2017-18	2018-19
Cash Inflows				
-Grants	127	431	248	144
-Equity	499	594	764	264
-Long term loans	1178	1196	1775	573
-Profit before Tax	-810	-903	-1246	-1753
-Depreciation	597	717	848	937
-Interest	373	382	504	639
-Bank borrowings for working capital	245	269	296	323
-Security deposit from consumers	0	0	0	0
-Long term Provisions	1738	1912	2103	2313
-Short term borrowings	0	0	0	0
Total Cash Inflow	3947	4597	5292	3440
Cash outflow				
-capital expenditure	1804	2220	2787	981
-Loan repayments	0	0	0	98
-Repayment of short term borrowings	0	0	0	0
-Interest payouts	373	382	504	639
-Increase in working capital	-1441	-280	-281	-352
-Interest on short term borrowings@13% p.a.	0	0	0	0
-Tax	0	0	0	0
Total cash outflow	736	2322	3010	1365
Net cash inflow	3211	2275	2282	2075
Opening cash balance from previous year	9716	12927	15202	17485
Closing cash balance	12927	15202	17485	19560

The scenario exhibits that even after substantial cleaning up of the accumulated loans under UDAY Scheme, there would be need of tariff hike of 4.6% in each year from FY 2016-17 to FY 2018-19 in order to have a turnaround by FY 2018-19.

Table-10.8C

Financial Position of the Utility (UDAY Scenario with Tariff Hikes)

Assumptions	UDAY				
Description	Units	2015-16	2016-17	2017-18	2018-19
Total unrestricted energy required		20106	21934	23567	25325
Requirement at state periphery	MU	23822	25889	27709	29620
AT & C Losses (As per Trajectory)	%	10.50%	10.25%	10.00%	10.00%
Collection efficiency	%	100.0%	100.0%	100.0%	100.0%
T&D Losses		15.6%	15.3%	15.0%	14.5%
Power purchase cost	Rs/Unit	4.050	3.840	3.850	3.900
Energy available at state periphery	MU	22708	26597	28093	30658
Shortage/Surplus of Power	MU	-1114	708	384	1038
State's Own Generation	MU	7352	7445	7877	8298
Purchased Power	MU	16470	19152	20216	22360
Revenue Parameters					
Average billing rate	Rs/Unit	4.98	4.93	4.91	4.89
Tariff increase	%	0.0%	4.6%	4.6%	4.6%
Effective Average billing rate	Rs/Unit	4.98	5.16	5.37	5.60
Energy sold within state	MU	20106	21934	23567	25325
Energy sold to other states	MU	0	708	384	1038
Expense					
Employee cost escalation	%	10%	10%	10%	10%
Repair & Maintenance escalation	%	6%	6%	6%	6%
Administrative & General escalation	%	6%	6%	6%	6%
Financial position of Utility					
	UDAY				
Description	Units	2015-16	2016-17	2017-18	2018-19
Net sales-Power	Rs Crores	10013	11523	12776	14484
Other income like meter rent, theft recov etc	Rs Crores	302	316	330	346
Revenue, Subsidies & Grants	Rs Crores	0	0	0	0
Other income	Rs Crores	330	359	390	425
Total Income		10645	12198	13496	15255
Expenditure					
Power Purchase	Rs Crores	6670	7354	7783	8720
Generation of Power	Rs Crores	240	240	240	240
Employee cost	Rs Crores	3039	3343	3677	4045
R & M Cost	Rs Crores	255	270	287	304
Admn. & General expenses	Rs Crores	280	297	314	333
Others	Rs Crores	0	0	0	0
Total expenses		10484	11505	12302	13643
Gross Profit	Rs Crores	160	693	1195	1612
Interest	Rs Crores	373	382	504	639
Depreciation	Rs Crores	597	717	848	937
Profit before tax	Rs Crores	-810	-405	-157	36
Tax	Rs Crores	0	0	0	0
Net Profit after taxes		-810	-405	-157	36

Implication on Tariff

The additional investment to the extent required under state plans and share thereof in new schemes would have an impact on the tariff. The same has been worked out and presented in Annexure-XVI.

Communication

Successful implementation of 24X7 Power Supply Scheme requires clear communication among all the stakeholders across the value chain, including the consumers. In order to avoid potential roadblocks in implementation due to poor communication and flow of information, the following table lists the primary responsibility of each stakeholder and the corresponding method in which it will be carried out.

A centralized corporate communication team can be formed at headquarters of the DISCOM

for looking at activities of overall communication strategy.

The financial situation in Kerala makes it imperative to raise tariffs while other initiatives including 24X7 supplies are implemented. Such tariff increases would inevitably impact consumers and meet with resistance. To address this, the utilities would clearly communicate their plans on implementing the reliable 24X7 supply scheme along with the other reliability and efficiency improvement measures that they are implementing. A high level of involvement of the Government of Kerala will also be required.

Table-11.1

Proposed Communication Responsibilities

Communication Objective	Responsibility	Frequency
“ Power for all” - Roll Out Plan	Power Secretary	Quarterly
Power Supply Position	CMD KSEBL	Daily
Energy Savings & Conservation	CE(T) Audit	Monthly
Planned Outages & Disruption	CMD, KSEBL	Daily
Real time feeder-wise Information	CMD, KSEBL	Daily
Status update on Deliverables	Power Secretary	Quarterly
Renewable Power	Director, KEDA	Quarterly
Generation- Projects, PLF & Fuel	CMD, KSEBL	Monthly
Transmission Projects – Physical Progress and Achievements	CMD, KSEBL	Monthly
Distribution – Progress ,Achievements, Losses, Consumer Initiatives etc.	CMD, KSEBL	Monthly

Information Technology Initiatives

The need to adopt IT in every sphere of utility operation is pervasive. Power is a complex product that must be consumed on a real time basis. The overall value involved in the process is very high. Even more importantly it touches all citizens. Yet, the information systems that drive the operations of the sector are generally very basic and information transparency and consistency is poor. While sporadic efforts have

been made in the past to improve this, quantum changes are required to increase IT adoption in all spheres of power sector operation.

IT Initiatives Adopted by KSEBL

- Introduction of IT in distribution in 43 ADDRP Towns under RAPDRP- Part-A.
- Introduction of SCADA in distribution in 3 ADDRP Towns under RAPDRP- Part-A.

Planned

- Introduction of IT in distribution in Non APDRP Area & rural area Departmentally

Table-11.2

Requirement of funds for establishment of requisite institutes in the state

Sl. No.	Name of Scheme/Project	Fund Requirement
1	Power Engineers Training and Research Centre (PETARC)	70 Lakhs
2	Regional Power Training Institutes (RPTI)	130 lakhs

Institutional Arrangement

A strong monitoring framework is essential to ensure the success of the “Power for all” scheme. The following structure is being proposed to undertake regular monitoring of the progress of all initiatives being under-taken in this scheme.

- **Government of India (GOI) Level Committee:** It is proposed that this committee will review the overall progress of the scheme on a quarterly basis and provide necessary support to ensure a coordinated response from the Central Govt. - where necessary. The committee may be constituted with the following members – PFC, REC, CEA, SECI, EESL, Ministry of Power Ministry of Coal, and MNRE.
- **State Government Level Committee:** It is proposed that a State level committee headed by the Chief Secretary will be formed to review the progress of the scheme on a quarterly basis. This committee will monitor the progress of the works undertaken as part of the scheme and issue directions to enable faster execution. This committee will be constituted with the following Principal Secretaries/ Secretaries of the Power, Finance, Urban Development, Agriculture and other relevant departments along with the CMD/Chairman/MD of state utilities.
- **Department Level Committee:** It is proposed that the Department level committee headed by the Power Secretary

will be formed and shall undertake steps required to ensure the projects are progressing as per the action plan. This committee will undertake progress reviews on a monthly basis. The committee will be constituted with the following members – Secretary (Power) and CMD of state utilities.

- **District Level Committee** – It is proposed to constitute a district level committee headed by the District Collector to take action that is necessary to ensure the projects are completed in a timely manner and address any issues pertaining to land or other relevant approvals. The committee will be constituted with the following members – District Collector and Superintendent Engineer of state utilities.
- **Project Monitoring Unit (PMU)** – A project monitoring unit shall be set up for monitoring the progress of the works being undertaken under this scheme. The PMU will operate under the Secretary, Energy and shall be operated by an external independent agency. The PMU shall be responsible for undertaking coordination, preparing the action plans and monitoring progress of all Works under the “Power for all” scheme. The PMU would also help facilitate in tracking the action steps and providing feedback to the various committee that are proposed to be set up under the scheme. Government of India shall provide grants for the PMU operations.



The committees that are being proposed above are required to be set up at the earliest to kick start the whole scheme. It is important that the committees keep meeting on a regular basis as per the frequency/ timelines mentioned above – to ensure that the objectives set out under the “Power for all” scheme are achieved.

Capacity Building

With the increase of IT in the Generation, Transmission & Distribution system and to meet the expectations of 24 X 7 power supply for the consumers in the state, it is important to focus on capacity building of the employees for enhancement of technical know-how for latest

technological developments and to increase the consumer satisfaction. The capacity building may also include consumer grievance system, awareness regarding importance of working with safety, outage management system, demand side management etc. It is also imperative to state that for serving the consumers in a different way change of mindset of the employees would be required. It is critical that Change Management initiatives are rolled out and institutionalized throughout the DISCOM for achieving better results. The details of the present employee in the KSEBL are as under:

Table-11.3

Details of Man Power of KSEBL as on 31.8.2015

Sl. No.	Wing	Sanctioned Strength	Working strength	Appointment during the month	Retirement during the month
1	Generation profit centre	*	1809	1	
2	Transmission profit centre	4293	3443	1	1
3	Distribution profit centre	24347**	25918	1	9
4	Corporate office	1278	881		1
	Total	36428	32051	2	10

* The Sanctioned Strength of the generation is not yet finalized.

** The Sanctioned Strength of Senior assistants, Meter readers and cashiers in the Electrical sections are not yet finalized. So these are not included in the total sanctioned strength of Distribution wing.

KSEBL is imparting in house training to its Employees in its Existing training institutes

Following are the Existing training institutes in the state/proposed institutes

- Power Engineers Training and Research Centre (PETARC), Moolamattom, Idukki.
- Regional Power Training Institute (RPTI), Chackai, Thiruvananthapuram.

- Regional Power Training Institute (RPTI), Pallom, Kottayam.

- Regional Power Training Institute (RPTI), Poochatty, Thrissur

- Regional Power Training Institute (RPTI), Kozhikode

The following are the details of requirement of training for technical & non technical category employees.



Table-11.4

Sl. No.	Technical	Non Technical
1	The Right to Information Act, 2005.	The Right to Information Act, 2005.
2	Team Building, Communication & Time Management	Team Building, Communication & Time Management
3	Stress Management/Yoga	Stress Management/Yoga
4	Organizational Awareness	Organizational Awareness
5	Energy Conservation, DSM	Energy Conservation, DSM
6	Standards of Performance	Service Matters
7	Service Matters	Revenue Accounting
8	Land Acquisition, Tree Cutting Compensation & PTCC Approval	Land Acquisition, Tree Cutting Compensation & PTCC Approval
9	Control Wiring & Cable Scheduling	Malayalam - File Drafting
10	Power Transformers - O & M	Disciplinary Procedures, Legal Aspects & Various Courts, Grievances Redressal Forums (CGRF, CDRF)
11	Ring Main Unit(RMU)	Customer Satisfaction, Interpersonal Relationship & Business Etiquettes
12	Communication/SCADA	Metering Regulations, Theft Detection & Penalties, TOD Billing
13	Disciplinary Procedures, Legal Aspects & Various Courts, Grievances Redressal Forums (CGRF, CDRF)	Work Measurement & Materials Management
14	Workshop on distribution transformer maintenance & TMR visit	Supply Code
15	Service Connection Procedures, Estimate Preparation & Tariff	Orientation Training Programme
16	Customer Satisfaction, Interpersonal Relationship & Business Etiquettes	Induction Level Training Programme
17	Relay & Protection	Audit & Audit Reply
18	Safety Awareness - Distribution	Taxes - Commercial Tax & Service Taxes
19	Safety Awareness - Transmission	Tariff & Various Types of Billing
20	Safety Awareness - Generation	Indian Companies Act
21	Metering Regulations, Theft Detection & Penalties, TOD Billing	TOD Billing
22	Metering, Detection of Theft & Misuse of Energy	Unauthorized use of Electricity Theft, Site Mahasar, Hearing, Compounding etc
23	Substation - Operation, Maintenance & Safety	Internal Software Trainings
24	Work Measurement & Materials Management	HRIS - Refresher
25	Refresher Training for Civil Engineers	ORUMA-NET
26	Distribution Lines-Design, Construction, Maintenance & Distribution Automation	E-Tendering
27	Supply Code	UNICODE - Malayalam Typing
28	Generation - Management & Maintenance	Computer Fundamentals
29	Induction Level Training Programme	SARAS Accounting Software
30	Preparation of Work Bill & Taxes	
31	Orientation Training Programme for Promotees	
32	Indian Companies Act	
33	TOD Billing	
34	Unauthorized use of Electricity Theft, Site Mahasar, Hearing, Compounding etc	
35	Health & First Aid	
36	Progress Report & Energy Audit	
37	PPE, use of PPE & Fire and rescue	
38	SOP, up keeping of office registers, survey report etc	

Sl. No.	Technical	Non Technical
39	HT Tariff & estimate Preparation	
40	Construction Standards of LT/HT Line & Design	
41	Transmission Lines- Design, Construction, Maintenance & Modern Trends	
42	Standards of Earthing, Protection of LT/HT Line & Equipments	
43	Cable Laying including ABC & various jointing	
44	Substation- Design, Construction, Earthing (Transmission)	
	Internal Software Trainings	
45	HRIS - Refresher	
46	ORUMA-NET	
47	E-Tendering	
48	UNICODE - Malayalam Typing	
49	Computer Fundamentals	
50	Supply Chain Management - Refresher	
51	STAAD	
52	SARAS Accounting Software	
Sl. No.	Technical	Non Technical
1	The Right to Information Act, 2005.	The Right to Information Act, 2005.
2	Team Building, Communication & Time Management	Team Building, Communication & Time Management
3	Stress Management/Yoga	Stress Management/Yoga
4	Organizational Awareness	Organizational Awareness
5	Energy Conservation, DSM	Energy Conservation, DSM
6	Standards of Performance	Service Matters
7	Service Matters	Revenue Accounting
8	Land Acquisition, Tree Cutting Compensation & PTCC Approval	Land Acquisition, Tree Cutting Compensation & PTCC Approval
9	Control Wiring & Cable Scheduling	Malayalam - File Drafting
10	Power Transformers - O & M	Disciplinary Procedures, Legal Aspects & Various Courts, Grievances Redressal Forums (CGRF,CDRF)

In view of the importance of the training on new technologies, there is a requirement for development and implementation of Human Resource training program so as to realize the dream of 24 X 7 power supply system in the state in its true sense.

KSEBL had already framed the capacity building program for GENCO,TRANSCO & DISCOM wing employees to kept aware them latest knowledge and skills and enabled them to undertake current and future responsibilities in more effective manner.

Table-11.5**PRESENT CAPACITY BUILDING PROGRAMME**

Sl. No.	GENCO	TRANSCO	DISCOM
1	Training on Service Matters	Training on Service Matters	Training on Service Matters
2	Safety Awareness	Safety Awareness	Safety Awareness
3	Statutory Training	Statutory Training	
4	AutoCAD		
5	Management Training program	Management Training program	Management Training program
6	Non Conventional Energy	Non Conventional Energy	Non Conventional Energy
7	Induction Level Training Programme (ILTP)	Induction Level Training Programme (ILTP)	Induction Level Training Programme (ILTP)
8		Design, Construction of Transmission Lines	
9	Taxation	Taxation	Taxation
10		LD and Power Management	Safety and Disaster Management
11	Accounting and Auditing in KSEBL	Accounting and Auditing in KSEBL	Accounting and Auditing in KSEBL
12	Thermal Power	Design construction of EHV Substation	
13		Power System Control & Protection	
14	Energy Auditing	Energy Auditing	Energy Auditing
15		Relay & Protection	Electricity Metering & Prevention of Power Theft
16	Project Management	Project Management	Project Management
17	Statutes & Regulations	Statutes & Regulations	Statutes & Regulations
18		Switchgear & Transformer Maintenance	
19	Power Equipment Testing	Power Equipment Testing	
20	Generation Operation & Maintenance	Communication, SCADA, fibre optic cables & systems	Design construction & maintenance of distribution lines and Transformers
21	Orientation Training for AEE	Orientation Training for AEE	Orientation Training for AEE
22	Training program on STAAD for Civil Engineers		
23	The Right to Information Act, 2005.	The Right to Information Act, 2005.	The Right to Information Act, 2005.
24	Team Building, Communication & Time Management	Team Building, Communication & Time Management	Team Building, Communication & Time Management
25	Stress Management/Yoga	Stress Management/Yoga	Stress Management/Yoga
26	Organizational Awareness	Organizational Awareness	Organizational Awareness
27		Power Transformer O&M	Energy Conservation, DSM
28	Service Matters	Service Matters	Service Matters
29	Revenue Accounting	Revenue Accounting	Revenue Accounting
30		Control Wiring & Cable Scheduling	
31		Land Acquisition, Tree Cutting Compensation & PTCC Approval	
32	Health & First Aid	Health & First Aid	Health & First Aid
33			Unauthorized use of Electricity Theft, Site Mahasar, Hearing, Compounding etc.

Sl. No.	GENCO	TRANSCO	DISCOM
34	Preparation of Work bill etc	Preparation of Work bill etc	Preparation of Work bill etc
35	Generation - Management & Maintenance		Maintenance in Distribution System
36			Ring Main Unit
37			PPE, use of PPE & Fire and rescue
38			SOP, up keeping of office registers, survey report etc
39			HT Tariff & estimate Preparation
40	Audit & Audit Reply	Audit & Audit Reply	Audit & Audit Reply
41	Supply Code	Supply Code	Supply Code
42			TOD Billing
43	Disciplinary Procedures, Legal Aspects (Role of Enquiry & Presenting Officer & Final Report) & Various Courts, Grievances Redressal Forums (CGRF, CDRF)	Disciplinary Procedures, Legal Aspects (Role of Enquiry & Presenting Officer & Final Report) & Various Courts, Grievances Redressal Forums (CGRF, CDRF)	Disciplinary Procedures, Legal Aspects (Role of Enquiry & Presenting Officer & Final Report) & Various Courts, Grievances Redressal Forums (CGRF, CDRF)
44			Customer Satisfaction, Interpersonal Relationship & Business Etiquettes
45	Indian Companies Act	Indian Companies Act	Indian Companies Act

The following C&D employee's category Training programs sponsored by GOI (MOP) under RAPDRP & RGGVY Schemes:

Table-11.6

Sl. No.	R-APDRP training programme to C & D employees under the central scheme R-APDRP through the nodal agency, PFC	Training given to
1	Best Practices in Distribution Operation & Management System	Technical
2	Disaster Management, Electrical Safety Procedures, and Accident Prevention.	do
3	Revenue Management & Loss Reduction	do
4	Communication & Customer Relations	do
5	Performance benchmarking and quality of supply and service	do
	National Training Programmes for the C&D employees - under the central scheme RGGVY through the nodal agency, REC-CIRE	
6	Lineman Training	Technical
7	Energy Metering, Billing(SE)	do
8	Energy Metering, Billing(OVR)	do
9	Financial Management, Stores Accounting and Office Administration	Non Technical
10	Safety, Accident Prevention and Disaster Management	Technical
11	Operation & Maintenance of Distribution Transformers, Prevention of failures and repairs	do

CHAPTER – 12 : YEAR WISE ROLL OUT PLAN

Deliverables						
Power for All – Roll Out Plan	Units	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	Total
(A) GENERATION						
State Sector						
Thermal	MW	0.00	40.00	0.00	0.00	40.00
Hydro (Renewable)	MW	-5.00	0.00	0.00	100.00	95.00
RES (MNRE)	MW	25.70	94.50	173.20	137.00	430.40
Private Sector						
Thermal	MW	647.10	424.25	221.50	0.00	1,292.85
Hydro (Renewable)	MW	0.00	0.00	0.00	0.00	0.00
RES (MNRE)	MW	0.00	5.00	238.60	46.40	290.00
Central Generating Station						
Thermal	MW	193.10	-286.60	0.00	0.00	-93.50
Hydro (Renewable)	MW	0.00	0.00	0.00	0.00	0.00
RES (MNRE)	MW	0.00	0.00	50.00	52.00	102.00
Nuclear	MW	133.00	43.00	0.00	0.00	176.00
Total	MW	993.90	320.15	683.30	335.40	2,332.75
(B) TRANSMISSION						
Inter State						
Substation (400/220kV)	Nos./MVA	1/630	-	1/315	-	945
Intra State						
400/220kV Substation	Nos./MVA	-	-	1/1000	2/1260	2260
Lines	Ckt km	-	-	108	-	-
220/110kV & 220/66 kV Substation	Nos./MVA	1/200	5/1200	4/800	5/1400	3600
220 kV Lines	Ckt km	24	71	213.5	32	-
110/66kV Substation	Nos./MVA	-	-	1/40	-	40
110 kV Lines	Ckt km	313	239	196	149	-
66kV Substation	Nos./MVA	-	-	-	-	-
66 kV Lines	Ckt km	18	35	19.5	-	-
Intra-State transmission network (augmentation) (220/110kV)	MVA	-	1420	200	680	2300



Deliverables						
Power for All – Roll Out Plan	Units	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	Total
(C) DISTRIBUTION						
No. of 33/66 KV Lines /feeders	No					
Total length of 33/66 KV lines	Ckt kms					
Total No. of 66/11kV & 33/11kV PSS	No	10 ⁽¹⁾	10 ⁽¹⁾	10 ⁽¹⁾		248
Total capacity of 66/11 kV& 33/11kV PSS	MVA	100 ⁽²⁾	100 ⁽²⁾	100 ⁽²⁾		3142
Total capacity of step down Power Transformer at 11 kV level at 400/110/11kV, 220/110/66/11 & 110/11kV PSS	MVA	547.5 ⁽³⁾	225 ⁽³⁾	125 ⁽³⁾	225 ⁽³⁾	5720
Total capacity of Power Transformer at 11 kV level in PSS	MVA	647.5	325	225	225	8862
Total No. of Distribution transformers	No	3200	3100	3000	3000	84,260
Total Capacity of Distribution transformers in MVA	MVA	320.2 ⁽⁴⁾	310 ⁽⁴⁾	300 ⁽⁴⁾	300 ⁽⁴⁾	9938.11
Total length of 11kV lines in Ckt. Kms	ckt kms	2800	2750	2700	2600	2665
Total length of LT Lines in Ckt. Kms	ckt kms	4000	4100	4000	4000	4322
No of households to be electrified	Nos	240511	240511			481022
AT & C Losses	%	10.50	10.25	10.00	10.00	
(D) RENEWABLE ENERGY (Already included in Generation under item (A) above)						
Solar	MW	1.10	78.50	319.20	115.00	513.80
Wind	MW	0.00	8.00	72.00	52.00	132.00
Small Hydro Power	MW	24.60	13.00	70.60	68.40	176.60
Biomass	MW	0.00	0.00	0.00	0.00	0.00
Total Renewable	MW	25.70	99.50	461.80	235.40	822.40

Note:

(1) 66/11 kV & 33/11 kV PSS added 13 no under RAPDRP-B, 17 no under DDUGJY & 3 no under IPDS scheme as per state data.

(2) Derived PSS capacity (MVA) considering 2X5 MVA Power Transformer.

(3) PSS Capacity addition under State govt. scheme refer Annexure-XIV.

(4) DTR capacity (MVA) derived considering 100 KVA DTR.



CHAPTER – 13 : SECTOR WISE INVESTMENT PLAN & FUND REQUIREMENT

(Rs in Crores)

		Sector	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	Total	Remarks
Generation	Projects Under Construction & Expansion	Thermal	20.00	50.00	40.00	0	110.00	
		Hydel	20.00	70.00	110.00	115.00	315.00	70% loan
		RES (SHP)	142.00	177.00	115.00	25.00	459.00	70% loan
	Projects Under R&M	Thermal	-	-	-	-	0.00	
		Hydel	10.00	10.00	30.00	30.00	80.00	70% loan
	Future Projects (COD within FY 2018-19)	RES (SHP, Solar, Wind)	24.00	281.00	110.00	97.00	512.00	70% loan
Total generation			216.00	588.00	405.00	267.00	1476.00	
Transmission	Intra State		294.24	359.48	1682.27	181.16	2517.15	
	Inter State		-	-	-	-	0.00	
Total Transmission			294.24	359.48	1682.27	181.16	2517.15	
State Plan								
Distribution			172.57	78.91	29.92	74.80	356.20	
	IPDS							
			50.00	199.15	199.15	149.15	597.45	
	DDUGJY (Approved)							
			161.79	161.79	161.79	0.00	485.37	
	DDUGJY (Un-approved)							
			308.88	308.88	308.88	308.88	1235.52	
	RAPDRP (Part-A)		142.30	65.90	0.00	0.00	208.20	
	RAPDRP (Part-B)		458.28	458.28	0.00	0.00	916.56	
Total Distribution			1293.82	1272.91	699.74	532.83	3799.30	
GRAND TOTAL			1804.06	2220.39	2787.01	980.99	7792.45	



GoK Data**CATEGORY-WISE GROWTH IN CONSUMERS**

	Consumers	Year-wise figures from FY 2009-10 to FY 2013-14					
		FY 2009-10	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
(i)	Domestic	7790132	8092072	8324961	8573938	8788916	9076604
(ii)	Commercial	1387345	1455790	1538786	1633689	1795160	1907589
(iii)	Industrial (LT)	122325	127354	132051	131583	137744	141711
(iv)	Industrial (HT & EHT)	2850	3212	3580	3894	4256	4682
(v)	Public Lighting	2927	3038	3160	3505	3789	4043
(vi)	Traction	8	8	8	8	8	9
(vii)	Agriculture	437877	446460	455078	460263	463006	472266
(viii)	Miscellaneous	12	12	13	10	11	12
	Total :	9743476	10127946	10457637	10806890	11192890	11606916

ANNEXURE-II**CENSUS 2011 DATA OF HOUSEHOLDS IN KERALA**

Description	Rural		Urban		Total	
	No.	(%)	No.	(%)	No.	(%)
No. of Households	4095674	53.08%	3620696	46.92%	7716370	100
No. of Electrified Households	3772137	51.78%	3512569	48.22%	7284706	94.41%
Balance Un-electrified Households	323537	74.95%	108127	25.05%	431664	5.59%

(Source: Census of India-2011)

DETAILED CALCULATION OF ENERGY DEMAND IN THE STATE UP TO FY 2018-19

Sl. No.	Particulars→ ↓	Calculation steps	Years			
			FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
A	DEMAND PROJECTIONS FOR ELECTRIFIED HOUSEHOLDS					
1	Consumption of Electrified Households					
2	Consumption (units per day per household)	Units	3.55	3.80	4.07	4.35
3	Annual Energy Requirement for existing electrified Household	MUs	10,029	10,731	11,483	12,286
B	ADDITIONAL ENERGY REQUIREMENTS FOR ELECTRIFIED DOMESTIC CONSUMERS					
1	Additional Energy Required for Electrified Households (Annual projection (-) current Energy available MUs)	MUs	656	1,358	2,109	2,913

C	ELECTRIFICATION OF UNELECTRIFIED HOUSEHOLDS (per year)					
1	Unelectrified Households	Nos.	481022			
2	Targeted Electrification of unelectrified					
3	Electrification of unelectrified Household	Nos.	2,40,511	2,40,511	-	-
4	Annual Energy Requirement for Electrification of unelectrified Household	MUs	312.00	667.00	714.00	764.00

D	ELECTRIFICATION OF NEWLY CONSTRUCTED HOUSEHOLDS (per year)					
1	Total Household - (nos.) FY 2014-15	8216501				
2	Yearly Increase in Total H/Hs	Nos	1,30,018	2,62,093	3,96,258	5,32,547
3	Annual Energy Requirement for newly constructed Household	MUs	169	364	588	846

E	ANNUAL ENERGY REQUIREMENTS					
1	Total Additional Annual Energy Requirement - Domestic Consumer	MUs	1,137	2,389	3,412	4,523
2	Current Energy Available - Total	MUs	18,426	18,426	18,426	18,426
3	Current Energy Available - Domestic	MUs	9,373	9,373	9,373	9,373
4	Total Domestic Annual Energy Requirement (Current + Projection)	MUs	10,510	11,762	12,785	13,896
5	Current Energy Available - Other than Domestic	MUs	9,053	9,053	9,053	9,053
6	Total Annual Energy Requirement - Other than Domestic Consumers (with 6% growth P.A.)	MUs	9596	10,172	10,782	11,429
7	Additional Energy Required for other than domestic (Cumulative)	MUs	543	1,119	1,729	2,376
8	Total Energy Requirements (all)	Nos.	20,106	21,934	23,567	25,325

BREAK UP & DETAILS OF CAPACITIES EXISTING AND LIKELY TO BE ADDED YEAR WISE

Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
A.	State Sector (Own) Generating Stations (SGS)								
A.1	SGS Thermal								
A.1.1	Cheemeni Coal Based Power Plant (2400 MW)	Thermal (Coal)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.1.2	Brahmapuram CCPP (400 MW)	Thermal (Gas)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.1.3	BDPP Gas Conversion (4x10 MW)	Thermal (Gas)	Kerala	0.00	0.00	40.00	40.00	40.00	40 MW will be available from 01/ Mar/ 2017.
A.1.4	Kozhikoda Diesel Power Plant (KDPP) (6X16MW)	Thermal (Diesel)	Kerala	96.00	96.00	96.00	96.00	96.00	
A.1.5	Brahmapuram Diesel Power Plant (BDPP) (3X 21.32MW)	Thermal (Diesel)	Kerala	63.96	63.96	63.96	63.96	63.96	
	Sub Total SGS Thermal			159.96	159.96	199.96	199.96	199.96	
A.2	SGS Hydro Electric Projects								
A.2.1	Idukki (6X 130MW)	Hydro (HEP)	Kerala	780.00	780.00	780.00	780.00	780.00	
A.2.2	Sabarigiri (4 X 55 MW + 2X60 MW)	Hydro (HEP)	Kerala	340.00	335.00	335.00	335.00	335.00	
A.2.3	Lower Periyar (3X60MW)	Hydro (HEP)	Kerala	180.00	180.00	180.00	180.00	180.00	
A.2.4	Kuttiyadi Addl. Extension HEP (2x50 MW)	Hydro (HEP)	Kerala	100.00	100.00	100.00	100.00	100.00	
A.2.5	Kuttiyadi (3X25MW)	Hydro (HEP)	Kerala	75.00	75.00	75.00	75.00	75.00	
A.2.6	Idamalayar (2 X 37.5 MW)	Hydro (HEP)	Kerala	75.00	75.00	75.00	75.00	75.00	
A.2.7	Pallivasal Extension (2x30 MW)	Hydro (HEP)	Kerala	0.00	0.00	0.00	0.00	60.00	60 MW will be

Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
									available from 01/ Jun/ 2018.
A.2.8	Sholayar (3 X 18 MW)	Hydro (HEP)	Kerala	54.00	54.00	54.00	54.00	54.00	
A.2.9	Nerianmangalam HEP (3x17.55 MW)	Hydro (HEP)	Kerala	52.65	52.65	52.65	52.65	52.65	
A.2.10	Sengulam HEP (4x12.8 MW)	Hydro (HEP)	Kerala	51.20	51.20	51.20	51.20	51.20	
A.2.11	Kakkad (2X25MW)	Hydro (HEP)	Kerala	50.00	50.00	50.00	50.00	50.00	
A.2.12	Kuttiyadi Extension HEP (1x50 MW)	Hydro (HEP)	Kerala	50.00	50.00	50.00	50.00	50.00	
A.2.13	Mankulam (2x20 MW)	Hydro (HEP)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.2.14	Thottiar (1x20 + 1x10 MW)	Hydro (HEP)	Kerala	0.00	0.00	0.00	0.00	40.00	40 MW will be available from 01/ Jun/ 2018.
A.2.15	Pallivasal (3 X 4.5MW 3X 8 MW)	Hydro (HEP)	Kerala	37.50	37.50	37.50	37.50	37.50	
A.2.16	Poringalkuthu HEP (4x9 MW)	Hydro (HEP)	Kerala	36.00	36.00	36.00	36.00	36.00	
A.2.17	Panniyar HEP (2x16.2 MW)	Hydro (HEP)	Kerala	32.40	32.40	32.40	32.40	32.40	
	Sub Total State Hydro Electric Project			1,913.75	1,908.75	1,908.75	1,908.75	2,008.75	
A.3	State Non-Conventional Energy Sources								
A.3.1	Kasargod Solar Park (100 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	100.00	100 MW will be available from 01/ Mar/ 2019.
A.3.2	Kasargod Solar Park (50 MW)	RES (MNRE)	Kerala	0.00	0.00	50.00	50.00	50.00	50 MW will be available from 01/ Mar/ 2017.
A.3.3	West Kallada Floating Solar (50 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	50.00	50.00	50 MW will be available from 01/ Dec / 2017.



Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
A.3.4	Kasargod Solar Park (50 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	50.00	50.00	50 MW will be available from 01/ Dec / 2017.
A.3.5	Neriamangalam Extension SHP (1x25 MW)	RES (MNRE)	Kerala	25.00	25.00	25.00	25.00	25.00	
A.3.6	Bhoothathankettu (3x8 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	24.00	24.00	24 MW will be available from 01/ Dec / 2017.
A.3.7	Poringalkutthu (1x24 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	24.00	24.00	24 MW will be available from 01/ Jun / 2017.
A.3.8	Chinnar (24.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.9	Upper Senugulam (24 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.10	Poringalkuthu Left Bank Extn SHP (1x16MW)	RES (MNRE)	Kerala	16.00	16.00	16.00	16.00	16.00	
A.3.11	Distributed Energy Plant (15 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	15.00	15 MW will be available from 01/ Mar / 2019.
A.3.12	Distributed Solar Energy Plant (15 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.13	PazhassiSagar (15.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.14	Barapole (2x7.5 MW)	RES (MNRE)	Kerala	0.00	15.00	15.00	15.00	15.00	15 MW will be available from 01/ Feb / 2016.
A.3.15	Kallada (2X7.5 MW)	RES (MNRE)	Kerala	15.00	15.00	15.00	15.00	15.00	
A.3.16	Malankara (3X3.5MW)	RES (MNRE)	Kerala	10.50	10.50	10.50	10.50	10.50	
A.3.17	Distributed Energy Plant (10 MW)	RES (MNRE)	Kerala	0.00	0.00	10.00	10.00	10.00	10 MW will be available from 01/



Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
									Mar / 2017.
A.3.18	Distributed Energy Plant (10 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	10.00	10.00	10 MW will be available from 01/ Mar / 2018.
A.3.19	Valanthode (8.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.20	Anakkayam (7.50 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.21	Vilangad SHP (3x2.5 MW)	RES (MNRE)	Kerala	7.50	7.50	7.50	7.50	7.50	
A.3.22	Marmala (7.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.23	Peruvannamoozhi (6.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	6.00	6 MW will be available from 01/ Mar / 2019.
A.3.24	Chathankottunada II (2x3 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	6.00	6.00	6 MW will be available from 01/ Jun / 2017.
A.3.25	Perumthenaruvi (2x3 MW)	RES (MNRE)	Kerala	0.00	0.00	6.00	6.00	6.00	6 MW will be available from 01/ Oct / 2016.
A.3.26	Kanjikode Solar Stage II (6 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	6.00	6.00	6 MW will be available from 01/ Dec / 2017.
A.3.27	Chembukadavu -III (6.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	6.00	6 MW will be available from 01/ Mar / 2019.
A.3.28	Maripuzha (6.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.29	RamakkalMedu Wind Hybrid (5 MW)	RES (MNRE)	Kerala	0.00	0.00	5.00	5.00	5.00	5 MW will be available from 01/ Mar / 2017.
A.3.30	Olikkkal (5.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	5.00	5 MW will be



Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
									available from 01/ Mar / 2019.
A.3.31	Western Kallar (5.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.32	Poozhithode SHEP (3X1.6MW)	RES (MNRE)	Kerala	4.80	4.80	4.80	4.80	4.80	
A.3.33	RanniPerinad SHP (2x2 MW)	RES (MNRE)	Kerala	4.00	4.00	4.00	4.00	4.00	
A.3.34	Chembukadavu-2(3X1.25MW)	RES (MNRE)	Kerala	3.75	3.75	3.75	3.75	3.75	
A.3.35	Kuttiyadi Tail Race(3X1.25MW)	RES (MNRE)	Kerala	3.75	3.75	3.75	3.75	3.75	
A.3.36	Urumi - 1(3X1.25MW)	RES (MNRE)	Kerala	3.75	3.75	3.75	3.75	3.75	
A.3.37	Vellathooval (2x1.8 MW)	RES (MNRE)	Kerala	0.00	3.60	3.60	3.60	3.60	3.6 MW will be available from 01/ Mar / 2016.
A.3.38	Ladrum (3.50MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.39	Lower Meenmutty (1X0.5+2X1.5MW)	RES (MNRE)	Kerala	3.50	3.50	3.50	3.50	3.50	
A.3.40	Adyanpara SHP (2x1.5 MW + 1x0.5 MW)	RES (MNRE)	Kerala	0.00	3.50	3.50	3.50	3.50	3.50 MW will be available from 01/ Sep / 2015.
A.3.41	Roof Top Solar Power Plant in Govt. Building (3.50 MW)	RES (MNRE)	Kerala	0.00	0.00	3.50	3.50	3.50	3.5 MW will be available from 01/ Dec / 2016.
A.3.42	Canal Bank Solar Power at Barapole (3.50 MW)	RES (MNRE)	Kerala	0.00	0.00	3.50	3.50	3.50	3.50 MW will be available from 01/ Dec / 2016.
A.3.43	Poovaramthodu (3.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	3.00	3.0 MW will be available from 01/ Mar / 2019.
A.3.44	Floating Solar at BanasuraSagar (3.0 MW)	RES (MNRE)	Kerala	0.00	0.00	3.00	3.00	3.00	3.0 MW will be available from 01/



Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
									Dec / 2016.
A.3.45	Kanjikode Solar Hybrid (3 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	3.00	3.00	3 MW will be available from 01/ Dec / 2017.
A.3.46	Kanjikode Wind Hybrid (3.0 MW)	RES (MNRE)	Kerala	0.00	0.00	3.00	3.00	3.00	3 MW will be available from 01/ Mar / 2017.
A.3.47	Peechad (3.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	13th Plan scheme
A.3.48	Peppara (1X3MW)	RES (MNRE)	Kerala	3.00	3.00	3.00	3.00	3.00	
A.3.49	Kakkayam (2x1.5 MW)	RES (MNRE)	Kerala	0.00	0.00	3.00	3.00	3.00	3.0 MW will be available from 01/ Feb / 2017.
A.3.50	Chembukadavu-1(3X0.9MW)	RES (MNRE)	Kerala	2.70	2.70	2.70	2.70	2.70	
A.3.51	Malampuzha(1X2.5MW)	RES (MNRE)	Kerala	2.50	2.50	2.50	2.50	2.50	
A.3.52	Chimmony SHP (1x2.5 MW)	RES (MNRE)	Kerala	0.00	2.50	2.50	2.50	2.50	2.5 MW will be available from 01/ Jun / 2015.
A.3.53	Urumi - 2(3X0.8MW)	RES (MNRE)	Kerala	2.40	2.40	2.40	2.40	2.40	
A.3.54	Kanjikkode Wind Project (9x0.225 MW)	RES (MNRE)	Kerala	2.03	2.03	2.03	2.03	2.03	
A.3.55	Upper Kallar (2.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	2.00	2 MW will be available from 01/ Mar / 2019.
A.3.56	RamakalMedu Solar Hybrid (2.0 MW)	RES (MNRE)	Kerala	0.00	0.00	2.00	2.00	2.00	2.0 MW will be available from 01/ Mar / 2017.
A.3.57	Mattupetty SHP (1x2 MW)	RES (MNRE)	Kerala	2.00	2.00	2.00	2.00	2.00	

Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
A.3.58	Solar Plants In KSEB Building (1.50 MW)	RES (MNRE)	Kerala	0.00	0.00	1.50	1.50	1.50	1.50 MW will be available from 01/ Dec / 2016.
A.3.59	Peechi SHP (1x1.25 MW)	RES (MNRE)	Kerala	1.25	1.25	1.25	1.25	1.25	
A.3.60	Solar Plant in Kollamkode S/s (1.0 MW)	RES (MNRE)	Kerala	0.00	0.00	1.00	1.00	1.00	1 MW will be available from 01/ Dec / 2016.
A.3.61	Solar Plant at Padinjarethara dam (1.0 MW)	RES (MNRE)	Kerala	0.00	0.00	1.00	1.00	1.00	1 MW will be available from 01/ Dec / 2016.
A.3.62	Solar Pumping Project at Kakkayam (1.0 MW)	RES (MNRE)	Kerala	0.00	0.00	1.00	1.00	1.00	1.0 MW will be available from 01/ Dec / 2016.
A.3.63	Floating Solar at Kakkayam (1.0 MW)	RES (MNRE)	Kerala	0.00	0.00	1.00	1.00	1.00	1 MW will be available from 01/ Dec / 2016.
A.3.64	Canal Top Solar Power Plant in Vilangad (1.0 MW)	RES (MNRE)	Kerala	0.00	0.00	1.00	1.00	1.00	1 MW will be available from 01/ Dec / 2016.
A.3.65	Kanjikode Solar Project (1 MW)	RES (MNRE)	Kerala	0.00	1.00	1.00	1.00	1.00	1.0 MW will be available from 01/ Sep / 2015.
A.3.66	Kozhinjampara solar plant (0.20 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.20	0.20	0.20 MW will be available from 01/ Dec / 2017.
A.3.67	Chalayur Colony Solar (0.096 MW)	RES (MNRE)	Kerala	0.00	0.10	0.10	0.10	0.10	0.10 MW will be available from 01/ Oct / 2015.
	Sub Total Non Conventional			113.43	139.13	234.63	407.83	544.83	



Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
	Energy Sources								
B	Central Generating Station (CGS)								
B.1	CGS Thermal								
B.1.1	RamagundamStg I & II AP CGS (2100 MW)	Thermal (Coal)	AP	246.40	246.40	246.40	246.40	246.40	
B.1.2	Talcher Stage II (2000 MW)	Thermal (Coal)	Odisha	427.27	427.27	427.27	427.27	427.27	
B.1.3	IGSTPS Jhajar (1500 MW)	Thermal (Coal)	Jhajar	167.00	319.00	0.00	0.00	0.00	Not available from Apr-16
B.1.4	Vallur STPS, TN (1500 MW)	Thermal (Coal)	TN	50.53	50.53	50.53	50.53	50.53	
B.1.5	SimhadriExp (1000 MW)	Thermal (Coal)	Odisha	90.80	90.80	90.80	90.80	90.80	
B.1.6	NLC New (1000 MW)	Thermal (Coal)	TN	0.00	0.00	32.40	32.40	32.40	32.4 MW will be available from 01/ Apr / 2016.
B.1.7	NLC II Stage 2 (840 MW)	Thermal (Coal)	TN	90.47	90.47	90.47	90.47	90.47	
B.1.8	NLC II Stage 1 (630 MW)	Thermal (Coal)	TN	63.32	63.32	63.32	63.32	63.32	
B.1.9	RamagundamStg III AP CGS (500 MW)	Thermal (Coal)	AP	61.35	61.35	61.35	61.35	61.35	
B.1.10	NLC II Exp (500 MW)	Thermal (Coal)	TN	82.35	82.35	82.35	82.35	82.35	
B.1.11	Tuticorin STPS (500 MW)	Thermal (Coal)	TN	41.10	41.10	41.10	41.10	41.10	
B.1.12	Tuticorin STPS Unit II (500 MW)	Thermal (Coal)	TN	0.00	41.10	41.10	41.10	41.10	41.10 MW will be available from 01/ Dec / 2015.
B.1.13	NLC Exp Stage 1 (420 MW)	Thermal (Coal)	TN	68.80	68.80	68.80	68.80	68.80	
B.1.14	RGCCPS NTPC Kayamkulam (Naptha)(2X116.6+126.6MW)	Thermal (Gas)	Kerala	359.58	359.58	359.58	359.58	359.58	
	Sub Total (CGS Thermal)			1,748.97	1,942.07	1,655.47	1,655.47	1,655.47	



Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
B.2	CGS (Nuclear)								
B.2.1	Koodankulam Nuclear PS (1000 MW)	Nuclear	TN	133.00	133.00	133.00	133.00	133.00	
B.2.2	Koodankulam Nuclear Unit 2 (1000 MW)	Nuclear	TN	0.00	133.00	133.00	133.00	133.00	133 MW will be available from 01/ Dec / 2015.
B.2.3	KAIGA Nuclear PS (880 MW)	Nuclear	Karnataka	73.74	73.74	73.74	73.74	73.74	
B.2.4	MAPS, Kalpakkam (500 MW)	Nuclear	TN	0.00	0.00	43.00	43.00	43.00	43 MW will be available from 01/ Apr / 2016.
B.2.5	MAPS, Kalpakkam (440 MW)	Nuclear	TN	23.11	23.11	23.11	23.11	23.11	
	Sub Total CGS Nuclear			229.85	362.85	405.85	405.85	405.85	
B.3	CGS (Non-Conventional Energy Sources)								
B.3.1	Wind Farm at Palakkad by NHPC (52 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	52.00	52 MW will be available from 01/ Dec / 2018.
B.3.2	Wind Farm at Palakkad by NHPC (50 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	50.00	50.00	50 MW will be available from 01/ Dec / 2017.
	Sub Total CGS NCES			0.00	0.00	0.00	50.00	102.00	
C	Independent Power Producer(IPP)								
C.1	IPP Thermal								
C.1.1	MP Steel Co Generation (IPP)(4MW + 3 X 2MW)	Thermal (Coal)	Kerala	10.00	0.00	0.00	0.00	0.00	Not available
C.1.2	BSES Kerala Power Ltd (Naptha IPP)(3X40.5MW +35.5MW)	Thermal (Gas)	Kerala	157.00	157.00	157.00	157.00	157.00	

Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
C.1.3	KPCL Power Plant (Naptha-IPP)(3 X 7.3 MW)	Thermal (Gas)	Kerala	21.90	0.00	0.00	0.00	0.00	PPA expired
	Sub Total (IPP Thermal)			188.90	157.00	157.00	157.00	157.00	
C.2	IPP Non- Conventional Energy Sources								
C.2.1	Solar IPP through bidding (200 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	200.00	200.00	200 MW will be available from 01/ Apr / 2017.
C.2.2	Wind Project at Ramakkalmedu (50 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.00	Duplication - to be removed
C.2.3	Inox Wind Farm at Palakkad (22 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	22.00	22.00	22 MW will be available from 01/ Apr / 2017.
C.2.4	Kakkadampoyil Stage I (21 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	21.00	21 MW will be available from 01/ Apr / 2018.
C.2.5	Wind Agali (IPP) (18.60 MW)	RES (MNRE)	Kerala	18.60	18.60	18.60	18.60	18.60	
C.2.6	Keezharkuthu (15 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	15.00	15 MW will be available from 01/ Apr / 2018.
C.2.7	Wind Ramakkalmedu(IPP)(19X 0.75MW)	RES (MNRE)	Kerala	14.25	14.25	14.25	14.25	14.25	
C.2.8	Karikkayam SHP Kerala IPP (10.50 MW)	RES (MNRE)	Kerala	10.50	10.50	10.50	10.50	10.50	
C.2.9	Ullunkal SHP (2X3.5MW)	RES (MNRE)	Kerala	7.00	7.00	7.00	7.00	7.00	
C.2.10	Anakampoil (6.75 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	6.75	6.75	6.75 MW will be available from 01/

Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015 (MW)	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
									Apr / 2017.
C.2.11	Iruttukanam SHP KERALA (IPP) (2X1.5MW)	RES (MNRE)	Kerala	4.50	4.50	4.50	4.50	4.50	
C.2.12	Pathankayam (4.0 MW)	RES (MNRE)	Kerala	0.00	0.00	4.00	4.00	4.00	4 MW will be available from 01/ Apr / 2016.
C.2.13	Meenvalloam SHP Kerala (3.0 MW)	RES (MNRE)	Kerala	3.00	3.00	3.00	3.00	3.00	
C.2.14	Arippara (3.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	3.00	3.00	3 MW will be available from 01/ Apr / 2017.
C.2.15	Inchavarakuthu (3.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	3.00	3 MW will be available from 01/ Apr / 2018.
C.2.16	Thoniyar (2.60 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	2.60	2.60	2.60 MW will be available from 01/ Apr / 2017.
C.2.17	Adakkathodu (2.50 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	2.50	2.50 MW will be available from 01/ Apr / 2018.
C.2.18	Kokkamullu (2.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	2.00	1 MW will be available from 01/ Apr / 2018.
C.2.19	Anakkal (2.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	2.00	6 MW will be available from 01/ Mar / 2019.
C.2.20	Kozhiyilakuthu (1.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	1.00	1.00	1 MW will be available from 01/ Apr / 2017.



Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
C.2.21	Thuval (1.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	1.00	1.00	1 MW will be available from 01/ Apr / 2017.
C.2.22	Madatharuvi (1.0 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	1.00	1.00	1 MW will be available from 01/ Apr / 2017.
C.2.23	Lower Marmala (0.90 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.00	0.90	0.90 MW will be available from 01/ Apr / 2018.
C.2.24	Kozhichal (0.75 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.75	0.75	0.75 MW will be available from 01/ Apr / 2017.
C.2.25	Panamkudantha (0.50 MW)	RES (MNRE)	Kerala	0.00	0.00	0.00	0.50	0.50	0.50 MW will be available from 01/ Apr / 2017.
C.2.26	Mankulam Mini HEP Kerala (HEP) (0.11 MW)	RES (MNRE)	Kerala	0.11	0.11	0.11	0.11	0.11	
C.2.27	Kallar Micro HEP, Kerala (0.05 MW)	RES (MNRE)	Kerala	0.05	0.05	0.05	0.05	0.05	
	Sub Total (IPP Non- Conventional Energy Sources)			58.01	58.01	62.01	300.61	347.01	
D	Purchase								
D.1.1	CSPDCL, Chattisgarh(through NVVN) (300 MW)	Thermal (Coal)	Chattisgarh	0.00	297.00	297.00	0.00	0.00	Case-1 bidding
D.1.2	OP Jindal STTP, Chattisgarh (200 MW)	Thermal (Coal)	Chattisgarh	0.00	0.00	165.00	165.00	165.00	DBFOO bidding
D.1.3	Raghunathpur TPS, West Bengal (DVC) (150 MW)	Thermal (Coal)	WB	0.00	46.50	46.50	142.50	142.50	MOU route
D.1.4	OP Jindal STTP, Chattisgarh (150	Thermal (Coal)	Chattisgarh	0.00	0.00	0.00	142.50	142.50	DBFOO bidding



Sl. No.	Power Sources/ Generating Stations	Type (Thermal/ Hydro/NRSE etc.)	Location of the Plant	As on March' 2015	Capacity Available as Planned				Remarks
					FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	
					(MW)	(MW)	(MW)	(MW)	
	MW)								
D.1.5	Maithon Right Bank TPP, Jharkhand (150 MW)	Thermal (Coal)	Jharkhand	0.00	140.50	140.50	140.50	140.50	MOU route
D.1.6	Maithon Right Bank TPP, Jharkhand (150 MW)	Thermal (Coal)	Jharkhand	0.00	0.00	150.00	150.00	150.00	MOU route
D.1.7	Jhabua Power Station,(115 MW)	Thermal (Coal)	MP	0.00	0.00	109.25	109.25	109.25	DBFOO bidding
D.1.8	Meija TPS, West Bengal (DVC) (100 MW)	Thermal (Coal)	WB	0.00	95.00	95.00	95.00	95.00	MOU route
D.1.9	BalcoKorba PS, Chattisgarh (100 MW)	Thermal (Coal)	Chattisgarh	0.00	0.00	0.00	95.00	95.00	DBFOO bidding
D.1.10	Jhabua Power Station, MP (100 MW)	Thermal (Coal)	MP	0.00	0.00	0.00	95.00	95.00	DBFOO bidding
D.1.11	Jindal India TPP, AngulOdisha (100 MW)	Thermal (Coal)	Odisha	0.00	0.00	0.00	95.00	95.00	DBFOO bidding
D.1.12	Bhavanapedu TPP, AP (100 MW)	Thermal (Coal)	AP	0.00	0.00	0.00	95.00	95.00	DBFOO bidding
D.1.13	Balco TPP Chattisgarh (Through PTC) (100 MW)	Thermal (Coal)	Chattisgarh	0.00	100.00	100.00	0.00	0.00	Case-1 bidding
	Sub Total (Purchase)			0.00	679.00	1103.25	1324.75	1324.75	
	Grand Total			4,412.87	5,406.77	5,726.92	6,410.22	6,745.62	



ANNEXURE-V**DETAILS OF EXISTING GRID SUB-STATION (ISTS)**

Sl. No.	Name of GSS	Voltage Ratio	No. of Transformers	MVA capacity	Total Transformer capacity(MVA)
400 kV GRID SUBSTATION (PGCIL)					
1	400 kV Pallippuram (Tiruvanthapuram North)	400/220 kV	3	3X315	945
2	400 kV Elapully (Palakkad)	400/220 kV	2	2X315	630
3	400 kV Kochin-East (Muvattupuzha)	400/220 kV	2	2X315	630
				Total	2205
400 kV GRID SUBSTATION (KSEB)					
1	400 kV Madakatara	400/220 kV	3	3X315	945
				Total (PGCIL+KSEB)	3150

UPCOMING/CAPACITY ADDITION OF 400 kV GRID SUBSTATION

Sl No.	Name of GSS	Voltage Ratio	No of Transformers	MVA Capacity	Addl Transformer capacity(MVA)	Target year
A (State)	Neeleswaram(mylaty)	400/220 kV	2	2X500	1000	FY 2017-18
	Kotyam(Ettumanoor)	400/220 kV	2	2X315	630	FY 2018-19
	Kollam (kundara)	400/220 kV	2	2X315	630	FY 2018-19
		400/220 kV				
				Sub Total	2260	STATE LEVEL
B (PGCIL)	Kozhikode(Aeekode)	400/220 kV	2	2X315	630	FY 2015-16
	Capacity addition of Kozhikode		1	315	315	FY 2017-18
	HVDC 2000MW Madakatara (TRICHU)	320kV		2000MW	-	FY 2018-19
				Sub Total	945	PGCIL LEVEL
				Total	3205	PGCIL+ STATE LEVEL

ANNEXURE-VI

**EXISTING 220/110kV , 220/66 kV ,220/33 kV, 110/66 kV, 110/33 kV & 66/33 kV GRID
SUBSTATION LIST**

SL.NO.	NAME OF THE SUBSTATION	VOLTAGE	TRANSFORMER CAPACITY(MVA)	VOLTAGE RATIO
A. 220/110kV substations				
1	MADAKKATHARA	220	200	220/110
			200	220/110
2	ORKATERRY	220	100	220/110
			100	220/110
3	NALLALAM	220	100	220/110
			100	220/110
			60	220/110
			60	220/110
4	POTHENCODE	220	200	220/110
			200	220/110
			200	220/110
5	EDAMON	220	100	220/110
			100	220/110
6	KUNDARA	220	200	220/110
			200	220/110
7	MALAPPARAMBA	220	100	220/110
			100	220/110
8	SHORNUR	220	100	220/110
			100	220/110
9	KALAMASSERY	220	200	220/110
			200	220/110
			200	220/110
			120	220/110
10	AREAKODE	220	160	220/110
11	KANHIRODE	220	160	220/110
			160	220/110
12	TALIPARAMBA	220	100	220/110
			100	220/110
13	EDAPPON	220	200	220/110
			200	220/110
14	BRAHMAPURAM	220	160	220/110
			160	220/110
15	MYLATTY	220	100	220/110
			100	220/110
16	PALAKKAD	220	160	220/110
			160	220/110
17	PALLOM	220	200	220/110
			200	220/110
		SUBTOTAL	5560	
B. 220/66kV substations				
1	KANIYAMPETTA	220	50	220/66



SL.NO.	NAME OF THE SUBSTATION	VOLTAGE	TRANSFORMER CAPACITY(MVA)	VOLTAGE RATIO
			50	220/66
		SUBTOTAL	100	
C. 220/33kV substations				
1	AMBALAMUGAL	220	22	220/33
			50	220/33
		SUBTOTAL	72	
	220/110 kV, 220/66 kV & 220/33 kV sub-station	Total	5732	
D. 110/66kV substations				
1	NALLALAM	110	40	110/66
			40	110/66
2	EDAMON	110	40	110/66
			40	110/66
3	KALAMASERRY		63	110/66
			63	110/66
4	EDAPPON	110	63	110/66
			63	110/66
5	PALLOM	110	63	110/66
			63	110/66
			63	110/66
6	AROOR	110	63	110/66
			63	110/66
7	MAVELIKKARA	110	40	110/66
			40	110/66
8	PUNNAPPRA	110	63	110/66
			63	110/66
9	VYTTILA	110	63	110/66
			40	110/66
10	MATTANCHERRY	110	25	110/66
			25	110/66
11	KALOOR		25	110/66
			25	110/66
12	ALUVA	110	63	110/66
			63	110/66
13	MUNDAYAD	110	40	110/66
			40	110/66
14	SASTHANCOTTA	110	20	110/66
			20	110/66
15	KUNNAMANGALAM	110	40	110/66
			40	110/66
16	CHEVAYOOR	110	25	110/66
			25	110/66
17	MALAPPURAM	110	40	110/66
			40	110/66
18	KANJIKODE	110	63	110/66
			63	110/66
19	VENNAKKARA	110	40	110/66

SL.NO.	NAME OF THE SUBSTATION	VOLTAGE	TRANSFORMER CAPACITY(MVA)	VOLTAGE RATIO
			40	110/66
20	PALA	110	40	110/66
			40	110/66
21	VAIKOM	110	40	110/66
			40	110/66
22	PARUTHIPPARA	110	63	110/66
			63	110/66
23	PARASSALA		50	110/66
			50	110/66
24	THIRUMALA	110	63	110/66
25	ATTINGAL	110	20	110/66
			20	110/66
26	TERLS	110	40	110/66
			40	110/66
27	CHALAKUDY	110	50	110/66
			50	110/66
28	VIYYUR	110	63	110/66
			63	110/66
		SUBTOTAL	2593	
E. 110/33 kV substations				
1	KANHIRODE	110	16	110/33
			16	110/33
2	TALIPARAMBA	110	16	110/33
			16	110/33
3	EDAPPON	110	16	110/33
4	EDATHUA	110	16	110/33
5	THYCATTUSSERY	110	16	110/33
			16	110/33
6	CHENGANOOR	110	16	110/33
7	KAYAMKULAM	110	16	110/33
8	PUNAPPRA	110	16	110/33
9	KALOOR	110	16	110/33
			16	110/33
10	NORTH PARUR	110	16	110/33
			16	110/33
11	MATTANNOR	110	16	110/33
12	PANOOR	110	16	110/33
13	PINARAYI	110	16	110/33
			16	110/33
14	AZHIKODE	110	16	110/33
15	MUNDAYAD	110	16	110/33
16	PAYYANNUR	110	16	110/33
17	CHERUVATHUR	110	16	110/33
			16	110/33
18	KANHAGAD	110	16	110/33
19	MULLERIYA	110	16	110/33
20	VIDYANAGAR	110	16	110/33

SL.NO.	NAME OF THE SUBSTATION	VOLTAGE	TRANSFORMER CAPACITY(MVA)	VOLTAGE RATIO
21	KOTTIYAM	110	16	110/33
			16	110/33
22	AMBALAPPURAM	110	16	110/33
			16	110/33
23	AGASTYAMOOZHI	110	16	110/33
			16	110/33
24	MEPAYUR	110	16	110/33
			16	110/33
25	QUILANDY	110	16	110/33
26	VADAKARA	110	16	110/33
27	KEEZHISSERY	110	16	110/33
28	MALAPPURAM	110	16	110/33
29	MELATTUR	110	16	110/33
30	CHELARI	110	16	110/33
			16	110/33
31	EDARIKODE	110	16	110/33
32	KOZHINJAMPARA	110	16	110/33
			16	110/33
33	KOLLENKODE	110	16	110/33
			16	110/33
34	VADAKKENCHERY	110	16	110/33
			16	110/33
35	MANNARKKAD	110	16	110/33
			16	110/33
36	PARALI	110	16	110/33
			16	110/33
37	KOOTANADU	110	16	110/33
38	KOPPAM	110	16	110/33
			16	110/33
39	PALA	110	16	110/33
			16	110/33
40	VAIKOM	110	16	110/33
41	THRIKKODITHANAM	110	16	110/33
42	PARASSALA	110	16	110/33
			16	110/33
43	THIRUMALA	110	16	110/33
44	ATTINGAL	110	16	110/33
			16	110/33
45	KILIMANOOR	110	16	110/33
			16	110/33
46	NEDUMANGAD	110	16	110/33
			16	110/33
47	KURUMASSERY	110	16	110/33
			16	110/33
48	MUVATTUPUZHA	110	16	110/33
			16	110/33
49	PERUMBAVOOR	110	16	110/33

SL.NO.	NAME OF THE SUBSTATION	VOLTAGE	TRANSFORMER CAPACITY(MVA)	VOLTAGE RATIO
50	MALLAPPALLY	110	16	110/33
51	PATHANAMTHITTA	110	16	110/33
			16	110/33
52	UDUMBANNOOR	110	16	110/33
			16	110/33
53	CHALAKUDY	110	16	110/33
			16	110/33
54	MALAYATTOR	110	16	110/33
			16	110/33
55	CHERPU	110	16	110/33
56	IRINJALAKUDA	110	16	110/33
			16	110/33
57	KANDASSANKADAVU	110	16	110/33
58	VALLAPAD	110	16	110/33
			16	110/33
59	OLLUR	110	16	110/33
			16	110/33
60	ATHANI	110	16	110/33
61	GURUVAYOOR	110	16	110/33
62	KUNNAMKULAM	110	16	110/33
63	VIYOOR	110	16	110/33
			16	110/33
64	WADAKKANCHERY	110	16	110/33
		SUBTOTAL	1552	
F.	66/33kV substations			
1	KANIYAMPETA	66	20	66/33
			20	66/33
2	PEERUMEDU	66	16	66/33
3	NILAMBUR	66	16	66/33
		SUBTOTAL	72	

ANNEXURE-VII**220 kV & 110 kV GRID SUBSTATION (UPCOMING NEW) & 220/110 kV TRANSFORMER CAPACITY
ADDITION IN EXISTING GSS**

A	220 kV & 110 kV GRID SUBSTATION (UPCOMING NEW)					
Sl No.	Name of GSS	Voltage Ratio	No of Transformer	MVA Capacity	Total MVA	Target year
1	Nileswaram	220/110kV	1	1X200	200	2015-16
2	Kunnamangalam	220/110kV	2	2x100	200	2016-17
3	Kakkayam	220/110kV	2	2X200	400	2016-17
4	Elamkur Substation(Manjeri)	220/110kV	2	2X100	200	2016-17
5	Challakuddy	220/110kV	2	2X100	200	2016-17
6	Kattakada	220/110kV	1	1X200	200	2016-17
7	Kakkad	220/110kV	2	2X100	200	2017-18
8	Kothamangalam	220/110kV	2	2X100	200	2017-18
9	Kuyilimala	220/110kV	2	2X100	200	2017-18
10	Kuyilimala	110/66 kV	1	1x40	-	2017-18
11	parippally	220/110kV	2	2X100	200	2017-18
12	Eramallur	220/110kV	2	2X200	400	2018-19
13	Kaloor	220/110kV	2	2X200	400	2018-19
14	Aluva	220/110kV	2	2X200	400	2018-19
15	Allumangalam	220/66kV	2	2X50	100	2018-19
16	Pallivasal	220/66kV	2	2X50	100	2018-19

B 220/110 kV Transformer capacity Addition in Existing GSS						
Sl. No.	NAME OF S/S WITH EXISTING CAPACITY	VOLTAGE RATIO	PROPOSED 220/110 KV CAPACITY ADDITION /ENHANCEMENT	Net Capacity Addition(MVA)	TARGET YEAR	Remarks
1	KATTAKADA (1X200MVA)	220/110 kV	1 X 200	200	2016-2017	Cap Addition
2	EDAMON (2X100MVA)	220/110kV	2 X 200	200	2017-2018	Cap Enhancement
3	DEAPPON (2X200MVA)	220/110 kV	3 X 200	200	2016-2017	Cap Addition
4	KUNDARA (2X200MVA)	220/110 kV	1 X 200	200	2016-2017	Cap Addition
5	PALLOM (2X200MVA)	220/110 kV	1 X 200	200	2016-2017	Cap Addition
6	KALAMASSERY (3X200MVA + (1X120MVA)	220/110 kV	1 X 200	80	2016-2017	1 No.120 MVA enhanced to 200 MVA
7	NALLALAM (2X100MVA + (2X60MVA))	220/110 kV	2 X 200	180	2016-2017	2x60MVA +1X100MVA replaced by 2x200MVA + 1x100MVA retained
8	AREAKODE (1X160 MVA)	220/110 kV	2 X 160	160	2016-2017	Cap Addition
9	PALAKKAD (2X160 MVA)	220/110 kV	2 X 200	80	2018-2019	Cap Enhancement
10	MYLATTY (2X100 MVA)	220/110 kV	2 X 200	200	2018-2019	Cap Enhancement
11	TALIPPARAMBA (2X100MVA)	220/110 kV	2 X 200	200	2018-2019	Cap Enhancement
12	MALAPPARAMBA (2X100MVA)	220/110 kV	2 X 200	200	2016-2017	Cap Enhancement
13	SHONOUR (2X100MVA)	220/110 kV	2 X 200	200	2018-2019	Cap Enhancement

ANNEXURE-VIII-A

SUMMARY OF THE YEAR WISE INVESTMENT FOR INTRA STATE TRANSMISSION PLAN
(FY 2015-16 to FY 2018-19)

Year Wise Investment Details					
Sl. No	Target Year	Km	S/s	Line	Total
1	FY 2015-16	355	5570	23854	29424
2	FY 2016-17	345	9463	26485	35948
3	FY 2017-18	537	8064	160163	168227
4	FY 2018-19	181	5174	12942	18116
	Total Amount (Rs. In lakhs)		28271	223444	251715

DETAILED BREAK-UP OF INVESTMENT PROPOSAL FOR TRANSMISSION (INTRA STATE)

Sl No.	Transmission Proposals	Target Year (FY)	km	S/s	Line
1	Transmission Proposals for the Period 2015-16				
2	220 kV Kattakada- Balarampuram-Vizhinjam Multi ckt Multivoltage line	2015-16	20		5997
3	220kV S/s Kothamangalam (Upgradation)	2015-16		2036	
4	220kV Karukadam-Kothamangalam Line	2015-16	4		675
5	110 kV Switching station, Panthalacode.	2015-16		2218	
6	66kV Sasthamkotta - Thevalakkara line	2015-16	1		
7	Upgradation of Edappon-Adoor 66 kV D/c line to 110 kV.	2015-16	16		1150
8	Upgradation of Ettumanur-Vaikom 66 kV line to 110 kV parameters.	2015-16	16		1000
9	66 kV LILO to Kattanam S/s from Mavelikara-Karunagapally line.	2015-16	2.5		160
10	LILO of 66kV Vytilla-Puthencruz line.	2015-16	2.5		180
11	North Parur-Cherai 110 kV line.	2015-16	7.2		635
12	110 kV tap line to Chowara S/s from Kalamassery-Chalakudy #2 line.	2015-16	0.7		115
13	LILO of 110kV Neriamangalam-Pala feeder to 110kV S/s Muttom	2015-16	5		
14	Peerumedu-Kattappana 110 kV D/c line.	2015-16	30		2136
15	Valapad-Kandassankadavu 110 kV DC line .	2015-16	14		266
16	110 kV LILO's to Kodungallur from Irinjalakuda -Valapad line.	2015-16	15.67		600
17	Kunnamkulam-Wadakkanchery 110 kV DC Interlinking line	2015-16	0.1	529	
18	Vadakkenchery-Kollengode 110 kV interlinking line.	2015-16	37		2761
19	Kalladikode-Parali 110 kV interlinking line.	2015-16	14		1250
20	LILO of 110kV Palakkad-Kollengode line to Chittur.	2015-16	2		150
21	110 kV LILO to Vallapuzha S/s from Shornur- Malaparamba line.	2015-16	0.1	787	25
22	Doubling of Malappuram-Tirur 110 kV line.	2015-16	26		120
23	110 kV DC line to Perinthalmanna from 220k kV S/s Malaparamba.	2015-16	5		70
24	LILO of 110kV Nallalam - Keezhissery line to 110kV S/s Pulikkal	2015-16	1		75
25	LILO of 110kV Malappuram - Keezhissery line to 110kV S/s Panakkad	2015-16	18		696
26	Chevayur-Swapnanagari-Gandhi Road 110 kV UG cable	2015-16	8		400
27	Doubling of Nallalam-Chevayur-WestHill 110 kV line.	2015-16	20		550
28	Doubling of 66 kV Kaniyambetta - Kuthumunda line in 110 kV parameter.	2015-16	12		861
29	Upgradation of 66kV Koothuparamba-Nedumpoyil line to 110 kV.	2015-16	18.6		1000
30	Doubling of Cheruvathur-Taliparamba 110 kV line.	2015-16	32		2780
	110 kV Vadakara - Thalassery Doubling.	2015-16	26.4		202
	TOTAL		354.77	5570	23854
	Transmission Proposals for the Period 2016-17				
1	Upgradation of 110kV Substation Kaloore to 220kV .	2016-17		2590	
2	220 kV Brahmapuram-Kaloore line (OH+UG).	2016-17	13.5		3803
3	LILO of 220kV Madakkathara-Elapully line at 220kV S/s Shornur .	2016-17	15		1746
4	Doubling of Mylatty-Kanhangad 110 kV line.	2016-17	16		124

Sl No.	Transmission Proposals	Target Year (FY)	km	S/s	Line
5	Doubling of Kaniaymbetta - Mananthavady 66kV feeder in 110kV parameters.	2016-17	8.8	1254	
6	Doubling of 66 kV Kuthumunda - Thamarassery line in 110 kV parameters.	2016-17	18		1189
7	LILO to Thottiyar HEP from Lower periyar- Madakkathara Line	2016-17	1km		460
8	110 kV LILO to Kinaloor S/s from Kuttiady-Chevayur line.	2016-17	3		219
9	Doubling of WestHill-Vadakara 110 kV line.		46		4000
10	110kV Agali-Kalladikode and Agali-Mannarkad M/C line as part of wind evacuation.	2016-17	58		4131
11	Mannarkkad-Kalladikode 110 kV 2nd circuit.	2016-17	22		1500
12	Cherpulassery-Mannarkkad 110 kV interlinking line.	2016-17	30		2500
13	LILO of 110kV Vadakkenchery-Kollengode line to Nenmara.	2016-17	1.4		
14	220 kV S/s, Chalakkudy.			2589	
15	LILO of 220 kV Lower Periyar-Madakkatharara line.	2016-17	9		1048
16	Upgradation of 66 kV Viyyur-Wadakanchery line to 110 kV.	2016-17	13.7		710
17	Conversion of Tap arrangements to LILO of 110kV Kalamassery-Chalakkudy 1&2 feeders feeding 110kV S/s Aluva .	2016-17			0
18	220 kV S/s, Aluva (Upgn.)	2016-17		3030	
19	Upgradation of 66kV Kalamassery-Aluva line to 220/110kV using Multicircuit-Multivoltage Towers.	2016-17	6.6		1390
20	Interlinking of 220kV S/s Aluva and 220kV Chalakkudy by upgradation of existing 66kV Aluva-Chalakkudy feeder to Multicircuit-Multivoltage feeder	2016-17	27		
21	Moovattupuzha-Piravom 110 kV DC line .	2016-17	18		1282
22	LILO to Eramallur S/s from 110kV Punnapra - Aroor & Punnapra - Mattancherry Line .	2016-17	1		71
23	110 kV tap line to Kavalam S/s from 110kV Pallom - Punnapra line.	2016-17	2		142
24	Upgradation of Ettumanur-Pala 66 kV line to 110 kV parameters.	2016-17	18		900
25	LILO of Edamon - Paruthippara line upto Mrithurmala (crossing point of 66kV Attingal - Palode line) for upgradation of 66kV S/s Palode.	2016-17	8		570
26	Veli-Muttathara 110 kV line.	2016-17	9		700
27	LILO of 110kV Paruthippara-Vattiyoorkavu line to Perrorkada.	2016-17	1		
	TOTAL		345	9463.39	26485.31
1	Transmission Proposals for the Period 2017-18				
2	Upgradation of existing 220kV Madakathara - Malaparamba - Areekode S/c to 400/220kV Multi Circuit corridor		105		47250
3	Upgradation of 66kV Kannampully - Nenmara line to 110kV.	2017-18	10		750
4	Upgradation of Pudukkad-Kattor line to 110kV.	2017-18	12.5	300	
5	Re conductoring of Perumanoor-Vyttila 66kV D/C line.	2017-18	3.4		224
6	Re conductoring of 66kV Thodupuzha - Koothattukulam line.	2017-18	16		1056
7	Upgradation of 66kV Kothamangalam - Koothattukulam line to 110kV.	2017-18	22.5		1486
8	Installation of 110/66 kV Transformer at Koothattukulam for back feeding Moolamattom and Kuruvilangadu at 66kV level.	2017-18		711	
9	Upgradation of Pallom-Mavelikkara D/C line to 110kV.	2017-18	31		2048
10	Upgradation of Edappon-Mavelikkara D/C line to 110kV.	2017-18	11		727

Sl No.	Transmission Proposals	Target Year (FY)	km	S/s	Line
11	Interlinking of GIS Kollam and Kavanad 110kV S/s using UG cable. This will provide a backup support incase of failure at Kundara.	2017-18	4		200
12	Upgradation of 66kV Sasthamcotta - Thevalakkara, and 66kV Sasthamcotta- East Kallada line to 110kV.	2017-18	13.7		1810
13	220 kV Areakode-Kanhirode DC line.	2017-18	120		96368
14	Upgradation of Attingal-Palode 66 kV line to 110 kV and providing tapping on 110kV Edamon-Paruthippara line	2017-18	19.6		450
15	Upgradation of 110kV Substation Kunnamangalam to 220kV .	2017-18		2589.39	
16	220kV LILO to Kunnamangalam S/s from Areakode-Kanhirode feeder	2017-18	2		919.7
17	Construction of additional 220kV Multi circuit Mylatty -Kanhirode Line using existing RoW	2017-18	85		
18	220kV Elamkur	2017-18		3274	
19	LILO of 220kV Madakkathara-Areakode line at Elamkur	2017-18	0.5		58
20	110kV Melattur-Nilambur line.	2017-18	30		2136.9
21	Upgradation of Manjeri-Nilambur-Edakara line to 110kV	2017-18	42		2774
22	400kV Ettumanur (Kottayam)S/s	2017-18		1190	
23	LILO of Thirunelveli-Cochin East to 400kV Ettumanur	2017-18	3		1206
	LILO of 220kV Pallom -Ambalamughal and Sabarigiri-Ambalamugal at 400kV s/s Kottayam	2017-18	6		699
	400 kV HVDC Chattisgarh-Raigarh-Madakkathara 2000MW link (CTU)	2017-18			
	TOTAL		537.2	8064.13	160163
	Transmission Proposals for the Period 2018-19				
1	Construction of 400kV S/s Mylatty (Kasargode) and 400kV D/c Line from Uduppi to Mylatty (by CTU or TBCB)	2018-19			
2	Upgradation of 110kV S/s Eramallur to 220kV	2018-19		2590	
3	Construction of 220kV Brahmapuram-Eramallur DC line	2018-19	18.9		2201
4	Upgradation of Tap line to Vaikom with LILO arrangement on Chertala-Aroor line.	2018-19	12.6		832
5	Upgradation of Ettumanoor - Pallom 66kV D/c line to 110kV and intervening substations Kottayam and Gandhinagar to 110kV.	2018-19	19	1250	1254
6	Upgradation of 66kV S/s Nangiarkulangara to 110kV and charging of Karuvatta s/s at 110kV.	2018-19		623	
7	Upgradation of Punnappra-Mavelikkara D/C line to 110kV.	2018-19	35		2310
8	Upgradation of Mavelikkara-Karunagapally-Sasthamcotta D/C line to 110kV.	2018-19	49		3234
9	Cherai-Kodungalloor 110kV D/c line on multicircuit multivoltage towers.	2018-19	12		855
10	Upgradation of Vyttila-Puthencruz line to 110kV.	2018-19	18		1200
11	Installation of 110/66kV Transformer at Peerumedu for back feeding Moozhiyar.	2018-19		711	
12	Upgradation of 66kV Kanjikode-Chittur line to 110kV (charging one circuit at 66kV for INDSIL and other at 110kV).	2018-19	16		1056
	TOTAL		181	5173.89	12942

RAPDRP PART-B LOAN SANCTIONED AND RELEASED BY POWER FINANCE CORPORATION LTD
40 schemes (Departmental execution)

Sl. No.	Name of Town/project	Sanctioned Project Cost (Rs. Crores)	Date of Sanction	Total loan amount (Rs. Crores)	Disbursement (15% of sanctioned project cost)	Date of release	Date of completion as per GoI	Amount utilised as on May 2014	% Achievement
1	Alappuzha	35.22	2.6.2010	4.24	2.544	01.09.2010	1.06.2015	8.27	23.48%
	Revision		3.8.12	4.57	2.739	20.12.2012			
2	Aroor	19.03	2.6.2010	4.76	2.856	01.09.2011	1.06.2015	5.30	27.85%
3	Attingal	10.02	16.8.2010	2.105	1.263	29.10.2010	15.08.2015	3.98	39.72%
	Revision		3.8.12	0.400	0.24	20.12.2012			
4	Chalakudy	4.72	16.8.2010	1.180	0.708	29.10.2010	15.08.2015	3.26	69.07%
5	Changanacherry	12.42	16.8.2010	3.105	1.863	29.10.2010	15.08.2015	7.16	57.65%
6	Cherthala	12.70	16.8.2010	3.175	1.905	29.10.2010	15.08.2015	8.73	68.74%
7	Chittur - Tattamangalam	6.30	2.6.2010	1.58	0.948	01.09.2011	1.06.2015	4.41	70.00%
8	Chokli-Peringathur	8.76	2.6.2010	2.19	1.314	01.09.2011	1.06.2015	3.58	40.87%
9	Guruvayur	10.64	16.8.2010	2.660	1.596	29.10.2010	15.08.2015	3.96	37.22%
10	Kanhangad	12.71	16.8.2010	3.1775	1.9065	29.10.2010	15.08.2015	3.38	26.59%
11	Kannur	80.2	16.8.2010	18.695	11.217	29.10.2010	15.08.2015	18.97	23.65%
	Revision		3.8.12	1.355	0.813	20.12.2012			
12	Kasaragod	11.72	16.8.2010	2.930	1.758	29.10.2010	15.08.2015	3.27	27.90%
13	Kayamkulam	9.98	2.6.2010	2.50	1.5	01.09.2011	1.06.2015	6.5	65.13%
14	Kodungallur	14.28	8.12.2010	3.1	1.8585	15.03.2011	7.12.2015	9.24	64.71%
	Revision		3.8.12	0.4725	0.2835	20.12.12			
15	Kollam	26.93	16.8.2010	6.7325	4.0395	29.10.2010	15.08.2015	20.07	74.53%
16	Kothamangalam	10.14	16.8.2010	2.535	1.521	29.10.2010	15.08.2015	4.27	42.11%
17	Kottayam	23.89	8.12.2010	5.97	3.5835	15.03.2011	7.12.2015	11.88	49.73%
18	Koyilandy	7.24	16.8.2010	1.810	1.086	29.10.2010	15.08.2015	2.64	36.46%
19	Kunnamkulam	5.53	2.6.2010	1.38	0.828	01.09.2011	1.6.2015	3.64	65.82%
20	Malappuram	7.26	2.6.2010	1.81	1.086	01.09.2011	1.6.2015	2.71	37.33%



Sl. No.	Name of Town/project	Sanctioned Project Cost (Rs. Crores)	Date of Sanction	Total loan amount (Rs. Crores)	Disbursement (15% of sanctioned project cost)	Date of release	Date of completion as per Gol	Amount utilised as on May 2014	% Achievement
21	Mattannur	8.69	16.8.2010	2.1725	1.3035	29.10.2010	15.08.2015	2.86	32.91%
22	Nedumangad	7.05	16.8.2010	1.7625	1.0575	29.10.2010	15.08.2015	5.24	74.33%
23	Neyyattinkara	5.77	2.6.2010	1.44	0.864	01.09.2011	1.06.2015	3.9	67.59%
24	Ottappalam	2.54	8.12.2010	0.64	0.381	15.03.2011	7.12.2015	2.36	92.91%
25	Palakkad	50.65	8.12.2010	12.66	7.5975	15.03.2011	7.12.2015	13.87	27.38%
26	Pappinissery	5.4	16.8.2010	1.350	0.81	29.10.2010	15.08.2015	2.17	40.19%
27	Paravur	5.19	16.8.2010	1.2975	0.7785	29.10.2010	15.08.2015	6.56	126.40%
28	Pathanamithitta	2.91	16.8.2010	0.7275	0.4365	29.10.2010	15.08.2015	1.98	68.04%
29	Payyanur	5.18	2.6.2010	1.29	0.774	01.09.2011	1.06.2015	4.74	91.51%
30	Perinthalmanna	4.42	16.8.2010	1.105	0.663	29.10.2010	15.08.2015	4.74	107.24%
31	Ponnani	3.54	16.8.2010	0.885	0.531	29.10.2010	15.08.2015	1.31	37.01%
32	Punalur	3.42	2.6.2010	0.86	0.516	01.09.2011	1.06.2015	3.08	90.06%
33	Shornur	3.79	8.12.2010	0.95	0.5685	15.03.2011	7.12.2015	2.73	72.03%
34	Thaliparamba	6.57	8.12.2010	1.64	0.9855	15.03.2011	7.12.2015	4.87	74.12%
35	Thiruvalla	16.6	16.8.2010	4.150	2.49	29.10.2010	15.08.2015	5.29	31.87%
36	Thodupuzha	13.97	16.8.2010	3.4925	2.0955	29.10.2010	15.08.2015	8.25	59.06%
37	Thrissur	29.15	8.12.2010	7.29	4.3725	15.03.2011	7.12.2015	12.83	44.01%
38	Tirur	5.70	2.6.2010	1.42	0.852	01.09.2011	1.06.2015	3.58	62.81%
39	Vadakara	13.33	8.12.2010	3.33	1.9995	15.03.2011	7.12.2015	7.42	55.66%
40	Varkala	7.23	16.8.2010	1.760	1.056	29.10.2010	15.08.2015	2.69	37.21%
	Revision		3.8.12	0.048	0.0285	20.12.2012			
	Total	530.79	0	132.697	79.617			235.69	44.40%

Sl no	Name of Town/project	Sanctioned Project Cost (Rs Crores)	Date of Sanction	Total loan amount (Rs Crores)	Disbursement ((60% of PFC sanction (15% of sanctioned project cost))	Date of release	Date of completion as per GoI	Amount utilised as on Feb. 2014	% Achievement
1	Ernakulam/Kochi	207.96	22.02.2011	51.990	31.194	28.6.2011	21.02.2016	2.5126	1.21%
2	Kozhikode	160.78	22.02.2011	40.195	24.117	28.6.2011	21.2.2016	6.6161	4.12%
3	Thiruvananthapuram	178.77	3.8.2012	44.693	26.816	20.12.2012	31.03.2017	0.000	
	Total	547.51		136.88	82.127			9.129	2%
	Part B Total	1078.3		269.58	161.744			244.82	22.70%



NETWORK ADDITION AFTER IMPLEMENTATION OF R-APDRP PART-B

Sl. No.	Details of Work	Unit	Target	Achievement up to Jan.15
1	Sub Transmission System Improvement Work			
2	33/11 KV or 66/11 KV SS : New	No	13.0	1.6
3	33/11 KV or 66/11 KV SS : Additional Transformer	No	5.0	3.0
4	New 33 KV feeders/Bifurcation:	KM	97.0	10.3
5	33/66 KV feeders Reconductoring/Augmentation	KM	23.3	23.3
6	33/11 KV or 66/11 KV SS : Installation of remote switchable breaker/switches *	No	5.0	5.0
7	33 kV or 66 KV Line Bay Extension at EHV station	No	1.0	0.0
8	11 kV Line : New Feeder/ Feeder Bifurcation	Km	2407.8	1483.1
9	11 kV Line : Reconductoring/Augmentation (OH)	KM	1140.8	495.0
10	11 kV Line : Installation of automated RMUs alongwith aux power supply to operate sw/breaker	No	2340.0	10.0
11	11 kV Line :Installation of remote communicable FPIs (O/C,E/F)	No	274.0	0.0
12	11 kV Line : Installation of remote switchable breakers alongwith aux power supply to operate sw/breaker *	No	955.0	0.0
13	Remote operable motors (DA) for SCADA compatibility in existing RMUs		484.0	0.0
14	Sectionaliser]		471.0	0.0
15	11 KV Bay Extension	No	12.0	6.0
16	Renovation & Modernisation of 33/11 kV SS	No	1.0	2.0
17	Installation of Distribution Transformer	No	2655.0	1895.0
18	Capacity enhancement /Replacement of LT sub-station	No	383.0	238.0
19	LT Line : New Feeder/ Feeder Bifurcation	KM	309.0	180.7
20	LT Line : Augmentation	KM	7543.8	4678.9
21	Capacitor Bank	No	6293.0	42.0
22	Aerial Bunched Cables	KM	1495.2	2.0
23	Metering	No	1334785.0	736739.0
24	Shifting of meters	No	58335.0	20951.0
25	UG cabling at pilgrim/tourist/religious centres	Km	81.4	8.8
26	R&M Transformer stations	No	622.0	277.0
27	Providing new AB S/w	No	205.0	107.0
28	Replacing LAs	No	516.0	180.0
29	Replacing PSC poles with A-pole	No	80.0	89.0
30	Standardisation/Renovation of 11 KV Structures	No	114.0	90.0
31	Sectionalising of 11 KV line	No	112.0	130.0
32	Replacement of damaged Line AB Switches	No	480.0	397.0
33	Installation of Distribution Box	No	1029.0	9.0
34	Providing PVC cable 95 sq mm	Km	1.0	1.0

Sl. No.	Details of Work	Unit	Target	Achievement up to Jan.15
35	Providing PVC cable 120 sq mm	Km	1.0	1.0
36	Installation of DO fuses	No	30.0	30.0
37	Renewal of LT poles	No	100.0	100.0
38	Jumper connection redoing	No	340.0	455.0
39	Earthing	No	125.0	204.0
40	Replacement of 66KV old CT at S/S	No	24.0	24.0
41	Replacement of 11 KV old cubicle with new 15 panel set	No	1.0	0.0
42	New transformer control & relay panel at s/s	No	2.0	0.0
43	new 11KV feeder cubicle	No	6.0	1.0
44	Replacement of service wire with 4/6sq:mm	No	53842.0	0.0

ANNEXURE-XI**RAJIV GANDHI Grameen Vidyudhikaran Yojana (RGGVY)****XTH PLAN SCHEME****(Rs. in Lakh)**

Name of scheme	Sanctioned Project Cost	Date of Sanction	Amount received from REC	Final project cost as per completion proposal	Date of completion	BPL service Connection		APL service connection effected
						Target	Effected	
Idukki	1995.22	05.08.2005	1818.692	2041.128	30.06.2010	16097	17238	641
XIth Plan scheme (I Phase)								
Kasargod	1460.71	10.03.2010	1149.576	1445.61	31.12.2014	4194	6616	1024
Kannur	1971.4	10.03.2010	1439.47	2285.51	31.12.2014	5136	9347	1230
Kozhikode	1692.93	10.03.2010	1212.291	1675.27	31.12.2014	11920	9741	880
Wayanad	1433.44	10.03.2010	968.599	1571.89	31.12.2014	5415	9959	418
Palakkad	1635.4	10.03.2010	1127.078	1716.95	31.12.2014	3955	18215	1100
Malappuram	3263.46	10.03.2010	2524.908	3147.1	31.03.2015	7897	10360	1781
	11457.3		8421.92	11842.3		38517	64238	6433
XIth Plan scheme (II Phase)								
Kollam	328.05	19.12.2011	180.207	479	31.03.2015	718	5009	884
Pathanamthitta	575.65	19.12.2011	316.912	646.6	31.03.2015	1977	2120	50
Alapuzha	1366.81	19.12.2011	753.235	1425.32	31.03.2015	5486	5388	750
Thiruvananthapuram	2182.13	14.02.2012	1197.032	2104.30*	Ongoing scheme and will be completed on 30.09.2015	3034	10103	10414
Kottayam	796.51	19.12.2011	436.944	706.11*		1118	2423	142
Ernakulam	2471.24	14.02.2012	698.906	1065.43*		3828	1575	484
Thrissur	1262.7	19.12.2011	693.556	784.90*		2678	3676	1187
TOTAL	8983.09		4276.79	7211.66		18839	30294	13911

District Wise Status of DPR Approval As On Date - 08/09/2015

State : KERALA

Sl.No.	Name of District	DPR Code	Electrification of UE Villages	Feeder Separation	Connecting / Unconnecting Hhs	Metering	System Strengthening	Sansad Adarsh Gram Yojna	Total DPR Cost (In Cr.)
KERALA STATE ELECTRICITY BOARD LIMITED									
1	Alappuzha	DDU:32:598:01	Nil	Nil	7.38	21.67	5.13	5.32	39.50
2	Ernakulam	DDU:32:595:01	Nil	Nil	5.11	19.18	10.50	3.22	38.01
3	Idukki	DDU:32:596:01	Nil	Nil	4.80	20.80	12.36	0.14	38.10
4	Kannur	DDU:32:589:01	Nil	Nil	9.73	23.59	3.46	2.67	39.45
5	Kasaragod	DDU:32:588:01	Nil	Nil	1.15	5.36	1.06	1.79	9.36
6	Kollam	DDU:32:600:01	Nil	Nil	4.47	17.36	8.58	3.64	34.05
7	Kottayam	DDU:32:597:01	Nil	Nil	6.53	20.24	11.62	4.03	42.42
8	Kozhikode	DDU:32:591:01	Nil	Nil	7.67	19.48	1.89	10.40	39.44
9	Malappuram	DDU:32:592:01	Nil	Nil	11.84	10.72	5.55	2.71	30.82
10	Palakkad	DDU:32:593:01	Nil	Nil	2.35	19.73	3.49	2.76	28.33
11	Pathanamthitta	DDU:32:599:01	Nil	Nil	6.18	8.35	6.02	5.03	25.58
12	Thiruvananthapuram	DDU:32:601:01	Nil	Nil	8.11	22.69	6.16	15.75	52.71
13	Thrissur	DDU:32:594:01	Nil	Nil	3.76	37.73	4.84	0.41	46.74
14	Wayanad	DDU:32:590:01	Nil	Nil	2.50	12.26	2.40	1.25	18.41
Total			Nil	Nil	81.58	259.16	83.06	59.12	482.92

DDUGJY DPR Abstract

Kerala State Electricity Board Ltd.

Item No	Item of Work	Unit	Rate (Rs. Lac)	System Strengthening		RHH Electrification		SAGY		Metering		Total		
				Qty	Amount (Rs. Lac)	Qty	Amount (Rs. Lac)	Qty	Amount (Rs. Lac)	Qty	Amount (Rs. Lac)	Unit	Qty	Amount (Rs. Lac)
1	11KV Line Augmentation	KM		1167.14	4148.88	642.76	1542.35	60.48	268.09	0.00	0.00	KM	1870.38	5959.32
2	33KV Substation Augmentation	No		2334.09	20041.05	5.00	608.13	0.00	0.00	0.00	0.00	No	2339.09	20649.18
3	BPL HHs	No		0.00	0.00	67282.00	2018.46	3301.00	99.03	0.00	0.00	No	70583.00	2117.49
4	Capacity Augmentation of DTR	No		0.00	0.00	540.00	1416.15	24.00	57.94	0.00	0.00	No	564.00	1474.09
5	Conversion of LT lines to ABC	KM		0.00	0.00	475.10	4380.42	97.56	1032.89	0.00	0.00	KM	572.66	5413.32
6	New DTR	No		0.00	0.00	2408.00	6985.03	109.00	348.17	0.00	0.00	No	2517.00	7333.20
7	New LT ABC	KM		0.00	0.00	641.61	6885.72	41.24	431.73	0.00	0.00	KM	682.85	7317.45
8	New LT OH Line	KM		0.00	0.00	3525.13	11935.32	207.41	732.54	0.00	0.00	KM	3732.54	12667.86
9	New 11KV Line	KM		2504.32	31371.54	1293.95	10610.45	180.75	1658.47	0.00	0.00	KM	3979.02	43640.45
10	New 33KV Line	KM		255.30	6594.39	0.00	0.00	0.00	0.00	0.00	0.00	KM	255.30	6594.39
11	New 33KV Bay	No		20.00	1039.00	0.00	0.00	0.00	0.00	0.00	0.00	No	20.00	1039.00
12	New 66KV Substation	No		1.00	360.00	0.00	0.00	0.00	0.00	0.00	0.00	No	1.00	360.00
13	New 33KV Substation	No		16.00	5423.00	0.00	0.00	0.00	0.00	0.00	0.00	No	16.00	5423.00
14	Reconductoring of LT OH	KM		0.00	0.00	5883.80	13866.82	286.39	763.21	0.00	0.00	KM	6170.19	14630.03
15	Renovation of DTR Substation and Earthing	No		0.00	0.00	2198.92	2313.99	78.00	57.65	0.00	0.00	No	2276.92	2371.64
16	DTR Metering	No		0.00	0.00	108.00	75.60	0.00	0.00	22088.00	3804.60	No	22196.00	3880.20
17	Feeder Metering	No		0.00	0.00	0.00	0.00	0.00	0.00	2924.00	443.63	No	2924.00	443.63
18	LT metering	No		0.00	0.00	0.00	0.00	0.00	0.00	1575997.00	16843.25	No	1575997.00	16843.25
19	New 11KV Spur Line			0.00	0.00	1214.11	6487.43	109.90	454.14	243481.00	3410.50		244805.01	10352.07
20	New 11KV Bay			16.00	85.03	23.00	137.00	2.00	10.00	0.00	0.00		41.00	232.03
21	LT metering (Shifting of Meter)			0.00	0.00	0.00	0.00	0.00	0.00	167331.00	1413.77		167331.00	1413.77
22	Conversion of LT ABC Cables to higher capacity ABC			0.00	0.00	26.00	234.00	0.00	0.00	0.00	0.00		26.00	234.00
23	33KV Line Augmentation			973.44	1691.67	0.00	0.00	0.00	0.00	0.00	0.00		973.44	1691.67
24	New 22KV Line			0.00	0.00	1.00	8.00	11.00	0.00	0.00	0.00		12.00	8.00
					70754.54		69504.87		5913.86		25915.75	Grand Total		172089.02

IPDS- TOWNWISE ABSTRACT

Sl. No.	CIRCLE	Sl.No.	NAME OF THE TOWN	Town wise Amount in Rs. Crs	Circle Total Amt in Rs. Crs	% AT&C loss
1	Kasaragod	1	Kasaragod (M)	10.86	28.69	35.50%
		2	Kanhangad (M + OG)	12.18		
		3	Nileswar	5.65		
2	Sreekandapuram	4	Mattannur (M)	6.53	23.97	19.41%
		5	Payyannur (M)	7.60		
		6	Taliparamba (M)	9.85		
3	Kannur	7	Kannur (M)	6.85	32.47	17.66%
		8	Kannur Cantonment (CB)	6.60		
		9	Koothuparamba (M)	8.67		
		10	Thalassery (M)	10.36		
4	Kalpetta	11	Kalpetta (M)	12.66	12.66	18.00%
5	Vadakara	12	Vadakara (M)	6.05	11.13	16.29%
		13	Quilandy (M)	5.08		
6	Kozhikode	14	Kozhikode (M Corp. + OG)	18.73	18.73	27.31%
7	Nilambur	15	Nilambur	11.88	11.88	18.43%
8	Tirur	16	Ponnani (M)	6.02	18.21	25.38%
		17	Tirur (M)	12.19		
		18	Kottakkal			
9	Manjeri	19	Manjeri (M)	3.49	15.14	15.95%
		20	Malappuram (M + OG)	6.09		
		21	Perinthalmanna (M)	5.56		
10	Shoranur	22	Shoranur (M)	5.73	10.37	15.22%
		23	Ottappalam (M)	4.64		
11	Palakkad	24	Palakkad (M)	15.36	34.85	12.52%
		25	Chittur-Thathamangalam (M)	19.49		
12	Thrissur	26	Kunnamkulam (M)	3.15	17.91	17.59%
		27	Guruvayoor (M)	3.92		
		28	Chavakkad (M)			
		29	Thrissur (M Corp.)	10.84		
13	Irinjalakuda	30	Kodungallur (M + OG)	6.36	18.86	21.05%

Sl. No.	CIRCLE	Sl.No.	NAME OF THE TOWN	Town wise Amount in Rs. Crs	Circle Total Amt in Rs. Crs	% AT&C loss
		31	Irinjalakuda (M)	4.25		
		32	Chalakudy (M)	8.25		
14	Perumbavoor	33	Perumbavoor (M)	4.31	54.87	26.38%
		34	Angamaly (M)	4.24		
		35	Aluva (M)	17.01		
		36	Paravur (M)	9.08		
		37	Kalamassery (M)	10.46		
		38	Muvattupuzha (M)	4.51		
		39	Kothamangalam (M)	5.28		
15	Ernakulam	40	Kochi (M Corp. + OG) (Part)	21.46	55.90	27.26%
		41	Thrissur (M)	34.44		
		42	Thodupuzha (M)	9.86	9.86	15.56%
16	Palai	43	Palai (M)	13.18	13.18	29.21%
	Kottayam	44	Vaikom (M)	3.66	17.44	15.72%
17		45	Kottayam (M)	9.54		
		46	Changanassery (M)	4.23		
18	Alappuzha	47	Cherthala (M)	5.72	15.30	22.12%
		48	Alappuzha (M + OG)	9.58		
19	Harippad	49	Kayamkulam (M)	4.99	14.94	22.31%
		50	Chengannur (M)	4.54		
		51	Mavelikkara (M)	5.42		
20	Pathanamthitta	52	Thiruvalla (M)	5.95	33.48	28.88%
		53	Pathanamthitta (M)	8.29		
		54	Adoor (M)	19.23		
21	Kollam	55	Kollam (M Corp. + OG) (Part)	24.47	43.19	11.80%
		56	Paravoor (M)	5.68		
		57	Karunagapally	13.05		
22	Kottarakkara	58	Punalur (M)	6.27	6.27	17.07%
23	Thiruvananthapuram (Urban)	59	Varkala (M)	6.36	39.91	25.70%
		60	Attingal (M)	7.20		

Sl. No.	CIRCLE	Sl.No.	NAME OF THE TOWN	Town wise Amount in Rs. Crs	Circle Total Amt in Rs. Crs	% AT&C loss
		61	Thiruvananthapuram (M Corp. + OG) (Part)	26.35		
24	Thiruvananthapuram(Rural)	62	Nedumangad (M)	12.85	32.86	31.47%
		63	Neyyattinkara (M)	20.01		
TOTAL				592.07	592.07	
Licensee						
25	Kochi		Cochin Port Trust	5.3846	5.3846	
TOTAL				597.46	597.46	

110/11 kV PROPOSED POWER SUB STATION

	Transmission Proposals	Unit Cost(Rs Lakhs)	secondary voltage level for Power Transformer	MVA Rating with No of Power Transformer	Total Capacity OF PSS (MVA)
Sl No.	Transmission Proposals for the Period 2014-15				
1	110 kV GIS, Kollam.	4369	11	2x20	40
2	110 kV S/s, Perinad.	601	11	2x12.5	25
3	66 kV S/s, East Kallada.	485	11	2x10	20
4	110kV S/s Erumeli	800	11	2x12.5	25
5	110 kV S/s, Enath.	779	11	2x12.5	25
6	110 kV S/s, Kodimatha. LILO from 110 kV Pallom - Punnapra line.	1033	11	2x12.5	25
7	110 kV S/s, Cherthala (Upgn)	800	11	2x12.5	25
8	110 kV S/s, Ernakulam North (Upgn.)	154	11	2x12.5	25
9	110 kV S/s, Angamaly (Upgn.). LILO from 110 kV Chalakkudy - Kurmasserry feeder (between CIAL tap & Kurumassery).	807	11	2x12.5	25
10	110 kV S/s, Nedumkandam (Upgn.)	623	11	2x12.5	25
11	110 kV S/s, Parappanangadi.	640	11	2x12.5	25
12	110 kV S/s ChandraNagar ,110 kV DC feeding from 110 kV S/s Kanjikode	476	11	2x12.5	25
13	66 kV S/s, Mankada.	283	11	1x10	10
14	Upgradation of 33kV S/s Thambalamanna to 110kV	870	11	2x12.5	25
15	110 kV GIS, Gandhiroad.	1550	11	2x20	40
16	66 kV S/s Chemperi in 110 kV Parameters.	718	11	2x10	40
		14988			425
Sl No.	Transmission Proposals for the Period 2015-16				
1	110 kV S/s, Vizhinjam (Upgn.)	811	11	2x12.5	25
2	110 kV S/s, Neyyattinkara (Upgn.)	790	11	2x12.5	25
3	110 kV S/s, Vattiyoorkavu (Upgn.)	194	11	2x12.5	25
4	66 kV S/s Thevalakkara	684	11	2x10	20
5	110 kV S/s, Adoor (Upgn.)	800	11	2x12.5	25
6	110 kV S/s, TECIL, Chingavanam.	940	11	2x12.5	25
7	66 kV S/s, Thiruvandoor in 110 kV parameters. LILO from 66kV Thiruvalla - Mavelikkara line.	1275	11	2x10	20
8	110 kV s/s Puthupally. LILO from Kanjirappally - Pambady line.	573	11	2x12.5	25
9	66 kV S/s, Kattanam (Upgn.)	600	11	2x10	20
10	66 kV S/s, Thrippunithura in 110 kV parameters.	725	11	2x10	20
11	110 kV S/s, Cherai.	1065	11	2x12.5	25
12	110 kV S/s, Chowara.	1195	11	2x12.5	25
13	110 kV S/s, Muttom	1000	11	2x12.5	25
14	110 kV S/s, Kodungallur (Upgn)	727	11	2x12.5	25
15	110 kV S/s, Mala (Upgn.)	807	11	2x12.5	25
16	110 kV S/s, Chittoor (Upgn.)	200	11	2x12.5	25
17	110kV Vallapuzha S/s	650	11	2x12.5	25

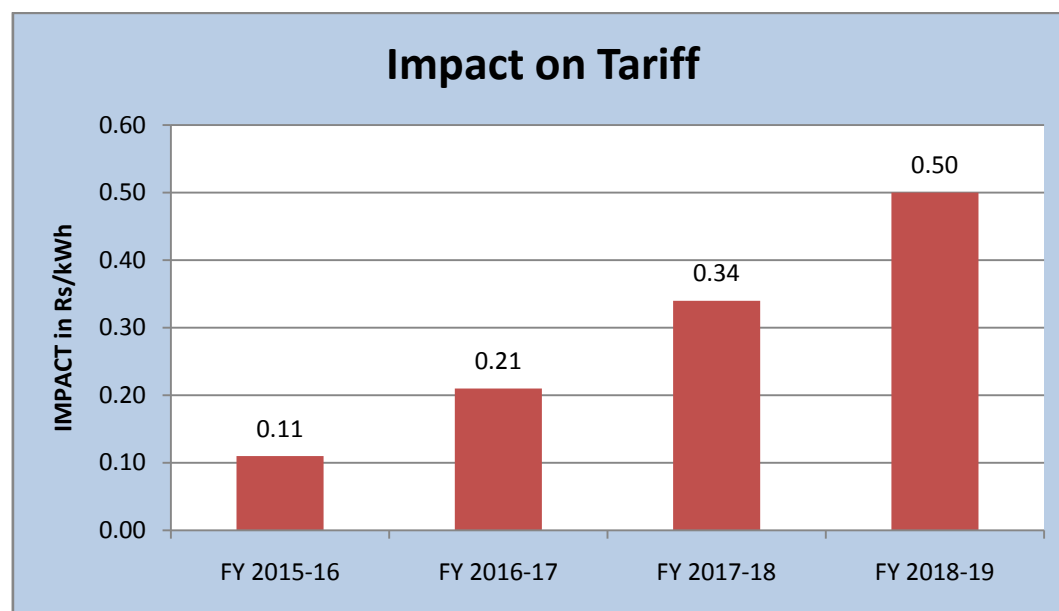
	Transmission Proposals	Unit Cost(Rs Lakhs)	secondary voltage level for Power Transformer	MVA Rating with No of Power Transformer	Total Capacity OF PSS (MVA)
18	110 kV S/s, Perinthalmanna (Upgn).	605	11	2x20	40
19	110 kV S/s, Pulikkal.	500	11	1x12.5	12.5
20	110 kV S/s, Panakkad.	650	11	2x12.5	25
21	110 kV GIS, Swapnanagari (Kalipoika).	1843	11	2x20	40
22	110 kV S/s, Kuttikkattur (Upgn.)	623	11	2x12.5	25
		17257			547.5
Sl No.	Transmission Proposals for the Period 2016-17				
1	110 kV S/s, Kinaloor.	815	11	2x12.5	25
2	110 kV S/s, Mankavu (Upgn.)	1000	11	2x12.5	25
3	110 kV S/s, Nenmara (Upgn.)	500	11	2x12.5	25
4	110kV Substation Eramallur.	600	11	2x12.5	25
5	110kV S/s Kavalam.	722	11	2x12.5	25
6	110 kV S/s, Ettumanur (Upgn.)	955	11	2x12.5	25
7	110 kV S/s, Palode (Upgn.)	1093	11	2x12.5	25
8	110 kV S/s, Muttathara.	1100	11	2x12.5	25
9	110 kV S/s, Peroorkada.	1106	11	2x12.5	25
		7891			225
Sl No.	Transmission Proposals for the Period 2017-18				
1	110 kV S/s, Kannampully (Upgn.)	500	11	2x12.5	25
2	Upgradation of Koothattukulam substation to 110kV.	623	11	2x12.5	25
3	110 kV S/s, Nilambur (Upgn.)	623	11	2x12.5	25
4	110 kV S/s, Edakkara (Upgn.)	623	11	2x12.5	25
5	110kV S/s Manjeri (Upgdn.)	623	11	2x12.5	25
		2992.03			125
Sl No.	Transmission Proposals for the Period 2018-19				
1	Upgradation of Anchal S/s to 110kV.	623	11	2x12.5	25
2	Upgradation of Karunagapally S/s to 110kV.	623	11	2x12.5	25
3	Upgradation of Chumatra and Thiruvalla S/s to 110kV.	1250	11	2x12.5	25
4	Upgradation of Ettumanoor-Koothattukulam 66kV D/c line including Upgradation of Kuravilangad S/s to 110kV.	623	11	2x12.5	25
5	Upgradation of Changanassery S/s to 110kV.	623	11	2x12.5	25
6	Upgradation of 66kV Alappuzha and Pathirapally S/s to 110kV.	1246	11	2x12.5	25
7	Upgradation of Edathala substation to 110kV by LILO of Aluva-Pallivasal line.	623	11	2x12.5	25
8	Upgradation of Vazhathope, Kattappana substations to 110kV for the proposed wind evacuation from Ramakkalmedu.	1246	11	2x12.5	25
9	Upgradation of 66kV S/s Peerumedu to 110kV.	623	11	2x12.5	25
		7480.27			225

ANNEXURE-XV**AVERAGE BILLING RATE**

Sl. No.	Description	Rate (Rs/unit)	FY 2015-16		FY 2016-17		FY 2017-18		FY 2018-19	
			MU	Rs Crores	MU	Rs Crores	MU	Rs Crores	MU	Rs. Crores
1	Domestic	3.39	10510	3564	11762	3989	12785	4336	13896	4712
2	Other than domestic	6.72	9596	6444	10172	6831	10782	7240	11429	7675
	Total		20106	10008	21934	10820	23567	11576	25325	12387
	Weighted average ABR	Rs/unit		4.98		4.93		4.91		4.89

Impact on Tariff

Impact on the Tariff due to new investment proposed has been worked out and summarized in the tables below:

**Per unit impact on tariff-An Assessment**

Description	Units	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19
Total energy requirement at state periphery	MU	23822	25889	27709	29620
Net sales-Power/Unit of input power	Rs/kWh	0.01	0.40	0.61	0.91
Total Income	Rs/kWh	0.01	0.40	0.61	0.91
Expenditure					
Power Purchase	Rs/kWh	-0.10	0.17	0.32	0.61
Employee cost	Rs/kWh	0.22	0.32	0.42	0.52
R & M Cost	Rs/kWh	0.01	0.02	0.02	0.03
Admn. & General expenses	Rs/kWh	0.01	0.02	0.02	0.03
Others	Rs/kWh	-0.02	-0.02	-0.02	-0.02
Total expenses	Rs/kWh	0.12	0.51	0.76	1.17
Interest	Rs/kWh	-0.03	0.02	0.07	0.10
Depreciation	Rs/kWh	0.03	0.08	0.12	0.14
Return on Equity @16%	Rs/kWh	0.03	0.04	0.04	0.01
Tax	Rs/kWh	0.00	0.00	0.00	0.00
Net Impact	Rs/kWh	0.11	0.21	0.34	0.50

400kV and 220kV network
with ISTS connection points

